Land at Bankside (Phase 2)
Banbury

Air Quality Assessment

Hallam Land Management

Brookbanks

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Contents

Appendix

1 Introduction

1.1 Brookbanks was commissioned to undertake an air quality assessment for a proposed residential development on land off Oxford Road in Banbury. The "Site" location is identified in Figure 1.

1.2 It is proposed to develop the Site to provide up to 850 residential properties with associated infrastructure and landscaping.

1.3 Cherwell District Council (CDC) has declared a number of Air Quality Management Areas (AQMA) within the borough due to exceedances of the annual mean NO_2 air quality objective at locations of relevant exposure. One of these is located in the centre of Banbury incorporating sections of the A361, the main road through Banbury, approximately 2.6km to the north of the Site. Although the Site does not fall within the AQMA, there is a risk that traffic generated by the operation of the Development would impact on air quality within the this AQMA. The impact of the Development on local air quality within this AQMA has therefore been considered.

1.4 This report presents the findings of a detailed air quality assessment of the potential impacts of the Proposed Development on local air quality during construction and operation. It also assesses the suitability of the Site for residential development with regards to exposure of future occupants to elevated pollution concentrations and impacts of the operational phase on local air quality. For both the construction and operational phases of the development the type, source and significance of potential impacts are identified and the measures that should be employed to minimise any identified impacts and exposure to elevated pollution are described.

1.5 A glossary of common air quality terminology is provided in Appendix A.

Figure 1: Site Location

2 Legislation and Policy

Air Quality Strategy for England, Scotland, Wales & Northern Ireland

2.1 The Government's policy on air quality within the UK is set out in the Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland (AQS) published in July 2007[1] , pursuant to the requirements of Part IV of the Environment Act 1995. The AQS sets out a framework for reducing hazards to health from air pollution and ensuring that international commitments are met in the UK. The AQS is designed to be an evolving process that is monitored and regularly reviewed.

2.2 The AQS sets standards and objectives for ten main air pollutants to protect health, vegetation and ecosystems. These are benzene (C_6H_6), 1,3-butadiene (C_4H_6), carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), particulate matter (PM_{10}, $PM_{2.5}$), sulphur dioxide (SO_2), ozone (O_3) and polycyclic aromatic hydrocarbons (PAHs).

2.3 The air quality standards are long-term benchmarks for ambient pollutant concentrations which represent negligible or zero risk to health, based on medical and scientific evidence reviewed by the Expert Panel on Air Quality Standards (EPAQS) and the World Health Organisation (WHO). These are general concentration limits, above which sensitive members of the public (e.g. children, the elderly and the unwell) might experience adverse health effects.

2.4 The air quality objectives are medium-term policy based targets set by the Government which take into account economic efficiency, practicability, technical feasibility and timescale. Some objectives are equal to the EPAQS recommended standards or WHO guideline limits, whereas others involve a margin of tolerance, i.e. a limited number of permitted exceedances of the standard over a given period.

2.5 For some pollutants there is both a long-term (annual mean) standard and a short-term standard. In the case of NO_2, the short-term standard is for a 1-hour averaging period, whereas for PM_{10} it is for a 24-hour averaging period. These periods reflect the varying impacts on health of differing exposures to pollutants (e.g. temporary exposure on the pavement adjacent to a busy road, compared with the exposure of residential properties adjacent to a road).

2.6 The AQS also contains a framework for considering the effects of a finer group of particles known as '$PM_{2.5}$' Local Authorities are required to work towards reducing emissions / concentrations of $PM_{2.5}$, but there is currently no statutory objective incorporated into UK law at this time.

2.7 The AQS objective levels relevant to this assessment are presented in Appendix B.

Local Air Quality Management (LAQM)

2.8 Part IV of the Environment Act 1995 also requires local authorities to periodically review and assess the quality of air within their administrative area. The Reviews have to consider the present and future air quality and whether any air quality objectives prescribed in Regulations are being achieved or are likely to be achieved in the future.

2.9 Where any of the prescribed air quality objectives are not likely to be achieved, the authority concerned must designate that part an Air Quality Management Area (AQMA).

[1] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland – July 2007

2.10 For each AQMA, the local authority has a duty to draw up an Air Quality Action Plan (AQAP) setting out the measures the authority intends to introduce to deliver improvements in local air quality in pursuit of the air quality objectives. Local authorities are not statutorily obliged to meet the objectives, but they must show that they are working towards them.

2.11 The Department of Environment, Food and Rural Affairs (Defra) has published technical guidance for use by local authorities in their Review and Assessment work[2]. This guidance, referred to in this chapter as LAQM.TG(16), has been used where appropriate in the assessment.

National Planning Policy Framework

2.12 Published on 27th March 2012, the National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these are expected to be applied.

2.13 At the heart of the NPPF is a presumption in favour of sustainable development. It requires Local Plans to be consistent with the principles and policies set out in the Framework with the objective of contributing to the achievement of sustainable development.

2.14 The revised NPPF[3] was published in July 2018 and states that 'planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas'. It outlines the principles upon which the planning process can take account of air quality impacts associated with new developments. It outlines the role of Local Plans in promoting sustainability and providing limitations on development in areas of poor air quality. An emphasis is placed on consultation with the planning authority to determine whether there are any local issues with the potential to affect the scope of an air quality assessment. Typical air quality mitigation measures are outlined highlighting the use of planning conditions and funding obligations to off-set any significant impacts.

Control of Dust and particulates Associated with Construction

2.15 Section 79 of the Environmental Protection Act (1990) provides the following definitions of statutory nuisance relevant to dust and particulates:

- *'Any dust or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance'*
- *'any accumulation or deposit which is prejudicial to health or a nuisance'*

2.16 Following this, Section 80 states that where a statutory nuisance is shown to exist, the local authority must serve an abatement notice. Failure to comply with an abatement notice is an offence and if necessary, the local authority may abate the nuisance and recover expenses.

2.17 In the context of the Proposed Development, the main potential for nuisance of this nature will arise during the construction phase - potential sources being the clearance, earthworks, construction and landscaping processes.

2.18 There are no statutory limit values for dust deposition above which 'nuisance' is deemed to exist - 'nuisance' is a subjective concept and its perception is highly dependent upon the existing conditions and the change which has occurred. However, research has been undertaken by a number of parties to determine community responses to such impacts and correlate these to dust deposition rates.

Cherwell Local Plan 2011 to 2031 (adopted July 2015)

[2] Department for Environment, Food and Rural Affairs (DEFRA), (2016): Part IV The Environment Act 1995 Local Air Quality Management Review and Assessment Technical Guidance LAQM.TG(16)
[3] Department for Communities and Local Government, National Planning Policy Framework, July 2018

2.19 The local plan sets out the long term spatial vision for the District and provides policies to assist in delivering the vision. The local plan contains no policies specific to air quality.

3 Methodology

Scope of Assessment

3.1 The scope of the assessment has been determined in the following way:

- Review of development proposals in the context of the surrounding area;
- Review of air quality data for the area surrounding the Site and background pollutant maps;
- Review of the traffic flow data, which has been used as an input to the air quality modelling assessment.

3.2 The development proposals will provide up to 850 dwellings with associated infrastructure and landscaping; therefore there is the potential for impacts on local air quality during both the construction and operational phases of the Proposed Development. The Banbury AQMA is located approximately 2.6km to the north of the Site. There is therefore a risk that traffic generated by the operational development will impact air quality within the AQMA.

3.3 Details of the assessment methodology and the specific issues considered are provided below.

Construction Phase Methodology

Construction Traffic

3.4 During construction of the Proposed Development, lorries will require access to the Site to deliver and remove materials; earthmoving plant and other mobile machinery will work on site and generators and cranes will also be in operation. These machines produce exhaust emissions; of particular concern are emissions of NO_2 and particulate matter (PM_{10} and $PM_{2.5}$).

3.5 No information has been provided on the number of vehicles that will be generated during the construction period, however, based on the size of the development proposals it is anticipated that there will be in excess of 50 additional Heavy Duty Vehicles (HDV) generated on the adjacent road network per day.

3.6 The recently published Environmental Protection UK (EPUK) and Institute of Air Quality Management (IAQM) air quality guidance[4] sets out criteria to assist in establishing when an air quality assessment will be required. These criteria indicate that significant impacts on air quality are unlikely to occur where a development results in less than 25 additional vehicles per day in locations within an AQMA and less than 100 outside of an AQMA. The Site is not located within or close to an AQMA, however the most direct route to the Site for traffic approaching from the M40 motorway is through an AQMA. Therefore, it is considered that construction traffic generated by the Proposed Development may impact the local NO_2, PM_{10} and $PM_{2.5}$ concentrations within the AQMA.

3.7 A qualitative assessment of the impact of emissions from construction traffic on local air quality has been undertaken using professional judgement and by considering the number and type of construction traffic and plant likely to be generated, the number and proximity of sensitive receptors to the Site and along the likely routes to be used by construction vehicles and the likely duration of the construction phase.

Construction Dust

[4] EPUK & IAQM (May 2015) Land-Use Planning & Development Control: Planning for Air Quality

3.8 To assess the potential impacts associated with dust and particulate matter releases during the construction phase and to determine any necessary mitigation measures, an assessment based on the latest guidance from the Institute of Air Quality Management[5] has been undertaken.

3.9 This approach divides construction activities into the following four categories:

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

3.10 The assessment methodology requires consideration of dust effects arising from three potential impacts:

- annoyance due to dust soiling;
- harm to ecological receptors; and
- the risk of health effects due to a significant increase in exposure to PM_{10}.

3.11 The three impacts are assessed taking into account the sensitivity of the area likely to experience these effects, with the results of the assessment being used to define appropriate mitigation measures to prevent any significant effects at nearby receptors.

3.12 The IAQM guidance sets out the assessment in a number of steps. The first is an initial screening assessment to determine if there are any sensitive receptors (both human and ecological) within 350 m of the site boundary or within 100m of the proposed construction haulage routes, thus determining the requirement for a more detailed evaluation.

3.13 Step 2 of the methodology assesses the risk of dust impacts for each construction activity and takes account of:

- the scale and nature of the works, which determines the potential dust emission magnitude (step 2a); and
- the sensitivity of the area (step 2b).

3.14 Risks are described in terms of there being a low, medium or high risk of dust effects for each of the four separate potential activities. This assessment is based on both IAQM criteria and professional judgement.

3.15 The outcome of the above two steps are then combined (step 2c) to identify the risk of dust impacts, which are described in terms of there being a low, medium or high risk of dust effects for each of the four activity groups and assuming no mitigation measures are in place.

3.16 Based on the identified risk, appropriate mitigation measures are identified as set out in the IAQM guidance.

3.17 All construction sites are different and the potential for dust impacts are dependent on a number of local factors. The methodology set out in the IAQM guidance is therefore considered as a framework for assessing dust impacts and a certain level of professional judgement is required in determining the effects from each site.

3.18 The significance of identified effects is evaluated post mitigation using professional judgement and assuming that the mitigation measures identified and set out within the assessment are implemented by way of a Dust Management Plan (DMP).

Operational Phase Methodology

[5] Institute of Air Quality Management, (February 2014), *Guidance on the Assessment of Dust from Demolition and Construction.*

3.19 The prediction of air quality at the Site and surrounding area has been undertaken using the ADMS Roads dispersion model. This is a commercially available dispersion model and has been widely validated for this type of assessment and used extensively in the Air Quality Review and Assessment process.

3.20 The model uses detailed information regarding traffic flows on the local road network and local meteorological conditions to predict pollution concentrations at specific locations selected by the user. Meteorological data from the Church Lawford Meteorological Station from 2016 has been used for the assessment.

3.21 The model uses traffic flow data and vehicle related emission factors to predict road specific concentrations of oxides of nitrogen (NO_x), PM_{10} and $PM_{2.5}$ at sensitive receptors selected by the user. The predicted concentrations of NO_x have been converted to NO_2 using the LAQM calculator on the Defra air quality website[6].

3.22 Traffic data for the road network in the vicinity of the Site have been provided by the transport consultants, Markides Associates Ltd, for the 2016 base year and the anticipated completion year of 2031 with and without development scenarios. A summary of the traffic data used in the assessment can be found in Appendix C. The data includes details of annual average daily traffic flows (AADT), vehicle speeds and percentage heavy duty vehicles (HDV).

3.23 To predict local air quality, traffic emissions predicted by the model must be added to local background concentrations. Background concentrations of NOx, NO_2, PM_{10} and $PM_{2.5}$ have been taken from the 2015 Defra background maps. 2016 background concentrations have been used for the future year scenarios in 2031 to ensure a worst-case prediction of future air quality. The background concentrations used in the assessment are provided in Figure 4c.

3.24 The emission factors released by Defra in December 2017, provided in the emissions factor toolkit EFT20167_8.0.1 and have been used within the ADMS model (Version 4.1.1.0) to predict traffic emissions in 2016 and 2031.

3.25 It is recommended, following guidance set out in LAQM.TG(16), that the model results are compared with measured data to determine whether the model results need adjusting to more accurately reflect local air quality. This process is known as verification.

3.26 LAQM.TG(16) recommends that model predictions should be within 25% (preferably 10%) of monitored concentrations for the model to be predicting with any degree of accuracy. The model has been used to predict NO_2 concentrations at a number of monitoring locations in the vicinity of the Site to verify the model results. This includes monitoring sites located within the AQMA.

3.27 The results of the comparison are presented below in Figure 3a.

Monitoring Locations	Measured Concentrations (NO_2)	Modelled Concentrations (NO_2)	% Difference
Bridge Street	33.0	40.3	22%
Bankside	17.9	22.3	25%
High Street	34.6	41.5	20%
Oxford Road / South	35.5	40.9	15%
Horsefair	38.8	40.9	5%
Oxford Road 2014	22.1	24.7	12%
Cherwell Street 2014	37.7	39.8	6%

Figure 3a: Comparison of Modelled and Monitored NO_2 Concentrations ($\mu g/m^3$)

3.28 The comparison of monitored and modelled concentrations indicates that the model is overpredicting annual mean NO_2 concentrations by up to 25%. The results of the modelling assessment have been adjusted using the methodology given in LAQM.TG(16). Full details of the verification and calculation of adjustment factors are provided in Appendix D.

3.29 There is no suitable monitoring data for PM_{10} or $PM_{2.5}$ to allow verification of the PM model results. However, LAQM.TG(16) suggests applying the NO_x adjustment factor to modelled road-PM where no appropriate verification

[6] http://uk-air.defra.gov.uk

against PM data can be carried out. The adjustment factors calculated for the NO_x data have therefore been used to adjust the predicted PM_{10} and $PM_{2.5}$ data.

3.30 LAQM.TG(16) does not provide a method for the conversion of annual mean NO_2 concentrations to 1-hour mean NO_2 concentrations. However, research[7] has concluded that exceedances of the 1-hour mean objective are generally unlikely to occur where annual mean concentrations do not exceed 60 µg/m^3. Care has been taken to ensure that locations where the 1-hour mean objective is relevant are included in the assessment.

3.31 Quantitative assessment of the impacts on local air quality from road traffic emissions associated with the operation of the development have been completed against the Air Quality Strategy objectives set out in Appendix B for NO_2, PM_{10} and $PM_{2.5}$.

Significance Criteria

3.32 The guidance issued by EPUK & IAQM relates to Air Quality considerations within the planning process and sets criterion which identify the need for an Air Quality Assessment, the type of Air Quality assessment required, and the significance of any predicted impact.

3.33 The guidance recommends that the impact at individual receptors is described by expressing the magnitude of incremental change in pollutant concentrations as a proportion of an Air Quality Assessment Level (AQAL) such as the air quality objectives set out in Appendix B. The significance of impact is then identified based on the incremental change in the context of the new total concentrations and its relationship with the assessment criteria, noting whether the impact is adverse or beneficial based on a positive or negative change in concentrations. The criteria suggested for assigning significance is set out in Figure 3b below.

Long-term average concentration at receptor in assessment year	% Change in Concentration relative to Air Quality Assessment Level (AQAL)			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Minor	Moderate
76-94% of AQAL	Negligible	Minor	Moderate	Moderate
95-102% of AQAL	Minor	Moderate	Moderate	Major
103-109% of AQAL	Moderate	Moderate	Major	Major
110% or more of AQAL	Moderate	Major	Major	Major

AQAL – Air Quality Assessment Level which in this assessment refers to the Air Quality Objectives set out in Appendix A
The percentage change in concentration should be rounded to a whole number
The table should only be used with annual mean concentrations
The descriptors are for individual receptors only: overall significance should be based on professional judgment
When defining the concentrations as a percentage of the AQAL use the 'without scheme' concentration where there is a decrease in pollutant concentrations and the 'with scheme' concentrations for an increase
The total concentration categories reflect the degree of potential harm by reference to the AQAL value. At exposure less than 75% of this value i.e. well below, the degree of harm is likely to be small. As exposure approaches and exceeds the AQAL, the degree of harm increases. This change naturally becomes more important when the result is an exposure that is approximately equal to, or greater than the AQAL
It is unwise to ascribe too much accuracy to incremental changes or background concentrations, and this is especially important when total concentrations are close to the AQAL. For a given year, it is impossible to define the new total concentrations without recognising the inherent uncertainty, which is why there is a category that has a range around the AQAL, rather than being exactly equal to it.

Figure 3b: Impact Descriptors for Individual Receptors

3.34 The EPUK & IAQM guidance notes that the criteria in Figure 3b should be used to describe impacts at individual receptors and should be considered as a starting point to make a judgement on significance of effects, as other influences may need to be accounted for. The EPUK & IAQM guidance states that the assessment of overall significance should be based on professional judgement, taking into account several factors, including:

- The existing and future air quality in the absence of the development;
- The extent of current and future population exposure to the impacts; and

[7] D Laxen and B Marner: Analysis of the relationship between 1-hour and annual mean nitrogen dioxide at UK roadside and kerbside monitoring sites (July 2003).

- The influence and validity of any assumptions adopted when undertaking the prediction of impacts.

Sensitive Receptors

3.35 LAQM.TG(16) describes in detail typical locations where consideration should be given to pollutants defined in the Regulations. Generally, the guidance suggests that all locations 'where members of the public are regularly present' should be considered. At such locations, members of the public will be exposed to pollution over the time that they are present, and the most suitable averaging period of the pollutant needs to be used for assessment purposes.

3.36 For instance, on a footpath, where exposure will be transient (for the duration of passage along that path) comparison with short-term standards (i.e. 15 minute mean or 1 hour mean) may be relevant. In a school, or adjacent to a private dwelling, however; where exposure may be for longer periods, comparison with long-term standards (such as 24 hour mean or annual mean) may be most appropriate. In general terms, concentrations associated with long-term standards are lower than short-term standards owing to the chronic health effects associated with exposure to low level pollution for longer periods of time.

3.37 For the completion of this assessment, consideration of the potential impacts of the Proposed Development on local air quality has been undertaken by predicting pollutant concentrations at receptors adjacent to the surrounding road network both within and outside the AQMA. The modelling assessment also predicted concentrations at six locations within the proposed development itself.

3.38 Details of the receptors are provided below in Figure 3c and their locations presented in Figure 3d. Receptors 28 to 33 are located within the boundary of the Proposed Development.

Receptor Number	Receptor Name/Location	Type	In AQMA	OS Grid Reference
1	4 South Bar Street	Residential (above shop)	Y	445328, 240318
2	21 South Bar Street	Residential (above shop)	Y	445342, 240225
3	Bus Stop South Bar Street	Bus Stop	Y	445331, 240140
4	6 Hightown Road	Residential	N	446052, 239984
5	49 Queensway	Residential	N	444561, 239896
6	125 Bloxham Road	Residential	N	444967, 239529
7	45 Horton View	Residential	N	445352, 239502
8	Bus Stop on Oxford Road	Residential	N	445469, 239641
9	24 Farmfield Road	Residential	N	445451, 239289
10	Horton General Hospital	Hospital	N	445526, 239612
11	92 Oxford Road	Residential	N	445474, 239586
12	132 Oxford Road	Residential	N	445576, 239348
13	Bus Stop on corner of Oxford Road/Grange Road	Bus Stop	N	445672, 239254
14	The Grange County Primary School	School	N	445892, 239169
15	The Grange County Primary School Playing Fields	School	N	445850, 239155
16	59 St Annes Road	Residential	N	445769, 239161
17	164 Oxford Road	Residential	N	445895, 238981
18	27 Arbury Close	Residential	N	446378, 238742
19	2 Farm Way	Residential	N	446564, 239245
20	100 Oxford Road	Residential	N	446637, 237853
21	Oxford Road opposite health club	Residential	N	446758, 237627
22	Cotefield House	Residential	N	446900, 237430
23	31 Twyford Road	Residential	N	447383, 236733
24	9 Twyford Gardens	Residential	N	447326, 236419
25	Adderbury Bowls Club	Leisure	N	447271, 236554
26	Christopher Rawlins Primary School	School	N	447426, 235872
27	Christopher Rawlins Primary School Grounds	School	N	447414, 235861
28	Within proposed development	Proposed Residential	N	446753, 237815
29	Within proposed development	Proposed Residential	N	446831, 238006
30	Within proposed development	Proposed Residential	N	447160, 238180
31	Within proposed development	Proposed Residential	N	447526, 237950
32	Within proposed development	Proposed Residential	N	447212, 237578
33	Within proposed development	Proposed School	N	447152, 237375

Figure 3c: Location of Receptors used in Modelling Assessment

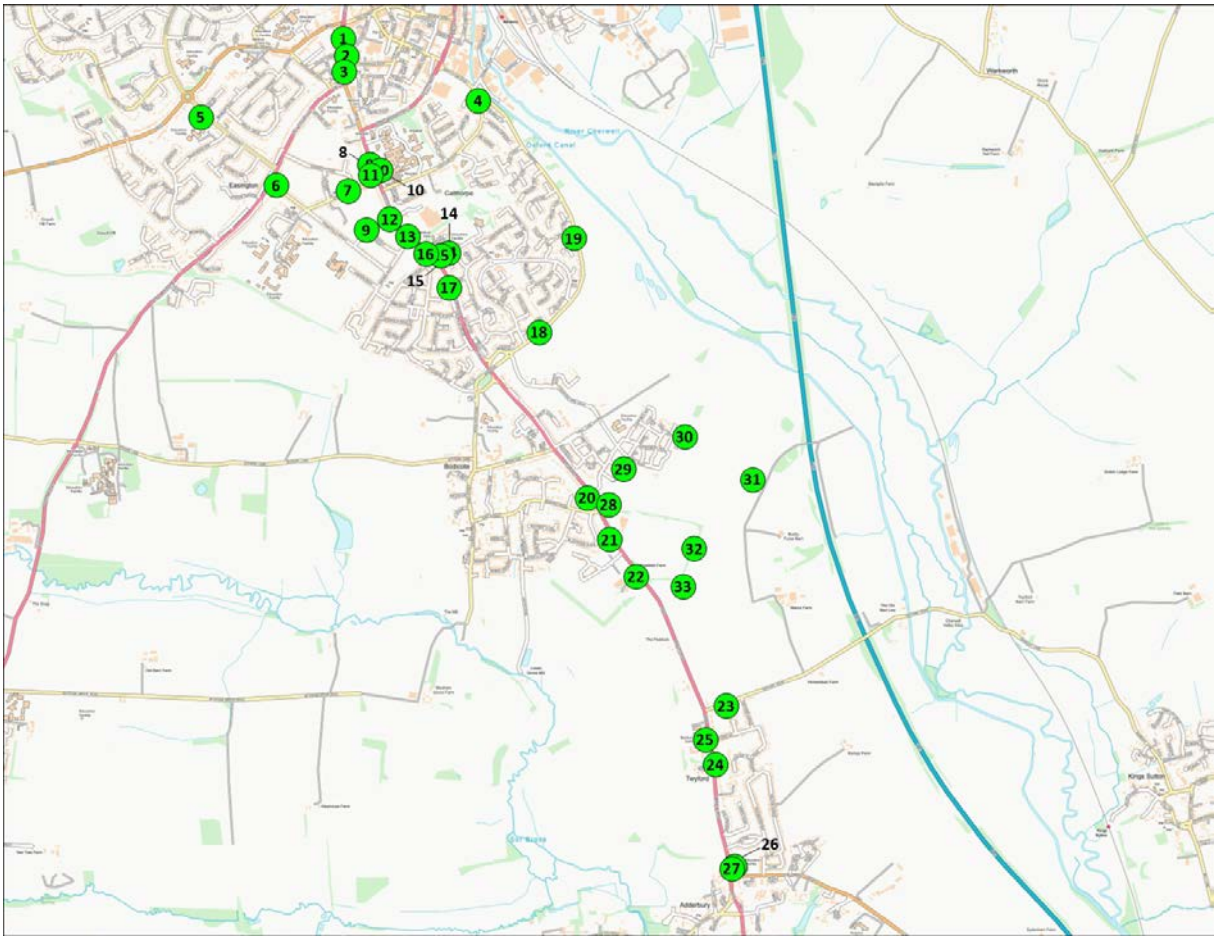

Figure 3d: Location of Receptors used in Modelling Assessment

4 Baseline Conditions

Cherwell District Council Review and Assessment of Air Quality

4.1 Cherwell District Council (CDC) has carried out detailed assessments of air quality throughout the regulatory area. The review and assessment process has identified exceedances of the annual mean NO_2 objective at a number of locations within the district including along the main road (A361) within Banbury. An AQMA has been declared incorporating the properties located along the section of the A361 between Bloxham Road and Castle Street. It lies approximately 2.6 km to the north of the development site.

Automatic Local Monitoring

4.2 CDC does not operate any automatic monitoring sites.

Non-automatic Local Monitoring

4.3 CDC currently operates 45 diffusion tube sites within the regulatory area monitoring concentrations of NO_2. Details of the sites that are considered relevant to the assessment are set out in Figure 4a below. With the exception of Horsefair, the data indicates that annual mean concentrations in Banbury are generally within the air quality objective of 40 µg/m^3.

4.4 Whilst NO_2 concentrations within the AQMA have mostly declined over the five year period, there is no long-term trend in the data that would suggest that there has been a significant decline in concentrations at locations outside the AQMA.

Location	Site Type	OS grid Ref	In AQMA	Annual Mean NO_2 Concentrations (µg/m^3)

				2013	2014	2015	2016	2017
Bridge Street	Kerbside	445961, 240595	N	34.1	32.8	33.6	33.0	33.1
Oxford Road 2014	Roadside	446774, 237620	N	-	20.9	19.4	22.1	20.3
Bankside	Roadside	446377, 239620	N	19.9	18.4	16.3	17.9	17.0
Oxford Rd / South Bar	Kerbside	445335, 240094	Y	39.9	37.6	33.2	35.5	33.4
High Street	Kerbside	445407, 240421	Y	38.3	38.3	35.3	34.6	35.0
Horsefair (triplicate)	Roadside	445351, 240578	Y	**42.2**	**42.4**	**40.9**	38.8	**41.8**
North Bar	Kerbside	445352, 240744	Y	39.6	39.6	38.9	36.5	36.9
Cherwell Street 2014	Roadside	445932, 240499	N	-	29.3	35.3	37.7	37.3
Cranleigh Close	Urban Background	444367, 239654	No	13.5	11.8	10.9	12.5	10.7
Sinclair Avenue	Urban Background	444274,241289	No	17.4	14.7	14.5	16.8	14.4
The Green, Adderbury	Kerbside	447403, 235723	No	31.9	30.4	28	28.3	26.8

Figure 4b: NO_2 Diffusion Tube Monitoring (bias corrected, µg/m^3)

Defra Background Maps

4.5 In the absence of local monitoring data for PM_{10} and $PM_{2.5}$ and for comparison with the measured background NO_2 data, concentrations have been obtained from the Defra background pollutant maps[8]. These 1 km grid resolution maps are derived from a complex modelling exercise that takes into account emissions inventories and measurements of ambient air pollution from both automated and non-automated sites. The latest background maps were issued in November 2017 and are based on 2015 monitoring data.

4.6 The maximum 2016 annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations at the proposed development site and the selected sensitive receptor locations have been determined from contour plots of the mapped data and are presented in Figure 4c. The mapped concentrations for all three pollutants are well within the relevant long-term air quality standards and the NO_2 concentrations are in good agreement with those measured at the urban background monitoring sites in Banbury.

4.7 The background concentration assumed for the assessment is the maximum mapped concentration over the study area, which represents a worst-case at the majority of the receptor locations. Furthermore, the 2016 data are assumed to be representative of existing and future (2031) background concentrations in the area, which is a highly conservative assumption.

Pollutant	Range over Study Area	Assessment Value	AQAL
NO_2	9.0 – 14.0	14.0	40
PM_{10}	12.5 – 15.5	15.5	40
$PM_{2.5}$	8.6 – 11.3	11.3	25

Figure 4c: Estimated Annual Mean Background Concentrations from Defra Maps (µg/m^3)

5 Assessment of Impact, Mitigation and Residual Effects

Construction Dust Impacts

Site and Surroundings

5.1 The Site is currently a large agricultural field. There are no buildings on the Site that would require demolition therefore impacts associated with demolition activities have not been considered within this report.

5.2 Based on the IAQM guidance sensitive receptors that may be affected by dust emissions during construction activities include residential properties, educational facilities, retail premises, places of work, recreational areas and ecological receptors. The nearest residential receptors are to the west on Oxford Road. To the north of the Site are properties within the Bankside Phase I development which is currently under construction. An assessment of construction related impacts in relation to human receptors is therefore considered necessary.

[8] https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2015

5.3 Dust emissions from construction activities are unlikely to result in significant impacts on ecologically sensitive receptors beyond 50 m from the site boundary. There are no sensitive ecological sites within 50 m of the site boundary therefore the risk of impacts on ecological receptors is negligible and has not been considered any further within this assessment..

5.4 As detailed in section 4, PM_{10} concentrations are not monitoring at any location within the district. Data presented in Figure 4c indicates background concentrations in the vicinity of the Site are less than 50% of the air quality objective of 40 µg/m^3. Based on professional experience PM_{10} concentrations at roadside locations are unlikely to be more than a few µg higher than background concentrations. Concentrations in the vicinity of the Site are therefore expected to be less than 24 µg/m^3

5.5 The precise behaviour of the dust, its residence time in the atmosphere, and the distance it may travel before being deposited would depend upon a number of factors. These include wind direction and strength, local topography and the presence of intervening structures (buildings, etc.) that may intercept dust before it reaches sensitive locations. Furthermore, dust would be naturally suppressed by rainfall.

5.6 A wind rose from Church Lawford Meteorological Station (2016) is provided below in Figure 5a, which shows that the prevailing wind is from a south-west direction. Properties located to the north-east are therefore most likely to experience significant impacts as a result of dust generated during the construction process. Land-use to the north-east of the Site is currently mainly agricultural land, although the Bankside Phase I development is currently under construction to north of the Site. To ensure a worst-case assessment, the receptors within the Bankside Phase I development have been included in the assessment of construction phase effects.

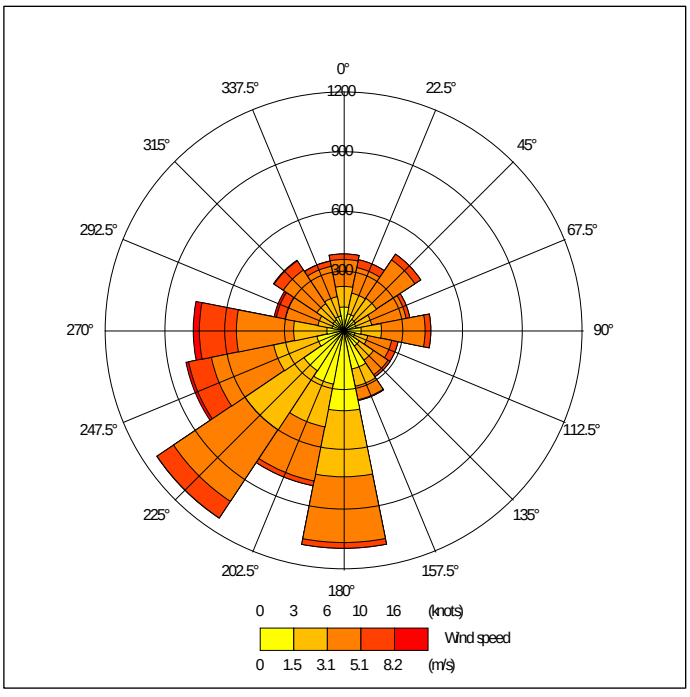

Figure 5a: Windrose from Church Lawford for 2016

Potential Dust Emission Magnitude

5.7 The dust emission magnitude is based on the scale of anticipated works at the Site and has been defined as small, medium or large for each of the three activities; earthworks, construction and trackout. A summary of the dust emission magnitude for each activity is set out in Figure 5b.

Earthworks

5.8 Earthworks are those activities involved in preparing the Site for construction such as excavation of material, haulage, tipping, stockpiling and levelling.

5.9 During the earthwork activities it is anticipated that there would be more than 10 earth moving vehicles on the site at any given time and the potential for storage bunds of more than 8m in height. The Site is therefore considered to have a dust emission class of 'large' with regards to earthwork activities.

Construction

5.10 There are a number of issues that can impact the dust emission class during construction activities including the size of the building, materials used for construction, the method of construction and the duration of the build.

5.11 Detailed information is currently unavailable on the construction process. Based on the size of the Proposed Development, the Site is considered to have a dust emission class of 'large' with regards to construction activities.

Trackout

5.12 The risk of impacts occurring during trackout is predominantly dependent on the number of vehicles accessing the Site on a daily basis. However, vehicle size and speed, the duration of activities and local geology are also factors which are used to determine the emission class of the Site as a result of trackout.

5.13 Given the size of the Proposed Development it is expected that there would be more than 50 Heavy Duty Vehicles (HDV) accessing the Phase 2 Development site each day, with the vehicles travelling on site over unpaved roads of more than 100 m in length. The Site is therefore classed as 'large' with regards to trackout activities.

Source	Magnitude
Earthworks	Large
Construction	Large
Trackout	Large

Figure 5b: Summary of Dust Risk Effects Before Mitigation

Sensitivity of Surrounding Area

5.14 The closest receptors adjacent to the Site are residential properties to the west and the residential properties currently under construction to the north. As set out in the IAQM guidance residential properties are classed as high sensitivity receptors. As there are over 10 within 20 m of the site boundary the overall sensitivity of the surrounding area is classed as high in relation to dust effects.

5.15 As detailed above, PM_{10} concentrations in the vicinity of the Site are expected to be less than 24 µg/m^3. Based on the number and proximity of the residential receptors to the site boundary and the local concentrations of PM_{10} the sensitivity of the surrounding area is considered to be 'low' with regards human health (PM_{10}) effects.

5.16 In relation to trackout, vehicles accessing and leaving the Site are expected to travel along Oxford Road to the north or south. There are residential properties within 20 m of the roadside, therefore the sensitivity of the surrounding area to effects from trackout is considered to be 'high' for dust soiling and 'low' for human health (PM_{10}) effects.

5.17 A summary of the sensitivity of the area surrounding the Site in relation to each activity is provided below in Figure 5c.

Source	Dust Soiling Effects	PM_{10} Effects
Earthworks	High	Low
Construction	High	Low
Trackout	High	Low

Figure 5c: Summary of Sensitivity of Surrounding Area

Summary of Dust Risk Effects

5.18 A summary of the potential dust risk effects prior to mitigation are presented in Figure 5d below.

Source	Dust Soiling Effects	PM_{10} Effects
Earthworks	High Risk	Low Risk
Construction	High Risk	Low Risk
Trackout	High Risk	Low Risk

Figure 5d: Summary of Dust Risk Effects Before Mitigation

5.19 The significance of potential dust impacts following the implementation of mitigation measures are identified later in this report.

Construction Traffic Impact

5.20 The greatest impact on air quality due to emissions from vehicles and plant associated with the construction phase will be in the areas immediately adjacent to the site access. It is anticipated that construction traffic will access the site via Oxford Road. It is considered likely that the construction traffic will be low in comparison to the existing traffic flow on this road.

5.21 Based on the current local air quality in the area, the proximity of sensitive receptors to the roads likely to be used by construction vehicles, and the likely number of construction vehicles that will be used the impacts are considered to be of negligible significance.

Operational Phase Impact

NO_2 Concentrations

5.22 Annual mean NO_2 concentrations predicted at the selected receptor locations are presented below in Figure 5e.

5.23 The results of the modelling assessment indicate that annual mean NO_2 concentrations in 2031, following the completion of the development, will be well the annual mean objective of 40 µg/m^3 (the AQAL) at all but one of the identified receptor locations. An exceedance of the AQAL is predicted at the bus stop on South Street both without and with the development in place. However, public exposure at this locations will be short-term only and an exceedance of the 1-hour mean objective for NO_2 is considered unlikely based on the predicted annual mean concentrations (guidance referred to earlier in the report indicates that exceedance of the 1-hour objective is unlikely where the annual mean concentration is below 60 µg/m^3). The significance of the traffic-related impact at this location is therefore considered to be negligible.

5.24 Traffic generated by the Proposed Development is predicted to result in a maximum increase in NO_2 concentrations of 0.89 µg/m^3 (2% of the AQAL) at 27 Arbury Close, which is close to Bankside, where the maximum change in flow is anticipated to occur. However, the predicted concentration (including the background) at this location is 53% of the AQAL and therefore the significance of the impact is negligible.

5.25 Annual mean NO_2 concentrations predicted at the receptors located within the development (28 to 33) are well below (less than 75%) the AQAL. It is expected that the 1-hour objective would also be met at all locations across the Site. As receptors located within the Development Site would not be exposed to NO_2 concentrations above the air quality objectives, the impact with regards new exposure is considered to be negligible.

Receptor	2031 Baseline	2031 Baseline + Development	Increase with Development (as a % of the AQAL)	Significance
4 South Bar Street	24.0	24.2	0%	Negligible
21 South Bar Street	23.7	23.8	0%	Negligible
Bus Stop South Bar Street	44.3	44.7	1%	Negligible

6 Hightown Road	24.3	24.6	1%	Negligible
49 Queensway	18.7	18.7	0%	Negligible
125 Bloxham Road	21.3	21.7	1%	Negligible
45 Horton View	19.9	20.2	1%	Negligible
Bus Stop on Oxford Road	31.4	31.5	0%	Negligible
24 Farmfield Road	18.0	18.2	0%	Negligible
Horton General Hospital	26.3	26.3	0%	Negligible
92 Oxford Road	24.8	24.9	0%	Negligible
132 Oxford Road	23.7	23.7	0%	Negligible
Bus Stop on corner of Oxford Road/Grange Road	28.1	28.0	0%	Negligible
The Grange County Primary School	19.5	19.4	0%	Negligible
The Grange County Primary School Playing Fields	23.1	23.0	0%	Negligible
59 St Annes Road	21.7	21.7	0%	Negligible
164 Oxford Road	25.8	25.7	0%	Negligible
27 Arbury Close	20.5	21.4	2%	Negligible
2 Farm Way	19.1	19.4	1%	Negligible
100 Oxford Road	22.9	22.9	0%	Negligible
Oxford Road opposite health club	21.1	21.0	0%	Negligible
Cotefield House	23.0	23.0	0%	Negligible
31 Twyford Road	18.8	19.0	0%	Negligible
9 Twyford Gardens	30.5	30.6	0%	Negligible
Adderbury Bowls Club	22.3	22.4	0%	Negligible
Christopher Rawlins Primary School	25.6	25.6	0%	Negligible
Christopher Rawlins Primary School Grounds	32.5	32.6	0%	Negligible
Within proposed development	-	19.6	-	-
Within proposed development	-	16.8	-	-
Within proposed development	-	16.4	-	-
Within proposed development	-	17.5	-	-
Within proposed development	-	16.7	-	-
Within proposed development	-	17.7	-	-

Figure 5e: Predicted Annual Mean NO_2 Concentrations (µg/m^3)

PM_{10} Concentrations

5.26 Annual mean PM_{10} concentrations predicted at the selected receptor locations are presented below in Figure 5f.

Receptor	2031 Baseline	2031 Baseline + Development	Increase with Development (as a % of the AQAL)	Significance
4 South Bar Street	16.6	16.6	0%	Negligible
21 South Bar Street	16.6	16.6	0%	Negligible
Bus Stop South Bar Street	19.4	19.4	0%	Negligible
6 Hightown Road	16.9	17.0	0%	Negligible
49 Queensway	16.1	16.1	0%	Negligible
125 Bloxham Road	16.4	16.5	0%	Negligible
45 Horton View	16.3	16.3	0%	Negligible
Bus Stop on Oxford Road	17.9	17.9	0%	Negligible
24 Farmfield Road	16.0	16.1	0%	Negligible
Horton General Hospital	17.1	17.1	0%	Negligible
92 Oxford Road	16.9	16.9	0%	Negligible
132 Oxford Road	16.8	16.8	0%	Negligible
Bus Stop on corner of Oxford Road/Grange Road	17.5	17.5	0%	Negligible
The Grange County Primary School	16.2	16.2	0%	Negligible
The Grange County Primary School Playing Fields	16.7	16.7	0%	Negligible
59 St Annes Road	16.5	16.5	0%	Negligible
164 Oxford Road	17.1	17.1	0%	Negligible
27 Arbury Close	16.4	16.5	0%	Negligible
2 Farm Way	16.3	16.3	0%	Negligible
100 Oxford Road	16.7	16.7	0%	Negligible
Oxford Road opposite health club	16.6	16.6	0%	Negligible
Cotefield House	16.8	16.8	0%	Negligible
31 Twyford Road	16.1	16.1	0%	Negligible
9 Twyford Gardens	17.8	17.8	0%	Negligible
Adderbury Bowls Club	16.6	16.6	0%	Negligible
Christopher Rawlins Primary School	16.9	16.9	0%	Negligible
Christopher Rawlins Primary School	17.7	17.7	0%	Negligible

Grounds				
Within proposed development	-	16.3	-	-
Within proposed development	-	15.9	-	-
Within proposed development	-	15.8	-	-
Within proposed development	-	15.9	-	-
Within proposed development	-	15.8	-	-
Within proposed development	-	16.0	-	-

Figure 5f: Predicted Annual Mean PM_{10} Concentrations (µg/m³)

5.27 The results of the modelling assessment indicate that predicted annual mean PM_{10} concentrations are less than 50% of the AQAL at the selected receptor locations, both with and without the proposed development.

5.28 The Proposed Development is predicted to increase PM_{10} concentrations by a maximum of 0.13 µg/m³ which equates to less than 0.5% of the AQAL. In accordance with the IAQM & EPUK significance criteria as set out in Figure 3b, the impact on local air quality with regards to this pollutant is considered to be negligible.

5.29 The number of exceedances of 50 µg/m³, as a 24-hour mean PM_{10} concentration, has been calculated from the annual mean following the approach set out by Defra in LAQM.TG(16):

$$A = -18.5 + 0.00145 \times annual\ mean^3 + (206/annual\ mean)$$

where A is the number of exceedances of 50 µg/m³ as a 24-hour mean PM_{10} concentration.

5.30 Based on the above approach, the maximum number of days where PM_{10} concentrations are predicted to exceed 50 µg/m³ is between 0 and 3 days at the selected receptors with a change of less than one day as a result of the operational development. The impact on short-term PM_{10} concentrations is therefore also considered to be negligible.

5.31 The 24-hour objective is also expected to be met at all locations within the Site. The introduction of new receptors to the Site would not result in exposure to PM_{10} concentrations above the relevant AQS objective levels therefore the impact with regards new exposure is considered to be negligible.

$PM_{2.5}$ Concentrations

5.32 Annual mean $PM_{2.5}$ concentrations predicted at the selected receptor locations are presented below in Figure 5g.

Receptor	2031 Baseline	2031 Baseline + Development	Increase with Development (as a % of the AQAL)	Significance
4 South Bar Street	12.0	12.0	0%	Negligible
21 South Bar Street	12.0	12.0	0%	Negligible
Bus Stop South Bar Street	13.7	13.7	0%	Negligible
6 Hightown Road	12.2	12.2	0%	Negligible
49 Queensway	11.7	11.7	0%	Negligible
125 Bloxham Road	11.9	11.9	0%	Negligible
45 Horton View	11.8	11.8	0%	Negligible
Bus Stop on Oxford Road	12.8	12.8	0%	Negligible
24 Farmfield Road	11.6	11.6	0%	Negligible
Horton General Hospital	12.3	12.3	0%	Negligible
92 Oxford Road	12.2	12.2	0%	Negligible
132 Oxford Road	12.1	12.1	0%	Negligible
Bus Stop on corner of Oxford Road/Grange Road	12.5	12.5	0%	Negligible
The Grange County Primary School	11.7	11.7	0%	Negligible
The Grange County Primary School Playing Fields	12.0	12.0	0%	Negligible
59 St Annes Road	11.9	11.9	0%	Negligible
164 Oxford Road	12.3	12.3	0%	Negligible
27 Arbury Close	11.8	11.9	0%	Negligible
2 Farm Way	11.8	11.8	0%	Negligible
100 Oxford Road	12.0	12.0	0%	Negligible
Oxford Road opposite health club	12.0	12.0	0%	Negligible
Cotefield House	12.1	12.1	0%	Negligible

31 Twyford Road	11.7	11.7	0%	Negligible
9 Twyford Gardens	12.7	12.7	0%	Negligible
Adderbury Bowls Club	12.0	12.0	0%	Negligible
Christopher Rawlins Primary School	12.1	12.1	0%	Negligible
Christopher Rawlins Primary School Grounds	12.6	12.7	0%	Negligible
Within proposed development	-	11.8	-	-
Within proposed development	-	11.5	-	-
Within proposed development	-	11.5	-	-
Within proposed development	-	11.6	-	-
Within proposed development	-	11.5	-	-
Within proposed development	-	11.6	-	-

Figure 5g: Predicted Annual Mean $PM_{2.5}$ Concentrations (µg/m³)

5.33 The results of the modelling assessment indicate that predicted annual mean $PM_{2.5}$ concentrations are less than 50% of the AQAL at the selected receptor locations, both with and without the proposed development.

5.34 The Proposed Development is predicted to increase $PM_{2.5}$ concentrations by a maximum of 0.1 µg/m³ which equates to less than 0.5% of the AQAL. In accordance with the IAQM & EPUK significance criteria as set out in Figure 3b, the impact on local air quality with regards to this pollutant is considered to be negligible.

Mitigation

Construction Phase

5.35 The control of dust emissions from construction site activities relies upon management provision and mitigation techniques to reduce emissions of dust and limit dispersion. Where dust emission controls have been used effectively, large-scale operations have been successfully undertaken without impacts to nearby properties.

5.36 A high risk of dust soiling impacts and a low risk of human health (PM_{10}) effects is predicted at adjacent receptors during construction of the Proposed Development. Appropriate mitigation measures for the Site have been identified following the IAQM guidance and based on the risk effects presented in Figure 5d. It is recommended that the 'highly recommended' measures set out in Appendix E are incorporated into a Dust Management Plan (DMP) and approved by CDC prior to commencement of any work on site:

5.37 In addition to the 'recommended' measures, the IAQM guidance also sets out a number of 'desirable' measures which should also be considered for inclusion within the DMP. These are also set out in Appendix E.

5.38 Following implementation of the measures recommended for inclusion within the DMP the impact of emissions during construction of the Proposed Development would be negligible.

Operational Phase

5.39 Concentrations of NO_2, PM_{10} and $PM_{2.5}$ predicted at all of the receptors included in the assessment are below the relevant AQS objective levels and the impact on local air quality is predicted to be negligible. The concentrations predicted within the Development Site were all well below the relevant AQS objective levels. Therefore no mitigation is considered necessary.

Residual Effects

Construction Phase

5.40 The residual effects of dust and particulate matter generated by construction activities will be minimised by following the mitigation measures outlined within this appraisal. The residual effects are therefore considered to be negligible.

Operational Phase

5.41 The residual impact of the Proposed Development on local air quality is considered to be negligible.

6 Conclusions

6.1 An air quality impact assessment has been carried out to assess both construction and operational impacts of the Proposed Development.

6.2 An assessment of the potential impacts during the construction phase has been carried out. This has shown that during this phase of the Proposed Development releases of dust and PM_{10} are likely to occur during site activities. Through good site practice and the implementation of suitable mitigation measures, the impact of dust and PM_{10} releases may be effectively mitigated and the resultant impacts are considered to be negligible.

6.3 The ADMS model has been used to predict the impact of the Development on local NO_2, PM_{10} and $PM_{2.5}$ concentrations and assess the suitability of the Site for residential use. The assessment found that concentrations of these pollutants would be below the relevant objective levels at all locations, including within the AQMA, and traffic generated by the development proposals would result in a negligible impact on local air quality.

6.4 Based on the above information, it is considered that air quality does not pose a constraint to development of the Site as proposed.

Appendix A – Air Quality Terminology

Term	Definition
Accuracy	A measure of how well a set of data fits the true value.
Air quality objective	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedances within a specific timescale (see also air quality standard).
Air quality standard	The concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects on sensitive sub groups (see also air quality objective).
Ambient air	Outdoor air in the troposphere, excluding workplace air.
Annual mean	The average (mean) of the concentrations measured for each pollutant for one year. Usually this is for a calendar year, but some species are reported for the period April to March, known as a pollution year. This period avoids splitting winter season between 2 years, which is useful for pollutants that have higher concentrations during the winter months.
AQMA	Air Quality Management Area.
DEFRA	Department for Environment, Food and Rural Affairs.
Exceedence	A period of time where the concentrations of a pollutant is greater than, or equal to, the appropriate air quality standard.
Fugitive emissions	Emissions arising from the passage of vehicles that do not arise from the exhaust system.
LAQM	Local Air Quality Management.
NO	Nitrogen monoxide, a.k.a. nitric oxide.
NO_2	Nitrogen dioxide.
NO_x	Nitrogen oxides.
O_3	Ozone.
Percentile	The percentage of results below a given value.
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
ppb parts per billion	The concentration of a pollutant in the air in terms of volume ratio. A concentration of 1 ppb means that for every billion (10^9) units of air, there is one unit of pollutant present.
ppm parts per million	The concentration of a pollutant in the air in terms of volume ratio. A concentration of 1 ppm means that for every billion (10^6) units of air, there is one unit of pollutant present.
Ratification (Monitoring)	Involves a critical review of all information relating to a data set, in order to amend or reject the data. When the data have been ratified they represent the final data to be used (see also validation).
µg/m³ micrograms per cubic metre	A measure of concentration in terms of mass per unit volume. A concentration of 1ug/m3 means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.
UKAS	United Kingdom Accreditation Service.
Uncertainty	A measure, associated with the result of a measurement, which characterizes the range of values within which the true value is expected to lie. Uncertainty is usually expressed as the range within which the true value is expected to lie with a 95% probability, where standard statistical and other procedures have been used to evaluate this figure. Uncertainty is more clearly defined than the closely related parameter 'accuracy', and has replaced it on recent European legislation.
USA	Updating and Screening Assessment.
Validation (modelling)	Refers to the general comparison of modelled results against monitoring data carried out by model developers.
Validation (monitoring)	Screening monitoring data by visual examination to check for spurious and unusual measurements (see also ratification).
Verification (modelling)	Comparison of modelled results versus any local monitoring data at relevant locations.

Appendix B – Air Quality Standards and Objectives

Air Quality Objectives currently included in the Air Quality Regulations 2000 and (Amendment) Regulations 2002 for the purpose of Local Air Quality Management (LAQM)						
Pollutant	Applies to	Standard		Objective		EU AQ Daughter Directive
		Concentration	*Measured as*	*Annual exceedances allowed*	Target date	
Nitrogen dioxide (NO_2)	All UK	200 µg/m^3	1 hour mean	18	31.12.2005	As objective. target: 01.01.2010
	All UK	40 µg/m^3	annual mean		31.12.2005	As standard. target: 01.01.2010
Particulate Matter (PM_{10}) (gravimetric)	All UK	40 µg/m^3	annual mean		31.12.2004	As standard. target: 01.01.2005
	All UK	50 µg/m^3	24 hour mean	35	31.12.2004	As objective. target: 01.01.2005
	Scotland	50 µg/m^3	24 hour mean	7	31.12.2010	As objective. target: 01.01.2010
	Scotland	18 µg/m^3	annual mean		31.12.2010	
Air Quality Objectives not currently included in the UK Regulations						
Particulate Matter ($PM_{2.5}$)	UK (except Scotland)	25 µg/m^3	annual mean		2020	As standard. target: 01.01.2010

Appendix C – Summary of Traffic Data

Traffic Data for 2016 Verification and Baseline

Road Link	Description	Average Speed (kph)	2016 Verification and Baseline	
			AADT	HDV (%)
1a	Horsefair north of High Street	20	19,510	5.1
1b	Horsefair north of High Street section approaching junction (reduced speed)	10	19,510	5.1
2a	High Street section approaching junction with Horsefair (reduced speed)	10	9,842	3.6
2b	High Street	20	9,842	3.6
2c	High Street section approaching junction with A4260 (reduced speed)	10	9,842	3.6
3a	B4035 West Bar Street section approaching junction with A361 (reduced speed)	10	7,644	1.9
3b	B4035 West Bar Street	25	7,644	1.9
4a	South Bar Street south of High St section approaching junction with High Street (reduced speed)	10	15,555	5.4
4b	South Bar Street south of High St	20	15,555	5.4
5a	South Bar Street north of Bloxham Road	20	15,877	5.3
5b	South Bar Street north of Bloxham Road section approaching junction with Bloxham Road (reduced speed)	10	15,877	5.3
6a	A361 Bloxham Road section approaching junction with Oxford Road (reduced speed)	15	11,382	4.3
6b	A361 Bloxham Road	30	11,382	4.3
6c	A361 Bloxham Road section approaching junction with Queensway (reduced speed)	15	11,382	4.3
7a	Queensway westbound	30	7,124	1.2
7b	Queensway westbound section approaching roundabout with B4035 (reduced speed)	15	7,124	1.2
7c	Queensway eastbound	30	7,124	1.2
7d	Queensway eastbound section approaching junction with A361 Bloxham Road (reduced speed)	15	7,124	1.2
8a	Springfield Avenue section approaching Bloxham Road (reduced speed)	15	7,868	1.5
8b	Springfield Avenue	30	7,868	1.5
9a	B4100 Oxford Road south of Bloxham Road section approaching Bloxham Road (reduced speed)	15	15,445	4.5
9b	B4100 Oxford Road south of Bloxham Road	30	15,445	4.5
10a	B4100 Oxford Road north of A4260 Upper Windsor Street	30	16,394	4.2
10b	B4100 Oxford Road north of A4260 Upper Windsor Street section approaching junction with A4260 (reduced speed)	15	16,394	4.2
11a	A4260 Upper Windsor Street section approaching junction with B4100 (reduced speed)	15	9,429	5.9
11b	A4260 Upper Windsor Street	30	9,429	5.9
11c	A4260 Upper Windsor Street section approaching junction with Swan Close Road (reduced speed)	15	9,429	5.9

12a	A4260 Oxford Road south of A4260 Upper Windsor Street section approach junction with UPS (reduced speed)	15	18,759	4.0
12b	A4260 Oxford Road south of A4260 Upper Windsor Street	30	18,759	4.0
13a	Cherwell Street south of Bridge Street section approaching junction with Swan Close Road (reduced speed)	15	23,492	4.5
13b	Cherwell Street south of Bridge Street	30	23,492	4.5
13c	Cherwell Street south of Bridge Street section approaching junction with Bridge Street (reduced speed)	15	23,492	4.5
14a	Bridge Street west of Cherwell Street section approaching junction with Cherwell Street (reduced speed)	15	3,558	20.4
14b	Bridge Street west of Cherwell Street section	30	3,558	20.4
15a	A4260 Cherwell Street north of Bridge Street section approaching junction with Bridge Street (reduced speed)	15	18,754	5.3
15b	A4260 Cherwell Street north of Bridge Street	30	18,754	5.3
16a	Bridge Street east of Cherwell Street section approaching junction with Cherwell Street (reduced speed)	15	15,498	2.0
16b	Bridge Street east of Cherwell Street	30	15,498	2.0
17a	Oxford Road (north of Horton View)	30	18,112	3.8
17b	Oxford Road (north of Horton View) section approaching junction with Horton Road (reduced speed)	15	18,112	3.8
18	Horton View	30	5,838	1.1
19	Hightown Road south of Bankside	30	6,206	1.3
20	Oxford Road between Horton View and Hightown Road	30	20,826	3.8
21	Oxford Road between Hightown Road and Farmfield	30	20,728	3.7
22	Farmfields Road	30	2,475	2.8
23	Oxford Road south of Farmfields	30	19,812	4.0
24a	Oxford Road north of Bankside	30	19,213	4.4
24b	Oxford Road north of Bankside section approaching Bankside (reduced speed)	15	19,213	4.4
25a	Oxford Road south of Bankside section approaching Bankside (reduced speed)	15	22,704	3.7
25b	Oxford Road south of Bankside	30	22,704	3.7
26	Bankside west of site entrance	30	8,291	1.2
27	Bankside east of site entrance	30	9,701	1.3
28	Oxford Road north of Weeping Cross	30	22,171	3.6
29	Weeping Cross	30	3,075	2.6
30	Oxford Road south of Weeping Cross	30	22,293	3.7
31	Oxford Road north of Twyford Road	30	22,226	3.7
32	Twyford Road	30	4,491	3.2
33	Oxford Road south of Twyford Road	30	19,844	4.3
34a	Oxford Road north of Aynho Road	30	18,761	4.4
34b	Oxford Road north of Aynho Road section approaching junction with Aynho Road (reduced speed)	15	18,761	4.4
35a	A4100 Aynho Road section approaching junction with Oxford Road (reduced speed)	15	11,171	3.4
35b	A4100 Aynho Road	30	11,171	3.4
36a	Oxford Road south of Aynho Road section approaching junction with Aynho Road (reduced speed)	15	16,593	4.5
36b	Oxford Road south of Aynho Road	30	16,593	4.5

37	M40 passing site	70	87,935	12.1
38	M40 north of site up to junc 11	70	87,935	12.1
39	Hightown Road north of Bankside	30	6,206	1.3

Traffic Data for 2031 Without Development

Road Link	Description	Average Speed (kph)	2031 Baseline	
			AADT	HDV (%)
1a	Horsefair north of High Street	20	24,442	4.1%
1b	Horsefair north of High Street section approaching junction (reduced speed)	10	24,442	4.1%
2a	High Street section approaching junction with Horsefair (reduced speed)	10	11,179	6.6%
2b	High Street	20	11,179	6.6%
2c	High Street section approaching junction with A4260 (reduced speed)	10	11,179	6.6%
3a	B4035 West Bar Street section approaching junction with A361 (reduced speed)	10	8,941	7.4%
3b	B4035 West Bar Street	25	8,941	7.4%
4a	South Bar Street south of High St section approaching junction with High Street (reduced speed)	10	18,707	3.9%
4b	South Bar Street south of High St	20	18,707	3.9%
5a	South Bar Street north of Bloxham Road	20	21,197	4.6%
5b	South Bar Street north of Bloxham Road section approaching junction with Bloxham Road (reduced speed)	10	21,197	4.6%
6a	A361 Bloxham Road section approaching junction with Oxford Road (reduced speed)	15	14,880	4.5%
6b	A361 Bloxham Road	30	14,880	4.5%
6c	A361 Bloxham Road section approaching junction with Queensway (reduced speed)	15	14,880	4.5%
7a	Queensway westbound	30	7,678	3.2%
7b	Queensway westbound section approaching roundabout with B4035 (reduced speed)	15	7,678	3.2%
7c	Queensway eastbound	30	7,678	3.2%
7d	Queensway eastbound section approaching junction with A361 Bloxham Road (reduced speed)	15	7,678	3.2%
8a	Springfield Avenue section approaching Bloxham Road (reduced speed)	15	7,532	2.2%
8b	Springfield Avenue	30	7,532	2.2%
9a	B4100 Oxford Road south of Bloxham Road section approaching Bloxham Road (reduced speed)	15	20,831	4.0%
9b	B4100 Oxford Road south of Bloxham Road	30	20,831	4.0%
10a	B4100 Oxford Road north of A4260 Upper Windsor Street	30	21,234	4.1%
10b	B4100 Oxford Road north of A4260 Upper Windsor Street section approaching junction with A4260 (reduced speed)	15	21,234	4.1%
11a	A4260 Upper Windsor Street section approaching junction with B4100 (reduced speed)	15	13,067	3.1%
11b	A4260 Upper Windsor Street	30	13,067	3.1%
11c	A4260 Upper Windsor Street section approaching junction with Swan Close Road (reduced speed)	15	13,067	3.1%

12a	A4260 Oxford Road south of A4260 Upper Windsor Street section approach junction with UPS (reduced speed)	15	24,074	4.1%
12b	A4260 Oxford Road south of A4260 Upper Windsor Street	30	24,074	4.1%
13a	Cherwell Street south of Bridge Street section approaching junction with Swan Close Road (reduced speed)	15	28,887	3.9%
13b	Cherwell Street south of Bridge Street	30	28,887	3.9%
13c	Cherwell Street south of Bridge Street section approaching junction with Bridge Street (reduced speed)	15	28,887	3.9%
14a	Bridge Street west of Cherwell Street section approaching junction with Cherwell Street (reduced speed)	15	6,316	9.3%
14b	Bridge Street west of Cherwell Street section	30	6,316	9.3%
15a	A4260 Cherwell Street north of Bridge Street section approaching junction with Bridge Street (reduced speed)	15	22,557	3.2%
15b	A4260 Cherwell Street north of Bridge Street	30	22,557	3.2%
16a	Bridge Street east of Cherwell Street section approaching junction with Cherwell Street (reduced speed)	15	15,557	4.7%
16b	Bridge Street east of Cherwell Street	30	15,557	4.7%
17a	Oxford Road (north of Horton View)	30	24,074	4.1%
17b	Oxford Road (north of Horton View) section approaching junction with Horton Road (reduced speed)	15	24,074	4.1%
18	Horton View	30	5,839	2.2%
19	Hightown Road south of Bankside	30	6,607	0.9%
20	Oxford Road between Horton View and Hightown Road	30	24,188	4.0%
21	Oxford Road between Hightown Road and Farmfield	30	24,188	4.0%
22	Farmfields Road	30	2,386	2.3%
23	Oxford Road south of Farmfields	30	23,155	4.1%
24a	Oxford Road north of Bankside	30	22,521	4.1%
24b	Oxford Road north of Bankside section approaching Bankside (reduced speed)	15	22,521	4.1%
25a	Oxford Road south of Bankside section approaching Bankside (reduced speed)	15	25,206	3.9%
25b	Oxford Road south of Bankside	30	25,206	3.9%
26	Bankside west of site entrance	30	6,871	1.4%
27	Bankside east of site entrance	30	10,267	2.1%
28	Oxford Road north of Weeping Cross	30	24,350	4.3%
29	Weeping Cross	30	1,145	9.0%
30	Oxford Road south of Weeping Cross	30	25,302	4.1%
31	Oxford Road north of Twyford Road	30	24,862	4.2%
32	Twyford Road	30	2,667	4.2%
33	Oxford Road south of Twyford Road	30	22,300	4.4%
34a	Oxford Road north of Aynho Road	30	21,048	4.6%
34b	Oxford Road north of Aynho Road section approaching junction with Aynho Road (reduced speed)	15	21,048	4.6%
35a	A4100 Aynho Road section approaching junction with Oxford Road (reduced speed)	15	6,429	7.6%
35b	A4100 Aynho Road	30	6,429	7.6%
36a	Oxford Road south of Aynho Road section approaching junction with Aynho Road (reduced speed)	15	20,598	6.8%
36b	Oxford Road south of Aynho Road	30	20,598	6.8%

37	M40 passing site	70	87,935	12.1%
38	M40 north of site up to junc 11	70	87,935	12.1%
39	Hightown Road north of Bankside	30	11,095	2.7%

Traffic Data for 2031 With Development

Road Link	Description	Average Speed (kph)	2031 Baseline + Development	
			AADT	HDV (%)
1a	Horsefair north of High Street	20	24,308	4.1%
1b	Horsefair north of High Street section approaching junction (reduced speed)	10	24,308	4.1%
2a	High Street section approaching junction with Horsefair (reduced speed)	10	10,659	6.9%
2b	High Street	20	10,659	6.9%
2c	High Street section approaching junction with A4260 (reduced speed)	10	10,659	6.9%
3a	B4035 West Bar Street section approaching junction with A361 (reduced speed)	10	8,857	7.9%
3b	B4035 West Bar Street	25	8,857	7.9%
4a	South Bar Street south of High St section approaching junction with High Street (reduced speed)	10	19,375	3.8%
4b	South Bar Street south of High St	20	19,375	3.8%
5a	South Bar Street north of Bloxham Road	20	21,696	4.5%
5b	South Bar Street north of Bloxham Road section approaching junction with Bloxham Road (reduced speed)	10	21,696	4.5%
6a	A361 Bloxham Road section approaching junction with Oxford Road (reduced speed)	15	14,745	4.5%
6b	A361 Bloxham Road	30	14,745	4.5%
6c	A361 Bloxham Road section approaching junction with Queensway (reduced speed)	15	14,745	4.5%
7a	Queensway westbound	30	7,748	3.2%
7b	Queensway westbound section approaching roundabout with B4035 (reduced speed)	15	7,748	3.2%
7c	Queensway eastbound	30	7,748	3.2%
7d	Queensway eastbound section approaching junction with A361 Bloxham Road (reduced speed)	15	7,748	3.2%
8a	Springfield Avenue section approaching Bloxham Road (reduced speed)	15	8,009	2.3%
8b	Springfield Avenue	30	8,009	2.3%
9a	B4100 Oxford Road south of Bloxham Road section approaching Bloxham Road (reduced speed)	15	20,827	4.0%
9b	B4100 Oxford Road south of Bloxham Road	30	20,827	4.0%
10a	B4100 Oxford Road north of A4260 Upper Windsor Street	30	21,223	4.1%
10b	B4100 Oxford Road north of A4260 Upper Windsor Street section approaching junction with A4260 (reduced speed)	15	21,223	4.1%
11a	A4260 Upper Windsor Street section approaching junction with B4100 (reduced speed)	15	12,758	3.0%
11b	A4260 Upper Windsor Street	30	12,758	3.0%
11c	A4260 Upper Windsor Street section approaching junction with Swan Close Road (reduced speed)	15	12,758	3.0%

12a	A4260 Oxford Road south of A4260 Upper Windsor Street section approach junction with UPS (reduced speed)	15	24,477	3.9%
12b	A4260 Oxford Road south of A4260 Upper Windsor Street	30	24,477	3.9%
13a	Cherwell Street south of Bridge Street section approaching junction with Swan Close Road (reduced speed)	15	28,822	3.8%
13b	Cherwell Street south of Bridge Street	30	28,822	3.8%
13c	Cherwell Street south of Bridge Street section approaching junction with Bridge Street (reduced speed)	15	28,822	3.8%
14a	Bridge Street west of Cherwell Street section approaching junction with Cherwell Street (reduced speed)	15	6,302	9.3%
14b	Bridge Street west of Cherwell Street section	30	6,302	9.3%
15a	A4260 Cherwell Street north of Bridge Street section approaching junction with Bridge Street (reduced speed)	15	22,548	3.2%
15b	A4260 Cherwell Street north of Bridge Street	30	22,548	3.2%
16a	Bridge Street east of Cherwell Street section approaching junction with Cherwell Street (reduced speed)	15	15,573	4.7%
16b	Bridge Street east of Cherwell Street	30	15,573	4.7%
17a	Oxford Road (north of Horton View)	30	24,477	3.9%
17b	Oxford Road (north of Horton View) section approaching junction with Horton Road (reduced speed)	15	24,477	3.9%
18	Horton View	30	6,129	2.4%
19	Hightown Road south of Bankside	30	6,670	0.9%
20	Oxford Road between Horton View and Hightown Road	30	24,152	3.8%
21	Oxford Road between Hightown Road and Farmfield	30	24,152	3.8%
22	Farmfields Road	30	2,517	2.2%
23	Oxford Road south of Farmfields	30	23,375	3.8%
24a	Oxford Road north of Bankside	30	22,584	3.8%
24b	Oxford Road north of Bankside section approaching Bankside (reduced speed)	15	22,584	3.8%
25a	Oxford Road south of Bankside section approaching Bankside (reduced speed)	15	22,188	4.0%
25b	Oxford Road south of Bankside	30	22,188	4.0%
26	Bankside west of site entrance	30	8,461	1.7%
27	Bankside east of site entrance	30	11,211	2.1%
28	Oxford Road north of Weeping Cross	30	24,651	4.1%
29	Weeping Cross	30	1,079	9.1%
30	Oxford Road south of Weeping Cross	30	25,438	4.0%
31	Oxford Road north of Twyford Road	30	25,009	4.1%
32	Twyford Road	30	3,002	5.1%
33	Oxford Road south of Twyford Road	30	22,467	4.4%
34a	Oxford Road north of Aynho Road	30	21,254	4.7%
34b	Oxford Road north of Aynho Road section approaching junction with Aynho Road (reduced speed)	15	21,254	4.7%
35a	A4100 Aynho Road section approaching junction with Oxford Road (reduced speed)	15	6,214	6.9%
35b	A4100 Aynho Road	30	6,214	6.9%
36a	Oxford Road south of Aynho Road section approaching junction with Aynho Road (reduced speed)	15	20,502	6.6%
36b	Oxford Road south of Aynho Road	30	20,502	6.6%

37	M40 passing site	70	87,935	12.1%
38	M40 north of site up to junc 11	70	87,935	12.1%
39	Hightown Road north of Bankside	30	11,841	2.7%

Appendix D – Model Verification

Most nitrogen dioxide (NO_2) is produced in the atmosphere by reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions. Verification of concentrations predicted by the ADMS model has followed the methodology presented in LAQM.TG(16).

Predicted annual mean road-NOx (i.e. the component of total NOx coming from road traffic) concentrations have been compared with the 2016 annual mean concentrations measured by seven CBC diffusion tubes, both within and outside the designated AQMA.

The measured NO_2 concentrations are converted into an equivalent measured road-NOx concentrations using the Defra NOx from NO_2 calculator and the 2016 mapped annual mean NO_2 concentration of 14.0 µg/m^3. The model is overpredicting the road-NOx concentrations at the modelling locations by between 5 and 25%.

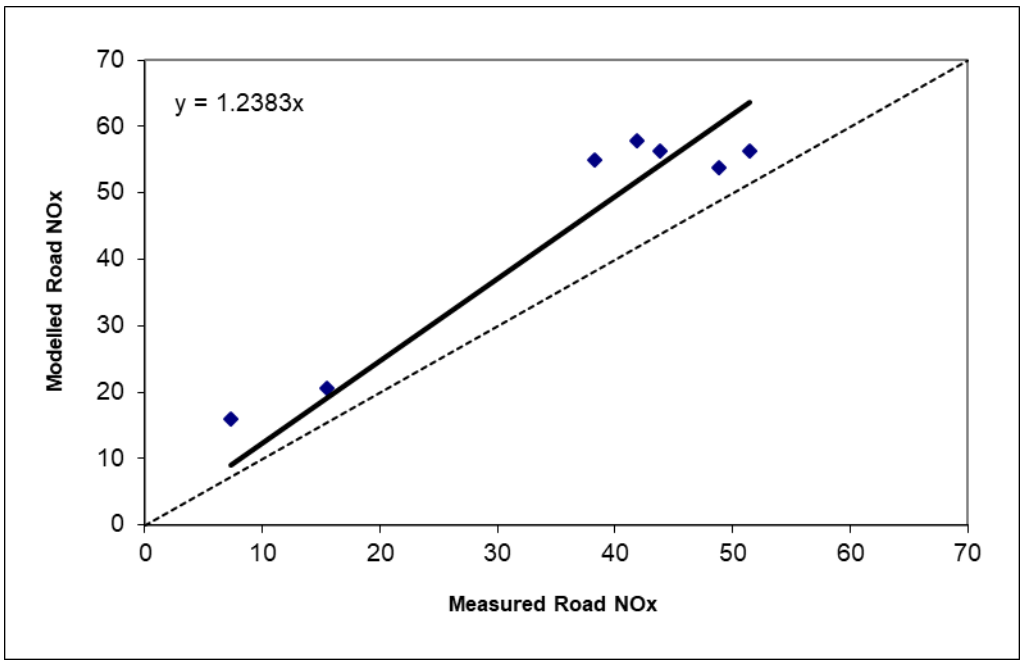

Figure D1: Comparison of Modelled Road NOx with measured Road NOx

A primary adjustment factor is determined as the ratio between the measured road-NO_x contribution and the model derived road-NO_x contribution, forced through zero (1/1.2383 = 0.808). This factor is applied to the modelled road-NO_x concentration for each monitoring location to provide an adjusted modelled road-NO_x concentration. An equivalent adjusted road-NO_2 concentration is then calculated using the DEFRA NO_x:NO_2 calculator, which can be added to the measured background to provide an adjusted modelled NO_2 concentration. A comparison between the adjusted modelled NO_2 concentration and the measured NO_2 concentration at each monitoring location is presented in Figure D2.

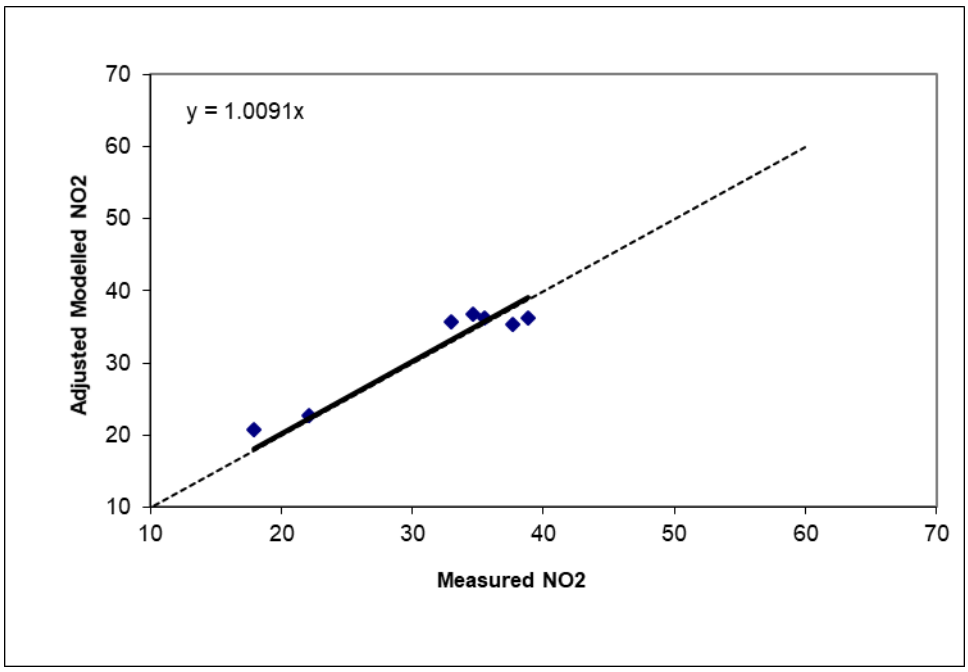

Figure D2: Comparison of Modelled Road NOx with measured Road NOx

The average performance of the model can be expressed as the Root Mean Square Error (RMSE), which in accordance with LAQM.TG(16) should ideally be less than 10% of the relevant air quality standard (in this case, the annual mean NO_2 objective of 40µg/m^3). The RMSE for the comparison of the adjusted modelled and measured NO_2 concentrations is 2.2 µg/m^3, 5.5% of the air quality objective. On this basis the modelled concentrations are considered to provide an acceptable estimate of local air quality and further adjustment is not required.

In the absence of particulate monitoring data suitable for verification, the adjustment factor has also been applied to the modelled Road-PM_{10} and Road-$PM_{2.5}$ concentrations, in accordance with the guidance.

Appendix E – Construction Mitigation Measures

The following measures are detailed in the IAQM guidance as being 'highly recommended' for site of the level of risk identified for the Site. It is therefore recommended that these measures are incorporated into a DMP and approved by CDC prior to commencement of any work on site:

- develop and implement a stakeholder communications plan that includes community engagement before work commences on site;
- display the name and contact details of the person accountable for air quality and dust issues on the site boundary (i.e. the environment manager/engineer or site manager);
- display the head or regional office contact information on the site boundary;
- record all dust and air quality complaints, identify cause, take appropriate measures to reduce emissions in a timely manner and record the measures taken;
- make the complaints log available to the local authority when asked;
- record any exceptional incidents that cause dust and/or air emissions, either on- or off- site and the action taken to resolve the situation in the log book;
- hold regular liaison meetings with other high risk construction sites within 500m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to undertand the interactions of the off-site transport/deliveries which might be using the same strategic road network routes;
- undertake daily on-site and off-site inspection, where receptors area nearby, to monitor, record inspection results and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100 m of the site boundary;
- carry out regular site inspections to monitor compliance with the DMP, record inspection results and make inspection log available to SODC when asked;
- increase frequency of site inspection by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged periods of dry or windy conditions;
- plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible;
- erect solid screens or barriers around dusty activities or the site boundary as necessary that are at least as high as any stockpiles;
- fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period;
- avoid site runoff of water or mud;
- keep site fencing, barriers and scaffolding clean using wet methods;
- remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site;
- cover, seed or fence stockpiles to prevent wind whipping
- ensure all vehicles switch off engines when stationary – no idling vehicles;
- avoid use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable;
- impose and signpost a maximum speed-limit of 15 mph on surfaced and 10 mph on un-surfaced haul roads and work areas;

- produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials;
- implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking and car-sharing);
- only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction e.g. suitable local exhaust ventilation systems;
- ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate;
- use enclosed chutes and conveyors and covered skips;
- minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate;
- ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods;
- avoid bonfires and burning of waste materials;
- re-vegetate earthworks and exposed areas to stablise surfaces as soon as practicable;
- use hessian, mulches or trackifiers where possible to revegetate or cover with topsoil;
- only remove the cover in small areas during work and not all at once;
- avoid scabbing (roughening or concrete surfaces) if 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;
- 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;
- use water-assisted dust sweepers on the access and local roads, to remove, as necessary, any material tracked out of the site;
- avoid dry sweeping of large areas;
- ensure vehicles entering and leaving the site are covered to prevent the escape of materials during transport;
- inspect on-site haul routes for integrity and instigate necessary repairs to the surfaces as soon as reasonably practicable;
- record all inspections of haul routes and any subsequent action in a site log book;
- install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned;
- implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud) as required;
- ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit.
- Access gates to be located at least 10m from receptors where possible.

The guidance also details the following measure which is considered to be ‘desirable’. It is recommended that this measure is also be considered for inclusion within the DMP:

- for smaller supplied of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust.