BUROHAPPOLD ENGINEERING

Technical Note

Project Trumpington South, Cambridgeshire

Subject Air quality constraints and opportunities desk study

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Executive Summary

This note presents an overview of the constraints and opportunities with regards to air quality for the proposed Trumpington development located on the border of South Cambridgeshire District Council (SCDC) and Cambridge City Council (CCC). The development site is bordered by Junction 11 of the M11 to the south, the M11 to the west and by Hauxton Road to the East. The M11 is a major pollution source within this area due to the high volume of traffic using this road, and the nearby junction has the potential to lead to elevated pollutant concentrations due to queuing and congestion.

A dispersion modelling study has therefore been undertaken to establish the likely air quality conditions at the proposed development site. Results from the modelling study indicate that pollutant concentrations are elevated at the roadside, with exceedances of the air quality objective predicted up to 25m from the M11 roadside. Pollutant concentrations decrease significantly after 25m separation from the roadside and are reduced to close to background levels after 100m.

The proposed masterplan indicates that residential properties will be located approximately 200m from the M11 roadside and junction. This distance will ensure that pollutant contribution from the roadside at the proposed development site is minimal. The maximum predicted NO_2 concentration at the proposed development site is 19.5µg/m^3, which is well below the air quality objective. It can therefore be concluded that air quality impacts associated with emissions from surrounding roads on future site occupants will not be significant.

In terms of development operation, the proposed masterplan seeks to discourage private cars and encourage active transport (walking and cycling) and public transport, with the implementation of car-free zones. The proposed masterplan also incorporates other elements that will have a positive impact on air quality, including zero-carbon homes and extensive tree planting across the site.

Any further mitigation required will be dependent on the outcome of a detailed air quality assessment which will be necessary to submit with the planning application. This should consider construction and operational phases and potential mitigation measures may include:

- Best practice measures for controlling emissions during construction;
- Provision for electric vehicle (EV) charging points;
- Use of non-combustion based heating; and
- Implementation of an air quality travel plan.

1 Introduction

This note presents an overview of the constraints and opportunities with regards to air quality for the proposed Trumpington development located on the border of South Cambridgeshire District Council (SCDC) and Cambridge City Council (CCC). The note provides an overview of key policy and guidance, and existing baseline conditions in the vicinity of the site. The note also presents a dispersion modelling study which has been carried out to determine the likely pollutant concentrations at the proposed development site, and subsequently provides details of the likely constraints and opportunities for the proposed development.

2 Policy and guidance

Part IV of the Environment Act 1995 places a duty on the Secretary of State for the Environment to develop, implement and maintain an Air Quality Strategy (AQS) with the aim of reducing atmospheric emissions and improving air quality. The latest AQS for England, Scotland, Wales and Northern Ireland was published in 2007, and provides the framework for ensuring the air quality limit values are complied with based on a combination of international, national and local measures to reduce emissions and improve air quality. This includes the statutory duty, also under Part IV of the Environment Act 1995, for local authorities to undergo a process of Local Air Quality Management (LAQM). This requires local authorities to regularly and systematically review and assess air quality within their boundaries against a series of objectives and appraise development and transport plans against these assessments.

In areas where air quality objectives are not likely to be met by the relevant target date, local authorities are required to declare an Air Quality Management Area (AQMA) and develop an air quality action plan in pursuit of the air quality objectives. The national air quality objectives relevant to this assessment are detailed in Table 1.

Table 1 NO_2 and PM_{10} National Air Quality Objectives included in the Air Quality (England) Regulations 2000

Pollutant	Objective	Date to be achieved and maintained thereafter
Nitrogen dioxide (NO_2)	200µg/m^3 measured as a 1-hour mean, not to be exceeded more than 18 times a year	31st December 2005
	40µg/m^3 measured as an annual mean	
Particulate Matter (PM_{10})	50µg/m^3 measured as a 24-hour mean, not to be exceeded more than 35 times a year	31st December 2004
	40µg/m^3 measured as an annual mean	

The majority of AQMAs in the UK have been declared for exceedances of nitrogen dioxide (NO_2) and particulate matter (PM_{10}) in relation to traffic emissions. The nearest AQMA to the proposed development site is located within CCC, and has been declared owing to exceedances of the annual mean air quality objective for NO_2 (40µg/m^3). This AQMA was declared in 2004, and the main source of pollution declared as road transport emissions. SCDC have declared two AQMA's which are located over 5km from the Trumpington site. Both AQMAs are presented in Figure 1.

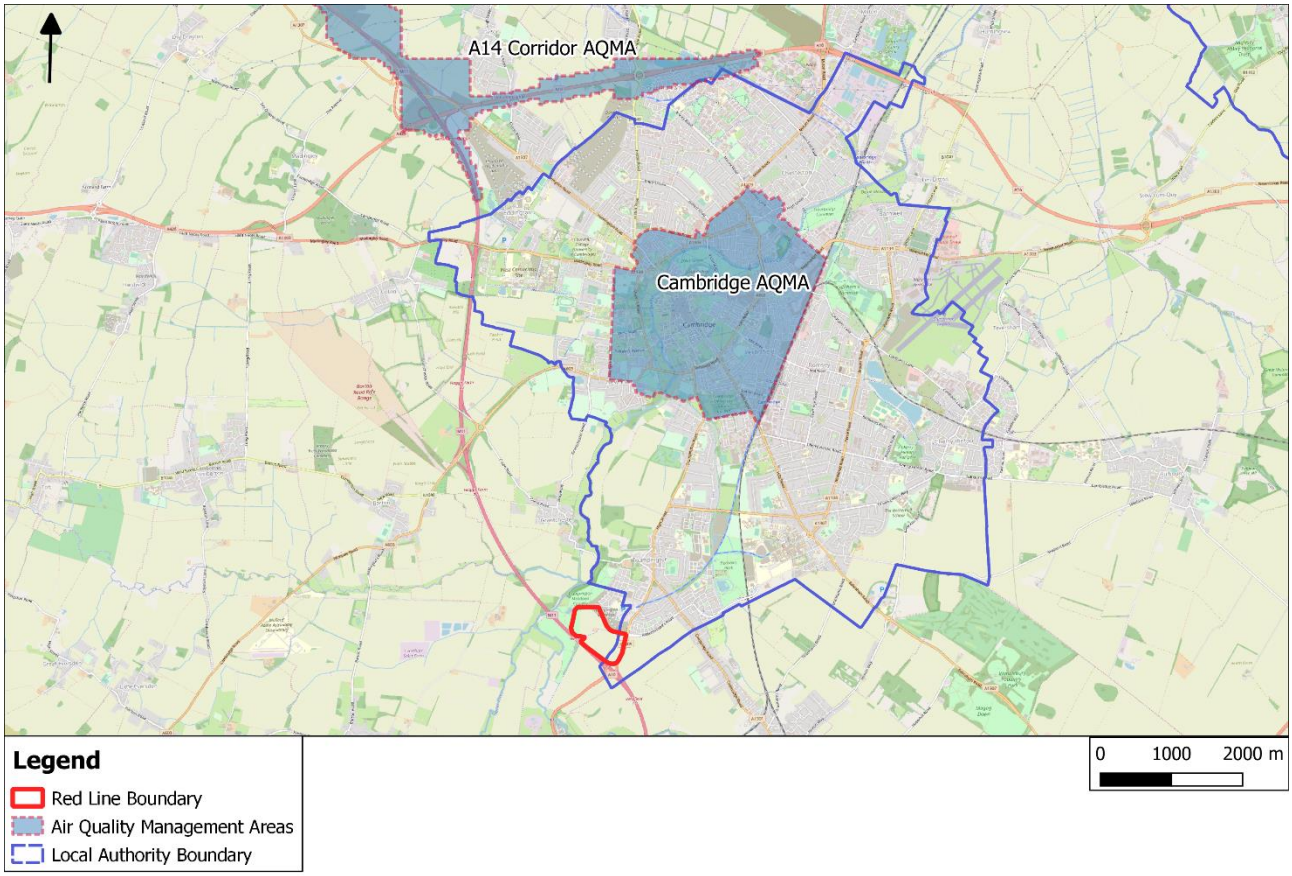

Figure 1 Air Quality Management Areas

As a result of the AQMA declaration, an Air Quality Action Plan[1] has been published by CCC which outlines the mitigation measures and strategic approach to be taken to improve air quality within the city centre and surrounding areas. A number of key priorities have been identified within the action plan, each of them are outlined below;

1. Reduce Emissions in the central areas of Cambridge
   "The source apportionment shows that traffic emissions are the main source of air pollution in the city, with major contributions from buses and HGVs in the historic city centre and from cars elsewhere. Only a small reduction in emissions is required to meet the National Air Quality Objectives. Completion of the measures in this Plan is expected to ensure that these Objectives are met by the earliest possible date."

2. Reduce emissions across Cambridge
   "The evolving work currently being carried out by the GCP to tackle congestion in Cambridge will be key to the immediate, medium and long term success of the Air Quality Action Plan. Realisation of the measures being developed is expected to reduce the level of emissions from traffic in general, and from public transport in particular."

3. Keep emissions low in the future
   "Keeping emissions low, and reducing them further in the future will require ongoing involvement with development and delivery of relevant transport and planning policies, strategies and plans."

[1] Cambridge City Council, 2018. Air Quality Action Plan URL

National Planning Policy Framework[2]

The National Planning Policy Framework (NPPF) (February 2019) underlines the importance of local authorities contributing towards improving and protecting the environment. The legislation points towards the need to focus on the enhancement of biodiversity, minimising waste and pollution, and mitigation/adaptation to climate change.

With particular regard to air quality management, Section 9 of the NPPF notes that the environmental impact of transport and traffic should be identified and assessed, whilst mitigating adverse effects to bring about net environmental gains. The guidance states that the planning system should actively manage patterns of growth, offering a choice of transport modes to reduce air pollution:

> *'Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions, and improve air quality and public health.'*

Further to this, Section 15 of the NPPF notes that 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 (CAZ), 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.

South Cambridgeshire Local Plan[3]

SCDC's local plan was formally adopted in 2018, it outlines the growth and development aims of the district and implements key strategies and policies which will underpin all future decisions relevant to spatial changes and growth of the borough. Air quality has been incorporated and considered throughout the plan, showing SDCS's aim to minimise impacts to air quality and limit the exposure to its residents. Policy SC/12- Air Quality is the most pertinent to this technical note, the policy states;

1. *"Where development proposals would be subject to unacceptable air quality standards or would have an unacceptable impact on air quality standards they will be refused.*
2. *Where emissions from the proposed development are prescribed by EU limit values or national objectives, the applicant will need to assess the impact on local air quality by undertaking an appropriate air quality assessment and detailed modelling exercise having regard to guidance current at the time of the application to show that the national objectives will still be achieved.*
3. *Development will not be permitted where it would adversely affect air quality in an Air Quality Management Area (AQMA); or lead to the declaration of a new AQMA through causing a significant deterioration in local air quality by increasing pollutant levels either directly or in directly or if it would expose future occupiers to unacceptable pollutant levels.*
4. *Larger development proposals that require a Transport Assessment and a Travel Plan as set out in Policy TI/2 will be required to produce a site based Low Emission Strategy. This will be a condition of any planning permission given for any proposed development which may result in the deterioration of local air quality and will be required to ensure the implementation of suitable mitigation measures.*
5. *Development will be permitted where:*
    a. *It can be demonstrated that it does not lead to significant adverse effects on health, the environment or amenity from emissions to air; or*

[2] MHCLG (February 2019) National Planning Policy Framework

[3] SCDC, 2018. South Cambridgeshire Local Plan 2018. URL

b. Where a development is a sensitive end use, that there will not be any significant adverse effects on health, the environment or amenity arising from existing poor air quality.

6. Specifically, applicants must demonstrate that:

a. There is no adverse effect on air quality in an Air Quality Management Area (AQMA) from the development;

b. Pollution levels within the AQMA will not have a significant adverse effect on the proposed use / users; e. The development will not lead to the declaration of a new AQMA;

c. The development will not interfere with the implementation of and should be consistent with the current Air Quality Action Plan;

d. The development will not lead to an increase in emissions, degradation of air quality or increase in exposure to pollutants at or above the health-based air quality objective;

e. Any impacts on the proposed use from existing poor air quality, are appropriately mitigated;

f. The development promotes sustainable transport measures and use of low emission vehicles in order to reduce the air quality impacts of vehicles.

7. Applicants shall, where appropriate, prepare and submit with their application, a relevant assessment, taking into account guidance current at the time of the application"

Cambridge City Council Local Plan

Cambridge City Council also adopted their local plan in 2018. The local plans were developed in tandem with one another, and so the overarching principles and framework for development are similar in intent and justification. As with SCDC's local plan, air quality is one of the key policies that have been implemented to achieve the objectives set out by the council. *Policy 36: Air quality, odour and dust* is presented below;

"Development will be permitted where it can be demonstrated:

a. that it does not lead to significant adverse effects on health, the environment or amenity from polluting or malodorous emissions, or dust or smoke emissions to air; or

b. where a development is a sensitive end-use, that there will not be any significant adverse effects on health, the environment or amenity arising from existing poor air quality, sources of odour or other emissions to air.

According to the end-use and nature of the area and application, applicants must demonstrate that:

c. there is no adverse effect on air quality in an air quality management area (AQMA);

d. pollution levels within the AQMA will not have a significant adverse effect on the proposed use/users;

e. the development will not lead to the declaration of a new AQMA;

f. the development will not interfere with the implementation of the current Air Quality Action Plan (AQAP);

g. any sources of emissions to air, odours and fugitive dusts generated by the development are adequately mitigated so as not to lead to loss of amenity for existing and future occupants and land uses; and

h. any impacts on the proposed use from existing poor air quality, odour and emissions are appropriately monitored and mitigated by the developer."

As well as this policy, air quality is also a key consideration in a number of other policies that will impact planning decisions and spatial changes in the borough. *Policy 29: Renewable and low carbon energy generation* states that proposals for development that utilise renewables and/or low carbon energy generation will be favoured and all proposals must show adverse impacts on the local environment must be minimised, notably in air quality management areas.

IAQM (2017) Land-Use Planning & Development Control: Planning for Air Quality[4]

This technical note has been completed following the principles and guidance of the IAQM Land-Use Planning & Development Control guidance document, the document outlines the key links air quality has to the spatial planning system and how planning can influence air quality and the exposure to poor air quality.

Principles of good practice are included in this guidance and these have been considered when reviewing mitigation measures and recommending the approach to design and operation of new developments. Good practice measures should be considered for all developments that have a potential to impact local air quality, key suggestions include:

- Ensuring developments do not conflict with the principles or the measures outlined by the local councils air quality plan;
- Minimise the creation of 'street canyons', and;
- Minimising the introduction of new exposure.

There are also suggestions of practical measures to address air quality issues including the incorporation of Electric Vehicle charging, implementing travel plans on larger developments and ensuring all gas fired boilers meet low emission standards. The best practice measures are closely aligned with the policies set out in the local plans.

The guidance also outlines the necessity to carry out a detailed air quality assessment on developments that meet certain criteria. The assessment will need to cover both the impact of the development on local air quality and also the exposure experienced by users or residents of the development. All assessments must consider;

- *"the background and future baseline air quality and whether this will be likely to approach or exceed the values set by air quality objectives*
- *the presence and location of Air Quality Management Areas as an indicator of local hotspots where the air quality objectives may be exceeded"*

The document also states that where air quality is in exceedance of an air quality objective, at areas of relevant exposure, the effect on residents or users should be considered significant, unless provision is made to reduce exposure by some means.

3 Baseline conditions

Local air quality management

The proposed development site is located on the boundary of Cambridge City Council (CCC) and South Cambridgeshire District Council (SCDC), approximately 4km from Cambridge city centre Due to the close proximity of the M11 the background concentration on site will likely be higher than other areas of Cambridgeshire.

As part of the air quality action plan, CCC[1] carried out an extensive modelling study and calculated the proportions of emissions from different vehicle types. Figure 2 shows the share of NO_x emissions on the Cambridge ring road; this may vary from actual conditions on site but gives a good indication of the likely source apportionment.

[4] IAQM (2017) Land-Use Planning & Development Control: Planning For Air Quality, URL

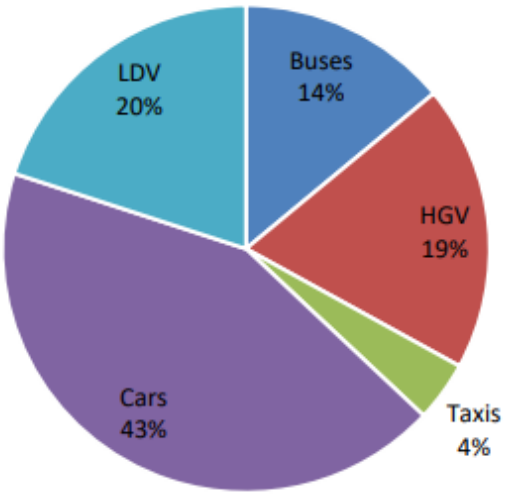

Figure 2 Share of NOx emissions on the Cambridge ring road (source: CCC Air Quality Action Plan 2018)

Local pollution sources

CCC air quality monitoring

Both CCC and SCDC monitoring sites have been reviewed, SCDC do not undertake monitoring in the vicinity of the site, however, CCC has an extensive air quality monitoring network many of which are within 2km of the proposed development site. Each year local authorities must publish an annual status report detailing annual monitoring results and identifying trends in air quality data.[5] Data from monitoring stations in close proximity to the development site is presented in Table 2 and monitoring locations are presented in Figure 3. The results indicate that NO_2 concentrations are mostly within air quality objective limits, however monitored concentrations at roadside site (and in particular at the DT6 site) are elevated when compared to background sites.

PM_{10} and $PM_{2.5}$ is monitored at two sites within Cambridge, both of which have monitored concentrations well below air quality limits across their operating years.

Table 2 Nearby air quality monitoring results

Site ID	Site Type	Distance from development site (km)	Annual Mean NO_2 Concentrations ($\mu g/m^3$)			
			2015	2016	2017	2018
DTS2	Roadside	0.9	-	36	32	30
DTS3	Roadside	0.9	-	25	21	18
DT51	Roadside	0.8	27	27	24	22
DTS4	Urban Background	1.2	-	22	18	17
DT27	Roadside	1.4	25	24	19	20
DT6	Roadside	**2.0**	**45**	**45**	**40**	37

[5] Cambridge City Council, 2019. 2019 Annual Status Report. URL

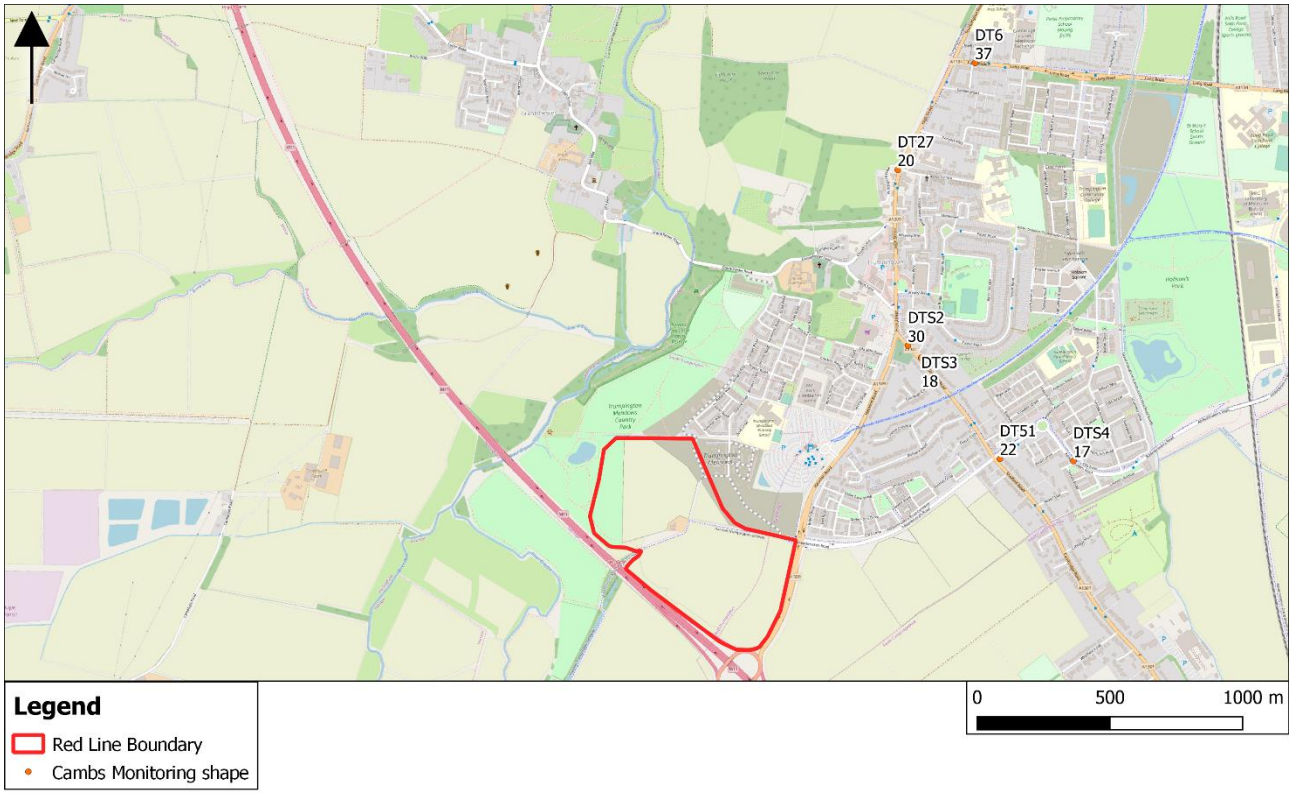

Figure 3 Nearby air quality monitoring locations

4 Dispersion Modelling Study

4.1 Methodology

On-site air quality conditions have been considered by carrying out a dispersion modelling study to predict concentrations of key pollutants across the proposed site.

Vehicle emissions have been predicted across a gridded area that covers the proposed site. A grid of this nature is useful in determining onsite concentrations, and the extent to which traffic emissions will impact upon the development site. The study has been carried out using ADMS-Roads, a new generation dispersion modelling system produced by Cambridge Environmental Research Consultants which can be used to assess the impact of road vehicles on local air quality. Unlike simpler spreadsheet screening tools, it can include parameters such as variable meteorological conditions, complex road networks (including the combined contribution of multiple road links on single sensitive receptors) and the capability of including the effects of complex terrain, atmospheric chemistry and street-canyon effects. The model is widely used by Local Authorities in the UK as part of their review and assessment of planning obligations.

The study considers traffic-related pollutant concentrations (NO_2 and PM_{10}) at the proposed development site.

4.2 Traffic Data

Traffic data has been obtained from Department for Transport (DfT) traffic flows[6] which have been used for the purposes of this study. These counts are freely available for public use and consist of actual counts supplemented by modelled counts for years where counts have not taken place. There are a number of DfT count points in the vicinity of the site which have been used in the dispersion modelling study. Whilst the DfT counts cover the majority of the key road links likely to affect

[6] Department for Transport (2019) Road Traffic Statistics URL

onsite conditions, DfT data was not available for the slip road to the south east corner of the development site. The appointed transport consultant, Vectos, has therefore supplied supplementary data for this slip road that has been used in the assessment. Traffic data used in the study are detailed in Table 3

The modelled road network is presented in Figure 4.

Table 3 Department for Transport Count Points use in assessment

DfT Count Point reference	Road Name	Count type	AADT	HGV%
16035	M11	Modelled	76532	12
81422	Hauxton Road N	Modelled	32239	3
81423	Hauxton Road S	Modelled	20185	2
81424	Shelford Road	Modelled	7073	2
81426	Addenbrooke Road	Manual	15451	2
47586	High Street	Modelled	20653	3
7990	Long Road	Modelled	13574	3
37603	Trumpington Road	Modelled	10560	14
N/A (Data supplied by transport consultant)	M11 Slip Road	Supplied by traffic consultant	12374	3

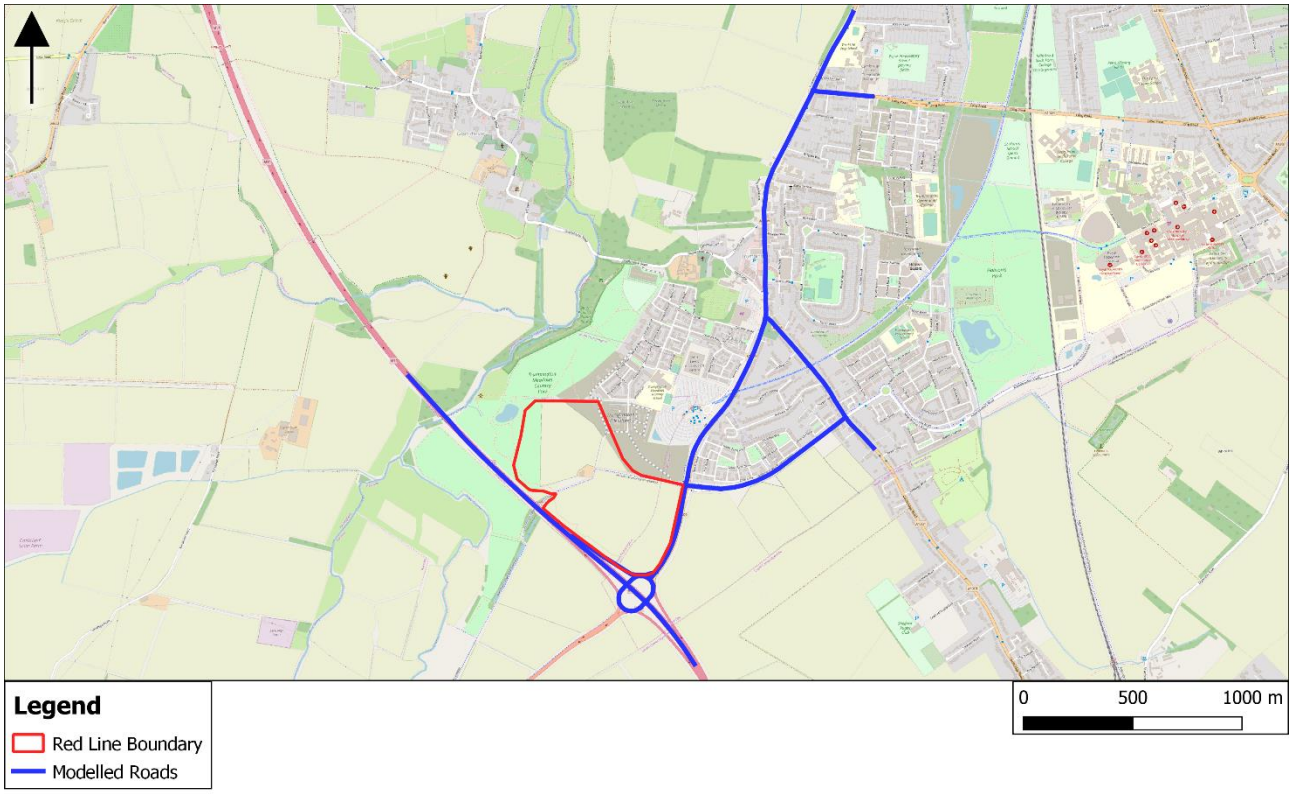

Figure 4 Modelled road links

4.3 Model Verification

In order to ensure modelled results are representative of real-world conditions, model verification has been carried out. NO_2 concentrations, have been compared against local monitoring data from 2018 in order to ensure that modelled results are representative of monitored data from the study area. Local Air Quality Management Technical Guidance (LAQM TG16)[7] provides a methodology for model verification, which has been followed for the purposes of this assessment. Road NO_x contribution was predicted at one roadside monitoring sites along Long Road (DT6). The site used for model verification is presented in Figure 5. Monitored NO_2 has been converted to NOx using the Defra NOx-NO_2 conversion spreadsheet[8], and background NOx has been removed in order to give monitored road NOx. Modelled and monitored road NOx are then compared in order to calculate an appropriate adjustment factor. The adjusted road contribution is then added to Defra's mapped background concentrations to give a total concentration.

[7] Defra (2016) Part IV of the Environment Act 1995: Local Air Quality Management: Technical Guidance (TG16), Department for Environment Food and Rural Affairs, April 2016

[8] DEFRA NOx to 2 Conversion Tool https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html

Figure 5 Verification monitoring sites

DT6 has been used as a verification site due to close proximity to the development site and DfT counts, which lead to a greater level of confidence in the modelled results. There are a two diffusion tubes located in close proximity to the site, DTS2 and DTS3, that have not been used in the verification process; these sites were located on roads that have seen significant changes in use (for example the introduction of Addenbrookes Road) and layout since the last DfT manual count, so the modelled counts used may not accurately reflect these changes.

Results from model verification are presented in Table 4. Results indicate that the model under-predicts road NOx contribution, and an adjustment factor of 2.01 has been (see Table 5 and Figure 7).The adjustment factor has subsequently been applied to all modelled road NOx concentrations.

Due to the absence of nearby PM_{10} monitoring it has not been possible to formally verify PM_{10} results, following guidance set out in TG16, the NO_x verification factor has been used instead.

Table 4 Model verification results

Monitoring Site ID	Modelled road NOx	Monitored road NOx	% Difference
DT6	26.4	53.1	-50.2

Figure 6 Modelled and monitored road NOx

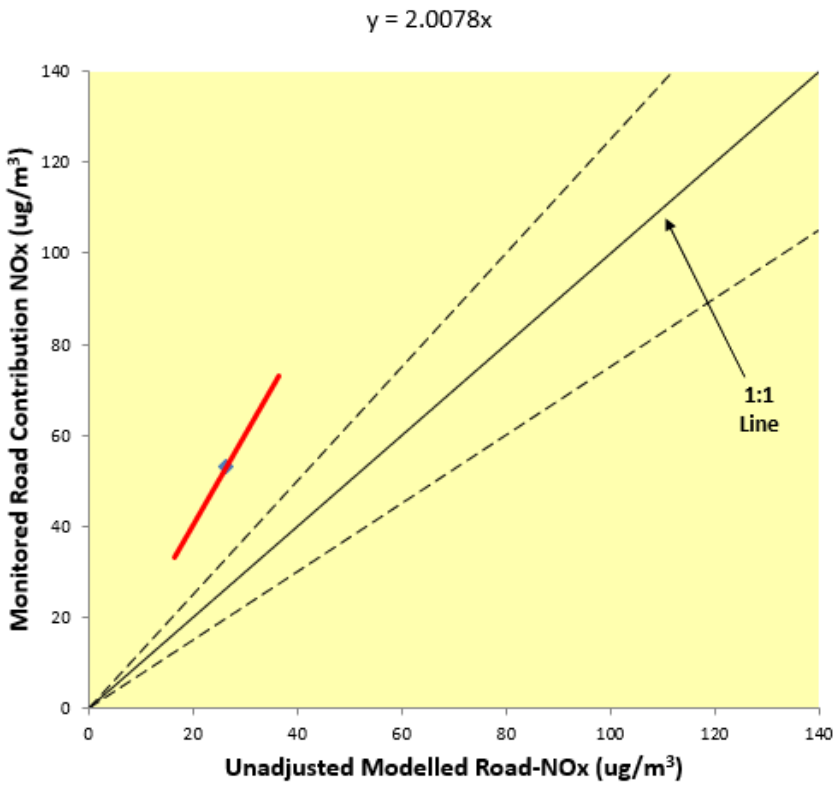

Table 5 Adjusted modelled road NOx

Monitoring Site ID	Background		Modelled Road NOx	Monitored Road NOx	Adjusted Modelled Road NOx	% Difference after Adjustment
	NOx	NO_2				
DT6	15.11	11.44	26.4	52.70	53.1	0.7

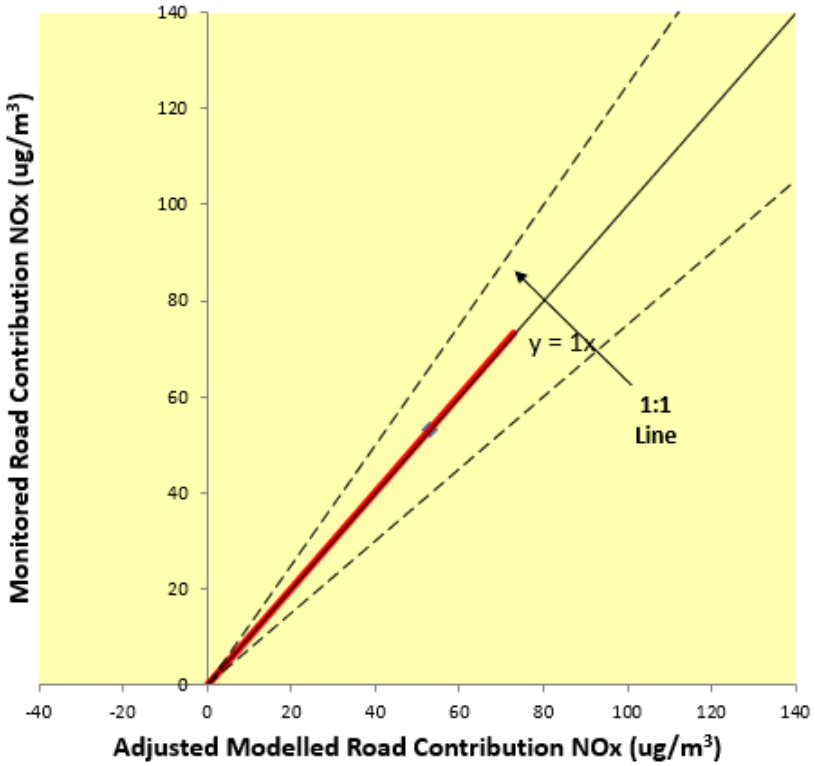

Figure 7 Adjusted modelled road NOx

NOx – NO_2 conversion and background concentrations

The model predicts NOx and PM_{10} road increment at the selected receptor points. These values are then added to relevant ambient background concentrations to enable the comparison with air quality objectives. NO_2 and PM_{10} background concentrations from 2018 were obtained from Defra's website[9]; these were added to the predicted road increment for all assessment scenarios. The NOx to NO_2 conversion spreadsheet, available from the UK Air Information Resources website (Defra, 2015)[10] has been used to calculate NO_2 concentrations from established NOx concentrations.

Surface roughness

One of the modelling parameters is surface roughness which represents the extent of mechanical turbulence in the atmosphere caused by the roughness of the ground over which the air is passing. A surface roughness value of 0.3m was used at the study and meteorological measurement areas which represents agricultural areas.

[9] Defra (2018) 2017 Background reference maps URL

4.4 Results

Whilst exact locations and site lay out are not frozen at this stage, the development edge strategy and masterplan layout give an indication as to where receptors will be located. The masterplan drawings have been incorporated into figures 8 and 9, which show the likely air quality conditions across the site.

As to be expected highest pollutant concentrations are located along the main bordering roads, namely the motorway and the motorway slip road. The dashed red line presented on Figure 8 indicates where NO_2 concentrations are predicted to be within 10% of air quality limit. This line extends to approximately 25m from the M11 roadside, and therefore within this distance, there is a risk of NO_2 concentrations exceeding the air quality objectives at ground level. Predicted NO_2 concentrations are close to background levels at roughly 100m (as indicated by the 20 µg/m^3 line in Figure 8) from the roadside.

PM_{10} concentrations were also predicted in this dispersion modelling study. As shown in Figure 9, PM_{10} concentrations are lower than NO_2 concentrations, due to reduced background concentrations and air quality objectives for PM_{10} are likely to be met across the proposed development site.

The proposed masterplan indicates that residential properties will be located approximately 200m from the M11 roadside and junction. This distance will ensure that pollutant contribution from the roadside at the proposed development site is minimal. The maximum predicted NO_2 concentration at the residential areas of the proposed development site is 19.5µg/m^3, which is well below the air quality objective. It can therefore be concluded that air quality impacts associated with emissions from surrounding roads on future site occupants will not be significant.

Figure 8 NO_2 Annual Mean Concentrations

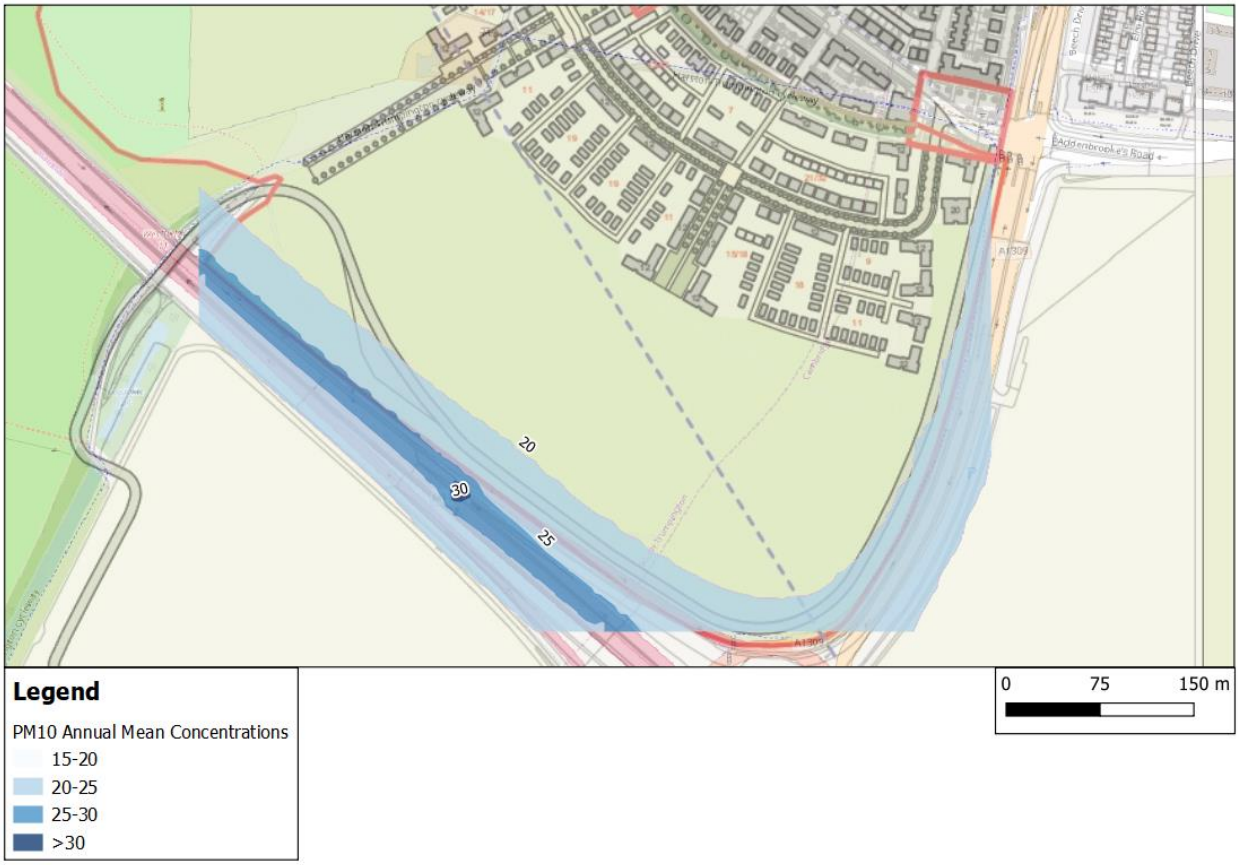

Figure 9 PM_{10} Annual Mean Concentrations

5 Constraints and opportunities

In terms of development operation, the proposed masterplan seeks to discourage private cars and encourage active transport (walking and cycling) and public transport, with the implementation of car-free zones. The proposed masterplan also incorporates other elements that will have a positive impact on air quality, including zero-carbon homes and extensive tree planting across the site.

During operation of the development, vehicle trips generated as a result of the development will have the potential to impact local air quality. It will be necessary to assess the impact of additional vehicle movements using dispersion modelling software in order to quantify the impact on pollutant concentrations, and where necessary, propose mitigation measures in order to minimise emissions from traffic generated by the development.

For this development, given its size and location recommended mitigation includes; the production of a detailed travel plan (with provision to measure its implementation and effect), which sets out measures to encourage sustainable means of transport (public transport, cycling and walking), and improved infrastructure and layouts to improve accessibility and safety. Other suggested mitigation for this development includes provision for electric vehicle (EV) charging spaces (ideally "rapid charge" points).

The use of any onsite combustion plant will give rise to emissions which will have an impact on air quality. The preference from an air quality perspective would therefore be for non-combustion-based heating systems, such as ground or air sourced heat pumps. Where any combustion plant is proposed (for example diesel generators), dispersion modelling should be carried out to determine the impact of emissions from such plant and advise on an appropriate stack height and any further emissions abatement/mitigation necessary. Ideally any stack should be placed on the tallest building onsite and downwind of sensitive receptors.

From the proposed site layout, there is ample separation between the introduced receptors and the motorway, as such mitigation measures that look to safeguard residents from existing pollution levels will not be needed. Measures such as sealed facades or NO_x filtration are not likely to be required, given the expected pollutant concentrations. Access roads will

be introduced by the development, which may lead to slight increases in concentrations of transport related emissions however the overall impact of these roads will be limited as they will only be used by those accessing the site and there will be an emphasis on electric vehicles in any event. The development should avoid the creation of street canyons, which limit pollution dispersion and lead to pollution hotspots where pollutants remain recirculating within the canyon. Residential units bordering any proposed access road should ensure an appropriate set back from the road and consider inclusion of green infrastructure/planting in these locations to minimise exposure to emissions.