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STRATA STERLING BARNSLEY WEST LIMITED

BARNSLEY WEST ROUNDABOUT APPLICATIONS

AIR QUALITY ASSESSMENT

DECEMBER 2019

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ST17019-001	Existing and Proposed Sensitive Receptor Locations	1:10,000@A3

EXECUTIVE SUMMARY

A detailed air quality assessment has been undertaken to accompany two separate planning applications for the proposed Barugh Green Road and Higham Common Road roundabouts, Barnsley. The proposed Highways Works at Barugh Green Road and Higham Common Road have been considered with the associated proposed new Link Road between the M1, Junction 37 and the A635, Barugh Green Road.

The assessment has also considered the potential dust and fine particulate matter effects associated with the construction phase of the development; and the air quality effects of road traffic emissions during the operational phase.

For the construction phase, the risk of dust soiling effects is classed as medium for earthworks, low for construction and medium for trackout; and the risk of human health effects is classed as low for earthworks, construction and trackout. Mitigation measures, based on best practice guidance, have been proposed to further reduce any potential impacts and, with these in place, it is concluded that any residual effects should be not significant.

For the operational phase assessment, annual mean nitrogen dioxide (NO_2) and fine particulate matter (PM_{10} and $PM_{2.5}$) concentrations have been modelled at fourteen existing sensitive receptor locations, using the most recent Emission Factor Toolkit available from DEFRA (v9). Predicted annual mean concentrations have been compared to the relevant air quality objectives and limit values.

The 2021 assessment concludes that the operational phase of the development will result in concentrations of NO_2 remaining below the air quality objectives with the exception of two of the fourteen receptors, both without and with the development. Concentrations of PM_{10} and $PM_{2.5}$, remain well below the air quality objectives, both without and with the development for 2021. All impacts are negligible at all receptors in 2021.

The 2033 assessment concludes that the operational phase of the development will result in negligible impacts at all receptors with the exception of one where there is a slight impact. Concentrations of NO_2, PM_{10} and $PM_{2.5}$ remain well below the air quality objectives at all of the assessed receptors both with and without the development in 2033.

A sensitivity analysis has been undertaken to provide a realistic upper-bound conservative approach. The impact of the development is predicted to be negligible at thirteen out of the fourteen sensitive receptors assessed for the assessment years of 2021 and 2033. There is a slight impact at one receptor in 2021 and moderate at the same receptor in 2033. The slight and moderate impacts are, however, at concentrations well below the objective level and no

new breaches of the objectives are predicted. Air quality effects are therefore considered to be 'not significant'.

The assessment demonstrates that the proposed development will not lead to an unacceptable risk from air pollution, or to any new breach in national objectives. Therefore, there are no material reasons in relation to air quality why the proposed scheme should not proceed, subject to appropriate planning conditions.

1 INTRODUCTION

1.1 Background

1.1.1 Wardell Armstrong LLP (WA) has been instructed by Strata Sterling Barnsley West Limited to undertake an air quality assessment to accompany two separate planning applications for the following proposed highways works in Barnsley, as follows:

- Application 1 – Barugh Green Road Roundabout; and
- Application 2 – Higham Common Road Roundabout.

1.1.2 It is understood that an associated link road, which falls within the local plan strategic development site allocation (MU1) at Barnsley West, will be the subject of a later planning application. However, for the purpose of this assessment, the potential air quality impacts of the entirety of the link road will be considered, to account for cumulative effects of the overall proposal (i.e. the completed link road between the Barugh Green Road and the Higham Common Road roundabouts).

1.1.3 This report details the results of the air quality assessment. The report discusses the potential dust and fine particulate matter impacts associated with the construction phase. An assessment has been undertaken of the potential air quality impacts of the additional road traffic generated by the proposed development. In addition, air pollutant concentrations are considered at fourteen existing sensitive receptor locations in the vicinity of the proposed development.

1.1.4 The report has been compiled using the most recent version of the Emission Factor Toolkit (EFT - version 9.0), which was released by DEFRA in May 2019.

2 LEGISLATION AND POLICY CONTEXT

2.1 Relevant Air Quality Legislation and Guidance

2.1.1 The air quality assessment has been undertaken in accordance with the following legislation and guidance:

- EU Ambient Air Quality Directive 2008/50/EC (i.e. the CAFE Directive);
- The Environment Act 1995;
- Department of Environment, Food and Rural Affairs, The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, July 2007;
- The Air Quality Standards Regulations 2010;
- Department for Environment, Food and Rural Affairs, Local Air Quality Management Technical Guidance LAQM.TG(16), February 2018;
- Ministry of Housing, Communities and Local Government, National Planning Policy Framework, July 2018;
- Department for Communities and Local Government, Planning Practice Guidance: Air Quality, March 2014; and
- Barnsley Metropolitan Borough Council. Barnsley Air Quality Action Plan April 2017 (updated 2019)

2.1.2 Further details of these documents are included in **Appendix A**.

2.2 Assessment Criteria

2.2.1 The relevant air quality objectives and limit values for this assessment are included within Table 1.

Table 1: Air Quality Objectives and Limit Values Relevant to the Assessment*

Pollutant	Objective/Limit Value	Averaging Period	Obligation
Nitrogen Dioxide (NO_2)	200µg/m^3, not to be exceeded more than 18 times a year	1-hour mean	All local authorities
	40µg/m^3	Annual mean	All local authorities
Particulate Matter (PM_{10})	50µg/m^3, not to be exceeded more than 35 times a year	24-hour mean	England, Wales and Northern Ireland
	40µg/m^3	Annual mean	England, Wales and Northern Ireland
	18µg/m^3	Annual mean	Scotland only

Table 1: Air Quality Objectives and Limit Values Relevant to the Assessment*			
Pollutant	**Objective/Limit Value**	**Averaging Period**	**Obligation**
Particulate Matter ($PM_{2.5}$)	Limit Value of 25µg/m^3	Annual mean	England, Wales and Northern Ireland
	10µg/m^3	Annual mean	Scotland only
**In accordance with the Air Quality Standards Regulations 2010*			

2.2.2 Further details of where these objectives and limit values apply are detailed in **Appendix A**.

3 ASSESSMENT METHODOLOGY

3.1 Construction Phase Assessment

3.1.1 To assess the impacts associated with dust and fine particulate matter releases during the construction phase of the development, an assessment has been undertaken in accordance with guidance from the Institute of Air Quality Management (IAQM)[1]. Further details of the construction assessment methodology are provided in **Appendix B**.

3.1.2 The closest sensitive human receptors to where construction phase activities will take place are residential dwellings. These are detailed in Table 2.

Table 2: Existing Sensitive Receptors Considered in the Construction Phase Assessment

Receptor	Direction from the Site	Approximate Distance from the Site Boundary
Residential dwelling on Barugh Green Road	East	<20m at the closest point
Residential dwellings on Barugh Green Road	West	<20m at the closest point
Residential dwellings on Higham Common Road	West	<20m at the closest point
Residential dwellings on Hermit Lane	North	<20m at the closest point

3.1.3 There are no ecological receptors, or potentially dust sensitive statutory designated habitat sites, within 50m of the site and/or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s). Ecological effects do not therefore need to be considered within this assessment.

3.1.4 The criteria used to assess the construction impact of the proposed development, and the associated significance of effects at existing sensitive receptors, are included in **Appendix B**.

3.2 Operational Phase Assessment

3.2.1 The atmospheric dispersion model ADMS-Roads (CERC, Version 4.1) has been used to assess the impacts associated with road traffic emissions during the operational phase assessment. The impacts have been assessed in accordance with guidance from

[1] Institute of Air Quality Management, Guidance on the Assessment of Dust from Demolition and Construction, February 2014

Environmental Protection UK (EPUK) and the IAQM[2]. Further details of the modelling and assessment methodology are provided in **Appendix C**.

3.2.2 NO_2, PM_{10} and $PM_{2.5}$ concentrations have been predicted at existing sensitive receptors, as these are the pollutants considered most likely to exceed the objectives and limit values.

3.2.3 Atmospheric dispersion modelling has been carried out to estimate pollutant concentrations, due to road traffic emissions, for four assessment scenarios as follows:

- **Scenario 1:** 2018 Verification and Base Year, the most recent year for which traffic flow information, local monitored pollution data and meteorological data is available;
- **Scenario 2:** 2021 Opening Year (without Barugh Green Road and Higham Common Road roundabouts);
- **Scenario 3:** 2021 Opening Year (with Barugh Green Road and Higham Common Road roundabouts);
- **Scenario 4:** 2033 Future Year (No link road, roundabouts or MU1 development); and
- **Scenario 5:** 2033 Future Year (including both roundabouts and link road).

Existing Sensitive Receptors

3.2.4 A number of representative existing sensitive receptors (identified as ESR 1 to ESR 14) have been selected for consideration in the air quality assessment. These have been chosen based on their sensitivity and their proximity to roads which will be affected by development generated traffic.

3.2.5 Details of these receptors considered are provided in Table 3, and their locations are shown on drawing ST17019-001.

Table 3: Existing Sensitive Receptors Considered in the Operational Phase Assessment

Receptor	Location	Grid Reference		Receptor Type
		Easting	Northing	
ESR 1	Residential dwelling on Barugh Green Road	431585	407943	Residential

[2] Moorcroft and Barrowcliffe et al, Land-Use Planning and Development Control: Planning for Air Quality (v1.2), January 2017

Table 3: Existing Sensitive Receptors Considered in the Operational Phase Assessment				
Receptor	Location	Grid Reference		Receptor Type
		Easting	Northing	
ESR 2	Residential dwelling on Barugh Green Road	431441	407964	Residential
ESR 3	Residential dwelling on Cawthorne Road	431037	408053	Residential
ESR 4	Residential dwelling at junction of Barugh Green Road and Higham Common Road	431054	408027	Residential
ESR 5	Residential dwelling on Higham Common Road	431362	406785	Residential
ESR 6	Residential dwelling on Higham Common Road	431375	406722	Residential
ESR 7	Residential dwelling on Higham Lane	431457	406329	Residential
ESR 8	Ibys Hotel on Whinby Road	432070	405944	Hotel
ESR 9	Residential dwelling on Barnsley Road Road	431960	405790	Residential
ESR 10	Residential property on Whinby Road	432113	405831	Residential
ESR 11	Residential property on Dodworth Road	432284	405923	Residential
ESR 12	Residential property on Dodworth Road	432281	405960	Residential
ESR 13	Residential property at junction of Barugh Green Road and Wilthorpe Road	432013	407862	Residential
ESR 14	Residential dwelling on Hermit Lane	431431	406899	Residential

Existing Sensitive Ecological Receptor Locations

3.2.6 There are no existing sensitive habitats located within 100m of any roads that development generated traffic will use. Therefore, an operational phase air quality ecological assessment has not been undertaken.

3.3 Limitations and Uncertainties

3.3.1 At present, there is a degree of uncertainty associated with the prediction of future NO_2 concentrations, and consequently the assessment of impacts relating to development generated road traffic emissions.

3.3.2 Air quality assessments make use of official sources of information (i.e. vehicle emission factors and background concentrations) which are increasingly considered to be overly optimistic. Monitoring data collected by the UK Government and local authorities shows that annual mean NO_2 concentrations have remained higher than previously expected (especially in roadside locations). This is widely thought to be due to the lower than expected decline in NO_x emissions from diesel vehicles (even as new

Euro standards have been introduced), coupled with an overall increase in the number of diesel vehicles on the road.

3.3.3 The vehicle emission factors used in this assessment are from Defra's Emission Factor Toolkit (EFT v9)[3], which is the most up-to-date version available. Although this is considered to be more realistic than earlier versions, uncertainty remains.

3.3.4 A position statement has recently been produced by the IAQM which deals specifically with the use of EFT v8.0 and the consideration of uncertainties in predicting future air quality[4]. The statement concludes that the approaches for dealing with this uncertainty should be decided on a case-by-case basis but may include use of a sensitivity test (which assumes that NO_x emissions will not reduce as quickly as within the EFT). The statement also highlights the need for careful consideration of the results of any sensitivity test, particularly with regard to assessing impacts and the significance of effects. A precautionary approach is recommended. At the time of writing no IAQM update has been provided for EFT v9.0, however it is considered uncertainty still exists.

3.3.5 This assessment has taken into account the uncertainties associated with predicting future air quality by amending the future Euro fleet composition by substituting all Euro 6D diesel cars and LGVs with Euro 6C. This will provide a reasonable worst-case upper-bound to the assessment. The sensitivity analyses have also used 2018 background concentrations. Further details of the methodology are provided in **Appendix C** and the results are detailed in Section 5 of this report.

3.3.6 No significant discrepancy is observed between the predicted and observed trends in PM_{10} and $PM_{2.5}$; therefore, the sensitivity analysis considers NO_2 only.

[3] Available from Defra Local Air Quality Management webpages (https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html)
[4] Institute of Air Quality Management, Dealing with Uncertainty in Vehicle NO_x Emissions within Air Quality Assessments v1.1, July 2018

4 BASELINE SITUATION

4.1 Barnsley Metropolitan Borough Council Local Air Quality Management

4.1.1 The proposed development site is located within the administrative area of Barnsley Metropolitan Borough Council (BMBC), which is responsible for the management of local air quality.

4.1.2 There are currently six Air Quality Management Areas (AQMA) declared by BMBC, the closest two to the application sites being the AQMA No.1 M1 Motorway, 100 metres either side of the central reservation within the Barnsley Borough, and the AQMA No.2A (A628 Dodworth Road).

4.1.3 There is one roadside continuous monitor and ten roadside NO_2 diffusion tubes in the vicinity of the developments, all located within AQMA No.2A. Monitoring data for 2018 (presented in BMBCs 2019 Annual Status Report) showed annual mean concentrations ranging from 25.7 µg/m^3 to 45.8 µg/m^3.

4.1.4 BMBC also operates an automatic background monitor for NO_2 at Barnsley Gawber, approximately 1km from the proposed roundabouts, which reported an annual average NO_2 concentration of 16 µg/m^3 in 2018.

4.1.5 BMBC monitors PM_{10} at one roadside site, but this is not in the vicinity of the proposed developments. No monitoring has been or is currently being undertaken for $PM_{2.5}$.

4.2 Background Air Pollutant Concentrations

4.2.1 The air quality assessment will take into account background concentrations upon which local, traffic derived pollution is superimposed.

4.2.2 Background NO_2, monitoring data is available from the BMBC operated Barnsley Gawber automatic monitoring location. The 2018 background concentrations, which is the most recent full year for which data is available, are detailed in Table 4. Background PM_{10} and $PM_{2.5}$ data have been taken from the Defra background maps for the appropriate grid square.

4.2.3 NO_2 data for 2021 and 2033 has been calculated by adjusting the monitored data by the ratio between 2021 (or 2033) and 2018 concentrations obtained from the 2017-based Defra background maps, in accordance with the method described in LAQM.TG(16).

Table 4: Background Pollutant Concentrations Used in the Air Quality Assessment					
Receptor	**Grid Square**	**Oxides of Nitrogen (NO_x)[a]**	**Nitrogen Dioxide (NO_2)[a]**	**Particulate matter (PM_{10})[b]**	**Particulate matter ($PM_{2.5}$)[b]**
2018 Annual Mean Concentrations (µg/m³)					
ESR 1 – 2	431500, 407500	23.09	15.59	10.72	6.72
ESR 3 – 4	431500, 408500	23.09	15.59	10.46	6.66
ESR 5 – 7, ESR 14	431500, 406500	23.09	15.59	12.27	7.50
ESR 8, ESR 10 – 12	432500, 405500	23.09	15.59	12.45	7.65
ESR 9	431500, 405500	23.09	15.59	10.01	6.52
ESR 13	432500, 407500	23.09	15.59	10.07	6.65
2021 Annual Mean Concentrations (µg/m³)					
ESR 1 – 2	431500, 407500	19.89	13.63	10.40	6.44
ESR 3 – 4	431500, 408500	19.89	13.63	10.14	6.39
ESR 5 – 7, ESR 14	431500, 406500	19.89	13.63	11.94	7.22
ESR 8, ESR 10 – 12	432500, 405500	19.89	13.63	12.12	7.37
ESR 9	431500, 405500	19.89	13.63	9.68	6.25
ESR 13	432500, 407500	19.89	13.63	9.74	6.37
2033 Annual Mean Concentrations (µg/m³)					
ESR 1 – 2	431500, 407500	14.98	10.47	10.06	6.15
ESR 3 – 4	431500, 408500	14.98	10.47	9.81	6.10
ESR 5 – 7, ESR 14	431500, 406500	14.98	10.47	11.60	6.92
ESR 8, ESR 10 – 12	432500, 405500	14.98	10.47	11.78	7.06
ESR 9	431500, 405500	14.98	10.47	9.34	5.95

Table 4: Background Pollutant Concentrations Used in the Air Quality Assessment					
Receptor	**Grid Square**	**Oxides of Nitrogen (NO_x)[a]**	**Nitrogen Dioxide (NO_2)[a]**	**Particulate matter (PM_{10})[b]**	**Particulate matter ($PM_{2.5}$)[b]**
ESR 13	432500, 407500	14.98	10.47	9.39	6.07
[a]Obtained from Barnsley Gawber automatic monitoring station					
[b]Obtained from the Defra 2017-based background maps for the appropriate grid square					

4.3 Modelled Baseline Concentrations at Existing Sensitive Receptors

4.3.1 The baseline assessment (i.e. scenarios 1, 2 and 4) has been carried out for the existing sensitive receptors considered. The adjusted NO_2 and unadjusted PM_{10} and $PM_{2.5}$ concentrations are detailed in Table 5.

Table 5: Predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations at Existing Sensitive Receptor Locations for 2018 Verification and Base Year, 2021 Opening Year and 2033 Future Year 'Without Development' Scenarios

Receptor	Calculated Annual Mean Concentrations (µg/m^3)								
	NO_2 (Adjusted)*			PM_{10} (Unadjusted)			$PM_{2.5}$ (Unadjusted)		
	Scenario 1: 2018	Scenario 2: 2021	Scenario 4: 2033	Scenario 1: 2018	Scenario 2: 2021	Scenario 4: 2033	Scenario 1: 2018	Scenario 2: 2021	Scenario 4: 2033
ESR 1	21.95	18.89	13.25	11.25	10.93	10.64	7.03	6.74	6.47
ESR 2	21.40	18.44	13.01	11.19	10.86	10.57	7.00	6.71	6.43
ESR 3	30.68	26.12	17.04	11.49	11.14	10.90	7.29	6.98	6.72
ESR 4	28.68	24.40	16.19	11.33	10.99	10.75	7.20	6.89	6.63
ESR 5	30.98	26.42	17.41	13.10	12.73	12.45	8.06	7.72	7.43
ESR 6	37.98	32.37	20.78	13.47	13.08	12.82	8.31	7.94	7.66
ESR 7	25.21	21.70	14.79	12.95	12.60	12.32	7.92	7.61	7.33
ESR 8	31.75	27.04	17.62	13.44	13.08	12.81	8.29	7.96	7.67
ESR 9	27.19	23.39	15.59	10.81	10.48	10.20	7.02	6.72	6.44
ESR 10	35.62	30.31	19.32	13.81	13.45	13.22	8.50	8.16	7.89
ESR 11	<u>55.53</u>	<u>47.39</u>	28.91	14.81	14.43	14.28	9.12	8.75	8.49
ESR 12	<u>50.06</u>	<u>42.64</u>	26.17	14.43	14.05	13.87	8.88	8.52	8.26
ESR 13	24.75	21.28	14.48	10.78	10.44	10.16	7.07	6.78	6.50
ESR 14	22.54	19.35	13.53	12.62	12.27	11.96	7.74	7.43	7.14

**NO_2 concentrations obtained by inputting predicted NO_x concentrations into the NO_x to NO_2 calculator[1] in accordance with LAQM.TG(16).*

<u>Underlined</u> values represent an exceedance of the relevant air quality objective.

4.3.2 The results show that all predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations are below the relevant objectives and limit values, except at ESR 11 and ESR 12, where an exceedance of the annual mean objective for NO_2 is predicted in 2018 and 2021. No exceedances of the annual mean objective for NO_2 are predicted in 2033.

5 IMPACT ASSESSMENT

5.1 Construction Phase

Step 2 – Impact Assessment

5.1.1 In accordance with the IAQM guidance, the main activities to be considered during the construction phase of the proposed development are demolition, earthworks, construction and trackout.

5.1.2 In this case, no demolition activities are proposed and so this has not been considered further.

5.1.3 Earthworks covers the processes of soil-stripping, ground-levelling, excavation and landscaping required prior to construction.

5.1.4 Construction activities focus on the proposed buildings, access roads and car parking areas.

5.1.5 Trackout is defined as the transport of dust and dirt by vehicles travelling from a construction site on to the public road network. This may occur through the spillage of dusty materials onto road surfaces or through the transportation of dirt by vehicles that have travelled over muddy ground on the site. This dust and dirt can then be deposited and re-suspended by other vehicles.

Step 2A

5.1.6 Step 2A of the assessment defines the potential dust emission magnitude from demolition, earthworks, construction and trackout in the absence of site-specific mitigation.

5.1.7 Examples of the criteria for the dust emission classes are detailed in **Appendix B**. The results of this step are detailed in Table 8.

Step 2B

5.1.8 Step 2B of the construction phase dust assessment defines the sensitivity of the area, taking into account the significance criteria detailed in **Appendix B**, for earthworks, construction and trackout. The sensitivity of the area to each activity is assessed for potential dust soiling, human health effects and ecological effects. As a worst-case approach, the assessment has focused on the most sensitive receptors (i.e. residential dwellings).

5.1.9 No demolition activities are proposed, and so this has not been considered further.

5.1.10 For earthworks and construction, there are currently between 10 and 100 receptors (residential in nature) within 50m of where these activities may take place, which is assumed to be the site boundary for the purposes of this assessment.

5.1.11 The routing of construction vehicles is unknown at this stage. Therefore, for the purposes of this assessment, worst case routing scenarios have been assumed for assessment of potential trackout impacts at nearby receptors.

5.1.12 As a result, for trackout, there are potentially between 10 and 100 receptors (residential in nature) within 20m of where trackout may occur for a distance of up to 200m from the site entrances (assuming vehicles travel along west along Barugh Green Road from the Barugh Green Road roundabout site, and north along Higham Common Road from the Higham Common Road Roundabout site).

Step 2C

5.1.13 Step 2C of the construction phase dust assessment defines the risk of impacts from each activity, by combining the dust emission magnitude with the sensitivity of the surrounding area.

5.1.14 The risk of dust impacts from each activity, with no mitigation in place, has been assessed in accordance with the criteria detailed in **Appendix B**. The results of this step are detailed in Table 6.

Summary of Step 2

5.1.15 Table 6 details the results of Step 2 of the construction phase assessment for human receptors.

Table 6: Construction Phase Dust Assessment for Human Receptors

	Activity			
	Demolition	**Earthworks**	**Construction**	**Trackout**
Step 2A				
Dust Emission Magnitude	N/A	Medium[a]	Small[b]	Medium[c]
Step 2B				
Sensitivity of Closest Receptors	N/A	High	High	High
Sensitivity of Area to Dust Soiling Effects	N/A	Medium	Medium	High

Table 6: Construction Phase Dust Assessment for Human Receptors				
	Activity			
	Demolition	Earthworks	Construction	Trackout
Sensitivity of Area to Human Health Effects	N/A	Low[d]	Low[d]	Low[d]
Step 2C				
Dust Risk: Dust Soiling	N/A	Medium Risk	Low Risk	Medium Risk
Dust Risk: Human Health	N/A	Low Risk	Low Risk	Low Risk

[a]Total site area estimated to be between 2,500 and 10,000m^2

[b]Total construction volume to be constructed is assumed to be less than 25,000m^3, with potentially dusty construction materials.

[c]As a robust assumption, number of construction phase vehicles estimated to be between 10 and 50 movements per day.

[d]Background annual mean PM_{10} concentration is taken Defra background maps, as detailed in Table 4.

Step 3 – Mitigation

5.1.16 During the construction phase, the implementation of effective mitigation measures will substantially reduce the potential for nuisance dust and particulate matter to be generated, which can be secured by planning condition.

5.1.17 Step 2C of the assessment has identified that the risk of dust soiling and human health effects is not negligible for all the activities and therefore site-specific mitigation will need to be implemented to ensure dust effects from these activities will be not significant.

Recommendations for Site-Specific Mitigation

5.1.18 Specific mitigation relating to dust control may be in the form of construction best practices or could include a dust management plan. Recommendations for mitigation within the IAQM guidance include:

- Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable;
- Protection of surfaces and exposed material from winds until disturbed areas are sealed and stable;
- Dampening down of exposed stored materials, which will be stored as far from

sensitive receptors as possible;

- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place;
- Avoidance of activities that generate large amounts of dust during windy conditions;
- Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery;
- Avoid dry sweeping of large areas;
- Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use;
- Ensure vehicles entering and leaving the site are covered to prevent escape of materials during transport;
- Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable);
- Minimisation of vehicle movements and limitation of vehicle speeds – the slower the vehicle speeds, the lower the dust generation;
- Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever the site size and layout permits; and
- Access gates to be located at least 10m from receptors, where possible.

5.1.19 All dust and air quality complaints should be recorded and appropriate measures be taken to identify causes and reduce emissions in a timely manner. Exceptional incidents which cause dust and/or emissions, and the action taken to resolve the situation, should be recorded in a log book and made available to BMBC on request.

5.1.20 It is recognised that the final design solutions will be developed with the input of the Contractor to maximise construction efficiencies, to use modern construction techniques and sustainable materials and to incorporate the particular skills and experience offered by the appointed contractor, all of which can be secured by condition.

Step 4 – Residual Effects

5.1.21 Step 4 of the construction phase dust assessment has been undertaken to determine the significance of the dust effects arising from demolition, earthworks, construction and trackout associated with the proposed development.

5.1.22 The implementation of effective mitigation measures during the construction phase, such as those detailed in Step 3, will substantially reduce the potential for nuisance dust and particulate matter to be generated and any residual impact should be **not significant**.

5.2 Operational Phase Assessment

Existing Sensitive Receptors

5.2.1 The impact assessment has been carried out for the representative existing sensitive receptors considered (i.e. ESR 1 to ESR 14).

5.2.2 Tables 7 to 9 detail the predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations for the 2021 opening year, for both the 'Without Development' and 'With Development' scenarios. The impact has been assessed in accordance with the descriptors included in **Appendix C**.

Table 7: Predicted Adjusted NO_2 Concentrations for 2021 at Existing Sensitive Receptors for Scenarios 2 and 3 (Using EFT Version 9)

Receptor	Calculated Annual Mean NO_2 Concentrations (µg/m^3)[a]				
	Without Development Concentration	With Development		Concentration Change as Percentage of AQAL	Impact[b]
		Concentration	Percentage in Relation to AQAL		
ESR 1	18.89	21.03	<75%	2 – 5%	**Negligible**
ESR 2	18.44	18.72	<75%	1%	**Negligible**
ESR 3	26.12	26.13	<75%	<0.5%	**Negligible**
ESR 4	24.40	24.42	<75%	<0.5%	**Negligible**
ESR 5	26.42	27.23	<75%	2 – 5%	**Negligible**
ESR 6	32.37	32.66	76 – 94%	1%	**Negligible**
ESR 7	21.70	21.74	<75%	<0.5%	**Negligible**
ESR 8	27.04	27.14	<75%	<0.5%	**Negligible**
ESR 9	23.39	23.57	<75%	<0.5%	**Negligible**

Table 7: Predicted Adjusted NO_2 Concentrations for 2021 at Existing Sensitive Receptors for Scenarios 2 and 3 (Using EFT Version 9)

Receptor	Calculated Annual Mean NO_2 Concentrations (µg/m³)[a]				
	Without Development Concentration	With Development		Concentration Change as Percentage of AQAL	Impact[b]
		Concentration	Percentage in Relation to AQAL		
ESR 10	30.31	30.40	<75%	<0.5%	**Negligible**
ESR 11	<u>47.39</u>	<u>47.45</u>	103 – 109%	<0.5%	**Negligible**
ESR 12	<u>42.64</u>	<u>42.69</u>	>110%	<0.5%	**Negligible**
ESR 13	21.28	21.32	<75%	<0.5%	**Negligible**
ESR 14	19.35	19.53	<75%	<0.5%	**Negligible**

[a] NO_2 concentrations obtained by inputting predicted NO_x concentrations into the NO_x to NO_2 calculator, in accordance with LAQM.TG(16)

[b] Assessed using the Impact Descriptors from the EPUK/IAQM guidance, included in Appendix C. Changes of less than 0.5% should be described as negligible.

<u>Underlined</u> values represent an exceedance of the relevant AQO.

Table 8: Predicted Adjusted PM_{10} Concentrations for 2021 at Existing Sensitive Receptors for Scenarios 2 and 3 (Using EFT Version 9)

Receptor	Calculated Annual Mean PM_{10} Concentrations (µg/m³)				
	Without Development Concentration	With Development		Concentration Change as Percentage of AQAL	Impact[a]
		Concentration	Percentage in Relation to AQAL		
ESR 1	10.93	11.08	<75%	<0.5%	**Negligible**
ESR 2	10.86	10.87	<75%	<0.5%	**Negligible**
ESR 3	11.14	11.14	<75%	<0.5%	**Negligible**
ESR 4	10.99	10.99	<75%	<0.5%	**Negligible**
ESR 5	12.73	12.79	<75%	<0.5%	**Negligible**
ESR 6	13.08	13.09	<75%	<0.5%	**Negligible**
ESR 7	12.60	12.61	<75%	<0.5%	**Negligible**
ESR 8	13.08	13.08	<75%	<0.5%	**Negligible**
ESR 9	10.48	10.48	<75%	<0.5%	**Negligible**

Table 8: Predicted Adjusted PM_{10} Concentrations for 2021 at Existing Sensitive Receptors for Scenarios 2 and 3 (Using EFT Version 9)

Receptor	Calculated Annual Mean PM_{10} Concentrations (µg/m³)				
	Without Development Concentration	With Development		Concentration Change as Percentage of AQAL	Impact[a]
		Concentration	Percentage in Relation to AQAL		
ESR 10	13.45	13.45	<75%	<0.5%	**Negligible**
ESR 11	14.43	14.43	<75%	<0.5%	**Negligible**
ESR 12	14.05	14.05	<75%	<0.5%	**Negligible**
ESR 13	10.44	10.44	<75%	<0.5%	**Negligible**
ESR 14	12.27	12.29	<75%	<0.5%	**Negligible**

[a]*Assessed using the Impact Descriptors from the EPUK/IAQM guidance, included in Appendix C. Changes of less than 0.5% should be described as negligible*

Table 9: Predicted Unadjusted $PM_{2.5}$ Concentrations for 2021 at Existing Sensitive Receptors for Scenarios 2 and 3 (Using EFT Version 9)

Receptor	Calculated Annual Mean $PM_{2.5}$ Concentrations (µg/m³)				
	Without Development Concentration	With Development		Concentration Change as Percentage of AQAL	Impact[a]
		Concentration	Percentage in Relation to AQAL		
ESR 1	6.74	6.83	<75%	<0.5%	**Negligible**
ESR 2	6.71	6.71	<75%	<0.5%	**Negligible**
ESR 3	6.98	6.98	<75%	<0.5%	**Negligible**
ESR 4	6.89	6.89	<75%	<0.5%	**Negligible**
ESR 5	7.72	7.75	<75%	<0.5%	**Negligible**
ESR 6	7.94	7.95	<75%	<0.5%	**Negligible**
ESR 7	7.61	7.61	<75%	<0.5%	**Negligible**
ESR 8	7.96	7.96	<75%	<0.5%	**Negligible**
ESR 9	6.72	6.72	<75%	<0.5%	**Negligible**
ESR 10	8.16	8.17	<75%	<0.5%	**Negligible**
ESR 11	8.75	8.75	<75%	<0.5%	**Negligible**

Table 9: Predicted Unadjusted $PM_{2.5}$ Concentrations for 2021 at Existing Sensitive Receptors for Scenarios 2 and 3 (Using EFT Version 9)					
Receptor	**Calculated Annual Mean $PM_{2.5}$ Concentrations (µg/m³)**				
	Without Development Concentration	**With Development**		**Concentration Change as Percentage of AQAL**	**Impact[a]**
		Concentration	**Percentage in Relation to AQAL**		
ESR 12	8.52	8.52	<75%	<0.5%	**Negligible**
ESR 13	6.78	6.78	<75%	<0.5%	**Negligible**
ESR 14	7.43	7.44	<75%	<0.5%	**Negligible**
[a]Assessed using the Impact Descriptors from the EPUK/IAQM guidance, included in Appendix C. Changes of less than 0.5% should be described as negligible					

5.2.3 The results of the assessment show that all predicted NO_2 concentrations are below the objective level except at ESR 11 and ESR 12 (both in AQMA No.2), where exceedances already exist without the addition of the roundabouts.

5.2.4 The results of the assessment show that all predicted PM_{10} and $PM_{2.5}$ concentrations, in all scenarios considered, are below the relevant objectives and limit values.

5.2.5 Tables 10 to 12 detail the predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations for the 2033 future year, for both the 'Without Development' and 'With Development' scenarios. The impact has been assessed in accordance with the descriptors included in **Appendix C**.

Table 10: Predicted Adjusted NO_2 Concentrations for 2033 at Existing Sensitive Receptors for Scenarios 4 and 5 (Using EFT Version 9)					
Receptor	**Calculated Annual Mean NO_2 Concentrations (µg/m³)[a]**				
	Without Development Concentration	**With Development**		**Concentration Change as Percentage of AQAL**	**Impact[b]**
		Concentration	**Percentage in Relation to AQAL**		
ESR 1	13.25	16.37	<75%	6 – 10%	**Slight**
ESR 2	13.01	13.13	<75%	1%	**Negligible**
ESR 3	17.04	15.57	<75%	<0.5%	**Negligible**
ESR 4	16.19	14.58	<75%	<0.5%	**Negligible**
ESR 5	17.41	17.63	<75%	1%	**Negligible**

Table 10: Predicted Adjusted NO_2 Concentrations for 2033 at Existing Sensitive Receptors for Scenarios 4 and 5 (Using EFT Version 9)					
Receptor	**Calculated Annual Mean NO_2 Concentrations (µg/m³)[a]**				
	Without Development Concentration	**With Development**		**Concentration Change as Percentage of AQAL**	**Impact[b]**
		Concentration	**Percentage in Relation to AQAL**		
ESR 6	20.78	20.75	<75%	<0.5%	**Negligible**
ESR 7	14.79	14.08	<75%	<0.5%	**Negligible**
ESR 8	17.62	17.77	<75%	<0.5%	**Negligible**
ESR 9	15.59	16.50	<75%	2 – 5%	**Negligible**
ESR 10	19.32	19.53	<75%	1%	**Negligible**
ESR 11	28.91	28.58	<75%	<0.5%	**Negligible**
ESR 12	26.17	25.90	<75%	<0.5%	**Negligible**
ESR 13	14.48	14.74	<75%	1%	**Negligible**
ESR 14	13.53	13.98	<75%	1%	**Negligible**
[a]NO_2 concentrations obtained by inputting predicted NO_x concentrations into the NO_x to NO_2 calculator, in accordance with LAQM.TG(16) *[b]Assessed using the Impact Descriptors from the EPUK/IAQM guidance, included in Appendix C. Changes of less than 0.5% should be described as negligible.*					

Table 11: Predicted Adjusted PM_{10} Concentrations for 2033 at Existing Sensitive Receptors for Scenarios 4 and 5 (Using EFT Version 9)					
Receptor	**Calculated Annual Mean PM_{10} Concentrations (µg/m³)**				
	Without Development Concentration	**With Development**		**Concentration Change as Percentage of AQAL**	**Impact[a]**
		Concentration	**Percentage in Relation to AQAL**		
ESR 1	10.64	11.15	<75%	<0.5%	**Negligible**
ESR 2	10.57	10.54	<75%	<0.5%	**Negligible**
ESR 3	10.90	10.63	<75%	<0.5%	**Negligible**
ESR 4	10.75	10.45	<75%	<0.5%	**Negligible**
ESR 5	12.45	12.45	<75%	<0.5%	**Negligible**

Table 11: Predicted Adjusted PM_{10} Concentrations for 2033 at Existing Sensitive Receptors for Scenarios 4 and 5 (Using EFT Version 9)

Receptor	Calculated Annual Mean PM_{10} Concentrations (µg/m^3)				
	Without Development Concentration	With Development		Concentration Change as Percentage of AQAL	Impact[a]
		Concentration	Percentage in Relation to AQAL		
ESR 6	12.82	12.77	<75%	<0.5%	**Negligible**
ESR 7	12.32	12.18	<75%	<0.5%	**Negligible**
ESR 8	12.81	12.85	<75%	<0.5%	**Negligible**
ESR 9	10.20	10.38	<75%	<0.5%	**Negligible**
ESR 10	13.22	13.26	<75%	<0.5%	**Negligible**
ESR 11	14.28	14.22	<75%	<0.5%	**Negligible**
ESR 12	13.87	13.82	<75%	<0.5%	**Negligible**
ESR 13	10.16	10.22	<75%	<0.5%	**Negligible**
ESR 14	11.96	12.06	<75%	<0.5%	**Negligible**

[a]Assessed using the Impact Descriptors from the EPUK/IAQM guidance, included in Appendix C. Changes of less than 0.5% should be described as negligible

Table 12: Predicted Unadjusted $PM_{2.5}$ Concentrations for 2033 at Existing Sensitive Receptors for Scenarios 4 and 5 (Using EFT Version 9)

Receptor	Calculated Annual Mean $PM_{2.5}$ Concentrations (µg/m^3)				
	Without Development Concentration	With Development		Concentration Change as Percentage of AQAL	Impact[a]
		Concentration	Percentage in Relation to AQAL		
ESR 1	6.47	6.76	<75%	<0.5%	**Negligible**
ESR 2	6.43	6.42	<75%	<0.5%	**Negligible**
ESR 3	6.72	6.56	<75%	<0.5%	**Negligible**
ESR 4	6.63	6.46	<75%	<0.5%	**Negligible**
ESR 5	7.43	7.43	<75%	<0.5%	**Negligible**
ESR 6	7.66	7.63	<75%	<0.5%	**Negligible**
ESR 7	7.33	7.25	<75%	<0.5%	**Negligible**

Table 12: Predicted Unadjusted $PM_{2.5}$ Concentrations for 2033 at Existing Sensitive Receptors for Scenarios 4 and 5 (Using EFT Version 9)					
Receptor	**Calculated Annual Mean $PM_{2.5}$ Concentrations (µg/m³)**				
	Without Development Concentration	**With Development**		**Concentration Change as Percentage of AQAL**	**Impact[a]**
		Concentration	**Percentage in Relation to AQAL**		
ESR 8	7.67	7.68	<75%	<0.5%	**Negligible**
ESR 9	6.44	6.54	<75%	<0.5%	**Negligible**
ESR 10	7.89	7.91	<75%	<0.5%	**Negligible**
ESR 11	8.49	8.46	<75%	<0.5%	**Negligible**
ESR 12	8.26	8.23	<75%	<0.5%	**Negligible**
ESR 13	6.50	6.53	<75%	<0.5%	**Negligible**
ESR 14	7.14	7.19	<75%	<0.5%	**Negligible**
[a]Assessed using the Impact Descriptors from the EPUK/IAQM guidance, included in Appendix C. Changes of less than 0.5% should be described as negligible					

5.2.6 The results of the assessment show that all predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations, in all scenarios considered, are below the relevant objectives and limit values.

Existing Sensitive Receptors – Sensitivity Analysis

5.2.7 Current evidence suggests that NO_2 background concentrations and emissions are not decreasing in accordance with expected reductions. The air quality sensitivity analysis has therefore been undertaken to provide a realistic conservative approach, which considers a more pessimistic future vehicle fleet composition and no improvement in background concentrations.

5.2.8 The sensitivity analysis has been carried out for the representative existing sensitive receptors considered (i.e. ESR 1 to ESR 14).

5.2.9 Tables 13 and 14 detail the predicted NO_2, concentrations for the 2021 opening year and 2033 future year consecutively, for both the 'without development' and 'with development' scenarios. The impact has been assessed in accordance with the descriptors included in **Appendix C**.

Table 13: Predicted Adjusted NO_2 Concentrations for 2021 at Existing Sensitive Receptors for Scenarios 2 and 3 – Sensitivity Analysis

Receptor	Calculated Annual Mean NO_2 Concentrations (µg/m³)[a]				
	Without Development Concentration	With Development		Concentration Change as Percentage of AQAL	Impact[b]
		Concentration	Percentage in Relation to AQAL		
ESR 1	21.12	23.34	<75%	6 – 10%	**Slight**
ESR 2	20.65	20.94	<75%	1%	**Negligible**
ESR 3	28.65	28.66	<75%	<0.5%	**Negligible**
ESR 4	26.85	26.87	<75%	<0.5%	**Negligible**
ESR 5	29.02	29.86	<75%	2 – 5%	**Negligible**
ESR 6	35.22	35.52	76 – 94%	1%	**Negligible**
ESR 7	24.07	24.12	<75%	<0.5%	**Negligible**
ESR 8	29.63	29.74	<75%	<0.5%	**Negligible**
ESR 9	25.83	26.01	<75%	<0.5%	**Negligible**
ESR 10	33.01	33.10	76 – 94%	<0.5%	**Negligible**
ESR 11	50.66	50.71	>110%	<0.5%	**Negligible**
ESR 12	45.76	45.82	>110%	<0.5%	**Negligible**
ESR 13	23.62	23.66	<75%	<0.5%	**Negligible**
ESR 14	21.61	21.80	<75%	<0.5%	**Negligible**

[a] NO_2 concentrations obtained by inputting predicted NO_x concentrations into the NO_x to NO_2 calculator, in accordance with LAQM.TG(16)

[b]Assessed using the Impact Descriptors from the EPUK/IAQM guidance, included in Appendix C. Changes of less than 0.5% should be described as negligible

Underlined values represent an exceedance of the relevant AQO.

5.2.10 The results of the assessment show that all predicted NO_2 concentrations are below the objective level at all ESR locations except ESR 11 and ESR 12, where an exceedance is predicted both with and without the proposed development in the opening year of 2021.

Table 14: Predicted Adjusted NO_2 Concentrations for 2033 at Existing Sensitive Receptors for Scenarios 4 and 5 – Sensitivity Analysis

Receptor	Calculated Annual Mean NO_2 Concentrations ($\mu g/m^3$)[a]				
	Without Development Concentration	With Development		Concentration Change as Percentage of AQAL	Impact[b]
		Concentration	Percentage in Relation to AQAL		
ESR 1	19.92	24.70	<75%	>10%	**Moderate**
ESR 2	19.57	19.74	<75%	<0.5%	**Negligible**
ESR 3	25.63	23.40	<75%	<0.5%	**Negligible**
ESR 4	24.28	21.86	<75%	<0.5%	**Negligible**
ESR 5	26.55	26.87	<75%	1%	**Negligible**
ESR 6	31.76	31.70	76 – 94%	<0.5%	**Negligible**
ESR 7	22.42	21.30	<75%	<0.5%	**Negligible**
ESR 8	26.72	26.96	<75%	1%	**Negligible**
ESR 9	23.56	24.71	<75%	2 – 5%	**Negligible**
ESR 10	29.17	29.52	<75%	1%	**Negligible**
ESR 11	43.31	42.84	103 – 109%	<0.5%	**Negligible**
ESR 12	39.36	38.97	95 – 102%	<0.5%	**Negligible**
ESR 13	21.82	22.24	<75%	1%	**Negligible**
ESR 14	20.48	21.18	<75%	2 – 5%	**Negligible**

[a] NO_2 concentrations obtained by inputting predicted NO_x concentrations into the NO_x to NO_2 calculator, in accordance with LAQM.TG(16)

[b]Assessed using the Impact Descriptors from the EPUK/IAQM guidance, included in Appendix C. Changes of less than 0.5% should be described as negligible

Underlined values represent an exceedance of the relevant AQO.

5.2.11 The results of the assessment show that, in the future year of 2033, all predicted NO_2 concentrations are below the objective level at all ESR locations except ESR 11, where an exceedance is predicted both with and without the proposed developments.

Assessment of Significance for Human Health

5.2.12 The significance of the overall effects of the proposed developments has been assessed in accordance with the EPUK/IAQM guidance. This assessment is based on

professional judgement and details of the assessor's experience is included in **Appendix D**.

5.2.13 The assessment of significance has taken into account a number of factors, including:

- Baseline pollutant concentrations in 2018 and 2021 are predicted to be below the relevant annual mean objectives and limit values at all receptors, with the exception of exceedances of the objective for NO_2 at ESR 11 and ESR 12;
- Baseline pollutant concentrations in 2033 are predicted to be below the relevant annual mean objectives and limit values at all receptors considered;
- The air quality impact assessment both predicts a negligible impact on concentrations of NO_2, PM_{10} and $PM_{2.5}$ at all existing sensitive receptors considered, with the development in place for 2021;
- The air quality impact assessment for 2033 predicts a negligible impact on concentrations of NO_2, PM_{10} and $PM_{2.5}$ at all, except one of the existing sensitive receptors considered, with the development in place. There is a 'slight adverse' impact for NO_2 concentration predicted at one location, although the concentration is still well below the objective level;
- The sensitivity analysis for 2021 predicts a negligible impact on concentrations of NO_2 at all except one of the existing sensitive receptors considered, with the development in place. There is a 'slight adverse' impact for NO_2 concentration predicted at one location, although the concentration is still well below the objective level; and
- The sensitivity analysis for 2033 predicts a negligible impact on concentrations of NO_2 at all except one existing sensitive receptors considered, with the development in place. There is a 'moderate adverse' impact for NO_2 concentration predicted at one location, although the concentration is still well below the objective level.

5.2.14 Based on the above factors, in accordance with the EPUK/IAQM guidance, the effect of the proposed development on human health is considered to be **not significant**.

Recommendations for Mitigation

5.2.15 The air quality assessment considers the potential impact of development-generated vehicles on air quality at fourteen sensitive receptor locations. In accordance with the

IAQM/EPUK guidance, it is considered that the overall effect of the proposed developments on air quality is **'not significant'**.

5.2.16 It is therefore not considered that there is a requirement for mitigation with respect to air quality at existing human receptor locations.

6 CONCLUSIONS

6.1 Construction Phase Assessment

6.1.1 The construction phase assessment has been undertaken to determine the risk and significance of dust and fine particulate matter effects from demolition, earthworks, construction and trackout associated with the proposed development, in accordance with guidance published by the IAQM.

6.1.2 With site specific mitigation measures in place and following best practice, the significance of dust and fine particulate effects from earthworks, construction and trackout is considered to be **not significant**.

6.2 Operational Phase Assessment

Existing Sensitive Receptors

6.2.1 The assessment has predicted pollutant concentrations at fourteen existing sensitive receptors in the vicinity of the proposed development site.

6.2.2 Predicted impacts on NO_2, PM_{10} and $PM_{2.5}$ concentrations are negligible at all existing sensitive receptor locations assessed, in the 2021 opening year, and no new exceedances of the relevant air quality objectives and target levels are predicted.

6.2.3 Predicted impacts on NO_2, PM_{10} and $PM_{2.5}$ concentrations are negligible at all existing sensitive receptor locations assessed, in the 2033 future year, with the exception of one 'slight adverse' impact for NO_2. The NO_2 concentration, however, is predicted to be well below the objective level at this receptor and there are no new predicted exceedances of the relevant air quality objectives and target levels.

6.2.4 Using a robust sensitivity analysis methodology, a 'slight adverse' impact on NO_2 concentration is predicted at one existing sensitive receptor location in 2021; however, the concentration is predicted to be well below the objective level at this receptor. No new breaches of air quality objectives are predicted as a result of the development. Air quality impacts are therefore considered to be **not significant** in 2021.

6.2.5 Using a robust sensitivity analysis methodology, 'moderate adverse' impact on NO_2 concentration is predicted at one existing sensitive receptor location in 2033; however, the concentration is predicted to be well below the objective level at this receptor. No new breaches of air quality objectives are predicted as a result of the

development. Air quality impacts are therefore considered to be **not significant** in 2033.

Recommendations for Mitigation

6.2.6 The overall effect of the Proposed Development on human receptors is considered to be '**not significant**'.

6.3 Summary

6.3.1 The assessment has demonstrated that the proposed development will not lead to an unacceptable risk from air pollution, nor will it lead to any breach of national objectives as required by national policy. There are no material reasons in relation to air quality why the proposed scheme should not proceed.

APPENDICES

Appendix A
Air Quality Legislation and Guidance

Appendix A: Air Quality Legislation and Guidance

European Legislation

A.1 The European Union (EU) Ambient Air Quality Directive 2008/50/EC[1] (i.e. the CAFE Directive) came into force in June 2008. This EU Directive consolidates previous air quality legislation, with the exception of the 4th daughter Directive[2], and sets air quality limit values for seven pollutants. The Directive also provides a regulatory framework for fine particulate matter smaller than 2.5µm in diameter ($PM_{2.5}$).

A.2 EU Directive 2008/50/EC was transposed into legislation in the UK on 11th June 2010 as The Air Quality Standards Regulations 2010[3].

National Air Quality Strategy

A.3 The Environment Act 1995 requires the UK government to prepare a national Air Quality Strategy. The first UK strategy was published in March 1997, setting out policies for the management of ambient air quality. This was subsequently updated in 2007[4].

A.4 The 2007 strategy establishes the framework for air quality management in England, Scotland, Wales and Northern Ireland. Air quality standards and objectives are set out for eight pollutants which may potentially occur at levels that give cause for concern. The strategy also provides details of the role that local authorities are required to take in working towards improvements in air quality, known as the Local Air Quality Management (LAQM) regime.

Air Quality Standards and Objectives

A.5 Air quality standards and objectives are set out in the strategy for the following pollutants: nitrogen dioxide (NO_2), sulphur dioxide (SO_2), carbon monoxide (CO), lead (Pb), fine particulate matter (PM_{10}), benzene (C_6H_6), 1, 3–butadiene (C_4H_6) and ozone (O_3).

[1] Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe
[2] Directive 2004/107/EC of the European Parliament and the Council of 15th December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air
[3] The Air Quality Standards Regulations 2010
[4] Department of Environment, Food and Rural Affairs, The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. July 2007

A.6 Objectives for each pollutant, except O_3, were first given statutory status in the Air Quality Regulations 2000[5] and Air Quality (Amendment) Regulations 2002[6]. These objectives are defined in the strategy as:

"the maximum ambient concentration not to be exceeded, either without exception or with a permitted number of exceedances, within a specified timescale."

A.7 The EU limit values, transposed into UK legislation as The Air Quality Standards Regulations 2010, are mostly the same as the air quality objectives in terms of concentrations; however, there are differences in determining how compliance is achieved.

A.8 Whilst there is no specific objective for $PM_{2.5}$ in England and Wales, a limit value of 25µg/m^3 is referred to in the regulations, which has been adopted for use in this assessment (as recommended by the LAQM Helpdesk). An objective has been set for $PM_{2.5}$ in Scotland since early 2016.

A.9 Examples of where these objectives and limit values apply are detailed in the Defra LAQM Technical Guidance document LAQM.TG(16)[7] and are included in Table A1.

Table A1: Examples of Where the Air Quality Objectives Should Apply

Averaging Period	Objectives Should Apply at:	Objectives Should Generally Not Apply at:
Annual mean	All locations where members of the public might be regularly exposed. Building façades of residential properties, schools, hospitals, care homes, etc.	Building facades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
24-hour mean and 8-hour mean	All locations where the annual mean objectives would apply, together with hotels. Gardens of residential properties[a]	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
1-hour mean	All locations where the annual mean and 24 and 8-hour objectives apply. Kerbside sites (e.g. pavements of busy shopping streets).	Kerbside sites where public would not be expected to have regular access

[5] The Air Quality Regulations 2000. SI No 928
[6] The Air Quality (Amendment) Regulations 2002
[7] Department for Environment, Food and Rural Affairs, Local Air Quality Management Technical Guidance LAQM.TG(16), February 2018

Table A1: Examples of Where the Air Quality Objectives Should Apply		
Averaging Period	**Objectives Should Apply at:**	**Objectives Should Generally Not Apply at:**
	Those parts of car parks and railway stations etc. which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more. Any outdoor locations to which the public might reasonably be expected to spend one hour or longer	
15-minute mean	All locations where members of the public might reasonably be exposed for a period of 15 minutes or longer	
[a] Such locations should represent parts of the garden where relevant public exposure is likely, for example where there is seating or play areas. It is unlikely that relevant public exposure to pollutants would occur at the extremities of the garden boundary, or in front gardens, although local judgement should always be applied		

Local Air Quality Management

A.10 LAQM legislation in the Environment Act 1995 requires local authorities to conduct the periodic review and assessments of air quality. These aim to identify all those areas where the objectives are being, or are likely to be, exceeded. Where exceedances are likely to occur, local authorities are required to declare an Air Quality Management Area (AQMA).

A.11 LAQM.TG(16) presents a streamlined approach for LAQM in England and Scotland; however, Northern Ireland is still considering changes to LAQM and therefore works according to the previous regime.

A.12 The Welsh Government amended the LAQM regime in Wales in 2017 by issuing new statutory policy guidance in order to bring the system into line with the Well-being of Future Generations (Wales) Act 20158. This aims to achieve compliance with the national air quality objectives in specific hotspots and to reduce exposure to pollution more widely, so as to achieve the greatest public health benefit.

A.13 Local authorities in England are required to produce Annual Status Reports (ASRs), and in Scotland, Annual Progress Reports (APRs). These replace all other reports which previously had to be submitted including Updating and Screening Assessments, Progress Reports and Detailed Assessments (which would be produced to assist with an AQMA declaration).

[8] Well-being of Future Generations (Wales) Act 2015 (anaw 2)

A.14 Local authorities now have the option of a fast track AQMA declaration option. This allows more expert judgement to be used and removes the need for a Detailed Assessment where a local authority is confident of the outcome. Detailed Assessments should however still be used if there is any doubt.

A.15 As part of the UK Government's requirement to improve air quality, selected local authorities in England are also currently investigating the feasibility of setting up Clean Air Zones (CAZs). These are areas where targeted action and co-ordinated resources aim to improve air quality within an urban setting, in order to achieve compliance with the EU limit values within the shortest possible time.

A.16 Five local authorities outside of London were initially selected to implement a CAZ by 2020 (Birmingham, Leeds, Nottingham, Derby and Southampton). A further 23 local authorities were subsequently chosen to investigate the feasibility of establishing a CAZ, and 33 local authorities may potentially have to proceed to this stage where compliance is not achieved.

National Policy - National Planning Policy Framework (2019)

A.17 The updated National Planning Policy Framework (NPPF)[9] was adopted on 19th February 2019 and the following paragraph is considered relevant to this assessment. Paragraph 181 states:

'Planning policies should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of AQMAs and Clean Air Zones, and the cumulative impacts from individual sites in local areas.

Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in AQMAs and Clean Air Zones is consistent with the local air quality action plan.'

[9] Ministry of Housing, Communities and Local Government, National Planning Policy Framework, February 2019

Planning Practice Guidance

A.18 The Planning Practice Guidance (PPG)[10], updated in March 2014, states that whether or not air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to generate air quality impacts in an area where air quality is known to be poor. They could also arise where the development is likely to adversely impact upon the implementation of air quality strategies and action plans and/or, in particular, lead to a breach of EU legislation (including that applicable to wildlife).

A.19 Where a proposed development is anticipated to give rise to concerns about air quality, an appropriate assessment needs to be carried out. Where the assessment concludes that the proposed development (including mitigation) will not lead to an unacceptable risk from air pollution, prevent sustained compliance with national objectives or fail to comply with the requirements of the Habitats Regulations, then the local authority should proceed to decision with appropriate planning conditions and/or obligations.

Barnsley Air Quality Action Plan April 2017 (updated 2019)

A.20 The Barnsley Air Quality Action Plan (AQAP)[11] has been prepared by Barnsley Metropolitan Borough Council (BMBC) to outline the actions the council will take to improve air quality in Barnsley between 2017 and 2021, with joint working between BMBC and Highways England where actions will impact on Highways England's road network.

A.21 The AQAP sets out 26 actions to be implemented to improve air quality, under five key themes:

- Reduce Traffic;
- Behavioural Change;
- Increase Efficiency;
- Improve Fleet; and
- Regulation.

A.22 Full details of the planned actions can be found in the AQAP.

[10] Department for Communities and Local Government. Planning Practice Guidance: Air Quality, March 2014
[11] Barnsley Metropolitan Borough Council. Air Quality Action Plan April 2017 (updated 2019).

Appendix B
Methodology for Construction Phase Assessment

Appendix B: Methodology for Construction Phase Assessment

Institute of Air Quality Management Guidance

B.1 The methodology for the construction phase dust assessment is set out in guidance from the Institute of Air Quality Management (IAQM)[12].

Step 1

B.2 Step 1 is to screen the requirement for a more detailed assessment. The guidance states that an assessment will normally be required where there are existing sensitive human receptors within 350m of the site boundary and/or within 100m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s).

B.3 With regards to ecological receptors, the guidance states that an assessment will normally be required where there are existing receptors within 50m of the site boundary and/or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s).

B.4 Where any of these criteria are met, it is necessary to proceed to Step 2.

Step 2

B.5 Step 2 determines the potential risk of dust arising in sufficient quantities to cause annoyance and/or health or ecological impacts. The risk is related to:

- The activities being undertaken (demolition, number of vehicles and plant etc);
- The duration of these activities;
- The size of the site;
- The meteorological conditions (wind speed, direction and rainfall);
- The proximity of receptors to the activity;
- The adequacy of the mitigation measures applied to reduce or eliminate dust; and
- The sensitivity of receptors to dust.

B.6 The risk of dust impacts is determined using four risk categories: negligible, low, medium and high risk. A site is allocated to a risk category based upon the following two factors (known as Step 2A and Step 2B).

[12] Institute of Air Quality Management, Guidance on the Assessment of Dust from Demolition and Construction, February 2014

B.7 **Step 2A** assesses the scale and nature of the works which determines the potential dust emission magnitude as small, medium or large. Examples of how the magnitude may be defined are included in Table B1.

Table B1: Determining the Dust Emission Magnitude of Construction Phase Activities

Activity	Dust Emission Class		
	Large	**Medium**	**Small**
Demolition	Total building volume >50,000m^3; Potentially dusty construction material (e.g. concrete); On-site crushing and screening; Demolition activities >20m above ground level	Total building volume 20,000-50,000m^3; Potentially dusty construction material; Demolition activities 10-20m above ground level	Total building volume <20,000m^3; Construction material with low potential for dust release (e.g. metal cladding or timber)
Earthworks	Total site area >10,000m^2; Potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size); >10 heavy earth moving vehicles active at any one time; Formation of bunds >8m in height; Total material moved >100,000 tonnes	Total site area 2,500-10,000m^2; Moderately dusty soil type (e.g. silt); 5-10 heavy earth moving vehicles active at any one time; Formation of bunds 4-8m in height; Total material moved 20,000-100,000 tonnes	Total site area <2,500m^2; Soil type with large grain size (e.g. sand); <5 heavy earth moving vehicles active at any one time; Formation of bunds <4m in height; Total material moved <20,000 tonnes; Earthworks during wetter months
Construction	Total building volume >100,000m^3; On-site concrete batching; Sandblasting	Total building volume 25,000-100,000m^3; Potentially dusty construction material (e.g. concrete); On-site batching	Total building volume <25,000m^3; Construction material with a low potential for dust release (e.g. metal cladding or timber)
Trackout	>50 HDV (>3.5t) outward movements[a] in any one day[b]; Potentially dusty surface material (e.g. high clay content); Unpaved road length >100m	10-50 HDV (>3,5t) outward movements[a] in any one day[b]; Moderately dusty surface material (e.g. high clay content); Unpaved road length 50-100m	<10 HDV (>3.5t) outward movements[a] in any one day[b]; Surface material with low potential for dust release; Unpaved road length <50m

a. A vehicle movement is a one way journey i.e. from A to B, and excludes the return journey
b. HDV movements during a construction project may vary over its lifetime, and the number of movements is the maximum not the average

B.8 **Step 2B** considers the sensitivity of the area to dust impacts which is defined as low, medium or high. The sensitivity categories for different types of receptors are described in Table B2.

Table B2: Sensitivity Categories for Dust Soiling, Human Health and Ecological Effects

Sensitivity Category	Dust Soiling Effects	Health effects of PM_{10}	Ecological Effects
High	Users can reasonably expect to enjoy a high level of amenity; Appearance, aesthetics or value of a property would be diminished; Examples include dwellings, museums and other culturally important collections, medium and long term car parks and car show rooms	Locations where members of the public are exposed over a period of time relevant to the air quality objective for PM_{10}; Examples include residential properties, hospitals, schools, and residential care homes	Locations with an international or national designation and the designated features may be affected by dust soiling; Locations where there is a community of a particularly dust sensitive species; Examples include a Special Area of Conservation with dust sensitive features
Medium	Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; The appearance, aesthetics or value of their property could be diminished; People or property wouldn't reasonably be expected to be continuously present or regularly for extended periods of time; Examples include parks and places of work	Locations where people are exposed as workers and exposure is over a period of time relevant to the air quality objective for PM_{10}; Examples include office and shop workers but will generally not include workers occupationally exposed to PM_{10}	Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; Locations with a national designation where the features may be affected by dust deposition; Examples include a Site of Special Scientific Interest with dust sensitive features

Table B2: Sensitivity Categories for Dust Soiling, Human Health and Ecological Effects			
Sensitivity Category	**Dust Soiling Effects**	**Health effects of PM_{10}**	**Ecological Effects**
Low	Enjoyment of amenity would not reasonably be expected; Property would not be diminished in appearance, aesthetics or value; People or property would be expected to be present only for limited periods of time; Examples include playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads	Locations where human exposure is transient; Examples include public footpaths, playing fields, parks and shopping streets	Locations with a local designation where the features may be affected by dust deposition; Examples include a Local Nature Reserve with dust sensitive features

B.9 Based on the sensitivity of individual receptors, the overall sensitivity of the area to dust soiling, human health and ecological effects is then determined using the criteria detailed in Tables B3 to B5, respectively.

Table B3: Sensitivity of the Area to Dust Soiling Effects on People and Property[ab]					
Receptor Sensitivity	**Number of Receptors**	**Distance from Source (m)[c]**			
		<20m	**<50m**	**<100m**	**<350m**
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low
a. The sensitivity to the area should be derived for each of the four activities *b. Estimate the total number of receptors within the stated distance. Only the highest level of sensitivity from the table needs to be considered* *c. For trackout, distances should be measured from the side of the roads used by construction traffic. Without site specific mitigation, trackout may occur for up to 500m from large sites, 200m from medium sites and 50m from small sites, measured from the site exit. The impact declines with distance from the site and it is only necessary to consider trackout impacts up to 50m from the edge of the road*					

Table B4: Sensitivity of the Area to Human Health Impacts[ab]							
Receptor Sensitivity	**Annual Mean PM_{10} Concentration[c]**	**Number of Receptors[d]**	**Distance from Source (m)[e]**				
			<20m	**<50m**	**<100m**	**<200m**	**<350m**
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
		1-10	Low	Low	Low	Low	Low
	24-28µg/m^3	>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

a. *The sensitivity to the area should be derived for each of the four activities*
b. Estimate the total number of receptors within the stated distance. Only the highest level of sensitivity from the table needs to be considered
c. Most straightforwardly taken from the national background maps, but should also take account of local sources. The values are based on 32µg/m^3 being the annual mean concentration at which an exceedance of the 24-hour mean objective is likely in England, Wales and Northern Ireland. In Scotland, there is an annual mean objective of 18µg/m^3
d. In the case of high sensitivity receptors with high occupancy (such as schools or hospitals) approximate the number of people likely to be present. In the case of residential dwellings, just include the number of properties
e. For trackout, distances should be measured from the side of the roads used by construction traffic

Table B5: Sensitivity of the Area to Ecological Impacts[ab]		
Receptor Sensitivity	**Distance from the Source (m)[c]**	
	<20	**<50**
High	High	Medium
Medium	Medium	Low
Low	Low	Low

a. *The sensitivity to the area should be derived for each of the four activities*
b. Only the highest level of sensitivity from the table needs to be considered
c. For trackout, distances should be measured from the side of the roads used by construction traffic

B.10 These two factors are combined in **Step 2C** to determine the risk of dust impacts with no mitigation applied.

B.11 The risk of dust effects is determined for four types of construction phase activities, with each activity being considered separately. If a construction phase activity is not taking place on the site, then it does not need to be assessed. The four types of activities to be considered are:

- Demolition;
- Earthworks;
- Construction; and
- Trackout.

B.12 The risk of dust being generated by demolition activities at the site is determined using the criteria in Table B6.

Table B6: Risk of Dust Impacts for 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

B.13 The risk of dust being generated by earthworks and construction at the site is determined using the criteria in Table B7.

Table B7: Risk of Dust Impacts for Earthworks and 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

B.14 The risk of dust being generated by trackout at the site is determined using the criteria in Table B8.

Table B8: Risk of Dust Impacts for Trackout			
Sensitivity of Area	**Dust Emission Magnitude**		
	Large	**Medium**	**Small**
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Medium Risk	Low Risk	Negligible

Step 3

B.15 Step 3 of the assessment determines the site-specific mitigation required for each of the activities, based on the risk determined in Step 2. Mitigation measures are detailed in guidance published by the Greater London Authority[13], recommended for use outside the capital by LAQM guidance, and the IAQM guidance document itself. Professional judgement should be used to determine the type and scale of mitigation measures required.

B.16 If the risk is classed as negligible, no mitigation measures beyond those required by legislation will be necessary.

Step 4

B.17 Step 4 assesses the residual effect, with mitigation measures in place, to determine whether or not these are significant.

[11] Greater London Authority, The Control of Dust and Emissions from Construction and Demolition: Best Practice Guidance, 2006

Professional Judgement

B.18 The IAQM guidance makes reference to the use of professional judgement when assessing the risks of dust and fine particulate matter from demolition and construction sites. Details of the experience of the personnel involved with the project are provided in **Appendix D**

Appendix C
Methodology for Operational Phase Assessment

Appendix C: Methodology for Operational Phase Assessment

Atmospheric Dispersion Modelling Inputs

C.1 The atmospheric dispersion model ADMS-Roads (CERC, Version 4.1) has been used to assess the potential air quality impacts associated with development-generated road traffic emissions. This dispersion model is widely used and accepted for the purpose of undertaking assessments to support both planning and Environmental Permit applications.

Traffic Flow Data

C.2 The ADMS-Roads model requires the input of detailed road traffic flow data for those routes which may be affected by the proposed development, or which will affect the site itself.

C.3 Traffic flow data has been obtained from the appointed Transport consultants, Fore Consulting, and from the Department for Transport (DfT) website[14].

C.4 The study extent of the model is shown in Figure C1, below.

[14] Department for Transport, Traffic Counts Interactive Map (Accessed at: https://roadtraffic.dft.gov.uk/#6/55.254/-11.107/basemap-regions-countpoints)

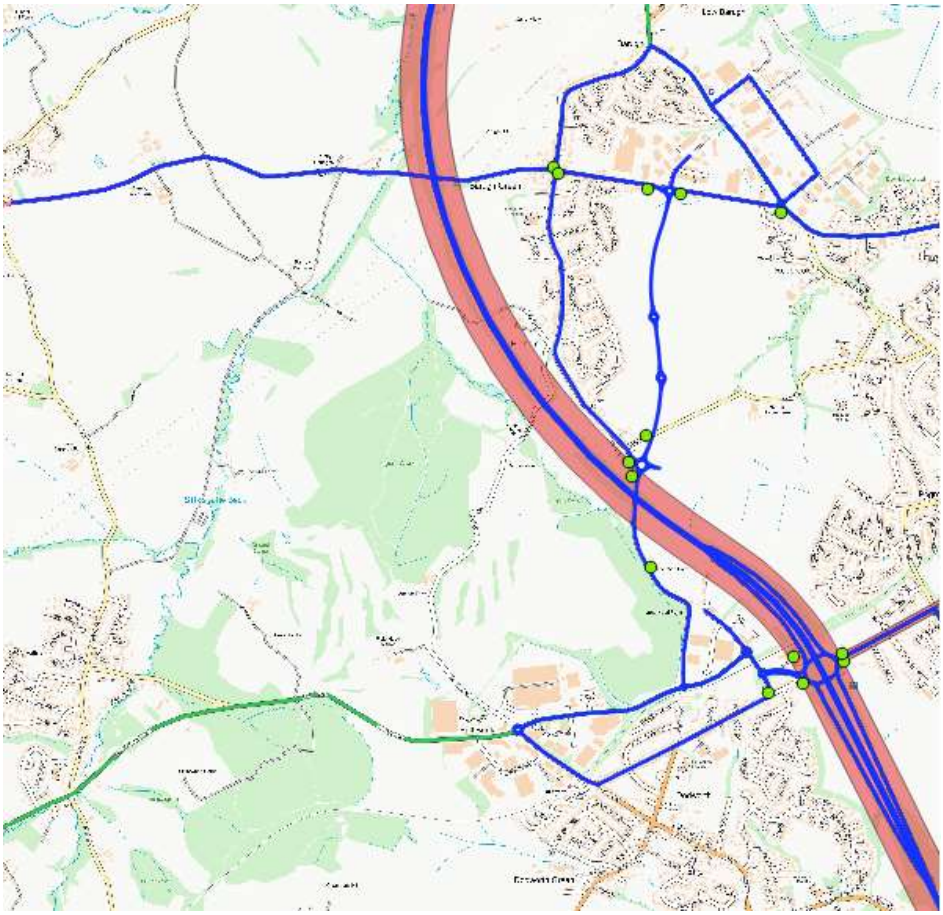


Figure C1: Study Extent of Atmospheric Dispersion Model. Roads are shown in blue. Existing Sensitive Receptor Locations are represented by green markers. The red shading represents the AQMA.

C.5 The traffic data used in the assessment is in 24-hour Annual Average Daily Traffic (AADT) format, with Heavy Duty Vehicle (HDV) numbers.

C.6 As no average speed limit information is available, speed limits have been used on free-flow sections of road. A reduction to 20kph has been included at locations where congestion or the slowing down of vehicles would be expected.

C.7 The traffic flow data used in the assessment is included in Tables C1 and C2 for 2021 and 2033 respectively.

Table C1: Traffic Data Used in the Air Quality Assessment

Link	Location	Speed (km/h)	Scenario 1: 2018 Verification and Base Year		Scenario 2: 2021 Opening Year, No Dev		Scenario 3: 2021 Opening Year, With Dev	
			AADT	HDV %	AADT	HDV %	AADT	HDV %
1	Cawthorne Road	97	8,574	2.19%	8,984	2.12%	8,984	2.12%
2	B6428 Barugh Lane	48	8,358	3.68%	8,757	3.56%	8,757	3.56%
3	Barugh Green Road	48	8,819	3.74%	9,240	3.62%	9,240	3.62%
4	Higham Common Road	48	6,645	3.17%	6,964	3.07%	6,964	3.07%
5	Barugh Green Road west	64	9,541	3.52%	9,998	3.41%	9,998	3.41%
6	Cannon Way	64	2,230	6.38%	2,337	6.17%	2,337	6.17%
7	Barugh Green Road east	64	9,906	3.68%	10,379	3.56%	10,379	3.56%
8	Site Access	64	N/A	N/A	0	N/A	0	N/A
9	Barugh Green Road west	64	10,309	3.37%	10,802	3.26%	10,802	3.26%
10	A637 Claycliffe Road	64	14,497	1.88%	15,190	1.82%	15,190	1.82%
11	Whaley Road	48	4,540	3.13%	4,757	3.03%	4,757	3.03%
12	A635	48	23,913	2.05%	25,057	1.98%	25,057	1.98%
13	M1 southbound off slip	81	7,334	3.18%	7,759	3.05%	7,759	3.05%
14	A628 Dodworth Road	48	26,872	3.51%	28,428	3.37%	28,428	3.37%
15	M1 southbound on slip	81	12,363	3.64%	13,077	3.49%	13,077	3.49%
16	M1 northbound off slip	81	12,011	4.55%	12,711	4.36%	12,711	4.36%
17	Whinby Road	64	25,313	4.09%	27,187	3.86%	27,187	3.86%
18	M1 northbound on slip	64	7,698	3.25%	8,137	3.12%	8,137	3.12%
19	Whinby Road east	64	24,476	4.16%	26,305	3.93%	26,305	3.93%
20	B6449	64	9,348	1.52%	9,939	1.45%	9,939	1.45%
21	Whinby Road north	48	19,043	4.90%	20,756	4.56%	20,756	4.56%
22	Capitol Close	48	1,388	7.38%	2,477	4.19%	2,477	4.19%
23	Whinby Road south	64	19,134	5.11%	20,852	4.76%	20,852	4.76%
24	Whinby Road west	64	18,246	4.86%	19,338	4.66%	19,338	4.66%
25	Higham Lane	97	9,086	2.69%	9,636	2.58%	9,636	2.58%
26	Whinby Road east	64	18,485	4.74%	19,583	4.54%	19,583	4.54%
27	Whinby Road west	64	14,884	5.16%	15,694	4.96%	15,694	4.96%

Table C1: Traffic Data Used in the Air Quality Assessment								
Link	Location	Speed (km/h)	Scenario 1: 2018 Verification and Base Year		Scenario 2: 2021 Opening Year, No Dev		Scenario 3: 2021 Opening Year, With Dev	
			AADT	HDV %	AADT	HDV %	AADT	HDV %
28	Higham Common Road north	48	9,280	2.45%	9,723	2.37%	9,723	2.37%
29	Site Access Employment	64	N/A	N/A	0	N/A	0	N/A
30	Site Access Link Road	64	N/A	N/A	0	N/A	0	N/A
31	Higham Common Road south	97	9,280	2.45%	9,723	2.37%	9,723	2.37%
32	M1 North of J37 Northbound	113	43,983	11.12%	46,287	11.12%	46,287	11.12%
33	M1 North of J37 Southbound	113	45,788	10.23%	48,187	10.23%	48,187	10.23%
34	M1 South of J37 Northbound	113	48,474	11.58%	51,014	11.58%	51,014	11.58%
35	M1 South of J37 Southbound	113	49,715	10.31%	52,320	10.31%	52,320	10.31%
36	M1 between Slip Roads Northbound	113	36,463	13.90%	38,303	13.98%	38,303	13.98%
37	M1 between Slip Roads Southbound	113	42,381	11.55%	44,561	11.58%	44,561	11.58%

Table C2: Traffic Data Used in the Air Quality Assessment						
Link	Location	Speed (km/h)	Scenario 4: 2033 Future Year, No Dev		Scenario 5: 2033 Future Year, With Dev	
			AADT	HDV %	AADT	HDV %
1	Cawthorne Road	97	10,260	2.13%	8,689	2.22%
2	B6428 Barugh Lane	48	10,001	3.67%	4,822	6.56%
3	Barugh Green Road	48	10,553	4.08%	7,160	4.74%
4	Higham Common Road	48	7,953	4.80%	3,823	5.67%
5	Barugh Green Road west	64	11,418	3.82%	9,199	3.76%
6	Cannon Way	64	2,669	5.50%	2,487	5.89%
7	Barugh Green Road east	64	11,853	3.92%	19,189	1.95%
8	Site Access	64	0	N/A	10,296	0.00%
9	Barugh Green Road west	64	12,337	3.63%	18,678	1.91%
10	A637 Claycliffe Road	64	17,348	1.62%	20,858	1.35%
11	Whaley Road	48	5,433	2.70%	5,289	2.77%
12	A635	48	28,616	2.08%	28,038	1.80%
13	M1 southbound off slip	81	8,850	2.92%	8,948	2.68%
14	A628 Dodworth Road	48	32,428	3.15%	31,203	3.12%
15	M1 southbound on slip	81	14,917	3.37%	15,002	3.08%
16	M1 northbound off slip	81	14,499	4.16%	14,980	3.75%
17	Whinby Road	64	30,955	3.98%	35,825	2.98%

Table C2: Traffic Data Used in the Air Quality Assessment						
Link	Location	Speed (km/h)	Scenario 4: 2033 Future Year, No Dev		Scenario 5: 2033 Future Year, With Dev	
			AADT	HDV %	AADT	HDV %
18	M1 northbound on slip	64	9,282	2.97%	9,585	2.69%
19	Whinby Road east	64	29,948	4.05%	35,189	2.98%
20	B6449	64	11,330	1.39%	15,080	0.97%
21	Whinby Road north	48	23,591	4.82%	27,745	3.46%
22	Capitol Close	48	2,684	3.93%	14,173	0.74%
23	Whinby Road south	64	23,699	4.99%	27,806	3.62%
24	Whinby Road west	64	22,054	4.94%	14,435	6.33%
25	Higham Lane	97	10,988	4.16%	4,699	5.36%
26	Whinby Road east	64	22,334	4.83%	15,326	5.88%
27	Whinby Road west	64	17,909	4.59%	17,730	4.46%
28	Higham Common Road north	48	11,104	2.11%	7,644	3.06%
29	Site Access Employment	64	0	N/A	0	0.00%
30	Site Access Link Road	64	0	N/A	8,765	0.00%
31	Higham Common Road south	97	11,104	2.11%	7,644	3.06%
32	M1 North of J37 Northbound	113	53,291	11.12%	53,291	11.12%
33	M1 North of J37 Southbound	113	55,478	10.23%	55,478	10.23%
34	M1 South of J37 Northbound	113	58,733	11.58%	58,733	11.58%
35	M1 South of J37 Southbound	113	60,236	10.31%	60,236	10.31%
36	M1 between Slip Roads Northbound	113	44,234	14.01%	43,752	14.26%
37	M1 between Slip Roads Southbound	113	51,386	11.59%	51,288	11.64%

Vehicle Emission Factors

C.8 The air quality assessment has used vehicle emission factors calculated using the Emissions Factor Toolkit (EFT) version 9, released in May 2019. This is the most up-to-date version of the EFT currently available.

C.9 As discussed in the section 3.4 of the report, there are uncertainties involved with the prediction of future NO_2 concentrations and therefore the air quality assessment incorporates a sensitivity analysis, which has applied 2018 background pollution concentrations and vehicle emission factors to the 2021 opening year to provide a robust conservative approach.

Meteorological Data

C.10 The meteorological data used in the atmospheric dispersion modelling has been

obtained from ADM Limited and is from the Emley Moor recording station, covering the period between 1st January and 31st December 2018.

C.11 The Emley Moor recording station is located approximately 10km to the northwest of the proposed development site and is considered to be the most representative of the conditions at the proposed development.

C.12 The 2018 wind rose for the Emley Moor Recording Station is shown in Figure C2.

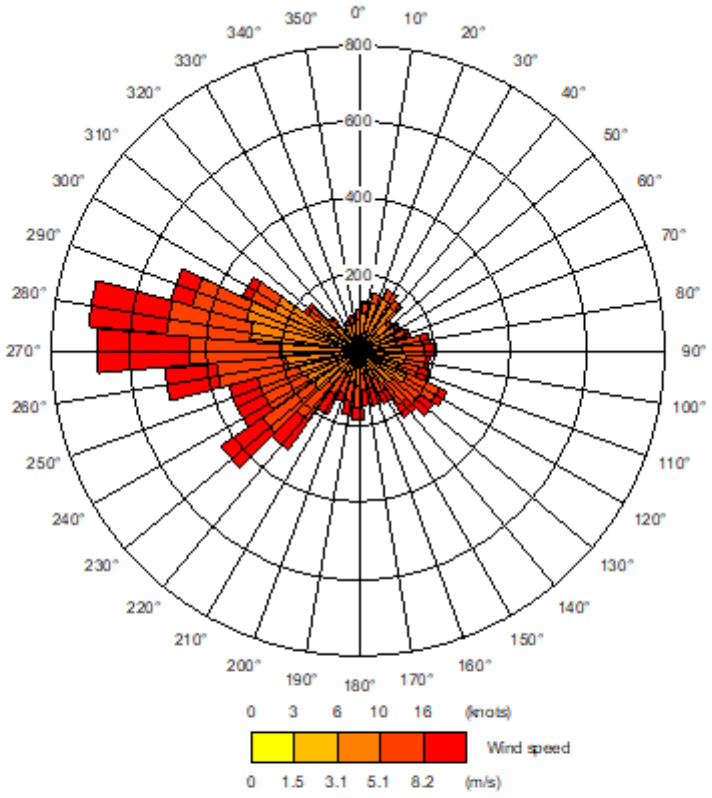


Figure C2: 2018 Wind Rose for the Emley Moor Meteorological Station

Dispersion and Meteorological Site Characteristics

C.13 The characteristics for the dispersion site and meteorological sites, included in the ADMS-Roads model, are detailed in Table C2.

Table C2: Dispersion and Meteorological Site Characteristics		
Setting	**Dispersion Site**	**Meteorological Site**
Surface Roughness	0.5m	0.02m
Surface Albedo	0.23	0.23
Minimum Monin-Obukhov Length	30m	30m
Priestley-Taylor Parameter	1	1

NO_x to NO_2 Conversion

C.14 In accordance with the guidance within LAQM.TG(16), the ADMS-Roads model has been run to predict the road-contribution NO_x concentrations for each receptor location. These have then been converted to NO_2 concentrations using the Defra NO_x to NO_2 calculator (v7.1)[15].

Model Validation and Verification

C.15 LAQM.TG(16) refers to model validation as *"the general comparison of modelled results against monitoring data carried out by model developers"*. ADMS-Roads is widely accepted by regulatory authorities for use in this type of assessment.

C.16 Model verification is used to check the performance of the model at a local level. The verification of the ADMS-Roads air dispersion model is achieved by modelling concentration(s) at existing monitoring location(s) in the vicinity of the proposed development and comparing the modelled concentration(s) with the measured concentration(s).

C.17 There are five roadside NO_2 diffusion tubes operated by BMBC adjacent to roads in the area for which traffic flow information is available. These are located along the A628 Dodworth Road. A number of diffusion tubes were also set up by AECOM to support the Sheffield City Region Infrastructure Fund (SCRIF) work; this data has been provided to us and details of the tubes used in this assessment are included below.

C.18 As no PM_{10} or $PM_{2.5}$ monitoring locations are situated along roads where traffic flow data is available, it has not been possible to carry out model verification for modelled PM_{10} or $PM_{2.5}$ concentrations.

C.19 The monitoring data that has been used in the model verification procedure is detailed in Table C3.

[15] Obtained from the Defra Local Air Quality Management (LAQM) web pages (accessed at: http://laqm.defra.gov.uk/tools-monitoring-data/no-calculator.html)

Table C3: NO_2 Diffusion Tube Monitoring Data Used for Verification Purposes				
Monitoring Location Reference	Site Type	Approximate Grid Reference		2018 Bias Adjusted NO_2 Annual Average Concentration (µg/m^3)
		Easting	Northing	
AECOM 1	Roadside	431453	407966	21.15
AECOM 2a	Roadside	431073	408139	25.21
AECOM 2b	Roadside	431158	408046	27.87
AECOM 5	Roadside	431951	407878	17.05
AECOM 8	Roadside	431404	406895	23.26
AECOM 9	Roadside	431447	406356	29.21
AECOM 10	Roadside	431510	405804	24.47
BMBC DT19	Roadside	432481	406068	25.70
BMBC DT20	Roadside	432535	406071	37.00
BMBC DT21	Roadside	432402	406013	45.80
BMBC DT22	Roadside	432351	405985	44.20
BMBC DT23	Roadside	432281	405951	43.40

C.20 The modelled road-contribution NO_x concentration for the diffusion tube has been compared against the measured road-contribution NO_x concentration for the same location. The measured concentration has been derived using the Defra NO_x to NO_2 calculator, taking into account the background NO_x concentration for the local area.

C.21 It is considered that the area of BMBC's AQMA No.2A along the A628 Dodworth Road represents an area likely to be subject to traffic congestion which does not apply elsewhere in the study network and therefore, a separate adjustment factor was calculated for the BMBC diffusion tubes DT19, DT20, DT21, DT 22 and DT23 located within this area and applied to the tubes and receptors in this area.

C.22 Following the model verification procedure for NO_2, an adjustment factor of 2.0304 was applied to NO_2 concentrations at ESRs 1 to 10 and ESRs 13 to 14 (outside AQMA No.2A), and an adjustment factor of 2.5903 applied to ESRs 11 and 12 inside AQMA No.2A.

C.23 There are no representative PM_{10} or $PM_{2.5}$ monitoring locations along the road network for which traffic flow information is available. Therefore, it has not been possible to undertake verification of PM_{10} or $PM_{2.5}$ concentrations.

Non-AQMA Verification

C.24 The comparison is shown in Figure C3. The equation of the trend line is based on linear regression through zero and provides an overall adjustment factor of 2.0304.

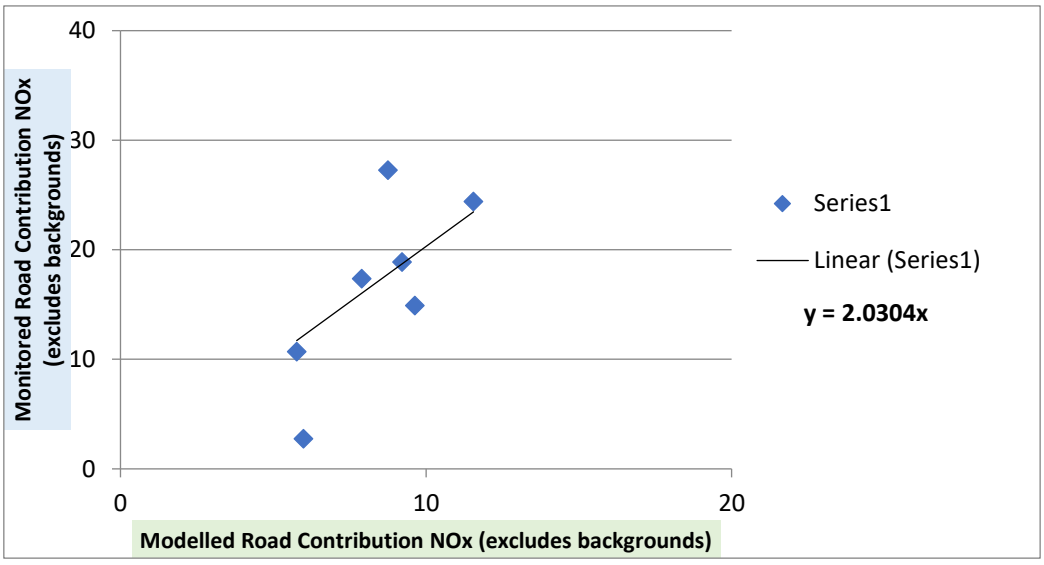


Figure C3: Comparison of Modelled Road Contribution NO_x Against Monitored Road Contribution NO_x Concentration (outside AQMA)

C.25 This adjustment factor has been applied to the modelled road-contribution NO_x concentrations for ESR locations outside AQMA No.2. The total NO_2 concentrations have been derived by combining the adjusted road-contribution NO_x concentration and background NO_2 concentration, using the Defra NO_x to NO_2 calculator.

C.26 A final comparison has been made between the total measured NO_2 concentrations and total modelled NO_2 concentrations, as shown in Table C4.

Table C4: Comparison Between Measured and Modelled NO_2 Concentrations

Monitoring Location Reference	Measured Total NO_2 Concentration ($\mu g/m^3$)	Adjusted Modelled Total NO_2 Concentration ($\mu g/m^3$)	Difference (%)
AECOM 1	21.15	21.65	2.39
AECOM 2a	25.21	25.13	-0.32
AECOM 2b	27.87	27.41	-1.67
AECOM 5	17.05	21.88	28.32
AECOM 8	23.26	25.53	9.75
AECOM 9	29.21	24.67	-15.56
AECOM 10	24.47	23.81	-2.71

C.27 A Root Mean Square Error (RMSE) calculation has been undertaken as part of the model verification for NO_2 concentrations. This has been carried out for the two monitoring locations included within the model verification, in accordance with the guidance detailed in LAQM.TG(16).

C.28 The RMSE calculation following adjustment is detailed in Table C5.

Table C5: RMSE Calculation for Nitrogen Dioxide Concentrations					
Monitoring Location	After Verification				
	Observed Value	Predicted Value	Difference	RMSE	RMSE as %AQO
AECOM 1	21.15	21.65	-0.50	2.67	6.68%
AECOM 2a	25.21	25.13	0.08		
AECOM 2b	27.87	27.41	0.46		
AECOM 5	17.05	21.88	-4.83		
AECOM 8	23.26	25.53	-2.27		
AECOM 9	29.21	24.67	4.54		
AECOM 10	24.47	23.81	0.66		

C.29 LAQM.TG(16) states that "ideally an RMSE value within 10% of the objective would be derived", a value of within 25% is considered acceptable. The results of the calculation show that following model verification, the RMSE value is within 10% (i.e. 4µg/m^3) of the objective (i.e. 40µg/m^3). Therefore, the model is considered to be performing to an acceptable standard at these locations.

AQMA No.2A Verification

C.30 The comparison is shown in Figure C4. The equation of the trend line is based on linear regression through zero, and provides an overall adjustment factor of 2.5903.

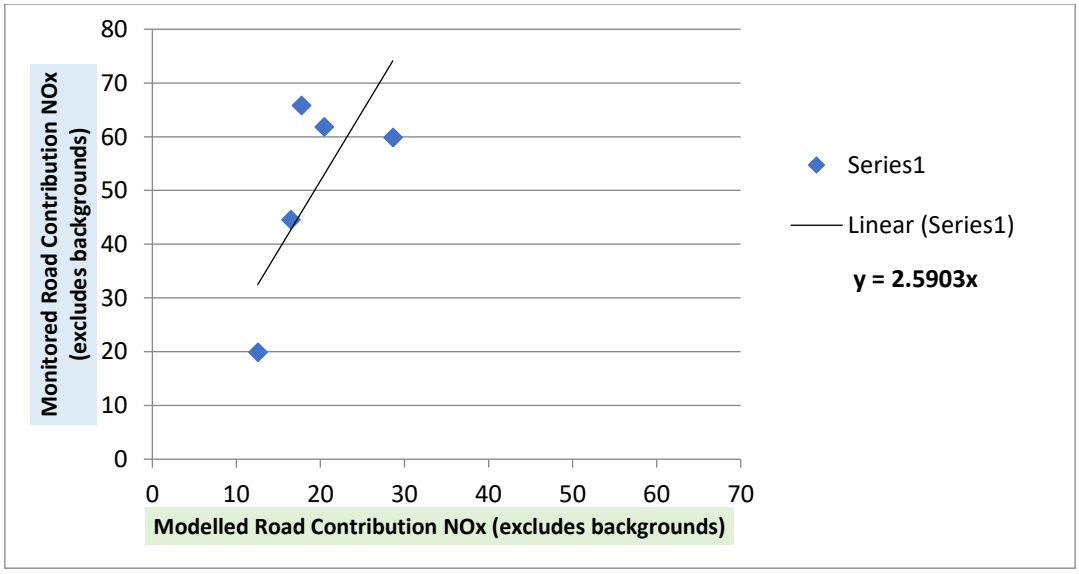


Figure C4: Comparison of Modelled Road Contribution NO_x Against Monitored Road Contribution NO_x Concentration (inside AQMA No.2A)

C.31 This adjustment factor has been applied to the modelled road-contribution NO_x concentrations for ESR locations outside AQMA No.2. The total NO_2 concentrations have been derived by combining the adjusted road-contribution NO_x concentration and background NO_2 concentration, using the Defra NO_x to NO_2 calculator.

C.32 A final comparison has been made between the total measured NO_2 concentrations and total modelled NO_2 concentrations, as shown in Table C4.

Table C4: Comparison Between Measured and Modelled NO_2 Concentrations

Monitoring Location Reference	Measured Total NO_2 Concentration (µg/m^3)	Adjusted Modelled Total NO_2 Concentration (µg/m^3)	Difference (%)
BMBC DT19	25.70	31.62	23.04
BMBC DT20	37.00	36.16	-2.27
BMBC DT21	45.80	37.58	-17.95
BMBC DT22	44.20	40.56	-8.24
BMBC DT23	43.40	49.03	12.97

C.33 A Root Mean Square Error (RMSE) calculation has been undertaken as part of the model verification for NO_2 concentrations. This has been carried out for the two monitoring locations included within the model verification, in accordance with the guidance detailed in LAQM.TG(16).

C.34 The RMSE calculation following adjustment is detailed in Table C5.

Table C5: RMSE Calculation for Nitrogen Dioxide Concentrations

Monitoring Location	After Verification				
	Observed Value	Predicted Value	Difference	RMSE	RMSE as %AQO
BMBC DT19	25.70	31.62	-5.92	5.45	13.61%
BMBC DT20	37.00	36.16	0.84		
BMBC DT21	45.80	37.58	8.22		
BMBC DT22	44.20	40.56	3.64		
BMBC DT23	43.40	49.03	-5.63		

C.35 LAQM.TG(16) states that "ideally an RMSE value within 10% of the objective would be derived", a value of within 25% is considered acceptable. The results of the calculation show that following model verification, the RMSE value is within 25% (i.e. 10µg/m^3) of the objective (i.e. 40µg/m^3). Therefore, the model is considered to be performing to an acceptable standard at these locations.

Assessment Criteria

Assessing the Impact of a Proposed Development on Human Health

C.36 Guidance has been prepared by Environmental Protection UK (EPUK) and the IAQM[16] with relation to the assessment of the air quality impacts of proposed developments

[16] Moorcroft and Barrowcliffe et al, Land-Use Planning and Development Control: Planning for Air Quality (v1.2), January 2017

and their significance.

C.37 The impact of a development is usually assessed at specific receptors, and takes into account both the long-term background concentrations, in relation to the relevant Air Quality Assessment Level (AQAL) at these receptors, and the change with the development in place.

C.38 The impact descriptors for individual receptors are detailed in Table C6.

Table C6: Impact Descriptors for Individual Receptors

Long Term Average Concentration at Receptor in Assessment Year*	Percentage Change in Concentration Relative to Air Quality Assessment Level (AQAL)*			
	1%	2-5%	6-10%	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

**Percentage pollutant concentrations have been rounded to whole numbers, to make it easier to assess the impact. Changes of 0% (i.e. less than 0.5% or 0.2µg/m^3) should be described as Negligible*

Determining the Significance of Effects

C.39 Impacts on air quality, whether adverse or beneficial, will have an effect on human health that can be judged as either 'significant' or 'not significant'.

C.40 Once the impact of the proposed development has been assessed for the individual impacts, the overall significance is determined using professional judgement. This takes into account a number of factors such as:

- The existing and future air quality in the absence of the development;
- The extent of the current and future population exposure to the impacts; and
- The influence and validity of any assumptions adopted when undertaking the prediction of impacts.

Appendix D

Professional Experience of Assessors

Appendix D: Professional Experience of Assessors

D.1 The assessment of air quality impacts, and the significance of the associated effects, takes into account the professional judgement of the assessor. Details of the experience of the personnel involved with the project are provided below:

Dr Paul Sanderson **Environmental Scientist**
BSc (Hons) MSc DPhil MIEnvSc MIAQM

Paul is a PhD qualified Air Quality Specialist, and Member of The Institution of Environmental Sciences and Institute of Air Quality Management who has completed a number of projects examining the air quality impact of various schemes including residential and commercial developments. He has good experience in the use of ADMS Roads advanced dispersion model for undertaking detailed air quality modelling.

Paul has been involved in large complex EIA schemes as well as smaller individual commissions as part of planning applications and also has experience in air quality monitoring using nitrogen dioxide diffusion tubes as well as undertaking numerous dust assessments.

Paul also has experience in liaising with transport consultants on traffic data requirements for input and taking responsibility for of undertaking the technical aspects relating to the dispersion modelling as well as preparation of technical reports and chapters.

Mariam Weatherley **Associate Director**
BSc (Hons) MSc CEnv MIEnvSc MIAQM **(Air Quality)**

Mariam is a Chartered Environmental Scientist, with wide experience in the environmental profession predominantly in relation to air quality, gained from 14 years employment in this sector. Mariam's background in environmental consultancy has provided her with a good range of skills and knowledge through the involvement in air quality projects both as individual commissions and as part of EIAs for public and private sector clients. Mariam has an advanced knowledge of modelling techniques and monitoring (including monitoring strategies, passive monitoring techniques and automatic stations) and has led teams of air quality specialists on technical assessments.

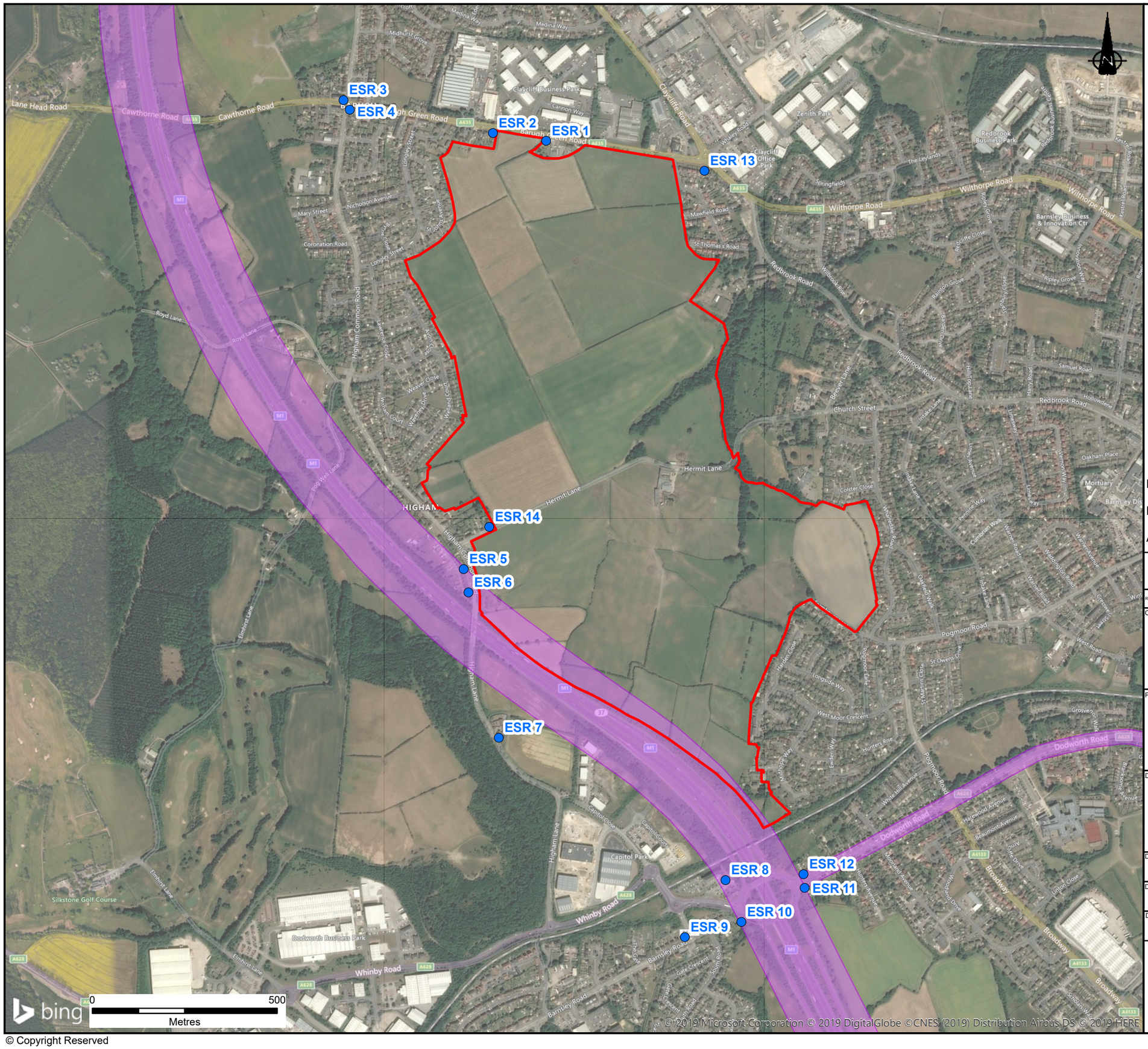
Mariam frequently carries out the role of Project Manager for air quality projects, offering specialist air quality analysis, interpretation and advice ensuring that the air quality aspects of the services are appropriately addressed.

Mark Dawson **Technical Director**

BSc (Hons), MA (Env Law), Dip (Air Pollution Control), Dip (Acoustics & Noise Control), CEnv, MIEnvSc, MIOA, MIAQM, FRMetS

Mark holds a Bachelor of Science degree in Geography, the Diploma in Air Pollution Control, the Diploma in Acoustics and Noise Control and a Masters in Environmental Law and Policy. Mark is a Chartered Environmentalist and Member of the Institute of Environmental Sciences, Institute of Acoustics, Institute of Air Quality Management and Fellow of the Royal Meteorological Society. Mark has over 30 years' experience in regulation and consultancy, having given expert witness evidence to over forty planning inquiries. Mark is the service lead for acoustics and air quality at Wardell Armstrong. He has extensive experience of managing commissions involving environmental impact assessment. He is involved in noise and air quality impact studies for residential, commercial, industrial and retail developments and mineral and waste operations. The majority of the work is carried out in support of planning applications and Mark has long experience of dealing with environmental health officers and planning officers.

DRAWING



KEY

- Site Boundary
- AQMA Boundary
- Existing Sensitive Receptors

Notes:

Boundaries are indicative.

Aerial imagery shown for context purposes only.

REVISION	DETAILS	DATE	DRAWN	CHK'D	APP'D

CLIENT

STRATA STERLING BARNSLEY WEST LIMITED

PROJECT

BARNSLEY WEST ROUNDABOUT APPLICATIONS

DRAWING TITLE

EXISTING SENSITIVE RECEPTORS

DRG No.	REV
ST17019-001	A

DRG SIZE	SCALE	DATE
A3	1:10,000	22/11/2019

DRAWN BY	CHECKED BY	APPROVED BY
EF	MW	MTW

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