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Dispersion Modelling Study: Buntingford, Hertfordshire

Client: Jubb Consulting Engineers Ltd

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E1. Introduction

E1.1. Air Pollution Services (APS), part of KALACO Group, has been commissioned by Jubb Consulting Engineers Ltd (the 'Client') to assess the air quality impacts associated with the proposed development at West of Buntingford, Buntingford, Hertfordshire (herein the 'Proposed Development') within the administrative boundary of East Herts District Council (EHDC).

E1.2. There are two sites adjacent to each other ('northern site' and 'southern site'). Each site has its own application; however, the baseline conditions are presented for both sites in this document.

E1.3. To carry out the assessment a detailed dispersion modelling study has been completed. Details of the modelling approach are presented in this document.

E1.4. It provides a modelling overview (Section E2); description of the model used (Section E3); the list of the modelled receptors (Section E4); meteorology and surface characteristics used (Section E5); details of roads modelling (Section E6); post-processing of model outputs (Section E7); uncertainties and limitations (Section E8) and a glossary of useful terms used in this assessment (Section E9).

Location Context

E1.5. The location of the Proposed Development is presented in Figure 1 for context.

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Figure 1: Proposed Development Location



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Assessment Year

E1.6. The Proposed Development southern site is anticipated to be operational at the earliest in 2028, while the full site including the northern site will be operational at the earliest of 2035 and these have been used as the assessment years.

E2. Modelling Overview

E2.1. Concentrations of nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$) have been predicted for:

- the existing year of 2019 (latest year with relevant monitoring data);
- the future year of 2028 (when the first phase of the Proposed Development may be operational); and
- the future year of 2035 (when the Proposed Development is expected to be fully operational).

E2.2. The year 2019 is selected to represent the existing conditions because it is the latest year with monitoring data which is unaffected by the COVID-19 pandemic and therefore the model can be appropriately verified.

E2.3. It should be noted that monitoring is being carried out in the local area. However, at the time of this assessment, the monitoring was not yet complete and thus this assessment will use monitoring data provided in the EHDC Air Quality Annual Status Report (ASR) (East Herts District Council, 2022).

E3. The Model

E3.1. Concentration contributions associated with the Proposed Development have been predicted across the local area using the Atmospheric Dispersion Modelling System (ADMS) suite of tools developed and validated by Cambridge Environmental Research Consultants (CERC).

E3.2. ADMS-Roads is used extensively throughout the UK for regulatory compliance purposes and Local Air Quality Management (LAQM) and is accepted as an appropriate tool by local authorities, Government and regulators. Version 5.0.1 of the model has been used for modelling of the road transport emissions.

E3.3. The model requires a range of input parameters which are discussed below.

E4. Modelled Receptors

E4.1. The model output locations are often referred to as receptors, although is some cases the locations may not represent locations of relevant exposure. For ease, this study uses the phrase receptor to represent the modelled output location.

Discrete Modelled Locations

E4.2. Concentrations of NO_2, PM_{10} and $PM_{2.5}$ have been predicted at:

- seven receptor locations within the local area (prefixed with E) (shown in Figure 2);
- 14 receptor locations within the northern site of the Proposed Development (prefixed with P) (shown in Figure 3). These receptors represent a range of exposure throughout the Proposed Development including near the site boundary and at locations of potential onsite roads; the

receptors have been modelled at a height of 1.5 m to represent ground floor locations of worst-case exposure at the Proposed Development. The southern site of the Proposed Development is employment provision and does not include any relevant receptors and will not introduce any long-term exposure and thus does not need to be assessed in terms of site suitability; and

- two monitoring site locations to carry out a model performance for verification for the roads modelling as shown in Figure 4.

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Figure 2: Receptor Locations in the Local Area



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Figure 3: Receptor Locations at the Proposed Development

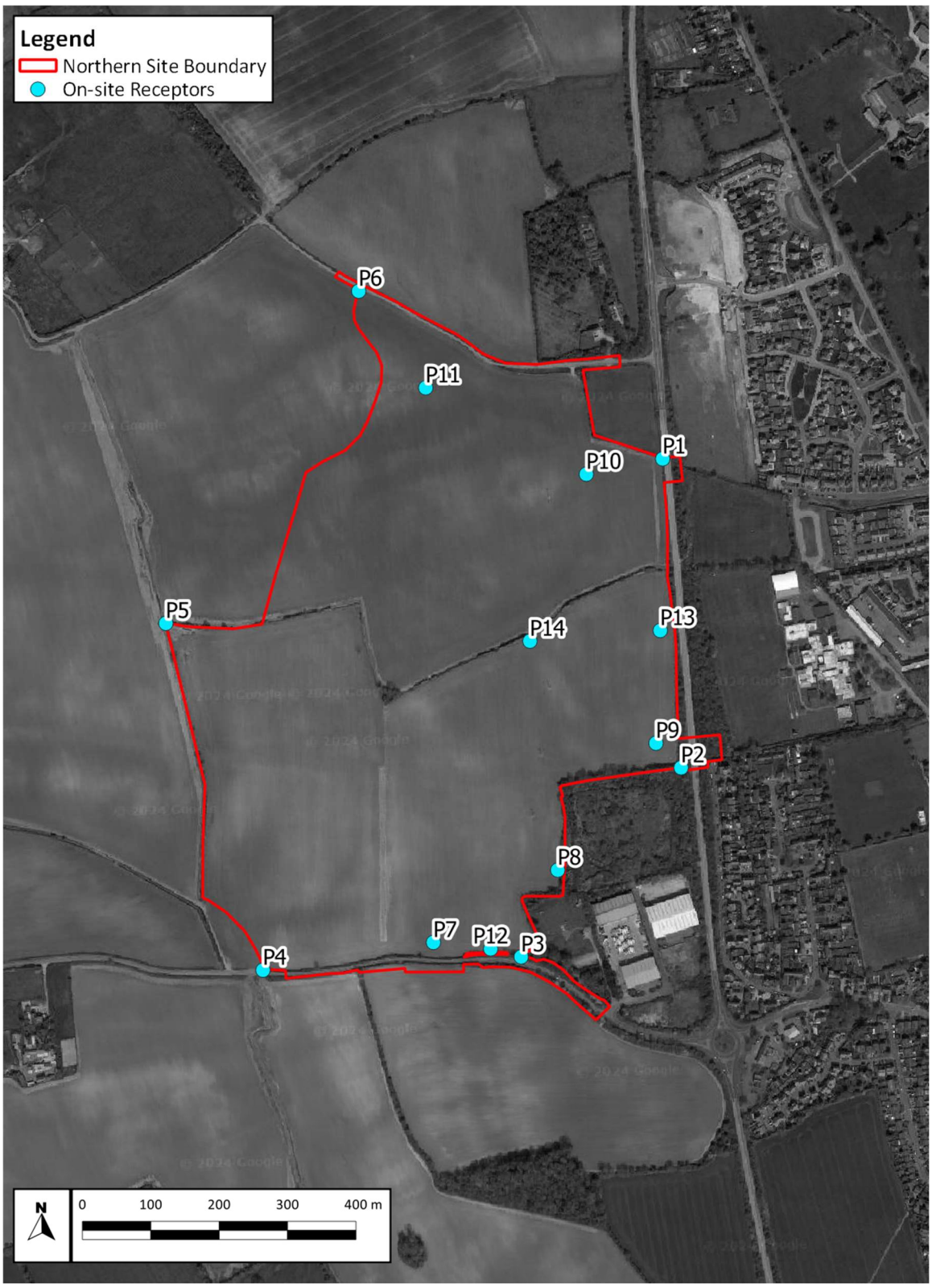


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Figure 4: Modelled Monitoring Site Locations



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E5. Meteorology and surface characteristics

Meteorology

E5.1. The dispersion model includes a meteorological pre-processor developed by the UK Met Office to calculate values of meteorological parameters in the boundary-layer. The pre-processor requires a set of meteorological parameters on an hour-by-hour basis: wind speed, wind direction, temperature and cloud cover.

E5.2. It is important to use meteorological data which is representative of the conditions within the Study Area. The Proposed Development is located in relatively flat lying location and is far from the coast, it is thus expected that coastal effects on meteorological conditions will not be prevalent in the Study Area.

E5.3. There are a limited number of sites in the UK where this data is measured and recorded. The nearest meteorological station is located at Stansted, approximately 20 km southeast of the Proposed Development. The wind rose for years 2016 to 2022 for this site is shown in Figure 5. Theoretically, the observed meteorological data typically represents measurements at a height of approximately 10 m above ground level.

E5.4. Data from 2019 has been used in the model as this is the same year as the monitoring data. 2019 is broadly representative of the other years.

Figure 5: Windrose of Wind Speed and Direction for Each Year from 2016 (Top Left) to 2022 (Bottom Right) of Observational Data at Stansted

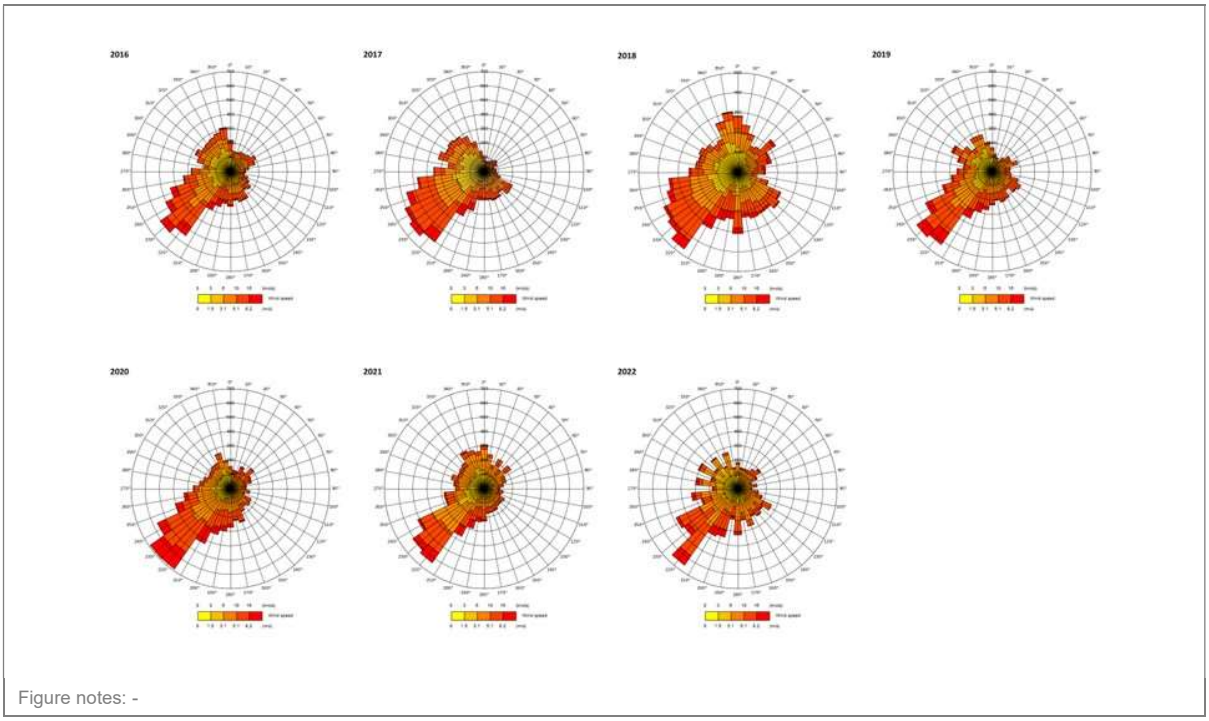


Figure notes: -

Surface Characteristics

E5.5. In addition to the meteorological data, the model requires values to be set for a number of meteorological related parameters, for both the area the meteorological data represents and the Study Area. Land-use and surface characteristics have an important influence in determining

turbulent fluxes and, hence, the stability of the boundary layer and atmospheric dispersion. Details of the parameter values used in the modelling are provided in Table 1 below.

E5.6. Surface roughness length used within the model represents the aerodynamic effects of surface friction and is defined as the height at which the extrapolated surface layer wind profile tends to zero. This value is an important parameter used by the built-in meteorological pre-processor of ADMS to interpret the vertical profile of wind speed and estimate friction velocities which are, in turn, used to define heat and momentum fluxes and, consequently, the degree of turbulent mixing. Surface roughness values for different land-use classifications have been specified. Accounting for differences between the area the data represents, and the Study Area is essential. Due to the size of the model domain, a variable surface roughness file has been used within the model based on the spatially variable land-uses and the equivalent roughness values from the dataset. Figure 6 shows the values used across the modelled domain. For the observational site (Stansted Airport), surface roughness is calculated based on land-use up to 1 km from the centre point (located on the observational site).

E5.7. The surface albedo is the ratio of reflected to incident shortwave solar radiation at the surface of the earth. This varies depending on the land use, and thus area-weighted average albedos have been derived for the meteorological data area and the dispersion site study area and used in the models. Albedo values have been associated with the different land uses. For this study Albedo has been calculated based on land-use up to 5 km from the centre point (both the Site and the observation site) and is an arithmetic mean. The mean includes an inverse distance weighting for distances over 1 km.

E5.8. The Priestley-Taylor parameter is a parameter representing the surface moisture available for evaporation. A Priestley-Taylor parameter of 1 has been set in the model.

E5.9. The CERC user guide explains that *"the Monin-Obukhov length provides a measure of the stability of the atmosphere. In very stable conditions in a rural area its value would typically be 2 to 20 m. In urban areas, there is a significant amount of heat generated from buildings and traffic, which warms the air above the town/city".* For large urban areas this is known as the urban heat island. It has the effect of preventing the atmosphere from ever becoming very stable. Minimum Monin-Obukhov length can be defined in the model to account for the urban heat island effect which is not represented by the meteorological data. Minimum M-O ratio is calculated based on land-use up to 5 km from the centre point (both the Site and the observation site) and is a geometric mean. The mean includes an inverse distance weighting for distances over 1 km.

Figure 6: Modelled Surface Roughness

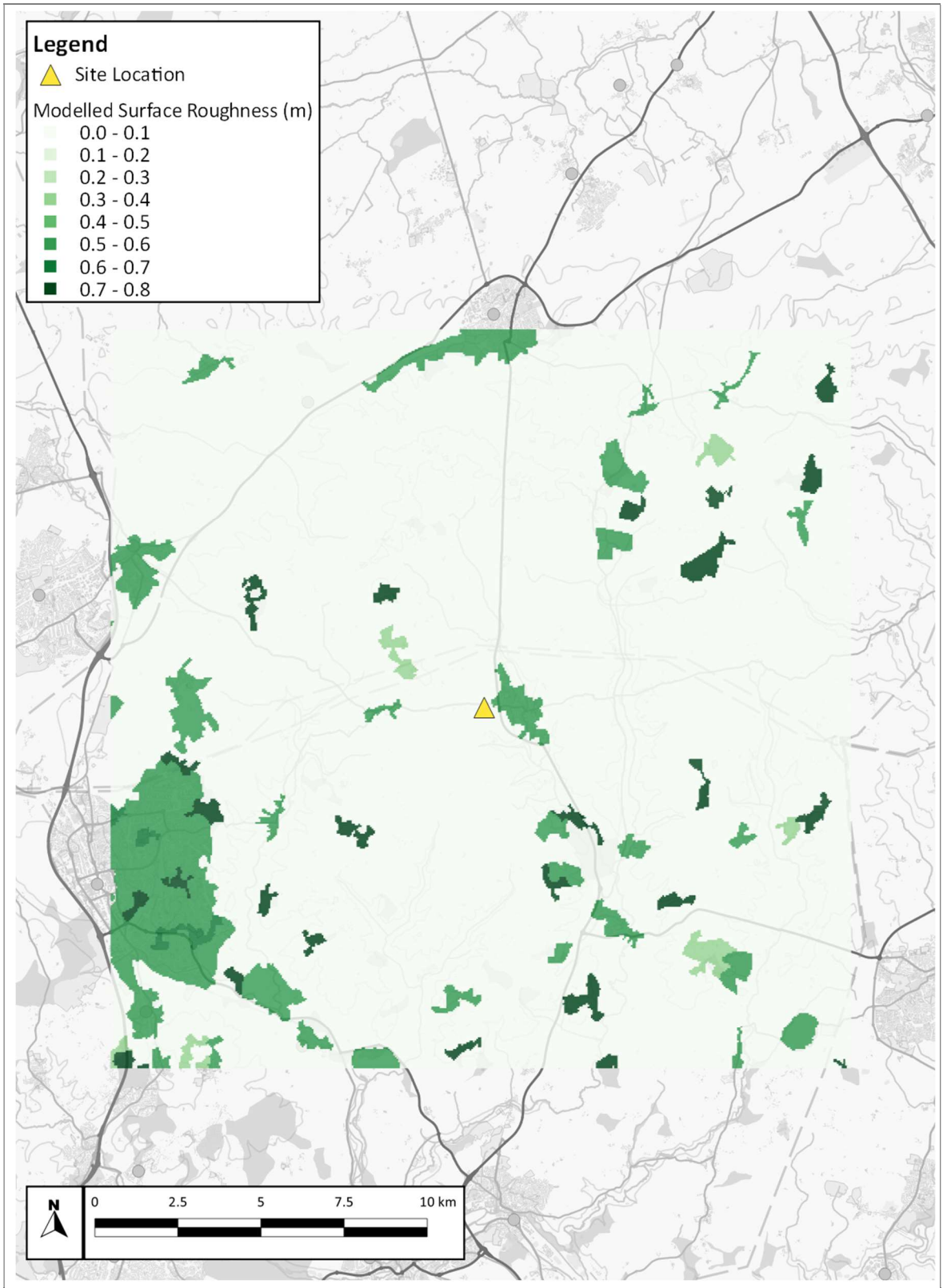


Figure notes: Contains OS Data © Crown Copyright and database right (2024).

Table 1: Meteorological Parameters Values Used in the Model

Parameter	Dispersion Site Value	Meteorological Site value
Latitude (°)	51.95	51.88
Surface roughness (m)	[a]0.061	0.005
Surface albedo	0.234	0.203
Minimum Monin-Obukhov length (m)	12.5	22.6
Priestley-Taylor parameter	1	1

Table notes:
a. This value has not been utilised in the model since a variable surface roughness file has been used instead.

Terrain

E5.10. The effects of complex topography on atmospheric flows can result in elevated pollutant concentrations. These effects are most pronounced when the terrain gradient exceeds 1 in 10, i.e. a 100 m change in elevation per 1 km step in horizontal plane. The gradients in the area surrounding the Proposed Development are relatively flat within 8 km. Therefore, the terrain module has not been used within model as the terrain would not have a significant impact on atmospheric flows. The local terrain data is based on Ordinance Survey Terrain 50 data and shown in Figure 7.

Figure 7: Modelled Terrain

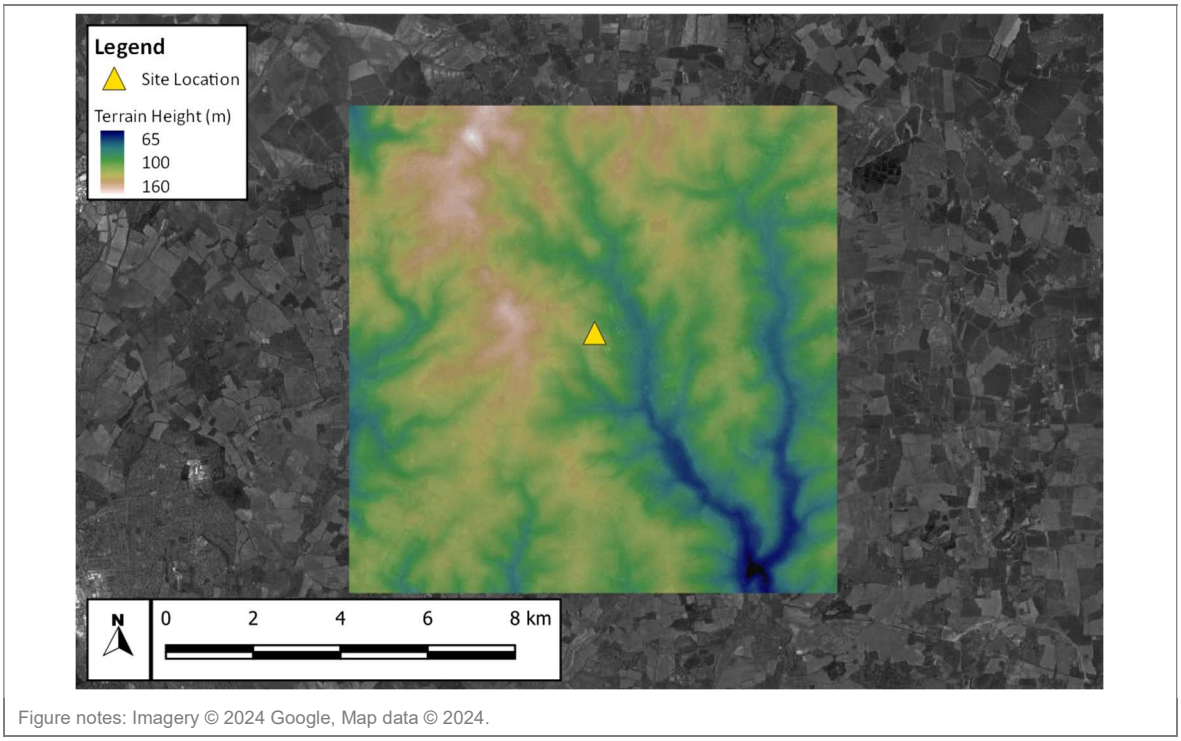


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E6. Roads Modelling

Traffic Flows

E6.1. Traffic data for the study area was provided by the Client for the following scenarios:

- 2023 baseline;
- 2035 baseline;

- 2035 southern site trip generation;
- 2035 northern site trip generation;
- 2035 combined total traffic flows (baseline + southern site + northern site).

E6.2. A factor derived from the Trip End Model Presentation Program (TEMPro) was used to scale the 2023 traffic flows to 2019. The 2019 traffic flows were used in order to validate the model, as the most recent representative year with available monitoring data was 2019.

E6.3. The southern site is anticipated to be operation in 2028. In order to assess the impacts on the local area from the southern site in 2028, a factor derived from TEMPro was utilised to scale the traffic flows from the 2035 scenarios to 2028.

E6.4. To account for traffic splits at the A10 / Baldock Road roundabout adjacent to the Proposed Development site, a junction calculation method was used.

E6.5. The traffic data for three modelled scenarios are provided in Table 2.

E6.6. The modelled road links, coloured to show the Proposed Development related traffic flows on the road network are shown in Figure 8 and Figure 9.

Table 2: Modelled AADT Flows

Modelled Road Link	2019 (%HDV)	2028 Baseline (%HDV)	2028 With Development (%HDV)	2035 Baseline (%HDV)	2035 Baseline with Development (%HDV)
Baldock Road West	9,375 (5)	10,495 (5)	11,524 (5)	11,030 (5)	11,920 (5)
Baldock Road West / A10 Roundabout	4,468 (5)	5,002 (5)	6,356 (4)	5,257 (5)	6,681 (4)
A10 North	9,143 (7)	10,234 (7)	10,461 (6)	10,756 (7)	10,983 (6)
A10 North / A10 Roundabout	4,571 (7)	5,117 (7)	5,225 (7)	5,378 (7)	5,492 (7)
A10 South	14,996 (7)	16,494 (7)	16,981 (7)	17,335 (7)	18,984 (7)
A10 South / A10 Roundabout	7,367 (7)	8,247 (7)	9,031 (7)	8,668 (7)	9,492 (7)
Baldock Road East	8,821 (5)	9,875 (5)	10,190 (5)	10,378 (5)	11,350 (5)
Baldock Road East / A10 Roundabout	4,411 (5)	4,937 (5)	4,937 (5)	5,189 (5)	5,675 (5)
High St N	2,952 (3)	3,305 (3)	3,444 (2)	3,473 (3)	3,745 (2)
High St S	7,178 (3)	8,035 (3)	8,212 (3)	8,445 (3)	9,070 (3)
Station Road	6,582 (3)	7,368 (3)	7,402 (2)	7,743 (3)	8,099 (2)
Throcking Lane	272 (1)	305 (1)	305 (1)	320 (1)	500 (1)
Site Access South	0 (0)	0 (0)	1,533 (0)	0 (0)	1,534 (2)
Site Access North	0 (0)	0 (0)	0 (0)	0 (0)	2,204 (1)
Table notes: -					

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Figure 8: Modelled Road Links including Traffic Flows for 2035 with Development Scenario at the Proposed Development

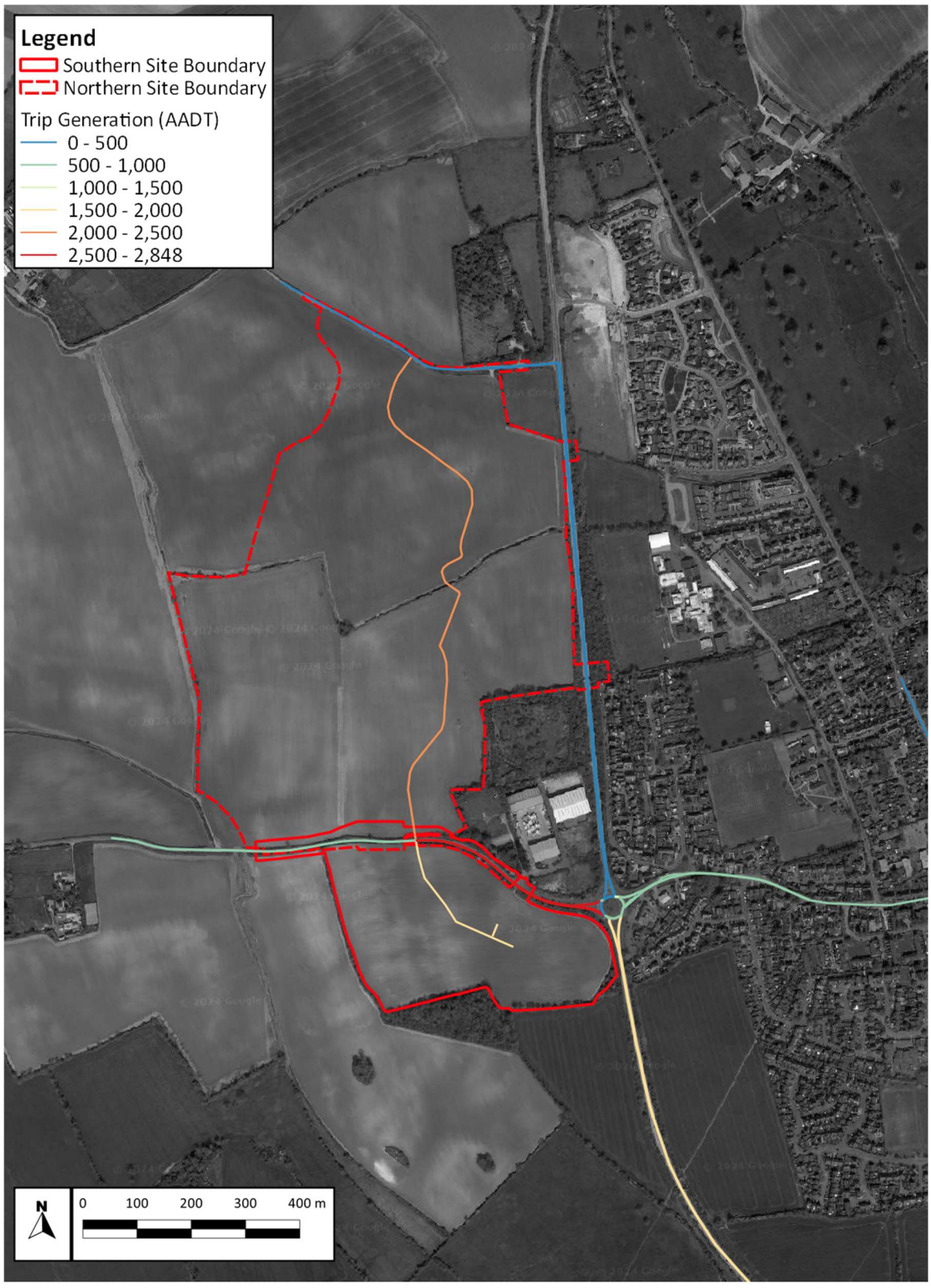


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Figure 9: Modelled Road Links including Traffic Flows for 2035 with Development Scenario in the Study Area

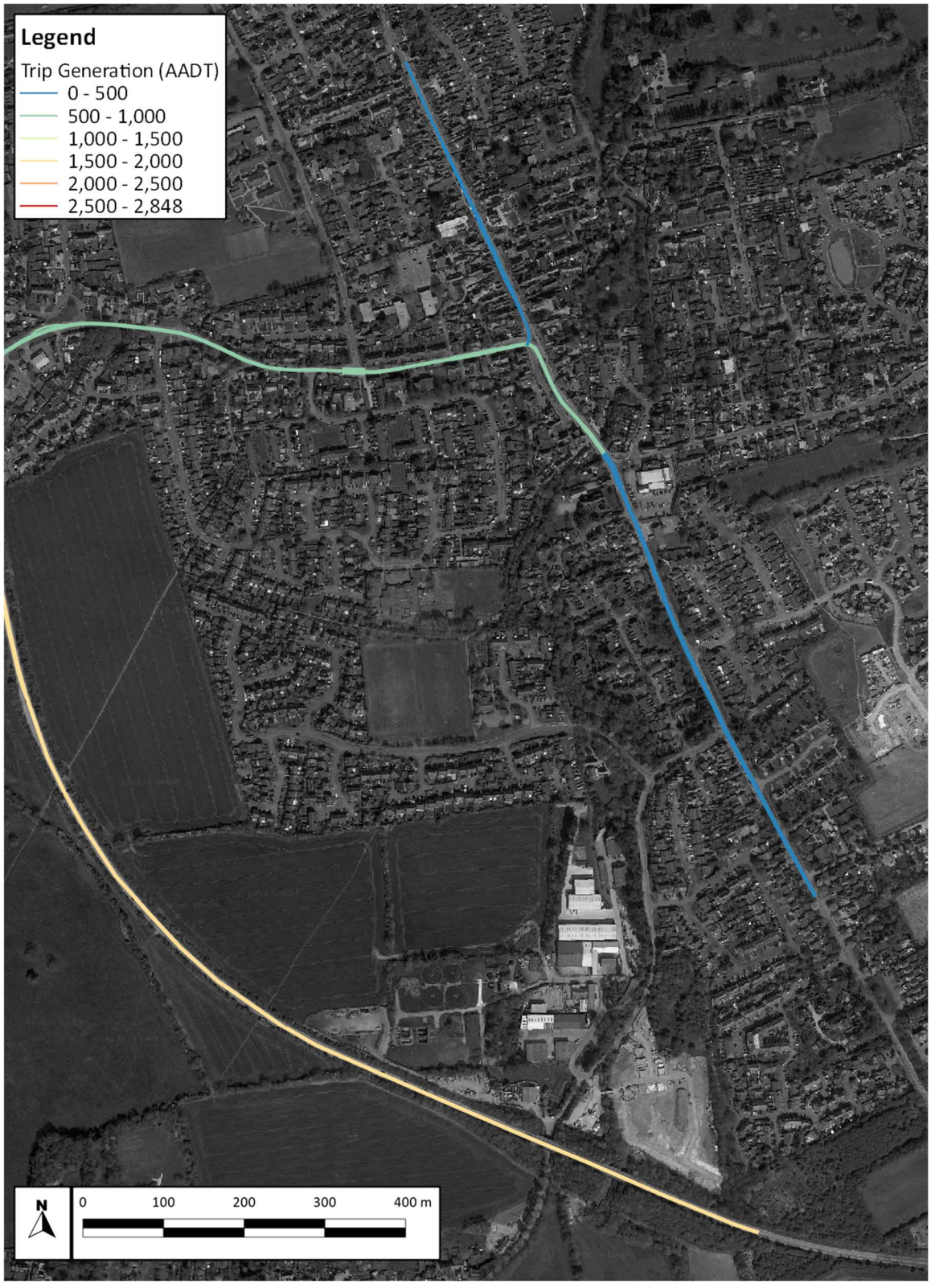


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Time-Based Profiles

E6.7. Vehicle emissions vary over time depending on the volume of traffic, this includes hourly, daily and seasonal variations. Seasonal (monthly) and diurnal (hourly) traffic flow profiles have been taken from DfT national statistics (DfT, 2020). Both urban and rural profiles have been followed for the modelled roads. These have been used in the model to adjust the emissions for each hour of the year modelled. Diurnal and seasonal traffic flow profiles are shown in Figure 10 to Figure 13.

Figure 10: Urban diurnal profile for each day of the week used in the model, where the factor is the value that the average daily emissions are multiplied by in the model

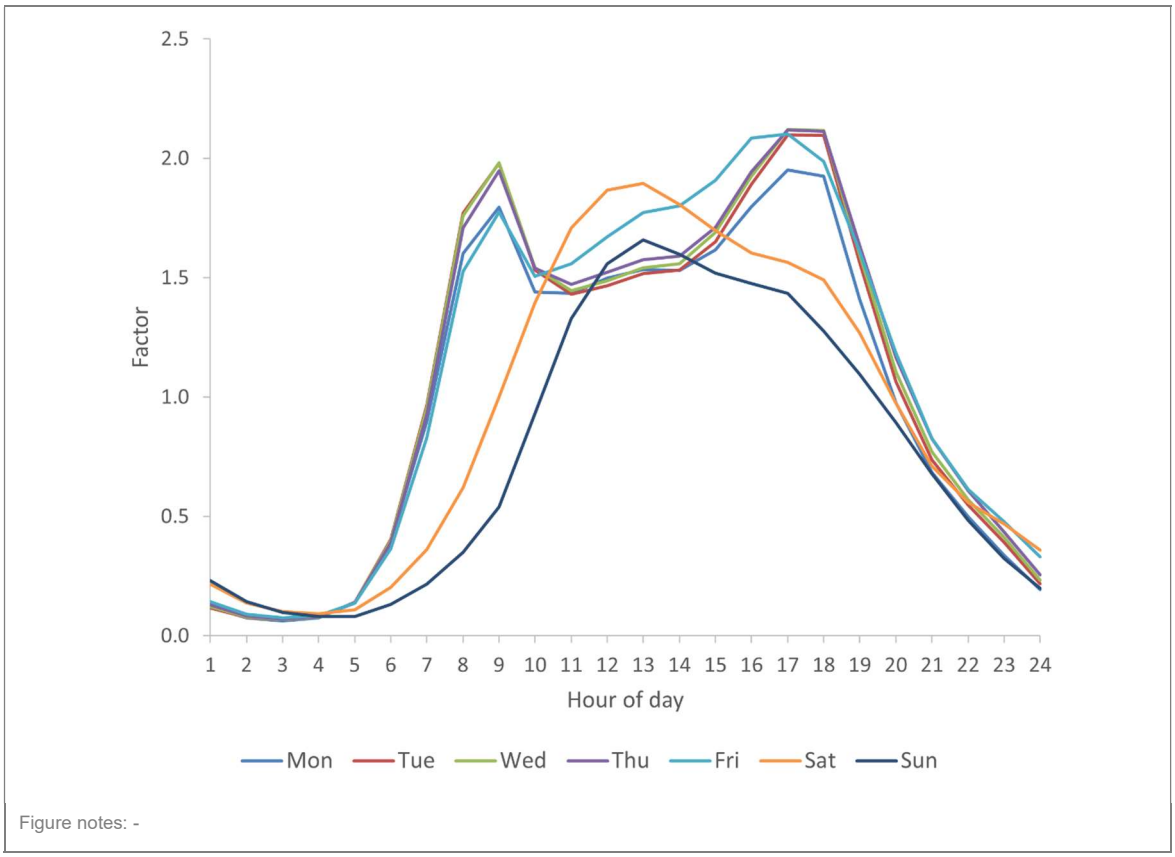


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Figure 11: Rural diurnal profile for each day of the week used in the model, where the factor is the value that the average daily emissions are multiplied by in the model

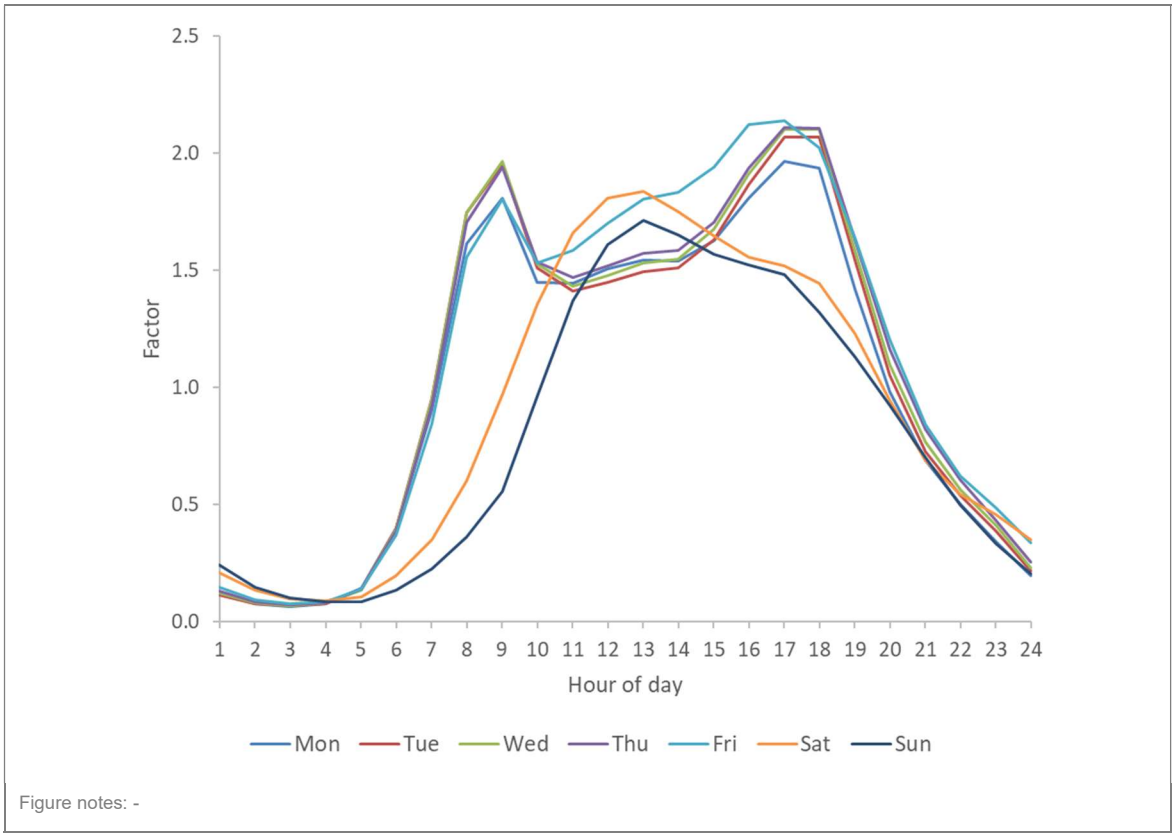


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Figure 12: Urban seasonal profile for each month of the year used in the model

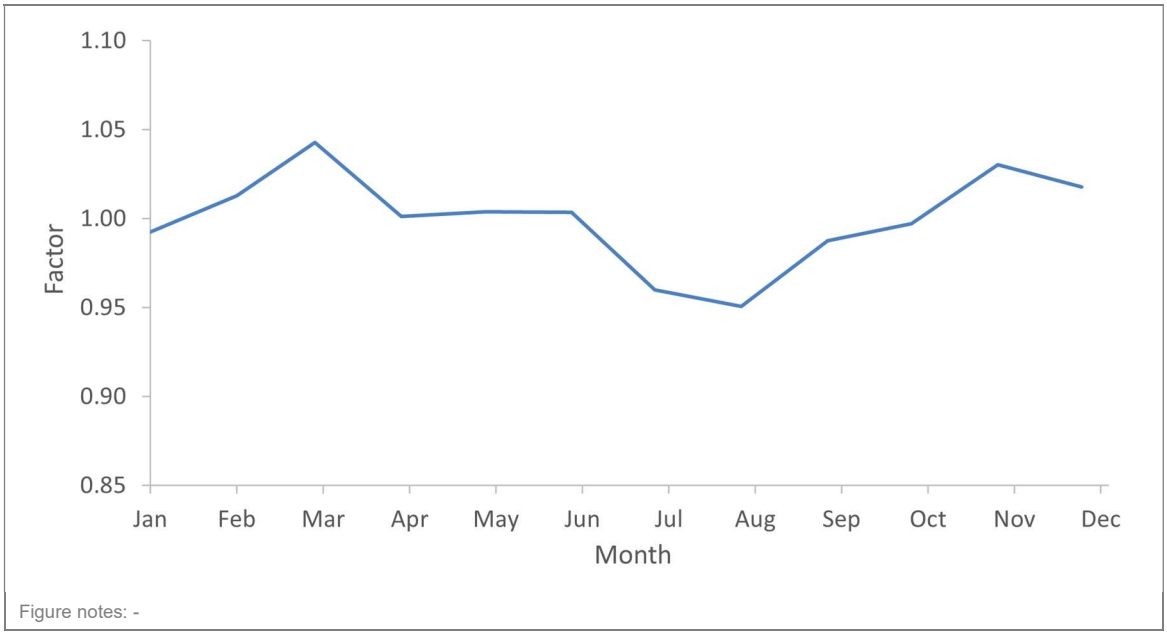


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Figure 13: Rural seasonal profile for each month of the year used in the model

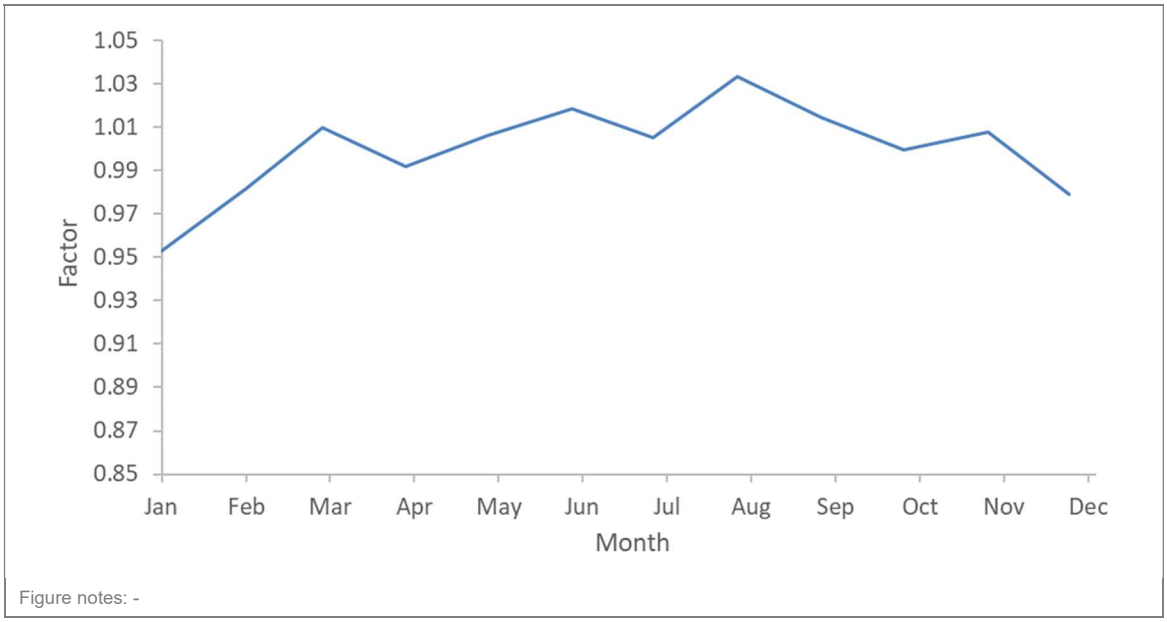


Figure notes: -

Vehicle Speeds

E6.8. Daily average vehicle speeds are required to calculate the pollutant emissions. These have been derived based on speed limits, road layout and information from Google traffic maps on typical speeds during different times of the day.

E6.9. Figure 14 and Figure 15 show the traffic speeds at the Proposed Development and in the study area. It should be noted that these speeds are representative of the 2035 with development scenario.

E6.10. It should be noted that link 28 (to the east of the roundabout) is a bus stop which was modelled with a 5 kph speed to ensure that contributions from the bus stop were accounted for.

Figure 14: Traffic Speeds around the Application Site in 2035 with Development

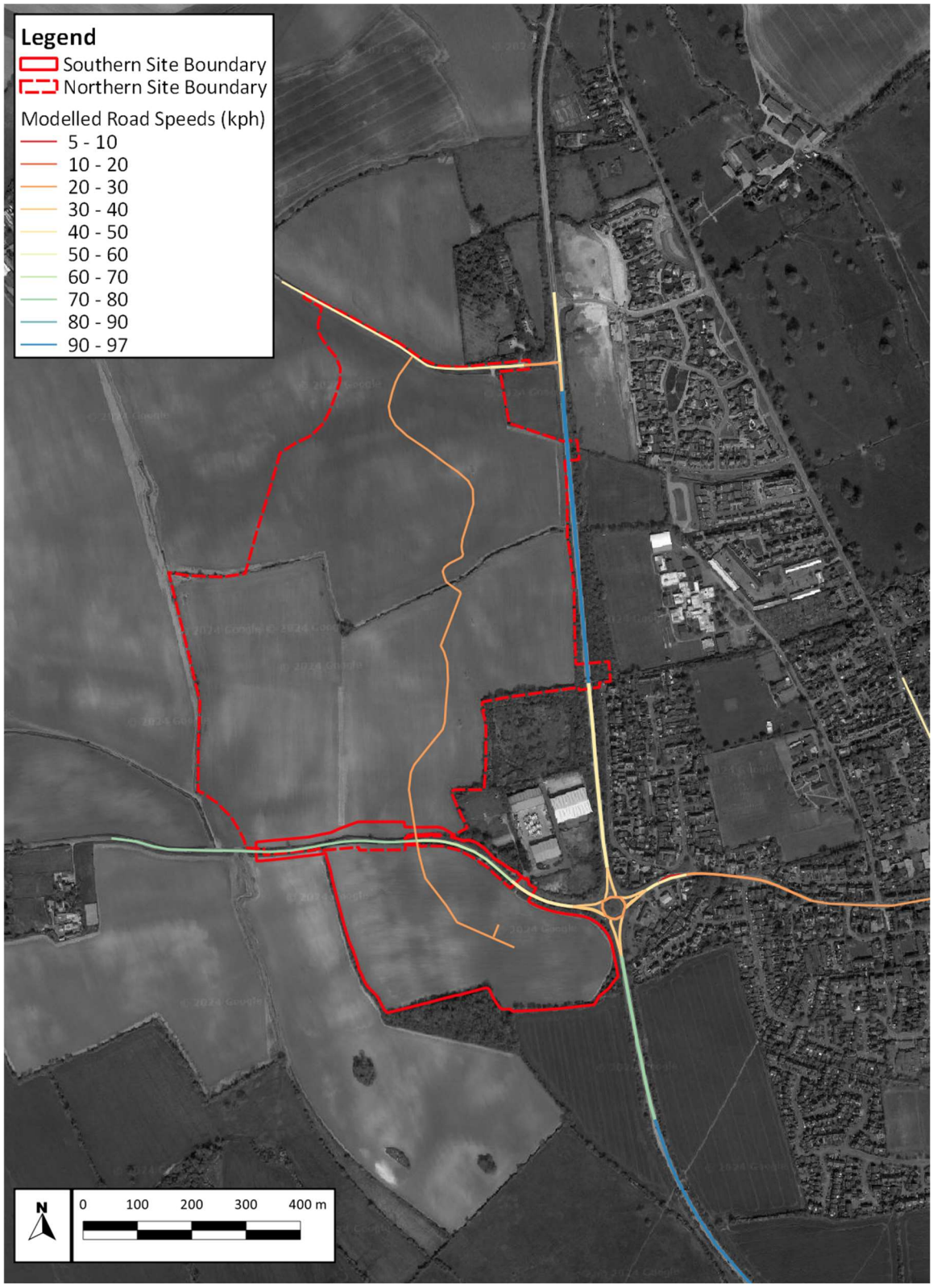


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Figure 15: Traffic Speeds in the Study Area

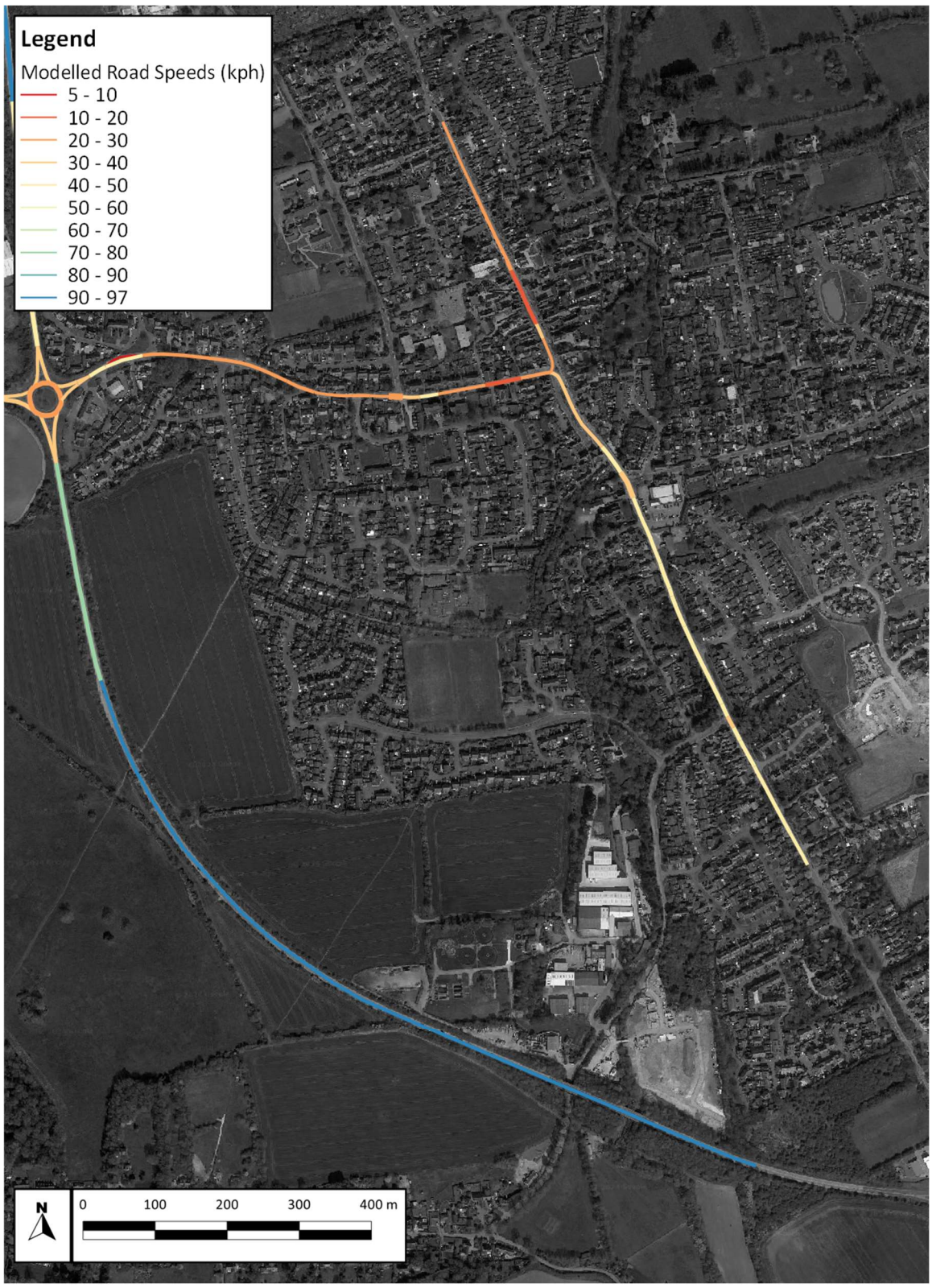


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Vehicle Emissions

E6.11. Emissions of road-NOx (i.e. the contribution from vehicles using roads), road-PM_{10} and road-$PM_{2.5}$ have been derived from the latest version of Defra's Emissions Factors Toolkit (EFT) (v12.0.1) using the traffic data presented in Table 2. The EFT is based on the COPERT 5 (Computer Programme to calculate Emissions from Road Transport) vehicle emission model and provides speed-average based emission rates. The EFT provides vehicle emission rates for the years 2017-2050; future years are based on a range of factors, such as expected vehicle fleet release dates, anticipated improvements in emission reduction technologies, expected uptake rates of different vehicles based on government policies, etc. It is, therefore, possible that the expected future emission rates in the EFT may differ from reality.

Road Gradients

E6.12. The road gradients included when calculating emissions have been derived from LiDAR data obtained from the Environment Agency (2019).

Fraction of Primary NO_2

E6.13. In addition to emission rates, the fraction of primary NO_2 (f-NO_2) has been obtained from the EFT. This represents the amount of NO_2 released from vehicle exhausts, before any further chemical reactions in the atmosphere, which becomes an important variable when post-processing the model predictions. In order to obtain the f-NO_2 value at each receptor location, the nitrous oxide (NOx) emission rates have been multiplied by f-NO_2 values to derive NO_2 emission rates. These NO_2 emissions have been included in the model and primary NO_2 concentrations have been predicted at the receptors. The predicted NOx concentrations have been divided by the predicted primary NO_2 concentrations to calculate the f-NO_2 values at the receptor locations. The f-NO_2 values have been used in the model post-processing.

Wake Effects

E6.14. As vehicles travel along a road a wake is left behind the vehicles as air in the path of travel is forced around the vehicle. The wake can be considered the turbulence induced by the movement of the vehicle, which affects the dispersion of pollution away from roads. The AADT traffic flows have been entered into the ADMS-roads dispersion modelling in order to account for vehicle wake effects which will vary on each link depending on the proportion of large vehicles to small vehicles.

Modelled Roads

E6.15. The road and geometries, widths, and heights included in the dispersion model have been aligned with data from Google Satellite and Ordinance Survey maps, which included carefully considering relative distances from the links to receptors and monitoring sites. The modelled roads are shown in Figure 16.

E6.16. A proportion of the roads in the local area are enclosed by buildings and vegetation, leading to restricted dispersion of pollution away from the roads and recirculation ('or trapping') of pollution within the streetscape area resulting in higher concentrations. This is known as a 'street canyon' effect. These roads have therefore been modelled as asymmetric street canyons using the Advanced Street Canyon Module, within the ADMS-Roads model, accounting for the fraction of

‘covered’ canyons. Where dispersion may be significantly affected, canyons have been included to account for this. Where there are no modelled receptor locations, adjacent to road links, no canyons have been entered for those links, but this does not mean there are not canyon like parameters along these road links. The widths of the modelled canyons are shown in Figure 17.

Figure 16: Modelled Road Links



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Figure 17: Modelled 'Street Canyon' Road Links



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Model Performance

E6.17. The modelling will inherently have some uncertainties and may not reflect real conditions in the local area. An important part of modelling is reviewing the model results carefully and checking the model setup parameters and input data to minimise uncertainties.

E6.18. LAQM.TG22 (Defra, 2022), provides local authorities with advice on good practice for modelling air quality. This advice is widely applied for air quality assessments of proposed developments, although it is specifically aimed at local authority's duties to review and assess air quality. LAQM.TG22 states that model verification, defined as a comparison of modelled results with monitoring results at relevant locations, is necessary (paragraph 7.550).

E6.19. There are many reasons why there may be a difference between modelled and monitored concentrations and LAQM.TG22 states "*Model verification is the process by which these and other uncertainties are investigated and where possible minimized".* (paragraph 7.552). It provides a list of the factors that may explain the differences including meteorological data, source activity data (e.g. data flow and speed), emission factors, model input parameters such as roughness length, and monitoring data.

E6.20. The advice in LAQM.TG22 is generic for all dispersion models. ADMS has been shown to predict concentrations well given sufficiently accurate data inputs.

E6.21. It is important to review the results of the modelling carefully and check the model setup parameters and input data. Once reasonable effects have been made to reduce the uncertainties

of input data for a model, further comparison of modelled and monitored results should be undertaken. Where discrepancies remain, consideration may be given to adjusting the model.

E6.22. Using good modelling techniques provides confidence that the model is performing as well as possible everywhere in the modelling area in the base year, not just at the monitoring locations. Modelling is often an iterative process that involves improving the model setup and evaluating the impact on model performance. The same principles need to be applied to the entire modelling study area to ensure the model performs well throughout the study area.

E6.23. All reasonable efforts have been made to improve the model inputs. The model has gone through several modelling iterations to consider whether the performance of the modelled inputs can be improved. Improvements are based on comparison with the measured concentrations at specific monitoring locations and where improvements have been made, they have been applied as a wholistic approach with systematic updates to the entire model study area to ensure that the model is not performing well exclusively at the monitoring locations. Iterations to the model can include changes in streetscape parameters, widths of road links, the heights of receptors and examining traffic data to improve the model performance using a systematic approach. Ultimately providing a model representative of the modelling area.

E6.24. A final model verification exercise has been undertaken to determine whether there are any final discrepancies and to derive a factor with which to adjust the predicted concentrations from the model so that they match local conditions as closely as possible.

E6.25. A good model performance should be based on at least three monitoring locations and is considered to be where:

- The comparison between the modelled and measured road NOx should be on average, less than a factor of two; and
- The final modelled and measured NO_2 root mean square error (RMSE) should be less than two $\mu g/m^3$.

E6.26. Where this is not the case and all reasonable efforts have been made to improve the model, it is then considered likely that the error is due to a fundamental input such as the raw traffic data. In these situations, it is considered important that the assessment should then account for the greater uncertainty in the analysis of the results.

Final Model Verification

E6.27. A final model verification exercised has been undertaken, following the guidance set out by Defra in Box 7.17 and Box 7.18 of LAQM.TG22 (Defra, 2022).

E6.28. Concentrations of road-NOx and primary NO_2, have been predicted for the year of 2019 using the ADMS-roads dispersion model at the following relevant monitors:

- EH70 – Outside 38 High St, Buntingford (Roadside); and
- EH73 – opp Horseshoe Cott's, Buntingford (Roadside).

E6.29. Ideally at least three monitoring sites would be used to the model performance, therefore the assessment considers the additional level of uncertainty associated with the modelling.

E6.30. Predictions have been made at the heights of the monitor inlets. The monitoring sites are shown in Figure 18 and Figure 19.

Figure 18: Monitoring Site Locations



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Figure 19: Monitoring Sites Streetview

EH70	EH73
	

Figure notes: Imagery © 2024 Google, Map data © 2024.

NO_2

E6.31. Initially, the measured NO_2 concentrations at the monitoring sites were inputted into Defra's NOx to NO_2 Calculator, along with the background NO_2 concentrations and f-NO_2 values, in order to obtain 'measured' road-NOx concentrations at the monitoring sites. The f-NO_2 factor at each monitoring site was calculated by taking the ratio of predicted primary NO_2 concentration to predicted road-NOx concentration.

E6.32. The predicted road-NOx concentrations have been compared to the 'measured' road-NOx concentrations and NOx factor calculated for each monitor, see Table 3.

Table 3: Measured and Modelled NOx Comparison

Monitor	Measured NO_2	Background NO_2	Predicted f-NO_2	Measured Road-NOx	Modelled Road-NOx	NOx Factor
EH70	23.70	8.93	0.16	32.65	15.76	2.072
EH73	28.20	9.00	0.15	45.00	33.75	1.333
Table notes: -						

E6.33. In general, the target is for the NOx factor to be less than two. Table 3 demonstrates that the model is underpredicting at the monitoring sites and the factor is slightly above the target value of 2 for EH70. As the factor is slightly above the ideal value there is the potential for slightly greater uncertainty in the model than otherwise but not to a significant degree.

E6.34. The comparison of road-NOx concentrations to 'measured' road-NOx concentrations is presented in Figure 20. An adjustment factor of 1.4655 has been derived from the equation of the linear trend line that has been fitted through zero. Since the model underpredicted concentrations, the predicted road-NOx concentrations have been adjusted with the adjustment factor to uplift the values to broadly match those measured at the monitoring sites, as shown in Figure 20.

Figure 20: Comparison of predicted NOx to 'measured' road-NOx

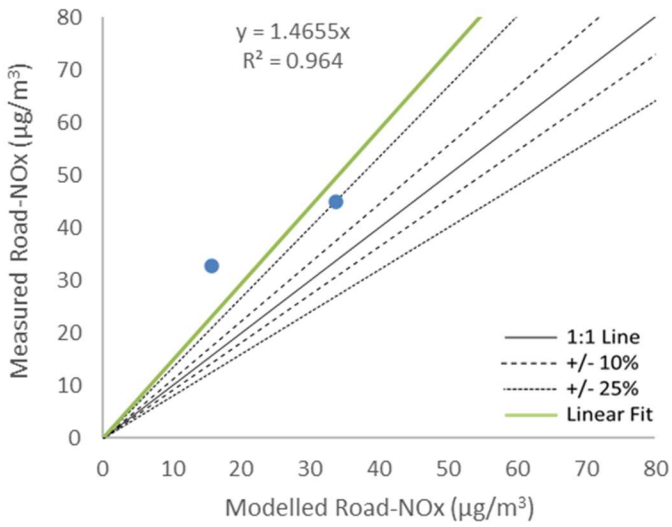


Figure Notes: -

E6.35. Figure 21 shows a comparison of the measured NO_2 concentrations and the total (i.e. road plus background) predicted NO_2 concentrations. Statistics of this comparison are given in Table 4, which demonstrate that the predicted NO_2 concentrations have an insignificant fractional bias (~0), but the RMSE is over the target of 2 µg/m³ but less than 4 µg/m³. This higher than desired error has been considered in the assessment of the results.

Figure 21: Comparison of predicted NO_2 to 'measured' NO_2

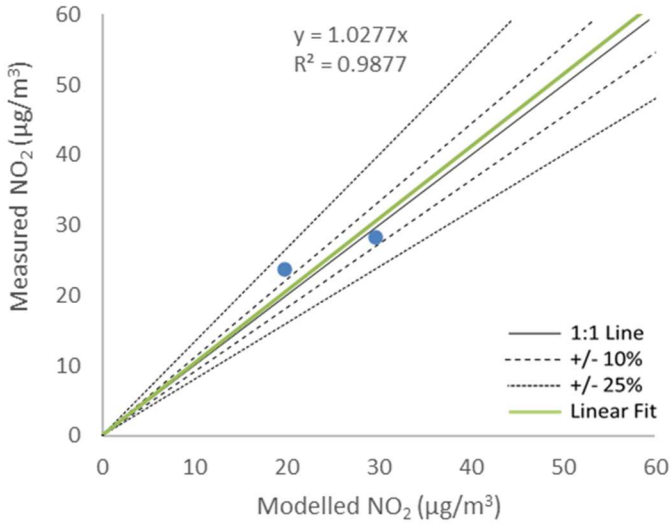


Figure Notes: -

Table 4: Correlation Coefficient, RMSE, and Fractional Bias

Statistic	NO_2
Correlation Coefficient (r) [a]	1.000
Root Mean Square Error (RMSE) [b]	2.973
Fractional Bias (FB) [c]	0.049

Table Notes:

a. This is used to measure the linear relationship between predicted and measured concentrations. A value of zero means no relationship and a value of 1 means absolute relationship (ideal value).

b. RMSE is used to define the average error or uncertainty in the model. The ideal value for NO^2 is zero, and a value within 10% of the objective (i.e., 4 µg/m^3) is general acceptable although models should always be improved where possible even where the value is less than 10% of the objective. Ideally less than 5% of the objective (i.e., 2 µg/m^3). If the value is greater than 25% of the objective (i.e., 10 µg/m^3) then it is recommended that the model be revisited (this only applies to NO_2).

c. This is used to identify if the model shows a systematic tendency to over or under predict. FB values range between -2 and +2 and has an ideal value of zero. Negative values indicate a model over-prediction and positive values indicate a model under-prediction.

PM_{10} and $PM_{2.5}$

E6.36. EHDC do not operate any PM monitors in the local area. Therefore, a verification exercise utilising particulate concentrations could not be carried out. In the absence of a pollutant-specific adjustment factor, the factor derived for NO_x has been applied to all predicted road-PM_{10} and road-$PM_{2.5}$ concentrations.

E7. Post Processing

Chemistry (Conversion of NOx to NO_2)

Roads

E7.1. Concentrations of road-NOx and primary NO_2 have been predicted at each receptor using the ADMS-Roads model. The primary NO_2 emission factor (f-NO_2) at each receptor has been calculated by taking the ratio of predicted primary NO_2 concentration to road-NOx concentration.

E7.2. The f-NO_2 values along with the adjusted modelled road-NOx concentrations and background NO_2 concentrations have been inputted into Defra's NOx to NO_2 calculator (v8.1) in order to obtain predicted road-NO_2 concentrations at each receptor. This tool has been run assuming the traffic is described as 'All Other Urban UK traffic', which is considered appropriate for the traffic associated with Buntingford. It should be noted, however, that receptor specific f-NO_2 values have been used in the NOx to NO_2 calculated, which supersede the traffic selection.

E8. Uncertainty and limitations

E8.1. The assessment involves a range of uncertainties, including the model inputs, assumptions, the model and post-processing of model results.

E8.2. Although there is uncertainty associated with air quality modelling, the predictions made by this assessment have been carried out in a robust manner in order to minimise uncertainties where possible; the approach has been to use reasonable worst-case assumptions.

E8.3. A brief overview of the key uncertainties is discussed below.

E8.4. This report does not consider the impacts on air quality associated with the COVID-19, as there remains too much uncertainty at this stage to consider this explicitly. In addition, the potential long-term implications of the pandemic on behaviour has not been considered, as it is too uncertain at this stage.

Roads modelling

E8.5. The emission factors involve a considerable amount of uncertainty. Emissions from the EFT are link averages and do not explicitly take account of acceleration or deceleration. Modelled speeds have

been adjusted to account for this where possible. Future year vehicle emission rates are also based on a range of factors, such as expected improvements in emission reduction technologies, expected uptake rates of different vehicles based on government policies, etc. It is therefore possible that the expected future emission rates in the EFT may differ from reality. Historically, evidence suggests that Defra's EFT over estimated reductions in NOx emissions from diesel vehicles which were not seen in practice. However, analyses of recent NOx measurements now provide evidence that diesel vehicle emission controls are working and as a result Defra's EFT (v12.0.1) is considered to be a reasonable reflection of the rate of reductions of specific vehicle emissions into the future. There remains uncertainty of the future traffic fleet composition (built into the EFT). In the absence of officially published alternative emissions, the approach of this assessment has been to utilise the EFT as recommended by Defra in the LAQM.TG22 guidance (Defra, 2022).

E8.6. The model itself is based on assumptions of a range of parameters, including road geometries, road widths, street canyons and meteorological related parameters. There is uncertainty in all these parameters, but the modelling has been setup in a robust way based on professional experience to best represent the conditions. One of the main uncertainties in the model is meteorological data; this has been based on measurements made at a representative meteorological station, and although meteorological conditions will remain similar, it is entirely likely that meteorological conditions will vary in subsequent years and lead to marginally different concentrations.

E8.7. The ambient background concentrations are also uncertain. While these are provided by Defra, the 1x1 km resolution is coarse, and the maps do not include all sources of pollution. Given the urban fringe location of the Proposed Development, it is considered likely that the background maps for this area are likely to be reasonable. To minimise uncertainty in the spatial resolution of the maps, the background concentrations have been interpolated to each receptor; essentially smoothing out the coarseness of the maps.

E8.8. Evidence (Grange, S, et al., 2017) suggests that the f-NO_2 has been decreasing in recent years, which is not taken into account within Defra's EFT or NOx to NO_2 Calculator. If lower f-NO_2 values were assumed, then the predicted concentrations would likely be slightly lower throughout the Proposed Development and local area. Until more detailed scientific analysis is undertaken to understand the full extent of why f-NO_2 is decreasing and how it will behave in the future, it remains an uncertainty.

E8.9. A model verification exercise has been undertaken to adjust the predicted concentrations from the model so that they match local conditions as best as possible. This has adjusted concentrations to match average conditions; some locations will remain underpredicted and some overpredicted. The model performs reasonably but there is some error and this is considered during the assessment of the results.

E9. Glossary

AADT	Annual Average Daily Traffic flow
ADMS	Atmospheric Dispersion Modelling Software
APS	Air Pollution Services
ASR	Annual Status Report
CERC	Cambridge Environmental Research Consultants

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COPERT 5	Computer Programme to Calculate Emissions from Road Transport
EFT	Emissions Factors Toolkits
EHDC	East Herts District Council
f-NO_2	Fraction of nitrogen dioxide
HDV	Heavy Duty Vehicles
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
NO_2	Nitrogen dioxide
NOx	Nitrogen oxides
NWP	Numerical Weather Prediction
PM_{10}	Small airborne particles, more specifically particulate matter less than 10 micrometres in aerodynamic diameter
$PM_{2.5}$	Small airborne particles, more specifically particulate matter less than 2.5 micrometres in aerodynamic diameter
RMSE	Root Mean Squared Error
TEMPro	Trip End Model Presentation Program
WRF	Weather Research and Forecasting
µg/m^3	Microgrammes per cubic metre

E10. References

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Environment Agency. (2019). *Defra Survey Data Download*. Retrieved from https://environment.data.gov.uk/DefraDataDownload/?Mode=survey

Grange, S, et al. (2017). Lower vehicular primary emissions of NO2 in Europe than assumed in policy projections. *Nature GeoScience*(ISSN 1752-0908), pp 914-920.

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Construction Dust Risk Assessment: Land South of A507, Buntingford

Client: Jubb Consulting Engineers Ltd

Reference: APS_P1207A_F2-2 **Date Published:** 11 June 2024

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F1. Introduction

F1.1. Air Pollution Services (APS), part of KALACO Group Ltd, has been commissioned to assess the air quality impacts associated with the proposed development at Land South of A507, Buntingford (herein the 'Proposed Development'). The Proposed Development is located within the administrative area of East Herts District Council (EHDC).

F1.2. This document sets out a risk assessment of dust impacts associated with the construction phase of the Proposed Development and sets out relevant mitigation for the construction works.

F2. Guidance

F2.1. The assessment has been carried out using approaches set out in the following guidance.

IAQM Guidance

F2.2. The Institute of Air Quality Management (IAQM) produced guidance (IAQM, 2024) on the assessment of dust from demolition and construction. This document provides a risk-based methodology for assessing construction impacts, including demolition and earthworks where appropriate. The guidance has been used throughout this assessment, which should be read in conjunction with this document.

F3. Construction Dust Assessment Approach

F3.1. The assessment method follows the approach provided by the IAQM guidance document (IAQM, 2024) which follows a sequence of steps:

- Step 1 is a basic screening stage, to determine whether the more detailed assessment provided in Step 2 is required.
- Step 2 is to assess the risk of dust impacts.
    - Step 2a determines the potential for dust to be raised from on-site works and by vehicles leaving the site.
    - Step 2b defines the sensitivity of the area to any dust that may be raised.
    - Step 2c combines the information from Steps 2a and 2b to determine the risk of dust impacts without appropriate mitigation.
- Step 3 uses this information to determine the appropriate level of site-specific mitigation required to ensure that there should be no significant impacts.
- Step 4 is to examine the residual effects and to determine whether these are significant.

F3.2. The approach developed by IAQM (2024), divide the activities on construction sites into four types to reflect their different potential impacts. These are:

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

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F4. The Proposed Development

F4.1. The Proposed Development site location is shown in Figure 1.

F4.2. The construction works may give rise to a risk of dust impacts during demolition, earthworks, construction and trackout.

Figure 1: Proposed Development Site Location

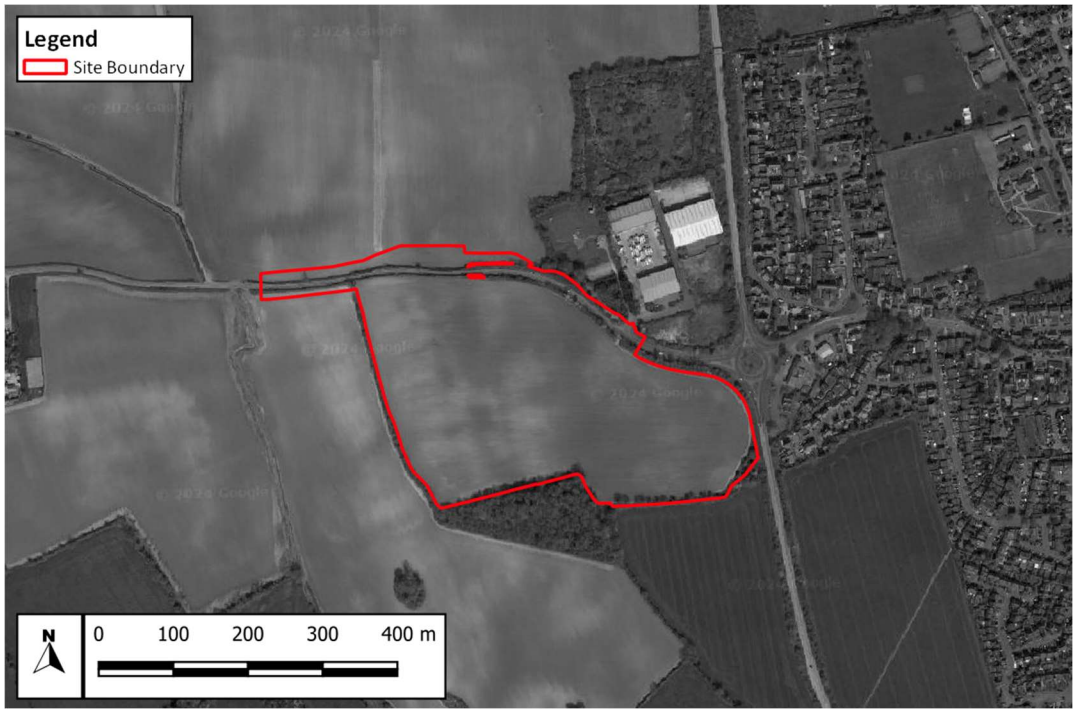


Figure notes: Imagery © 2024 Google, Map data © 2024.

F5. Step 1

F5.1. Step 1 of the assessment procedure is to screen the need for a detailed assessment. The guidance provides distance-based criterion in Box 1 of the guidance which states:

An assessment will normally be required where there is:

- *a 'human receptor' within:*
  - 250 m of the boundary of the site; or
  - 50 m of the route(s) used by construction vehicles on the public highway, up to 250 m from the site entrance(s).
- *an 'ecological receptor' within:*
  - 50 m of the boundary of the site; or
  - 50 m of the route(s) used by construction vehicles on the public highway, up to 250 m from the site entrance(s).

F5.2. There are human receptors within the distances set out in the guidance (see Figure 1), thus a detailed assessment is required for human receptors.

F6. Step 2

F6.1. The following section sets out Step 2 of the assessment procedure.

Potential Dust Emission Magnitude

F6.2. The guidance explains that the dust emission magnitude is based on the scale of the anticipated works and should be classified as Small, Medium, or Large. The guidance provides examples of the magnitude classification for each of the potential stages.

Demolition

F6.3. The Proposed Development is not expected to include any demolition. Based on the illustrative criteria in the IAQM guidance, the dust emission class for demolition is considered *n/a.*

Earthworks

F6.4. The dust generated by the earthworks depends on the nature of the earth and soil at the application site. The characteristics of the soil have been defined using the British Geological Survey's UK Soil Observatory website (2024) and are set out in Table 1. Overall, it is considered that, when dry, this soil has the potential to be moderately dusty.

Table 1: Soil Conditions at the Application Site

Category	Record
Soil layer thickness	Deep
Soil texture	Medium to light (silty) to heavy
Subsoil grain size	Mixed (argrillic-rudaceous)
European Soil Bureau Description	Glacial till
Table notes: -	

F6.5. The area of earthworks is unknown but the whole site covers an area that is approximately 133,900 m^2. Dust will arise mainly from the handling and transport of dusty materials (such as dry soil). The Proposed Development will likely be completed in a number of phases, helping to minimise dust. However, to provide a conservative assessment, phasing has not been taken into account. Based on the illustrative criteria in the IAQM guidance document, the dust emission magnitude for earthworks is considered Small.

Construction

F6.6. The Proposed Development includes the erection of employment facilities and a park (informal open space, playing fields, Sustainable Drainage Systems (SuDS) and structural planting). The total volume for construction is unknown but is likely to be above 75,000 m^3. Based on the illustrative criteria in the IAQM, the dust emission magnitude for construction is considered Large.

Trackout

F6.7. The number of HDVs leaving the site on a single day is currently unknown. There is expected to be more than 50 HDV movements per day as the construction of the Proposed Development will be phased. These HDVs may lead to dust and dirt being tracked out. Based on the example definitions set out in the IAQM guidance, the dust emission magnitude for trackout is considered *Large.*

Summary of Potential Dust Emission Magnitude

F6.8. Table 2 summarises the dust emission magnitude from the construction phases of the Proposed Development.

Table 2: Summary of Potential Dust Emission Magnitudes

Activity	Dust Emission Magnitude
Demolition	n/a
Earthworks	Large
Construction	Large
Trackout	Large
Table notes: -	

Sensitivity of the Study Area

F6.9. The guidance explains that the sensitivity of the area should take account of a number of factors including:

- the specific sensitivities of receptors in the area;
- the proximity and number of those receptors;
- in the case of PM_{10}, the local baseline concentration; and
- site-specific factors, such as whether there are natural shelters, such as trees, to reduce the risk of wind-blown dust.

F6.10. The IAQM guidance document provides examples of high, medium and low sensitivity receptors for each of the potential effects. These are provided in Box 6 to Box 8 of the guidance and consideration should be given to the additional factors presented in Box 9 of the guidance. The guidance also provides a series of matrices (Tables 2, 3 and 4 of the guidance document) to determine the sensitivity of the area based on the receptor sensitivity, number of receptors, the proximity to the dust emission activity and baseline PM_{10} concentration. Residential properties are considered high sensitivity receptors to dust soiling and elevated levels of PM_{10}.

F6.11. Figure 2 shows the site location with several bands representing 20 m, 50 m, and 100 m distances from the application site. There is one medium sensitivity property within 20 m of the application site, and one high sensitivity property within 50 m of the site. There are between 10 to 100 high sensitivity properties within 100 m of the application site. Based on Table 2 of the IAQM guidance document, the sensitivity of the area to dust soiling impacts will be *Medium*.

F6.12. Annual mean PM_{10} predicted background concentrations in the vicinity of the Proposed Development are predicted to be a maximum of 15.5 $\mu g/m^3$ (most appropriate value set out in APS_P1207A_D1-2). There are between 10 to 100 high sensitivity properties that are likely to be exposed to these concentrations within 100 m of the application site. Based on Table 3 of the IAQM guidance, the sensitivity of the area to human health impacts due to elevated levels of PM_{10} during the demolition, earthworks and construction stages will be *Low*.

F6.13. There are no designated ecological sites in the vicinity of the Proposed Development. Based on Table 4 of the IAQM guidance, the sensitivity of the area to ecological impacts due to dust during the demolition, earthworks and construction stages will be *Negligible*.

Figure 2: Distance Buffers from Application Site

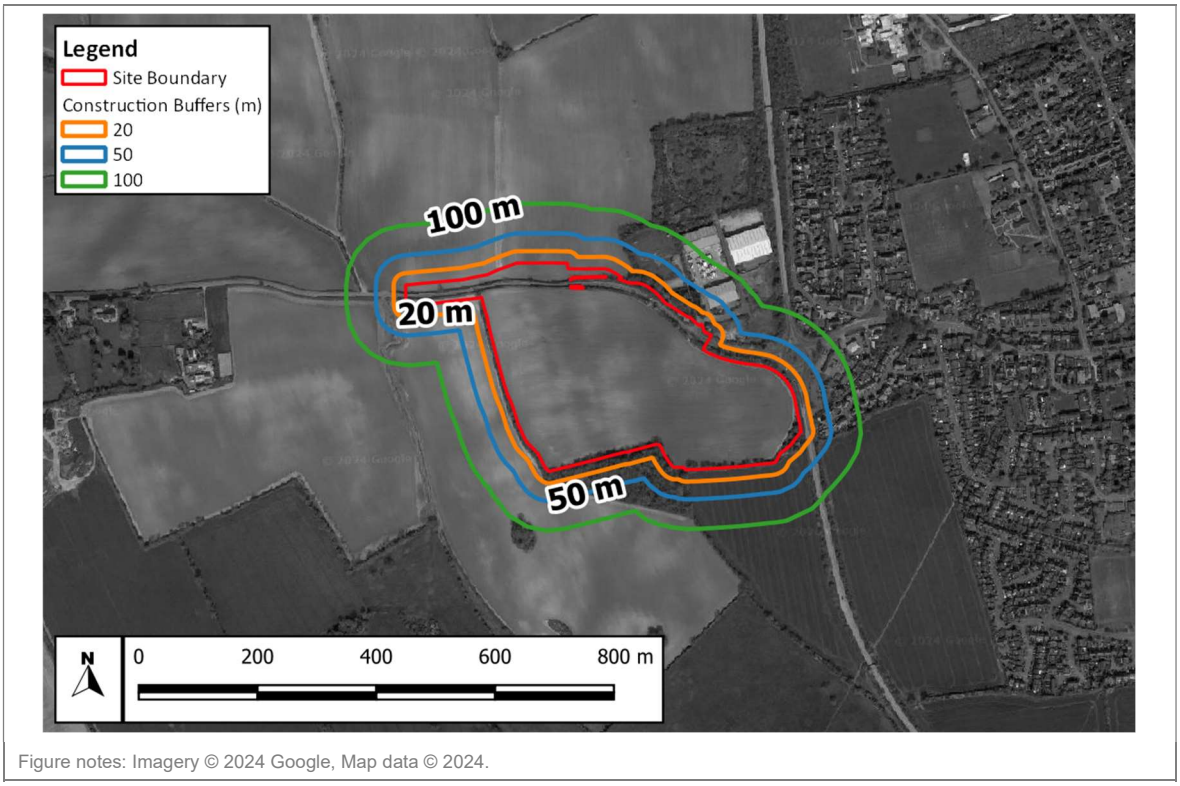


Figure notes: Imagery © 2024 Google, Map data © 2024.

F6.14. The guidance recommends consider the risk of impacts up to 250 m from the site boundary. The potential for trackout along all routes up to this distance has been considered. The guidance explains that where there is a *Large* dust emission magnitude for trackout there is a risk to receptors within 50 m of the road that material is being tracked out along. There will be more than one medium sensitivity properties within 20 m of the roads along which material could be tracked. There will be between 1 to 10 high sensitivity properties within 50 m of the roads along which material could be tracked, and thus the area is considered to be of *Medium* sensitivity to dust soiling impacts due to trackout. In terms of human health, the area is considered to be of *Low* sensitivity.

F6.15. There are no designated ecological sites within the vicinity of the Proposed Development. Based on Table 4 of the IAQM guidance, the sensitivity of the area to ecological impacts due to trackout will be *Negligible*.

Figure 3: Distance Buffers from road lanes where dirt may be tracked out from the site

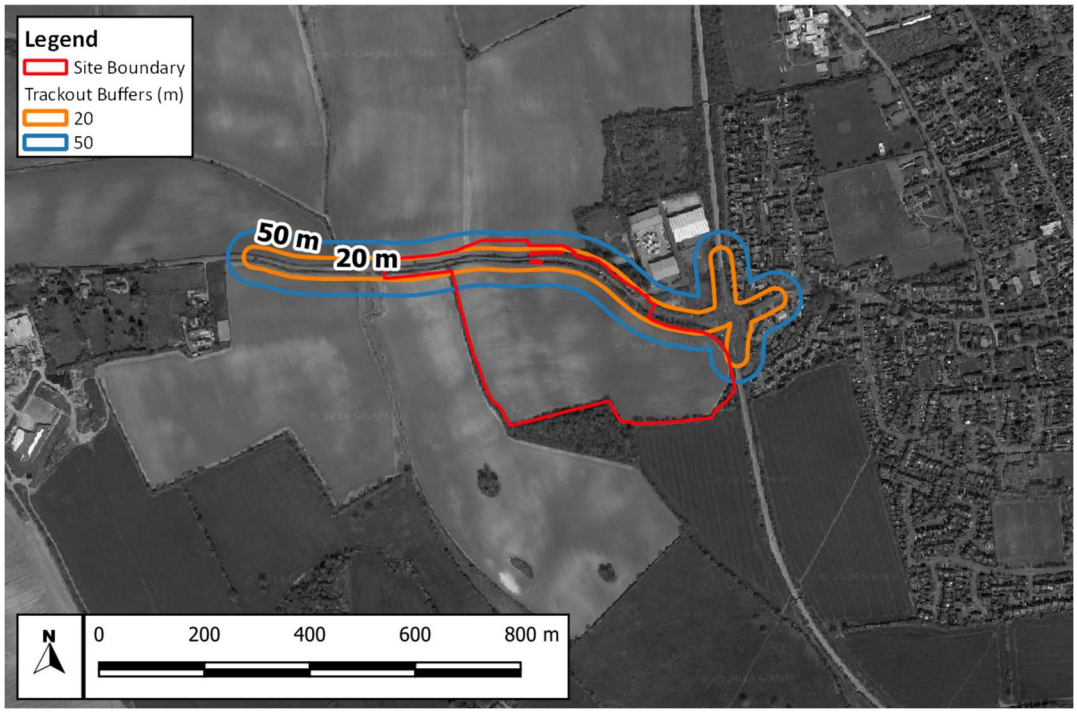


Figure notes: Imagery © 2024 Google, Map data © 2024.

F6.16. Table 3 summarises the sensitivity of the area around the proposed construction works based on the highest level of sensitivity determined for each stage.

Table 3: Summary of Sensitivity of the Surround Area

Potential Impact	Sensitivity of the Surrounding Area			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Medium	Medium	Medium	Medium
Human Health	Low	Low	Low	Low
Ecology	Negligible	Negligible	Negligible	Negligible
Table notes: n/a				

Risk of Dust Effect

F6.17. The guidance has, helpfully, provided a series of matrices (Table 2, Table 3 and Table 4 of the guidance document) to determine the potential impact at receptors based on the receptor sensitivity, number of receptors and the proximity to the dust emission activity.

F6.18. The dust emission magnitudes in Table 2 have been combined with the sensitivities of the area in Table 3 using the matrices in the guidance (Table 6, Table 7, Table 8 and Table 9 of the guidance), in order to assign a risk category to each activity. The resulting risk categories for the four construction activities, without mitigation, are set out in Table 4.

Table 4: Summary of Dust Risk for each Stage

Potential Impact	Risk			
	Demolition [a]	Earthworks [b]	Construction [c]	Trackout [d]
Dust Soiling	Negligible	Medium Risk	Medium Risk	Medium Risk
Human Health	Negligible	Low Risk	Low Risk	Low Risk
Ecological	Negligible	Negligible	Negligible	Negligible

Table notes:
a. Based on Table 6 of the IAQM guidance document.
b. Based on Table 7 of the IAQM guidance document.
c. Based on Table 8 of the IAQM guidance document.
d. Based on Table 9 of the IAQM guidance document.

Significance of effects

F6.19. The IAQM guidance does not provide a method for assessing the significance of effects before mitigation and advises that pre-mitigation significance should not be determined.

F7. Step 3

F7.1. The risk categories set out in Table 4 have been used to determine the appropriate level of mitigation as set out in Section F8 below of this document (step 3 of the assessment procedure).

F8. Mitigation

F8.1. Measures to mitigate emissions will be required during the construction phase of the Proposed Development in order to minimise impacts upon nearby sensitive receptors.

F8.2. The Proposed Development has been identified as Low risk for dust soiling during earthworks, construction and trackout. In terms of human health, the Proposed Development has been identified as Low Risk during earthworks, construction and trackout. The Proposed Development is not expected to include any demolition and thus the risks arising from demolition works are n/a. In terms of ecology, the Proposed Development has been as Negligible Risk, as set out in Table 4.

F8.3. The IAQM guidance document describes measures that should be employed, as appropriate, to reduce the impacts. In addition to this the IAQM has also published guidance on monitoring during demolition and construction (IAQM, 2018). Based on the finding of this assessment, a set of measures that are both highly recommended and desirable to be incorporated into the specification for the construction works has been drawn up. These measures are shown in Table 5, to Table 9.

F8.4. The mitigation measures for the application site should be written into a dust management plan (DMP). The DMP may be integrated into a Code of Construction Practice or the Construction Environmental Management Plan and may require monitoring.

F8.5. Where mitigation measures rely on water, it is expected that only sufficient water will be applied to damp down the material. There should not be any excess to potentially contaminate local watercourses.

Table 5: Communication

Measure	Highly Recommend / Desirable
Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.	Highly Recommended
Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.	Highly Recommended
Display the head or regional office contact information.	Highly Recommended
Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk, and should include as a minimum the highly recommended measures in this document. The desirable measures should be included as appropriate for the site. In London additional measures may be required to ensure compliance with the Mayor of London's guidance. The DMP may include monitoring of dust deposition, dust flux, realtime PM10 continuous monitoring and/or visual inspections.	Highly Recommended

Table 6: Dust Management

Measure	Highly Recommend / Desirable
Site Management	
Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.	Highly Recommended
Make the complaints log available to the local authority when asked.	Highly Recommended
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.	Highly Recommended
Monitoring	
Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, 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 site boundary, with cleaning to be provided if necessary.	Desirable
Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked.	Highly Recommended
Increase the frequency of site inspections 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 dry or windy conditions.	Highly Recommended
Agree dust deposition, dust flux, or real-time PM_{10} continuous monitoring locations with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on site or, if it a large site, before work on a phase commences. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction.	Highly Recommended
Preparing and maintaining the site	
Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.	Highly Recommended
Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.	Highly Recommended
Fully enclose site or specific operations where there is a high potential for dust production and the site is actives for an extensive period.	Highly Recommended

Avoid site runoff of water or mud.	Highly Recommended
Keep site fencing, barriers and scaffolding clean using wet methods.	Highly Recommended
Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.	Highly Recommended
Cover, seed or fence stockpiles to prevent wind whipping.	Highly Recommended
Operating vehicle/machinery and sustainable travel	
Ensure all vehicles switch off engines when stationary - no idling vehicles.	Highly Recommended
Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.	Highly Recommended
Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate).	Desirable
Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing).	Desirable
Operations	
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.	Highly Recommended
Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.	Highly Recommended
Use enclosed chutes and conveyors and covered skips.	Highly Recommended
Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.	Highly Recommended
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.	Highly Recommended
Waste management	
Avoid bonfires and burning of waste materials.	Highly Recommended

Table 7: Measure Specific to Earthworks

Measure	Highly Recommend / Desirable
Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.	Desirable
Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable.	Desirable
Only remove the cover in small areas during work and not all at once.	Desirable

Table 8: Measure Specific to Construction

Measure	Highly Recommend / Desirable
Avoid scabbling (roughening of concrete surfaces) if possible.	Desirable
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.	Highly Recommended

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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.	Desirable
For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust.	Desirable

Table 9: Measure Specific to Trackout

Measure	Highly Recommend / Desirable
Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use.	Highly Recommended
Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.	Highly Recommended
Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.	Highly Recommended
Record all inspections of haul routes and any subsequent action in a site log book.	Highly Recommended
Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.	Highly Recommended
Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).	Highly Recommended
Access gates to be located at least 10 m from receptors where possible.	Highly Recommended
Avoid dry sweeping of large areas.	Highly Recommended

F9. Summary

F9.1. The construction works have the potential to create dust and emissions. During construction it will therefore be necessary to apply a package of mitigation measures to minimise dust emission. With these measures in place, it is expected that any residual effects will be '*not significant*'. The IAQM guidance recognises that even with a rigorous dust management plan in place, it is not possible to guarantee that the dust mitigation measures will be effective all the time, for instance under adverse weather conditions. The local community may therefore experience occasional, short-term annoyance. The scale of this would not normally be considered sufficient to change the conclusion that the effects will be '*not significant*'.

F10. Glossary

APS	Air Pollution Services
DMP	Dust Management Plan
EHDC	East Herts District Council
HDV	Heavy Duty Vehicle
IAQM	Institute of Air Quality Management
SuDS	Sustainable Drainage Systems

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F11. References

British Geological Survey. (2024). *UK Soil Observatory (UKSO)*. Retrieved from British Geological Survey: http://mapapps2.bgs.ac.uk/ukso/home.html

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Air Quality at Locations of Human Health Exposure: Land South of A507, Buntingford

Client: Jubb Consulting Engineers

Reference: APS_P1207A_G2-2 **Date Published:** 12 June 2024

Rev.	Date	Description	Prepared	Reviewed	Authorised
01	19/02/2024	Issued	EJ	KL	KL
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KALACO Group Limited, companies house registration number: 11808160

G1. Introduction

G1.1. Air Pollution Services (APS), part of KALACO Group, has been commissioned to assess the air quality impacts associated with the proposed development at Land South of A507, West of Buntingford, Buntingford (herein the 'Proposed Development'). The Proposed Development is located within the administrative area of East Herts District Council (EHDC).

Location Context

G1.2. EHDC has investigated air quality within the administrative area as part of its responsibilities under the Local Air Quality Management (LAQM) regime. The Council have not declared any air quality management areas (AQMAs) within its administrative area.

G1.3. The Proposed Development is located within the town of Buntingford, the A10 runs along the eastern most edge of the site. The application site can be accessed via Baldock Road (A507).

G1.4. There are some human health receptors (residential properties) close to the application site, including along Baldock Road, as well as human health receptors (residential properties) in Buntingford town centre and along / near main roads connecting the application site and Buntingford town centre.

G2. Methodology

Guidance

G2.1. The assessment has been carried out using approaches set out in the following guidance.

Guidance on Land-Use Planning & Development Control: Planning For Air Quality

G2.2. Environmental Protection UK (EPUK) in partnership with The Institute of Air Quality Management (IAQM) have produced guidance on Land-Use Planning & Development Control: Planning For Air Quality (EPUK/IAQM, 2017). EPUK and IAQM have produced this guidance to ensure that air quality is adequately considered in the land-use planning and development control processes. It provides a means of reaching sound decisions, having regard to the air quality implications of development proposals and provides guidance on how air quality considerations of individual schemes may be considered within the development control process, by suggesting a framework for the assessment of the impacts of developments on local air quality.

LAQM Technical Guidance

G2.3. Defra and the devolved administrations have published a guidance document on LAQM - Local Air Quality Management Technical Guidance (LAQM.TG22) (Defra, 2022). This document is designed to support local authorities in carrying out their duties under the Environment Act 1995, the Environment (England) Order 2002, and subsequent regulations including the Environment Act 2021. LAQM is the statutory process by which local authorities monitor, assess, and take action to improve local air quality. The Technical Guidance provides tools, approaches and technical information related to air quality.

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Approach Overview

G2.4. Standard practice is to assess the impacts of a proposed development on local air quality in relation to human health exposure, using the EPUK and IAQM guidance on Land-Use Planning & Development Control: Planning For Air Quality.

G2.5. The EPUK and IAQM guidance provides a staged approach to considering air quality assessments:

- Stage 1) Initial screening
- Stage 2) Detailed screening
- Stage 3) Simple or Detailed assessment

G2.6. The approach includes elements of professional judgement.

Impacts of the Development on the Local Area

G2.7. Table 6.1 of the EPUK and IAQM guidance (2017) provides the Stage 1 screening criteria. The approach first considers the size and parking provision of a development; if the development is residential and is for fewer than ten homes or covers less than 0.5 ha, or is non-residential and will provide less than 1,000 m^2 of floor space or cover a site area of less than 1 ha, and will provide ten or fewer parking spaces, then there is no need to progress to a Stage 2 and in general there is no need to consider the impacts of the development on the local area.

Stage 2 Screening Criteria

G2.8. The guidance provides example criteria and states the following in relation to the criteria:

"They are intended to function as a sensitive "trigger" for initiating an assessment in cases where there is a possibility of significant effects arising on local air quality. This possibility will, self-evidently, not be realised in many cases. The criteria should not be applied rigidly; in some instances, it may be appropriate to amend them on the basis of professional judgement, bearing in mind that the objective is to identify situations where there is a possibility of a significant effect on local air quality".

G2.9. The guidance notes that consideration should still be given to the potential impacts of neighbouring sources on the site, even if assessment of impacts of the development on the surrounding area is screened out.

Road Traffic Assessments

G2.10. The second stage then compares the changes in vehicle flows on local roads that a development will lead to against specified screening criteria. Where these criteria are exceeded, a detailed assessment is required, although the guidance advises that *"the criteria provided are precautionary and should be treated as indicative",* and *"it may be appropriate to amend them on the basis of professional judgement".*

G2.11. The criteria relating to road traffic are:

- A change of LDV flows of:
  - more than 100 AADT within or adjacent to an AQMA
  - more than 500 AADT elsewhere.

- A change of HDV flows of:
  - more than 25 AADT within or adjacent to an AQMA
  - more than 100 AADT elsewhere.
- Where roads are realigned near to sensitive receptors and the change in alignment is 5 m or more and the road is within an AQMA. Applies to junctions that cause traffic to significantly change vehicle acceleration/deceleration, e.g. traffic lights, or roundabouts.
- Where bus flows will change by:
  - more than 25 AADT within or adjacent to an AQMA
  - more than 100 AADT elsewhere.

Simple or Detailed Assessments

G2.12. Where an air quality assessment is identified as being required, then this may take the form of either a Simple Assessment or a Detailed Assessment. It is not uncommon for assessments to utilise detailed dispersion models to predict pollutant concentrations and impacts on local air quality (Detailed Assessment), however, it should be noted that exceeding a screening criterion in Table 6.2 of the guidance does not automatically lead to the requirement for a Detailed Assessment and the use of professional judgement and sufficient evidence can be considered appropriate at times (Simple Assessment).

G2.13. The guidance also outlines what the content of the air quality assessment should include, and this has been adhered to in the production of this report.

G2.14. Given the nature of the Proposed Development a detailed assessment has been carried out.

Criteria for this Assessment

G2.15. The human-health related Air Quality Objectives (AQOs) and Limit Values (LVs) for England for the pollutants relevant to this project are detailed in Table 1.

Table 1: Air Quality Objectives and Limit Values

Pollutant	Time Period	Source of AQAL [a]	Concentration, and the number of exceedances allowed per year (Percentile if applies)	Date AQAL to be Achieved From and Maintained After
Human Health				
Nitrogen Dioxide (NO_2)	1-hour Mean	AQO / Limit Value	200 µg/m^3 not to be exceeded more than 18 times a year (99.79th percentile)	31st December 2005 / 1st January 2010
	Annual Mean	AQO / Limit Value	40 µg/m^3	31st December 2005 / 1st January 2010
Particulate Matter (PM_{10})	24-hour Mean	AQO / Limit Value	50 µg/m^3 not to be exceeded more than 35 times a year (90.41th percentile)	31st December 2004 / 1st January 2005
	Annual Mean	AQO / Limit Value	40 µg/m^3	31st December 2004 / 1st January 2005
Particulate Matter ($PM_{2.5}$)	Annual Mean	AQO / Target Value	25 µg/m^3 / 20 µg/m^3	2020

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	Annual Mean	EA EAL [e]	5 µg/m^3	-

Table notes:

[a] Air Quality Objectives (AQOs) from the Air Quality Strategy; limit values, target values and critical levels from the Air Quality Standards Regulations; and EA EALs from the Environmental Agency Air emissions risk assessment for your environmental permit guidance.

$PM_{2.5}$ Targets

G2.16. The Government has set two $PM_{2.5}$ targets an annual mean concentration target (AMCT) and a population exposure reduction target (PERT), along with interim targets. At the time this report was completed the Chief Planning Office's advice stated (DLUHC, 2023):

G2.17. *"The new targets will also need to be integrated into the planning system, and in setting out planning guidance for local authorities and businesses, we will consider the specific characteristics of $PM_{2.5}$. The guidance will be forthcoming in due course, until then we expect local authorities to continue to assess local air quality impacts in accordance with existing guidance."*

G2.18. Therefore, no explicit consideration of these targets have been included. For information the targets (and interim targets) are:

- AMCT – 10 µg/m^3 or less by 2040 and an interim target of 12 µg/m^3 or less by 2028; and
- PERT – 35 % reduction by 2040 compared to a baseline of 2018.

G2.19. Compliance with these is determined based on relevant and representative $PM_{2.5}$ monitoring.

Relevant exposure

G2.20. The locations of relevant exposure for AQOs and LVs are set out in Table 2.

Table 2: Locations of relevant exposure

Receptor Locations	Relevant exposure
AQO	The annual mean AQO applies at locations where members of the public might be regularly exposed, such as building façades of residential properties, schools, hospitals, and care homes. The 24-hour mean AQO applies at the annual mean locations of exposure as well as at hotels and residential gardens. The 1-hour mean AQO applies at the annual mean locations of exposure and at hotels, residential gardens and any outdoor location where members of the public might reasonably be expected to spend one hour or longer, such as busy pavements, outdoor bus stations and locations with outdoor seating. Places of work like factories or offices are not considered places where members of the public might be regularly exposed and therefore the AQO's do not apply at these locations.
LV	In accordance with Article 2(1), Annex III, Part A, paragraph 2 of Directive 2008/50/EC detailed locations where compliance with the LVs does not need to be assessed: *"Compliance with the limit values directed at the protection of human health shall not be assessed at the following locations:* *a) Any locations situated within areas where members of the public do not have access and there is no fixed habitation;* *b) In accordance with Article 2(1), on factory premises or at industrial installations to which all relevant provisions concerning health and safety at work apply; and* *c) On the carriageway of roads; and on the central reservation of roads except where there is normally pedestrian access to the central reservation".* The government models compliance with the Directive at locations 4 m from the kerbside, 2 m high, more than 25 m from major road junctions and adjacent to at least 100 m of road length where the LVs apply.

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Table notes: n/a

Describing Impacts and Defining Significance

Long-term (Annual Mean) Impacts on Air Quality at Locations of Human Health Exposure

G2.21. The approach set out in the EPUK and IAQM guidance provides a method for describing the impacts on local air quality arising from development.

G2.22. Impact descriptors for individual receptors are used which expresses the magnitude of incremental change as a proportion of a relevant AQAL and then examining this change in the context of the new total concentration and its relationship with the assessment criterion. Table 3 sets out the matrix for determining the impact descriptor for annual mean concentrations at individual receptors, based on Table 6.3 in the EPUK and IAQM guidance document (EPUK/IAQM, 2017).

G2.23. As part of the dispersion modelling study a comparison between modelled concentrations and measured concentrations has been carried out (see report APS_P1207A_E1-1). Due to the uncertainty in the modelling, a pragmatic approach for defining the AQAL for use with Table 3 has been applied. This approach is to deduct the calculated root mean square error (RMSE) calculated from the nitrogen dioxide (NO_2) comparison (approximately 4 µg/m^3) from the AQOs. This results in a more stringent approach when assessing the operational impacts of the Proposed Development on the local area.

Table 3: Annual Mean Impact Descriptors for Individual Receptors

Annual Mean Concentration with Proposed Development (µg/m³)	% Change in Concentration relative to the AQO (µg/m³)			
	1	2-5	6-10	>10
75% or less of AQO	Negligible	Negligible	Slight	Moderate
76-94% of AQO	Negligible	Slight	Moderate	Moderate
95-102% of AQO	Slight	Moderate	Moderate	Substantial
103-109% of AQO	Moderate	Moderate	Substantial	Substantial
110% or more of AQO	Moderate	Substantial	Substantial	Substantial
Table notes: -				

Short-term (24-hour, 8-hour, 1-hour and 15-minute mean) Impacts on Human Health

G2.24. Previous research carried out on behalf of Defra and the devolved administrations identified that, where road traffic is the dominate pollutant source, exceedances of the 1-hour mean NO_2 AQO are unlikely to occur where the annual mean is below 60 µg/m^3 (Defra, 2021). Where annual mean concentrations are below these levels the short-term impacts are considered negligible.

G2.25. When considering the total concentration, impacts are considered negligible where the AQAL is not breached.

Planning Significance

G2.26. The approach developed by EPUK and IAQM (2017) has been used. The guidance is that the assessment of significance should be based on professional judgement, with the overall air quality impact of the development described as either 'significant' or 'not significant'.

G2.27. If none of the criteria in Stage 1 and 2 are met, then there should be no requirement to carry out an air quality assessment for the impact of the development on the local area, and the impacts can be considered as having a not significant effect.

G2.28. Where the impacts are negligible the overall significance is judged to be 'not significant'.

G2.29. Where a Simple or Detailed assessment is carried out, in drawing the determination of significance, the following factors should be taken account of:

- the existing and future air quality in the absence of the development;
- the extent of current and future population exposure to any impacts;
- the influence and validity of any assumptions adopted when undertaking the prediction of impacts;
- the potential for cumulative impacts. In such circumstances, several impacts that are described as "slight" individually could, taken together, be regarded as having a significant effect for the purposes of air quality management in an area, especially where it is proving difficult to reduce concentrations of a pollutant. Conversely, a "moderate" or "substantial" impact may not have a significant effect if it is confined to a very small area and where it is not obviously the cause of harm to human health; and
- the judgement on significance relates to the consequences of the impacts; i.e. will they have an effect on human health that could be considered as significant? In the majority of cases, the impacts from an individual development will be insufficiently large to result in measurable changes in health outcomes that could be regarded as significant by health care professionals.

G2.30. The guidance is clear that other factors may be relevant in individual cases.

Assessment Approach - Compliance with the Limit Values

G2.31. There is no magnitude of change in relation to compliance with the limit values. Good practice in relation to the Limit Value assessment is to consider whether the Proposed Development delays compliance with or causes a breach. The effect is based on whether any location which would be used for compliance reporting is impacted. A delay is judged to be significant.

G3. Operational Phase Impact Assessment

Impacts on Air Quality Objectives

G3.1. The potential air quality impacts during the operation of the Proposed Development are discussed in this section. The predicted concentrations in 2028 at the modelled locations in the local area both with and without the Proposed Development in operation are discussed with relation to the AQOs.

G3.2. The locations of the modelled receptors are shown in Figure 1.

Figure 1: Modelled Receptor Locations near the Proposed Development

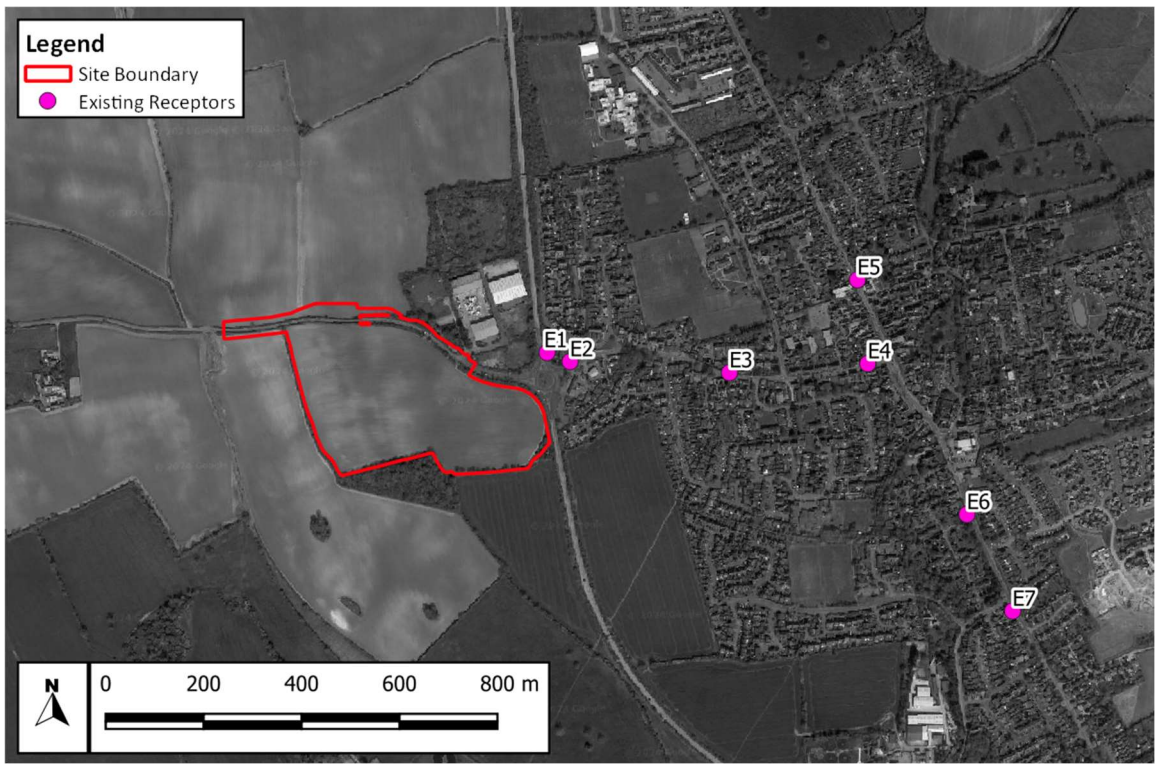


Figure notes: Imagery © 2024 Google, Map data © 2024.

G3.3. The potential air quality impacts during the operation of the Proposed Development are discussed in this section.

Annual Mean Impacts

G3.4. The predicted annual mean concentrations for each receptor, as well as the impact descriptors, are given in Table 4, Table 5 and Table 6 for NO_2, PM_{10} and $PM_{2.5}$ respectively. All values are well below the AQOs, no new exceedances are created, and no existing exceedances are worsened. The impacts of the Proposed Development are thus described as negligible at all receptor locations, including within Buntingford Town Centre.

Table 4: Predicted Annual Mean NO_2 Concentrations in 2028 and Impact Descriptor (µg/m^3)

Receptor (height (m))	No Development	With Development	Impact Descriptor
E1 (1.5)	9.4	9.5	Negligible
E2 (1.5)	10.4	10.6	Negligible
E3 (1.5)	10.7	10.9	Negligible
E4 (1.5)	14.2	14.4	Negligible
E5 (1.5)	11.5	11.7	Negligible
E6 (1.5)	10.2	10.2	Negligible
E7 (1.5)	10.3	10.4	Negligible
AQO	**40**		**-**

Table notes: -

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Table 5: Predicted Annual Mean PM_{10} Concentrations in 2028 and Impact Descriptor (µg/m^3)

Receptor	No Development	With Development	Impact Descriptor
E1 (1.5)	14.6	14.8	Negligible
E2 (1.5)	14.7	14.8	Negligible
E3 (1.5)	14.7	14.7	Negligible
E4 (1.5)	15.4	15.5	Negligible
E5 (1.5)	14.7	14.7	Negligible
E6 (1.5)	14.2	14.2	Negligible
E7 (1.5)	14.6	14.6	Negligible
AQO	**40**		-
Table notes: -			

Table 6: Predicted Annual Mean $PM_{2.5}$ Concentrations in 2028 and Impact Descriptor (µg/m^3)

Receptor (height (m))	No Development	With Development	Impact Descriptor
E1 (1.5)	10.0	10.2	Negligible
E2 (1.5)	10.2	10.3	Negligible
E3 (1.5)	9.8	9.9	Negligible
E4 (1.5)	11.9	12.0	Negligible
E5 (1.5)	10.4	10.5	Negligible
E6 (1.5)	10.6	10.6	Negligible
E7 (1.5)	10.3	10.3	Negligible
AQO	**25** [a]		-
Table notes: a. Not in Regulations and there is no legal requirement for local authorities to meet it.			

Short-term Impacts

G3.5. The predicted short-term NO_2 and PM_{10} AQOs are likely to be achieved as the predicted concentrations are well below the indicative annual mean equivalents for these AQOs of 60 µg/m^3 for 1-hour NO_2 (see Table 4) and 32 µg/m^3 for 24-hour mean PM_{10} (see Table 5). The impacts on the short-term AQOs are therefore considered negligible.

Limit Value Compliance

G3.6. Existing levels of air pollution are predicted by Defra to be below the LVs in the current year (2024) and is predicted to improve when the Proposed Development is operational in 2028. Predicted concentrations within the Proposed Development are below all the LV and will therefore not lead to any delay in the compliance of the limit values.

G4. Significance of Operational Air Quality Effects on Human Health

Summary

G4.1. A summary of the impacts in relation to the air quality at locations of human exposure are set out in Table 7.

Table 7: Human Health Impact Descriptors

Pollutant	Annual mean	Short-term mean
NO_2	Negligible	Negligible
PM_{10}	Negligible	Negligible
$PM_{2.5}$	Negligible	Negligible
Table notes: -		

Significance of Operational Air Quality Effects

G4.2. The operational air quality effects on locations of human health exposure without additional mitigation are judged to be 'not significant'. This professional judgement takes account of the assessment that:

- The annual mean impacts of pollutant emissions in relation to the human health receptors are described as negligible, as set out in Table 7; and
- The short-term mean impacts of pollutant emissions in relation to the human health receptors are negligible, as set out in Table 7.

G5. Glossary and References

Glossary

APS Air Pollution Services

AQMA Air Quality Management Area

AQO Air Quality Objective

EHDC East Herts District Council

EPUK Environmental Protection UK

IAQM Institute of Air Quality Management

LAQM Local Air Quality Management

LAQM.TG22 Local Air Quality Management Target 22

Limit Values (LV) Legally binding EU parameters that must not be exceeded. Limit values are set for individual pollutants and are made up of a concentration value, an averaging time over which it is to be measured, the number of exceedances allowed per year, if any, and a date by which it must be achieved. Some pollutants have more than one limit value covering different endpoints or averaging times.

NO_2 Nitrogen dioxide

NOx Nitrogen oxides

PM_{10} Small airborne particles, more specifically particulate matter less than 10 micrometres in aerodynamic diameter

$PM_{2.5}$ Small airborne particles, more specifically particulate matter less than 2.5 micrometres in aerodynamic diameter

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RMSE	Root Mean Squared Error
WHO	World Health Organization
µg/m³	Microgrammes per cubic metre

G6. References

Defra. (2021). Local Air Quality Management Technical Guidance (TG16). Retrieved from https://laqm.defra.gov.uk/technical-guidance/

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Air Quality Neutral Assessment: Land South of A507, Buntingford

Client: Jubb Consulting Engineers Ltd

Reference: APS_P1207A_K2-2 **Date Published:** 21 February 2024

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K1. Introduction

K1.1. Air Pollution Services (APS), part of KALACO Group, has been commissioned to assess the compliance with the air quality neutral (AQN) benchmarks in relation to the proposed development at Land South of A507, West of Buntingford, Buntingford, Hertfordshire (herein the 'Proposed Development'). The Proposed Development is located within the administrative area of East Herts District Council (EHDC).

K1.2. Irrespective of the significance of operational air quality effects of an individual scheme, a small incremental change can cumulatively with other developments worsen air quality and AQN assessments are designed to reduce the risk of cumulative impacts. 'Air Quality Neutral' is a term for developments that do not contribute to air pollution beyond allowable benchmarks.

K1.3. EHDC have set out the need for an AQN assessment to accompany planning applications. This document sets out the AQN assessment.

K1.4. The current application is an outline application and much of the detailed information in not currently available. Where assumptions have been made, they are presented.

K2. Methodology

Guidance Documents

East Herts District Council Sustainability Supplementary Planning Document

K2.1. EHDC published the Sustainability SPD (2021) which outlines the requirement for development in the district to be AQN. The SPD guidance links back to the guidance development by the Greater London Authority (GLA) for AQN assessments in London in 2014. The 2014 GLA guidance has been superseded due to the range of out of data considerations such as the benchmarks developed. The SPD guidance states:

"Within the application process, major developments must submit an air quality neutral assessment as part of an Air Quality Impact Assessment. Minor developments in or near to an AQMA must submit an Air Quality Neutral Assessment (they will not be required to submit an Air Quality Impact Assessment). The assessment should take into account the following elements and compare them to the Air Quality Neutral Benchmarks provided in Appendix C."

Approach Overview

K2.2. The methodology follows the approach set out in the Sustainability SPD (East Herts District Council, 2021).

K2.3. The assessment involves comparing emissions associated with the Proposed Development against benchmarks for properties and development of a similar nature. There are two sets of benchmarks, which cover the two main sources of air pollution from new developments:

- Building Emissions Benchmark (BEB) - emissions from equipment used to supply heat and energy to the buildings.

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- Transport Emissions Benchmark (TEB) - emissions from private vehicles travelling to and from the development.

K2.4. The SPD states:

"The assessment should take into account the following elements and compare them to the Air Quality Neutral Benchmarks provided in Appendix C."

K2.5. In relation to the building emissions it states:

"Determine the relevant emission benchmark for buildings for NO_2 and PM_{10} at the site, based on its land use class and location. Calculate the site's NO_2 and PM_{10} emissions from buildings and compare them with the buildings benchmark. The assessment should present the data used in the calculation, including the plant emission data."

K2.6. In relation to the transport emissions it states:

"Determine the relevant emission benchmark for transport for NO_2 and PM_{10} at the site. Calculate the site's NO_2 and PM_{10} emissions from transport and compare them with the transport benchmark. The assessment should present the data used in the calculation."

K2.7. A development must meet both benchmarks separately in order to be Air Quality Neutral. If one or both benchmarks are not met, appropriate mitigation or offsetting will be required.

K2.8. Although unclear, the first table of Appendix C is considered to define the BEB and the second table is considered to define the TEB.

K3. Proposed Development Emission Sources

K3.1. The Proposed Development is classed as a major development.

K3.2. The energy strategy for the Proposed Development is currently unknown. However, it is expected that the Proposed Development will include some on-site combustion plant. All plant will conform to the minimum standards for combustion plant set out in the SPD. It is assumed no combined heat and power (CHP) plant will be include in the development at this stage. The natural gas combustion in the boilers is assumed to have no significant particulate matter (PM) emission. Therefore, it is only the NOx emissions which need to be considered in relation to the BEB.

K3.3. The Proposed Development is estimated to generate 1,611 car trips per day.

K4. Building Emissions

K4.1. The Building Emission Benchmark (BEB) for each land use category relevant to the development is presented in Table 1. The guidance does not include benchmark emissions for use classes E(c) and E(g) and so the portion of the Proposed Development that will fall into those use classes cannot be accounted for using their own benchmarks; instead, following the recommendation in the guidance, they have been assumed to have the same emissions as B2 – B8.

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Table 1: Calculation of Benchmarked Building Emissions for the Development

Land Use	GFA (m^2)	NOx		PM_{10}	
		Building Emission Benchmark (g/m^2/annum)	Benchmarked Emissions (kg/annum)	Building Emission Benchmark (g/m^2/annum)	Benchmarked Emissions (kg/annum)
B2 – B8	27,420	36.6	1,003.6	3.0	80.9
Total Benchmarked Building Emission		-	**1,003.6**	-	**80.9**

K4.2. The total benchmarked building NOx and PM_{10} emissions for the Proposed Development (based on use classes B2 – B8 only) are 1,003.6 kg/annum and 80.9 kg/annum, respectively. The client has stated that details regarding the on-site combustion plant are currently unknown, therefore it is not possible to calculate the building emissions. Thus, it is not possible to state whether the proposed development is air quality neutral in terms of building-related emissions.

K5. Transport Emissions

K5.1. The guidance provides Transport Emission Benchmarks (TEBs) for residential, office and retail use classes. The guidance does not provide emission benchmarks for use classes B2 – B8 or E(c) / E(g) and thus the emissions from the Proposed Development cannot be assessed against a benchmark. Therefore, the transport emissions associated with the Proposed Development have been assessed against the land use class for Office (B1) and are shown in Table 2.

Table 2: Calculation of Benchmarked Trip Rates for the Development

Land Use	Number of Dwellings	NOx (g/dwelling/ annum)	NOx (kg/annum)	PM_{10} (g/dwelling/ annum)	PM_{10} (kg/annum)
C3	27,420	68.5	1,878.3	11.8	323.6
Total Transport Emission Benchmark		-	**1,878.3**	-	**323.6**

K5.2. Based on the information provided by the Client, which is set out in Section K3, there will be 1,611 car related trips generated by the development. Table 8 of report commissioned by the GLA (GLA 80371) "Air Quality Neutral Planning Support Update" (GLA, 2014) states the average distance travelled by car per trip in outer London is 10.8 km (note, the benchmarks presented in Appendix C of the SPD are the outer London benchmarks).

K5.3. An emission factor for both NOx and PM_{10} was derived from the Department for Transport's (DfT's) Emissions Factor Toolkit (EFT) (v12.0.1.). Based on the factor, the 1,611 cars are expected to emit 290.2 kg/annum of NOx (0.0457 g/vehicle/km x 1,611 vehicles/day x 10.8 km/vehicle x 365 days per year) and 207.1 kg/annum of PM_{10} (0.0326 g/vehicle/km x 1,611 vehicles/day x 10.8 km/vehicle x 365 days per year).

K5.4. When considering the emissions generated by the 1,611 car trips per day relative to the benchmarks, the Proposed Development is better than the benchmarks in terms of both NOx emissions and PM_{10} emissions.

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K6. Mitigation and Off-setting

Mitigation measures

K6.1. Full details of design and application are required to provide mitigation measures.

Offsetting payments

K6.2. Full details of design and application are required to determine any mitigation measures. Once measures have been accounted for any necessary offsetting payments can be determined following the damage cost approach in the SPD. It is not appropriate at this stage to present any calculations.

K7. Summary

K7.1. At this stage the full design details are unavailable and therefore it is currently unknown whether the Proposed Development is compliant with the AQN benchmarks. Further details of the scheme are required; once available, any necessary mitigation measures and offsetting payments will be determined.

K8. Glossary

APS	Air Pollution Services
AQN	Air Quality Neutral
BEB	Building Emission Benchmark
GLA	Greater London Authority
mg/kWh	Milligrams per kilo watt hour
mg/Nm^3	Milligrams per nanometre cubed
NOx	Nitrogen oxides
$PM_{2.5}$	Particulate Matter with a diameter of less than 2.5 micrometres
PM_{10}	Particulate Matter with a diameter of less than 10 micrometres
SPG	Supplementary Planning Guidance
TEB	Transport Emission Benchmark

K9. References

East Herts District Council. (2021). *East Herts Sustainability Supplementary Planning Document.*