STORTHES HALL, KIRKBURTON

Proposed Residential Development

Air Quality Assessment

Prepared for: Ubrique Investments Limited

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1.0 INTRODUCTION

SLR Consulting Ltd (SLR) has been commissioned by Ubrique Investments Ltd to undertake an Air Quality Assessment to support a planning application for a proposed residential development of up to 261 dwellings (C3 use-class) at Storthes Hall, Kirkburton (the 'Proposed Development'). The Proposed Development is to be situated on an existing student accommodation area off Storthes Hall Lane (the 'Site').

The Site is located in the town of Kirkburton, within the Kirklees Council (KC) administrative area, one of the five authorities that constitutes the West Yorkshire Combined Authority (WYCA). The Site is approximately 5.0km to the south-east of Huddersfield town centre and is centred at the approximate National Grid Reference (NGR): x418070, y412780. The Site is bounded by:

- Storthes Hall Lane to the immediate north, with North Spring Wood and Carr Wood beyond;
- rural land and residential properties to the east, with commercial properties beyond;
- a sports club and associated sports grounds to the south, with Boothroyd Wood and Wood Lane situated further afield; and
- Storthes Hall Lane to the immediate east, with residential dwellings located opposite at a minimum separation distance of 10m.

Primary vehicular access to the Site will be via existing entrances off Storthes Hall Lane to the north-west and south-west of the Proposed Development.

1.1 Scope of Assessment

Preassessment consultation with the Environmental Health Officer (EHO) at KC was undertaken to agree upon the scope and methodology of the Air Quality Assessment. The following scope of works has been undertaken as agreed with KC[1]:

- Baseline Evaluation;
- Construction Phase Assessment;
- Operational Phase Assessment; and
- Mitigation Measures.

[1] Email communication received from Rebecca Muff, Principal Technical Officer on 1st July 2022.

2.0 RELEVANT AIR QUALITY LEGISLATION AND GUIDANCE

2.1 Legislative Context

A dual set of regulations, applicable to National and Local Government separately are currently operable within the UK.

2.1.1 National Obligations

The Air Quality Standards Regulations 2010[2] (AQSR) transpose both the EU Ambient Air Quality Directive (2008/50/EC), and the Fourth Daughter Directive (2004/107/EC) within UK legislation, in order to align and mirror European obligations. The AQSR includes Limit Values which are legally binding ambient concentration thresholds, however, must be assessed at specific locations (micro and macroscale sampling points). Carriageways or central reservations of roads and any location where the public do not have access (e.g. industrial sites) are exempt. If the sampling point does not comply with the siting locations (Schedule 1: AQSR), then strict comparison cannot be made.

Following the UK's withdrawal from the EU, the Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020[3] was introduced to mirror revisions to supporting EU legislation. The fine particulate matter (as $PM_{2.5}$) Limit Value is 20µg/m^3 (to be met by 2020).

The responsibility of achieving the AQSR (and European equivalent Directives) is a national obligation for Central Government and Devolved Administrations who undertake assessments on an annual basis. Local Authorities have no responsibility to achieve the AQSR or the European equivalent Directives, unless otherwise instructed to assist Central Government under Ministerial Direction.

In response to persistent exceedances, the Government published its 2017 plan[4] for reducing roadside nitrogen dioxide (NO_2) concentrations in order to achieve compliance in the shortest time possible. This has resulted in the introduction of Clean Air Zones across England, however, KC were not identified as required to conduct a feasibility study.

2.1.2 Environment Targets (Fine Particulate Matter) Regulations

The Environmental Targets (Fine Particulate Matter) (England) Regulations 2023[5] introduced an annual mean concentration target of 10µg/m^3 to be met across England by 2040. Central Government and Devolved Administrations is responsible for meeting this target, however not until 2040. Local Authorities have no responsibility to achieve this target.

2.1.3 Local Obligations

Part IV of the Environment Act 1995 (as amended) requires the Secretary of State to publish a national Air Quality Strategy (AQS) every five years and established the system of Local Air Quality Management (LAQM) for Local Authorities to regularly review and assess air quality within its area.

The Air Quality (England) Regulations 2000 (as amended) ('the Regulations') provide the statutory basis for the Air Quality Objectives Local Authorities must adhere to under LAQM in England. $PM_{2.5}$ is not currently cited within the Regulations; Local Authorities are however required to work towards reducing $PM_{2.5}$.

The Air Quality Objectives apply at locations where members of the public are regularly present and might reasonably be expected to be exposed to pollutant concentrations over the relevant averaging period (relevant

[2] The Air Quality Standards Regulations (England) 2010, Statutory Instrument No 1001, The Stationary Office Limited.

[3] The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020, Statutory Instrument No. 1313, The Stationary Office Limited.

[4] UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations, 2017.

[5] The Environmental Targets (Fine Particulate Matter) (England) Regulations 2023. UK Statutory Instruments 2023 No. 96.

exposure). Table 2-2 provides an indication of those locations. Where any of the prescribed Air Quality Objectives are not likely to be achieved, the authority must designate an Air Quality Management Area (AQMA). For each AQMA, the local authority is required to prepare an Air Quality Action Plan (AQAP), which details measures the authority intends to introduce to deliver improvements in local air quality in pursuit of the objective.

The latest AQS for England was published in 2023[6]. The AQS provides the delivery framework for air quality management across England for local authorities and summarises the air quality standards and objectives operable within England for the protection of public health and the environment.

The ambient air quality standards of relevance this assessment (collectively termed Air Quality Assessment Levels (AQALs) throughout this report) are provided in Table 2-1. These are primarily based upon the Air Quality Objectives Local Authorities are responsible for achieving – reflective of the Local Planning Authority's duties. The $PM_{2.5}$ AQSR AQAL has also been included for completeness, to provide an indicative assessment (as the sampling point may not comply with the siting locations prescribed under Schedule 1: AQSR).

Table 2-1
Relevant Ambient AQALs

Pollutant	AQAL (µg/m^3)	Averaging Period
NO_2	40	Annual mean
	200	1-hour mean (not to be exceeded on more than 18 occasions per annum)
Particles (PM_{10})	40	Annual mean
	50	24-hour mean (not to be exceeded on more than 35 occasions per annum)
Particles ($PM_{2.5}$)	20	Annual mean

Table Notes:
The $PM_{2.5}$ AQAL is not prescribed within the Air Quality (England) Regulations 2000 / 2002 and there is no requirement for local authorities to meet it. Exceedances are only valid at specific siting locations (Schedule 1: AQSR).

Table 2-2
Human Health Relevant Exposure

AQAL Averaging Period	AQALs should apply at	AQALs should not apply at
Annual Mean	Building facades of residential properties, schools, hospitals etc.	Facades of offices Hotels Gardens of residences Kerbside sites
24-hour mean	As above together with hotels and gardens of residential properties	Kerbside sites where public exposure is expected to be short term
1-hour mean	As above together with kerbside sites of regular access, car parks, bus stations etc.	Kerbside sites where public would not be expected to have regular access

[6] Air Quality Strategy: Framework for Local Authority Delivery, Department for Environment Food and Rural Affairs, April 2023.

2.1.4 Environmental Protection Act 1990

The Environmental Protection Act 1990[7] sets out provisions for the regulation of statutory nuisances. Section 79 sets out this statutory nuisance as, '*any dust, steam, smell or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance*'.

Section 79 requires that, where a complaint of a statutory nuisance is made to it by a person living within its area, a Local Authority must take steps as are reasonably practicable to investigate the complaint and decide whether the odour is prejudicial to health or a nuisance. Fractions of dust greater than 10µm (i.e. greater than PM_{10}) in diameter typically relate to nuisance effects as opposed to potential health effects and therefore are not covered within the UK AQS. In legislation there are currently no numerical limits in terms of what level of dust deposition constitutes a nuisance.

2.2 National Policy

2.2.1 Clean Air Strategy

The 2019 Clean Air Strategy8 sets out the Government's proposals aimed at delivering cleaner air in England and indicates how devolved administrations intend to make emissions reductions. It sets out the comprehensive action that is required from across all parts of government and society to deliver clean air.

2.2.2 Environment Improvement Plan 2023

The 2023 Environment Improvement Plan9 is the first revision of the UK Government's 25 Year Environment Plan (25YEP) – planned on a five-year rolling cycle. This document sets out the 5-year delivery plan to improve the natural environment. The 2023 Environment Improvement Plan builds on the 2019 Clean Air Strategy by setting environmental targets and commitments to reduce air pollution.

2.2.3 National Planning Policy Framework

The 2021 update to the National Planning Policy Framework10 (NPPF) sets out planning policy for England. The NPPF states that the planning system should contribute to and enhance the natural and local environment, by preventing new development from contributing to or being adversely affected by unacceptable concentrations of air pollution and development should, wherever possible, help to improve local environmental conditions such as air quality.

In specific relation to air quality policy, the document states:

> ***Chapter 15 - Conserving and Enhancing the Natural Environment***
>
> *"Para 186. Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan."*

[7] The Environmental Protection Act 1990. Available at http://www.legislation.gov.uk/ukpga/1990/43/contents.

[8] The Clean Air Strategy, Defra. January 2019.

[9] Environmental Improvement Plan 2023, Defra. 2023.

[10] National Planning Policy Framework, Ministry of Housing, Communities & Local Government, 2021.

The NPPF is accompanied by web based supporting Planning Practice Guidance (PPG) which includes guiding principles on how planning can take account of the impacts of new development on air quality. In regard to air quality, the PPG states:

> *"The Department for Environment, Food and Rural Affairs carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with relevant Limit Values […] It is important that the potential impact of new development on air quality is taken into account where the national assessment indicates that relevant limits have been exceeded or are near the limit […]."*
>
> *"Whether air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to have an adverse effect on air quality in areas where it is already known to be poor, particularly if it could affect the implementation of air quality strategies and action plans and/or breach legal obligations (including those relating to the conservation of habitats and species). Air quality may also be a material consideration if the proposed development would be particularly sensitive to poor air quality in its vicinity."*

The PPG sets out the information that may be required within the context of a supporting air quality assessment, stating that "*Assessments need to be proportionate to the nature and scale of development proposed and the potential impacts (taking into account existing air quality conditions) […] Mitigation options will need to be locationally specific, will depend on the proposed development and need to be proportionate to the likely impact*."

2.3 Local Policy

The Kirklees Local Plan[11] was adopted on 27th February 2019 and sets out strategies and policies for development in the district through to 2031. It contains the following policies which relate to air quality:

> "***LP21: Highways and access***
>
> *Proposals shall demonstrate that they can accommodate sustainable modes of transport and be accessed effectively and safely by all users. New development will normally be permitted where safe and suitable access to the site can be achieved for all people and where the residual cumulative impacts of development are not severe. Proposals shall demonstrate adequate information and mitigation measures to avoid a detrimental impact on highway safety and the local highway network. Proposals shall also consider any impacts on the Strategic Road Network.*
>
> *All proposals shall: […]*
>
> *c. be accompanied by a supporting Transport Assessment or Transport Statement where the development would generate significant trip generation, providing detail as to the impact on highway safety, air quality, noise and light restrictions; […]"*
>
> "***LP47: Healthy, active and safe lifestyles***
>
> *The council will, with its partners, create an environment which supports healthy, active and safe communities and reduces inequality.*
>
> *Healthy, active and safe lifestyles will be enabled by: […]*
>
> *g. ensuring that the current air quality in the district is monitored and maintained and, where required, appropriate mitigation measures included as part of new development proposals;*
>
> *h. creating high-quality and inclusive environments incorporating active design and the creation of safe, accessible and green environments which minimise and mitigate against potential harm from risks such as pollution and other environmental hazards; […]"*

[11] Kirklees Council, Local Plan Strategy and Policies, adopted February 2019.

*"**LP51: Protection and improvement of local air quality***

1. Development will be expected to demonstrate that it is not likely to result, directly or indirectly, in an increase in air pollution which would have an unacceptable impact on the natural and built environment or to people.

2. Proposals that have the potential to increase local air pollution either individually or cumulatively must be accompanied by evidence to show that the impact of the development has been assessed in accordance with the relevant guidance. Development which has the potential to cause levels of local air pollution to increase must incorporate sustainable mitigation measures that reduce the level of this impact. If sustainable measures cannot be introduced the development will not be permitted.

3. Where the development introduces new receptors into Air Quality Management Areas or Areas of Concern or near other areas of relatively poor air quality, for example near roads or junctions, the development must incorporate sustainable mitigation measures that protect the new receptors from unacceptable levels of air pollution. Where sustainable mitigation measures cannot be introduced which prevent receptors from being exposed to unsafe levels of air pollution, development will not be permitted."

2.4 Assessment Guidance

This assessment has been carried out in accordance with the following principles contained within the guidance documents below.

- West Yorkshire Air Quality and Emissions Technical Planning Guidance[12];
- Department for Environment Food and Rural Affairs (Defra): Local Air Quality Management Technical Guidance (LAQM.TG (22))[13];
- Defra: COVID-19: Supplementary Guidance. Local Air Quality Management Reporting in 2021[14];
- Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM): Land-Use Planning and Development Control: Planning for Air Quality[15] (hereafter referred to as the 'EPUK & IAQM guidance');
- IAQM: Guidance on the Assessment Dust from Demolition and Construction[16]; and
- IAQM: Implications of the COVID-19 pandemic on air quality monitoring and assessments[17].

[12] West Yorkshire Low Emissions Strategy. Air Quality and Emissions Technical Planning Guidance, 2016.

[13] Local Air Quality Management Technical Guidance 22, Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland. August 2022.

[14] Defra and the Greater London Authority, COVID-19: Supplementary Guidance. Local Air Quality Management Reporting in 2021. April 2021.

[15] EPUK and IAQM, Land-Use Planning and Development Control: Planning for Air Quality, v1.2 2017.

[16] IAQM, Guidance on the Assessment Dust from Demolition and Construction, v1.1 2016.

[17] IAQM, Implications of the COVID-19 pandemic on air quality monitoring and assessments. 6th April 2021.

3.0 ASSESSMENT METHODOLOGY

3.1 Development Classification

The Proposed Development comprises a residential development of up to a maximum of 261 residential units (C3 use-class). This meets the criteria for 'Medium' development, presented below in Table, as detailed in the West Yorkshire Air Quality and Emissions Technical Planning Guidance.

Table 3-1
Development Classification Criteria

Land Use	Description	Criteria
C3 Dwelling Houses	Dwellings for individuals, families or not more than six people living together as a single household.	>50 Units

The Proposed Development is not anticipated to meet the criteria for 'Major' development, as detailed in Table 2 of the West Yorkshire Air Quality and Emissions Technical Planning Guidance.

As such, it is initially considered that the Proposed Development constitutes 'Medium' development.

3.2 Construction Phase

The construction dust assessment has been undertaken in accordance with IAQM guidance. The assessment of risk is determined by considering the risk of dust effects arising from four activities in the absence of mitigation:

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

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

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

The first stage of the assessment involves a screening review to determine if there are sensitive receptors within threshold distances of the site activities associated with the construction phase of the scheme. A detailed assessment is required where a:

- human receptor is located within 350m of the Site, and/or within 50m of routes used by construction vehicles, up to 500m from the site entrance(s); and/or
- ecological receptor is located within 50m of the Site, and/or within 50m of routes used by construction vehicles, up to 500m from the site entrance(s).

The dust emission class (or magnitude) for each activity is determined on the basis of the guidance, indicative thresholds, and professional judgement. The risk of dust effects arising is based upon the relationship between the dust emission magnitude and the sensitivity of the area. The risk of impact is then used to determine the appropriate mitigation requirements, whereby through effective application, residual effects are considered to be 'not significant'.

Given the short-term nature of the construction phase and the comparatively low volume of vehicle movements that will likely arise (when compared to the operational phase, for which a full assessment has been undertaken), there is not considered to be any potential for significant air quality effects from development related road traffic emissions during the construction phase. Such potential effects have therefore been scoped out from requiring detailed assessment based on their assumed 'insignificant' effect on air quality in reference to the EPUK & IAQM guidance.

3.3 Exposure Assessment

An 'exposure assessment' has been undertaken following the West Yorkshire *Air Quality and Emissions, Technical Planning Guidance* to determine whether future occupants of the scheme are likely to be exposed to existing levels of poor air quality.

3.4 Operational Phase

In order to appropriately assess road traffic impacts associated with the operation of the Proposed Development, detailed dispersion modelling has been undertaken using the Cambridge Environmental Research Consultants (CERC) ADMS-Roads v5.0.0.1 dispersion model, focussing on concentrations of NO_2, PM_{10} and $PM_{2.5}$ for the following scenarios:

- 2019 Verification / Base Case (2019 BC) – Base flows for the year (2019);
- 2032 Do Minimum (2032 DM) – Without development flows for the assumed year of opening (2032), inclusive of any relevant committed development flows; and
- 2032 Do Something (2032 DS) – 'Do Minimum' flows, plus all trips associated with the Proposed Development flows for the proposed year of opening (2032).

For the above future year scenarios (2032), emission factors for 2030 have been utilised given the limited scope of compatibility between the Emissions Factors Toolkit (EFT)[18], the NO_2 Adjustment for NO_x Sector Removal Tool[19] and Defra's NO_x to NO_2 conversion tool (v8.1)[20] beyond 2030. The adoption of 2030 emission factors is considered a conservative approach given the predicted year-on-year reduction built into the EFT.

Details of model inputs are discussed in turn, below. Advanced inputs are discussed in Appendix A.

3.4.1 Traffic Inputs

Traffic data was provided by Optima Highways & Transportation – the appointed transport consultant. This data has principally informed the spatial extent and inclusion of initial road links within the assessment.

Traffic speeds were modelled at the relevant speed limit for each road. However, where appropriate, the speeds have been reduced to simulate queues at junctions, traffic lights and other locations where queues or slower traffic are known to be an issue, in accordance with LAQM.TG(22). Traffic speeds have been assumed to be consistent across all the modelled scenarios.

The EFT version 11.0 developed by Defra[18] has been used to determine vehicle emission factors for input into the ADMS-Roads dispersion model.

[18] Defra, EFT v11.0 (2021). https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html.
[19] Defra NO_2 Adjustment for NO_x Sector Removal Tool (v8.0).
[20] Defra NO_x to NO_2 Calculator v8.1 (2020), available at https://laqm.defra.gov.uk/air-quality/air-quality-assessment/no2-adjustment-for-nox-sector-removal-tool/.

To initially inform the spatial extent of the model, changes in traffic volumes on the local road network were compared to screening thresholds provided within EPUK & IAQM guidance i.e. 500 Light Duty Vehicles (LDV) and/or 100 Heavy Duty Vehicles (HDV) as 24-hour Annual Average Daily Traffic (AADT) outside of an AQMA.

Any road links in which the AADT was below the screening thresholds were omitted from the detailed assessment as air quality effects in association with the operational phase are believed to be 'insignificant' in reference to the EPUK & IAQM guidance.

Details of the traffic flows used in this assessment are provided in Appendix A, whilst the modelled roads in relation to the Site are presented in Figure 3-2. It is noted that traffic flows generated by the Proposed Development are based upon an earlier iteration of the scheme which proposed 300 dwellings. As the Proposed Development now seeks permission for 261 dwellings, associated trip generation and road traffic emissions will be lower. As such, impacts on air quality will be correspondingly lower than that presented herein.

3.4.2 Meteorological Data

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

The dispersion modelling has been undertaken using 2019 data from the Leeds Bradford Airport meteorological station, located approximately 28.5km to the north-east of the Site – the closest representative meteorological station relative to the Site, and at a comparable elevation.

LAQM.TG(22) recommends that meteorological data should have a percentage of usable hours greater than 85%. 2019 meteorological data from Leeds Bradford Airport meteorological station includes 8,760 lines of usable hourly data for the year, i.e. 100% usable data. This is therefore suitable for the dispersion modelling exercise.

A surface roughness value of 0.5m was used to represent the dispersion site (parkland and open suburbia). Whereas a surface roughness value of 0.005m was used to represent the meteorological station (open grassland).

A wind rose is presented in Figure 3-1.

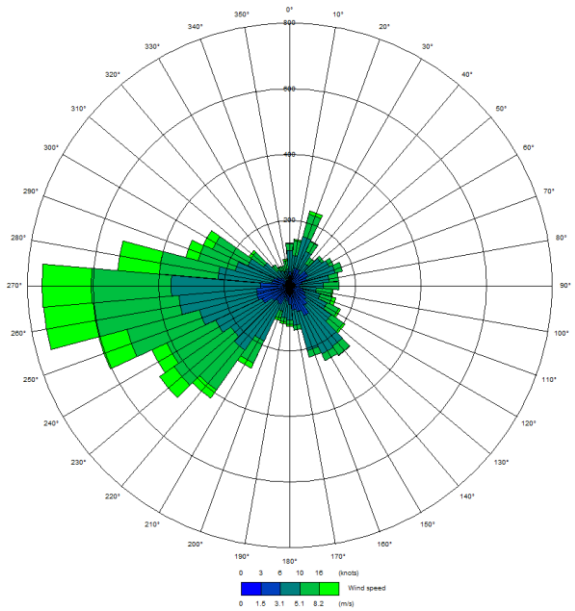

Figure 3-1 Wind Rose for Leeds Bradford Airport Meteorological Station (2019)

3.4.3 Background Concentrations

In the absence of locally representative background monitoring sites, annual mean background concentrations used for the purposes of the assessment have been obtained from the Defra supplied background maps (2018

reference year)[21], based on the 1km grid squares which cover the modelled area. Further detail on these datasets can be found in Section 4.1.3.

As the relationship between NO_2 and NO_x is not linear, the NO_2 Adjustment for NO_x Sector Removal Tool[19] has been used – in accordance with LAQM.TG(22). No adjustment for background concentration variability with height has been made.

3.4.4 Sensitive Receptors

Human receptors considered in the assessment of emissions from road traffic are shown Table 3-2, whilst their locations are illustrated in Figure 3-2.

Receptors R1 – R25 are representative of worst-case exposure locations at existing receptors within the Site locale, relative to the affected road network discussed (i.e. the roads exceeding the EPUK & IAQM threshold). Receptors R17 and R18 are located at the façade of public restaurants therefore representing short-term exposure only (i.e. the 1-hour mean NO_2 and 24-hour mean PM_{10} AQALs).

All receptors were considered in relation to exposure at breathing height relative to the adjacent modelled road, at ground level, i.e. 1.5m height. Receptor locations represent relevant exposure – in accordance with LAQM.TG(22) are presented in Table 3-2.

Table 3-2
Receptor Locations Considered

Receptor	X	Y	Height (m)	Short-Term Only
R1	417728	412469	1.5	N
R2	417709	412434	1.5	N
R3	417734	412390	1.5	N
R4	417816	412628	1.5	N
R5	417862	412720	1.5	N
R6	417921	412813	1.5	N
R7	418448	412938	1.5	N
R8	418824	413355	1.5	N
R9	418903	413356	1.5	N
R10	418895	413442	1.5	N
R11	418811	413578	1.5	N
R12	418747	413708	1.5	N
R13	418756	414101	1.5	N
R14	418734	414083	1.5	N
R15	418621	414651	1.5	N
R16	418521	415009	1.5	N
R17	418283	415408	1.5	Y
R18	418189	415545	1.5	Y
R19	418094	415618	1.5	N
R20	417905	415877	1.5	N

[21] Defra Background Maps (2018-Reference) http://uk-air.defra.gov.uk/data/laqm-background-home.

Receptor	X	Y	Height (m)	Short-Term Only
R21	417933	415920	1.5	N
R22	417878	416002	1.5	N
R23	417791	416219	1.5	N
R24	418734	414186	1.5	N
R25	417706	416365	1.5	N

3.4.5 Model Outputs

The background pollutant values discussed in Section 4.1.3 have been used in conjunction with the concentrations predicted by the ADMS-Roads model to calculate predicted total annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$ for each respective scenario.

For the prediction of annual mean NO_2 concentrations at receptor locations, the road NO_x contributions (adjusted as per Appendix A) have been converted to total NO_2 following the methodology in LAQM.TG(22) using the latest version of Defra's NO_x to NO_2 conversion tool (v8.1)[20]. The traffic mix within the calculator was set to 'All other UK traffic' and 'Kirklees District' was selected as the local authority. The modelled NO_2 road contribution was then added to the appropriate NO_2 background concentration value to obtain an overall total annual mean NO_2 concentration.

For the prediction of short-term NO_2 impacts, LAQM.TG(22) advises that it is valid to assume that exceedences of the 1-hour mean AQAL for NO_2 are unlikely to occur where the annual mean NO_2 concentration is <60µg/m^3. This approach has thus been adopted for the purposes of this assessment, at relevant receptor locations with an applicable exposure period.

For the prediction of short-term PM_{10}, LAQM.TG(22) provides an empirical relationship between the annual mean and the number of exceedences of the 24-hour mean AQAL for PM_{10} that can be calculated as follows:

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

This relationship has thus been adopted to determine whether exceedences of the short-term PM_{10} AQAL are likely in this assessment.

Verification of the ADMS-Roads assessment has been undertaken as per Appendix A. All results presented in the assessment are those calculated following the process of model verification, using an adjustment factor of 2.649 for NO_2, PM_{10} and $PM_{2.5}$.

3.4.6 Assessing Significance

Guidance for determining the significance of a development's impact on local air quality is provided by EPUK & IAQM.

When describing the developmental impact at a specific receptor, the resultant total concentration as well as the magnitude of change in relation to respective AQALs are both considered – using the approach detailed in Table 3-3.

Table 3-3
Impact Descriptor Matrix for Receptors

Long Term Average Concentration at Receptor in Assessment Year	Change in Concentration relative to AQAL			
	1%	2-5%	6-10%	>10%
75% or less of AQAL	Negligible	Negligible	Slight	Moderate

Long Term Average Concentration at Receptor in Assessment Year	Change in Concentration relative to AQAL			
	1%	2-5%	6-10%	>10%
76-94% of AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial
Changes < 0.5% will be described as Negligible.				

Following derivation of impacts at all receptor locations assessed, the overall significance of the developmental 'effect' is determined based upon consideration, as necessary, of the following factors:

- the existing and future air quality in the absence of the Proposed Development;
- the extent of current and future population exposure to the impacts;
- the worst-case assumptions adopted when undertaking the prediction of impacts; and
- the extent to which the Proposed Development has adopted best practice to eliminate and minimise emissions.

3.4.7 Uncertainty

Dispersion modelling is inherently uncertain and is principally reliant on the accuracy and representativity of its inputs. In acknowledgement of this, the ADMS-Roads dispersion model has been verified with the latest representative publicly available local monitoring data, as collected by KC.

In addition, there is a widely acknowledged disparity between emission factors and ambient monitoring data[22]. To help minimise any associated uncertainty when forming conclusions from the results, this assessment has utilised the latest EFT version 11.0 utilising COPERT 5.3 emission factors, and associated tools/datasets published by Defra. The appropriate application of EFT v11.0 is consistent with the IAQM's comments in withdrawal of the Position Statement on '*Dealing with Uncertainty in Vehicle NOx Emissions within Air Quality Assessments*' (October 2016)[23].

[22] Carslaw, et al. (2011). Trends in NO_x and NO_2 emissions and ambient measurements in the UK.

[23] https://iaqm.co.uk/wp-content/uploads/2013/02/iaqm_uncertainty_vehicle_NOx_emission_withdrawn-02.pdf.

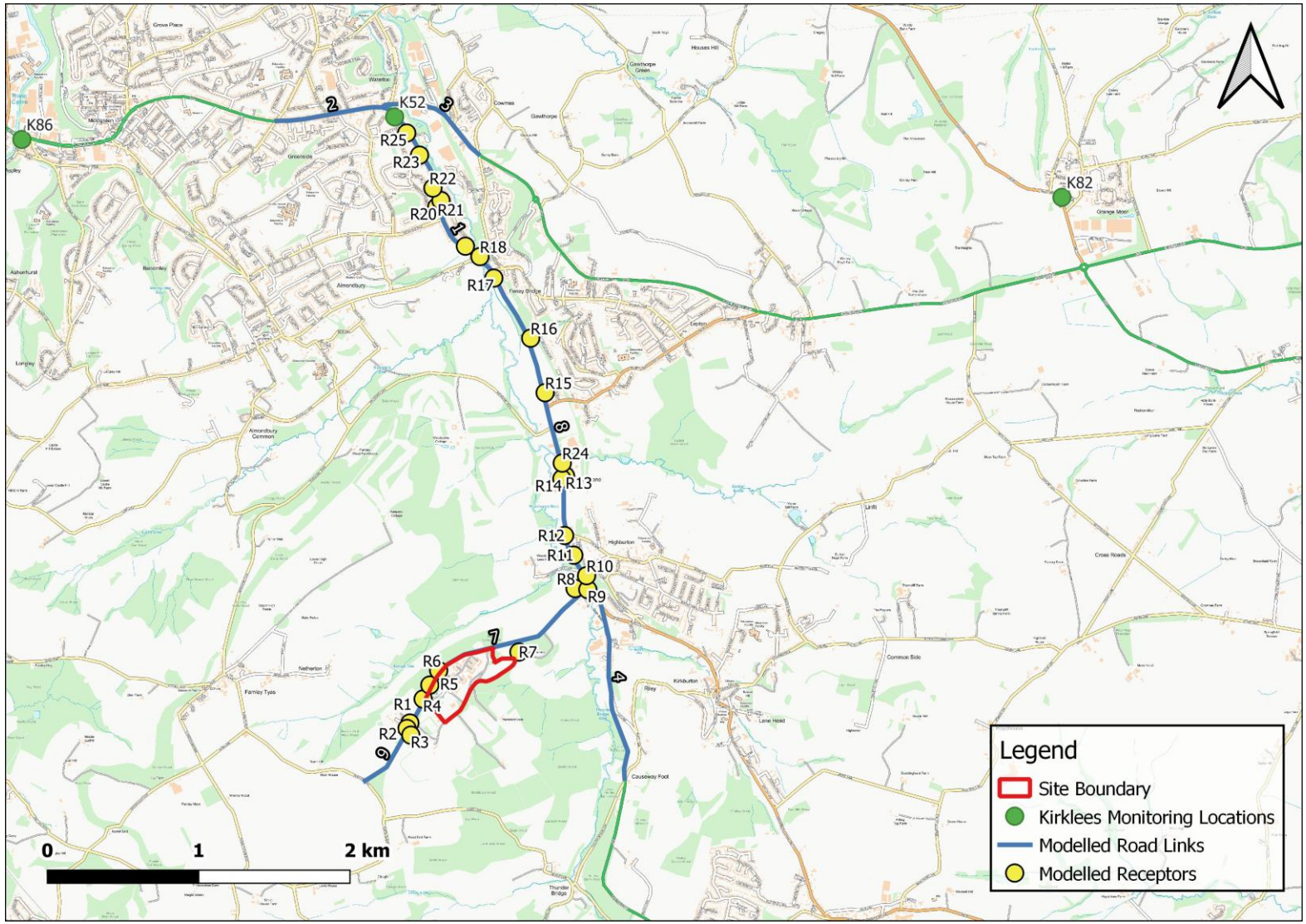

Figure 3-2
Modelled Road Links, Receptors and Monitoring Locations

4.0 BASELINE ENVIRONMENT

4.1 Baseline Air Quality

Monitoring data collected prior to the COVID-19 pandemic (i.e. pre-2020) has been used to characterise the baseline environment, as pollutant concentrations monitored during 2020 and 2021 are expected to be atypical, and not representative of the local environment and have therefore not been considered.

Furthermore, an IAQM position statement[17] on the '*use of 2020 and 2021 monitoring datasets*' recommends:

> *"If you are carrying out an air quality study that includes validation against monitoring data, use 2019 monitoring data as the last typical year."*

4.1.1 LAQM Review and Assessment

KC, in fulfilment of statutory requirements, has conducted an on-going exercise to review and assess air quality within their administrative area. The latest publicly available LAQM report for KC (not impacted by the COVID-19 pandemic) at the time of writing is the 2020 Annual Status Report[24] (ASR).

KC currently has ten declared AQMAs within the district, the nearest of which to the Site is AQMA 9: Huddersfield Town Centre, located approximately 4.5km to the northwest of the Site. AQMA 9 was declared in 2017 for the exceedence of the annual mean NO_2 AQAL at locations of relevant exposure.

4.1.2 Review of Air Quality Monitoring

Automatic Air Quality Monitoring

The UK Automatic Urban and Rural Network (AURN) is a countrywide network of air quality monitoring stations operated on behalf of Defra. The closest AURN monitor to the Site is the Dewsbury Ashworth Grove Urban Background AURN (NGR: x421912, y424060) an 'urban background' site defined by LAQM.TG (22) guidance as *"An urban location distanced from sources and therefore broadly representative of city-wide background conditions*". The Dewsbury Ashworth Grove Urban Background AURN is located over 10km north-east of the Site within the town of Dewsbury.

In addition to the AURN site discussed above, KC undertook automatic (continuous) air quality monitoring at 2 locations during 2019. The nearest automatic monitor to the Site is the Roadside 3 (RS3 - Bradley) monitor located approximately 7.8km south of the Site.

Given the separation distances between these monitors and the Site, automatic monitoring locations have not been considered.

Passive Diffusion Tube Monitoring

Passive NO_2 diffusion tube monitoring is currently undertaken by KC within the development locale, at numerous locations, in fulfilment of their statutory LAQM obligations.

The details and results of the monitoring locations of relevance to the Site are presented Table 4-1 and Table 4-2 respectively, whilst their locations are illustrated in Figure 4-2. All monitoring data presented has been ratified and adjusted (where necessary) by KC.

[24] Kirklees Council, 2020 Air Quality Annual Status Report (ASR), June 2020.

Table 4-1
LAQM Diffusion Tube Monitoring Sites: Details

Site ID	Site Location	Site Type	NGR (m)		Height (m)	Within AQMA	Distance to Site (km)
			X	Y			
K85	Shepley	Roadside	419380	409777	2.0	No	3.0
K52	Penistone Road Waterloo	Roadside	417627	416472	2.0	No	3.5
K86	Kings Mill Lane	Roadside	415164	416323	2.0	No	4.4
K56	Wakefield Road Huddersfield	Roadside	415009	416420	2.0	Yes	4.6
K82	Grange Moor	Roadside	422036	415941	2.0	No	4.7

Table 4-2
LAQM Diffusion Tube Monitoring Sites: Results

Site ID	2019 Data Capture %	Annual Mean NO_2 Concentration ($\mu g/m^3$)				
		2015	2016	2017	2018	2019
K85	100.0	-	-	-	23.87	21.13
K52	100.0	36.23	36.47	34.64	34.20	30.67
K86	100.0	-	-	-	32.59	29.07
K56	100.0	39.93	40.00	39.56	39.47	34.87
K82	92.0	-	-	-	20.33	17.53

As displayed in Table 4-2, annual mean NO_2 concentrations recorded at all considered diffusion tube locations were below the annual mean AQAL ($40\mu g/m^3$) for the year 2019. Annual mean NO_2 concentrations at K56 have been below the AQAL since 2016.In 2019 all reported concentrations displayed decreases in concentrations in comparison to 2018 monitored concentrations. A downward trend in concentrations can be seen in the period 2016-2019 at locations K52 and K56, this downward trend is supported further in Section 3.2.1 of the KC 2020 Air Quality ASR in which concentrations falling year on year from 2017 is referenced.

The empirical relationship given in LAQM.TG (22) states that exceedences of the 1-hour mean NO_2 AQAL for are unlikely to occur where annual mean concentrations are $<60\mu g/m^3$. This indicates that an exceedence of the 1-hour mean AQAL is unlikely to have occurred at the considered diffusion tubes over the presented period.

4.1.3 Defra Mapped Background Concentrations

Defra maintains a nationwide model of existing and future background air quality concentrations at a 1km grid square resolution which is routinely used to support LAQM requirements and air quality assessments. The data sets include semi-empirical annual average concentration estimates for NO_x, NO_2, PM_{10} and $PM_{2.5}$ using a base year of 2018 (the year in which comparisons between modelled and monitoring are made).

Annual mean background concentrations of NO_x, NO_2, PM_{10} and $PM_{2.5}$ have been obtained from the Defra published background maps (2018 reference year)[25], based on the 1km grid square which covers the modelled domain. The Defra mapped background concentrations for the base year (2019), and for consistency with the model the year 2030 in lieu of the predicted Proposed Development opening year (2032) have been presented in Table 4-3.

[25] Defra Background Maps (2018-Reference).

Table 4-3
Defra Background Pollutant Concentrations

Grid Square (X,Y) (m)	Year	Annual Mean Concentration (µg/m^3)			
		NO_x	NO_2	PM_{10}	$PM_{2.5}$
417500, 412500	2019	10.2	7.9	9.5	6.3
	2030	7.6	6.0	8.8	5.7
418500, 412500	2019	10.3	8.0	9.3	6.2
	2030	7.6	6.0	8.5	5.7
418500, 413500	2019	10.9	8.4	9.5	6.4
	2030	8.1	6.4	8.7	5.8
418500, 414500	2019	11.9	9.1	9.9	6.6
	2030	8.8	6.9	9.2	6.0
418500, 415500	2019	12.9	9.9	12.3	7.3
	2030	9.5	7.4	11.3	6.7
417500, 415500	2019	13.6	10.4	10.8	7.3
	2030	10.0	7.8	10.0	6.7
417500, 416500	2019	16.1	12.0	11.8	8.0
	2030	11.9	9.1	10.9	7.4
AQAL		-	***40***	***40***	***20***

All of the mapped background concentrations presented are 'well below' the respective annual mean AQALs.

4.2 DEFRA PCM

The *West Yorkshire Air Quality and Emissions Technical Planning Guidance* states that DEFRA's National Pollutant Climate Mapping (PCM) GIS website[26] should be used to ascertain if the development is located within 20m of roads at or above the relevant national objective.

Figure 4-1 illustrates that there is no mapped data available for Storthes Hall Lane, north of the site. The closest road with mapped roadside NO_2 concentrations is the A629 located approximately 1.5km north-east of the Site. Here, roadside NO_2 concentrations are approximately 21-30µg/m^3.

[26] https://uk-air.defra.gov.uk/data/gis-mapping, accessed September 2022.

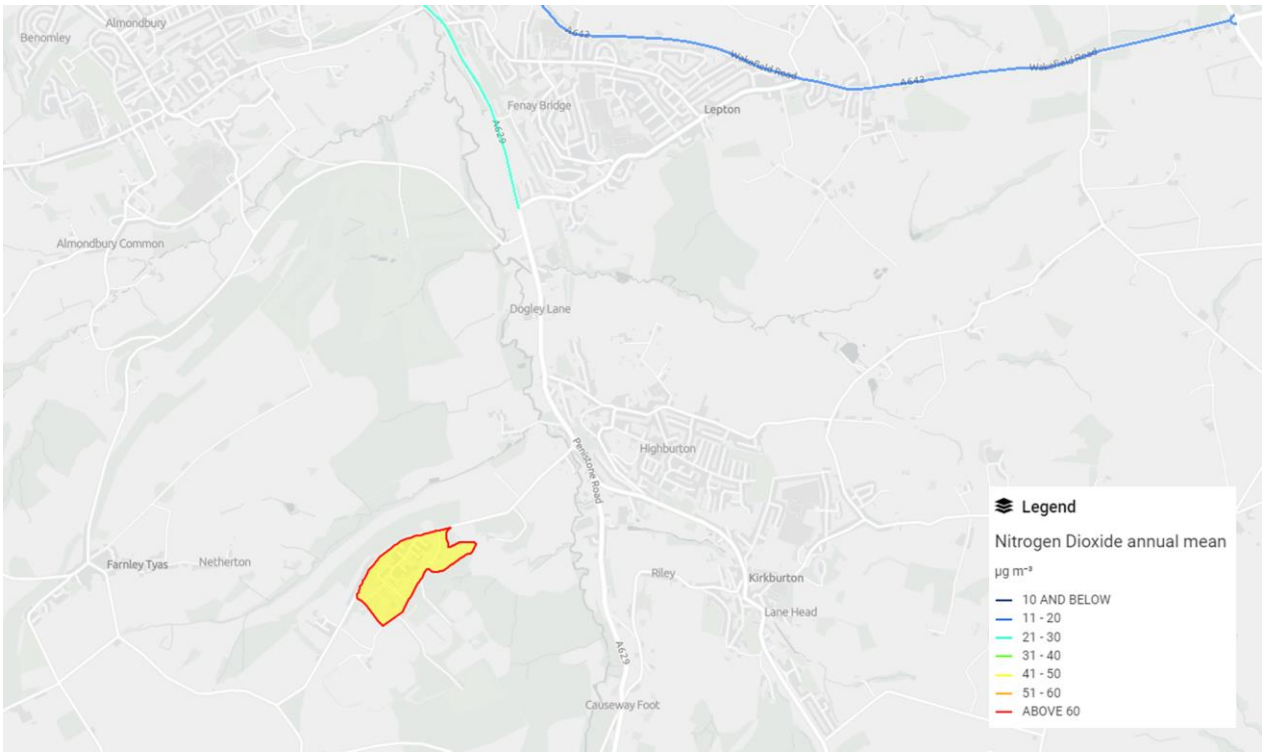

Figure 4-1
DEFRA PCM Model Output

Figure 4-2
Proposed Development Setting, AQMAs and Monitoring Locations

5.0 CONSTRUCTION PHASE ASSESSMENT

This section presents the potential air quality impacts and effects associated with the construction of the Proposed Development.

5.1 Construction Dust Assessment

Where figures relating to area of the site, volume of the site, approximate number of construction vehicles or distances to receptors are given, these relate to thresholds as defined in the IAQM guidance to guide the assessor to define the dust emissions magnitude and sensitivity of the area.

5.1.1 Assessment Screening

There are 'human receptors' within 350m of the Site and 'designated habitat sites' within 50m of the Site boundary or 50m of the roads anticipated to witness construction traffic movements, up to 500m of the Site entrance(s). Therefore, an assessment of construction dust on human receptors and ecological receptors is required.

5.1.2 Potential Dust Emissions Magnitude

Demolition

The Site currently comprises of existing student accommodation blocks, facilities and associated infrastructure. These buildings / structure require demolition prior to proceeding with wider construction works. Demolition of the accommodation blocks has potential for dust release due to the concrete and brickwork. The total building volume requiring demolition is believed to be >50,000m^3. As such, the dust emission magnitude for demolition is therefore initially considered to be 'large'.

Earthworks

It is considered that Site earthworks are required as part of the clearance of the Site ahead of construction. However it is not expected that earthworks will be completed over an area greater than 10,000m^2 at any given time nor require the formation of bunds >8m in height.

The dust emission magnitude for earthworks is therefore initially considered to be 'medium'.

Construction

Taking into account the number of proposed dwellings, the total building volume associated with the Proposed Development is predicted to be >100,000m^3. However, due to the typical phased nature of construction of residential schemes, the total building volume associated with the Proposed Development is not expected to be >100,000m^3 at any given time.

The dust emission magnitude for construction is therefore initially considered to be 'medium'.

Trackout

Construction vehicles are anticipated to access the Site via existing highway connections to the Site along Storthes Hall Lane.

No details are available at the time of assessment regarding the number of HDV movements associated with construction works. However, the number of predicted outward HDV movements in any one day is unlikely to be greater than 50. Due to the pre-existing road layout and existing tarmac road-surface, it is anticipated any unpaved roads will be <100m in length.

The dust emission magnitude for trackout is therefore initially considered to be 'medium'.

Summary

A summary of the determined dust emission magnitude for each activity is presented in Table 5-1.

Table 5-1
Potential Dust Emission Magnitude

Activity	Dust Emission Magnitude
Demolition	Large
Earthworks	Medium
Construction	Medium
Trackout	Medium

5.1.3 Sensitivity of the Area

Dust Soiling Impacts

Overall, there are estimated 10 - 100 highly sensitive residential receptors within 20m of the Site. In addition, there are considered to be between 10 -100 highly sensitivity receptors within 20m of sections of Site accesses within 200m (commensurate of a medium site[27]) of the Site entrance.

The sensitivity of the area with respect to dust soiling effects on people and property in relation to demolition, earthworks, construction and trackout is considered to be 'high'.

Human Health Impacts

The 2019 mapped background PM_{10} concentration (2018 reference year) for the $1km^2$ grid square centred on the development (centroid NGR: x417500, y412500) is estimated to be 9.5µg/m³ (i.e. falls into the <24µg/m³ class).

Given the above information regarding the number and type of receptors within 20m of the Site boundary and access roads up to 200m from the Site entrance, the sensitivity of the area with respect to human health impacts in relation to demolition, earthworks, construction and trackout is therefore considered to be 'low'.

Ecological Impacts

There are areas of ancient woodland (North Spring Wood and Hartley Bank Wood) located to the north and south of the Site, both located within 20m of the Site boundary and within 20m of construction access roads. The North Spring Wood and Hartley Bank Wood ancient woodland designations are considered to be low sensitivity ecological receptors in accordance with the stated IAQM guidance.
The sensitivity of the areas with respect to ecological impacts in relation to demolition, earthworks, construction and trackout activities is therefore 'low'.

Summary

A summary of the sensitivity of the area for each potential impact and activity is presented in Table 5-2.

Table 5-2
Sensitivity of the Area

Potential Impact	Sensitivity of Surrounding Area			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	High	High	High	High
Human Health	Low	Low	Low	Low
Ecological	Low	Low	Low	Low

[27] As per the IAQM's 'Guidance on the Assessment of Dust from Demolition and Construction', without site-specific mitigation, trackout may occur along the public highway up to 500m from large sites, 200m from medium sites and 50m from small sites (determined by the calculated trackout dust emission magnitude), as measured from the site exit.

5.1.4 Risk of Impacts (Unmitigated)

The outcome of the assessment of the potential 'magnitude of dust emissions', and the 'sensitivity of the area' are combined in Table 5-3 below to determine the risk of impact which is used to inform the selection of appropriate mitigation.

Table 5-3
Risk of Dust Impacts

Potential Impact	Demolition	Earthworks	Construction	Trackout
Dust Soiling	High Risk	Medium Risk	Medium Risk	Medium Risk
Human Health	Medium Risk	Low Risk	Low Risk	Low Risk
Ecological	Medium Risk	Low Risk	Low Risk	Low Risk

5.1.5 Mitigation

Following the construction dust assessment, the Site is found to be at worst a 'High Risk' in relation to dust soiling effects on people and property, 'Medium Risk' in relation to human health, and 'Medium Risk' in relation to dust soiling effects on ecological designations (Table 5-3). However, potential dust effects during the construction phase are considered to be temporary in nature and may only arise at particular times (i.e. certain activities and/or meteorological conditions).

Nonetheless, commensurate with the above designation of dust risk, mitigation measures, as identified by IAQM guidance are required to ensure that any potential impacts arising from the construction phase of the Proposed Development are reduced and, where possible, completely removed. In accordance with IAQM guidance, providing effective mitigation measures are implemented, such as those outlined in Section 8.1, construction dust effects are considered to be 'not significant'.

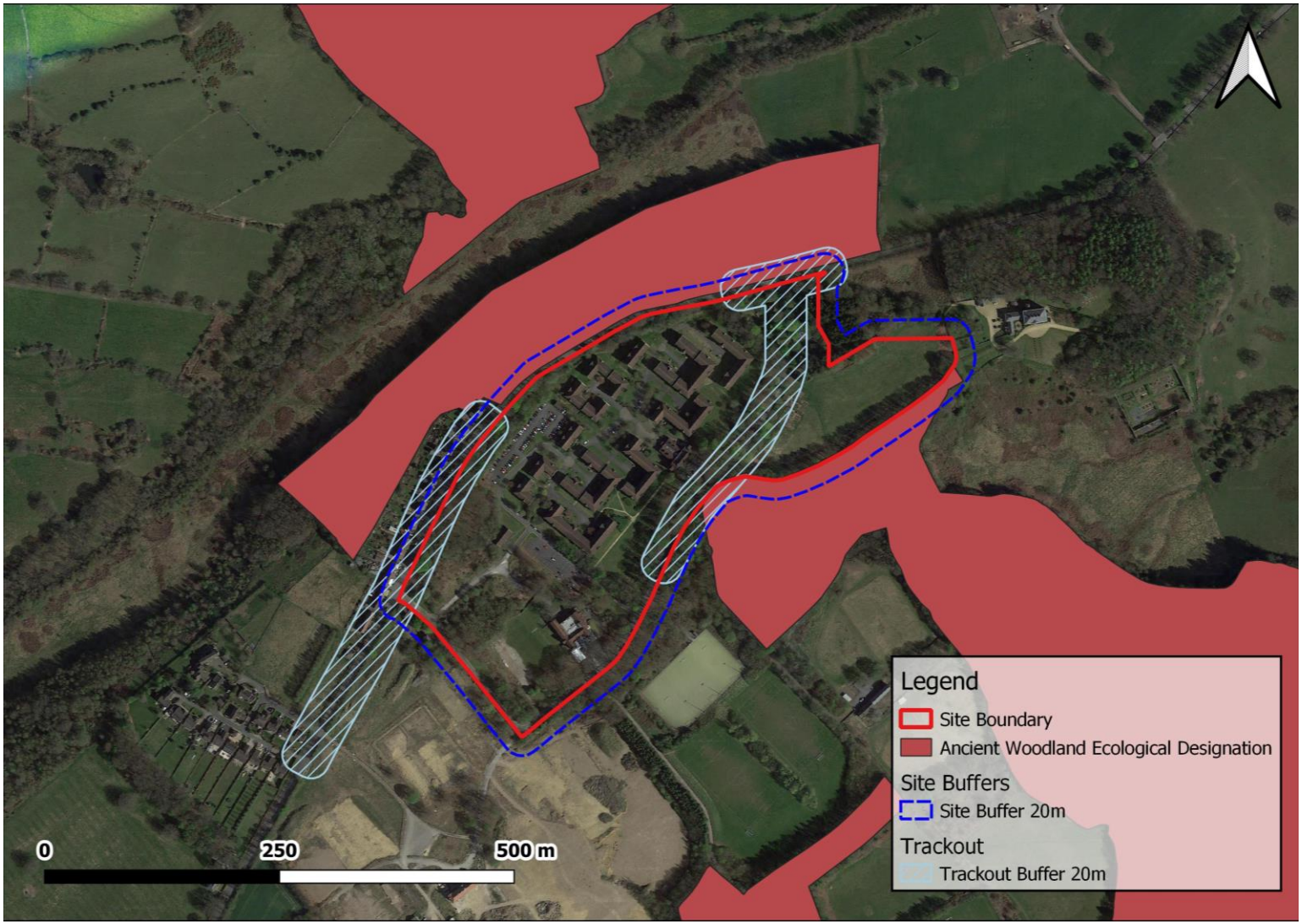

Figure 5-1
Construction Dust Assessment Buffer

6.0 BASELINE SITE SUITABILITY REVIEW

This section presents a review of KC's monitoring data and the *West Yorkshire Air Quality and Emissions Technical Planning Guidance* in consideration with the Proposed Development, for the purposes of identifying requirements for mitigation to be embedded into the scheme design.

6.1 West Yorkshire Air Quality and Emissions Technical Planning Guidance – Exposure Assessment

Stage 2 / Section 5.2 of the *West Yorkshire Air Quality and Emissions Technical Planning Guidance* requires an 'exposure assessment' to determine whether future occupants of the scheme are likely to be exposed to existing levels of poor air quality. An 'exposure assessment' is required if the development meets any of the following criteria:

- the proposal is adjacent to or within an AQMA;
- the proposal is in a location 20m from roads at or above the relevant national objective highlighted on the DEFRA GIS modelled maps (http://uk-air.defra.gov.uk/data/gismapping);
- the proposal is one of the Land Use types:
    - C1 to C3;
    - C4 (Homes of Multiple Occupation); or
    - D1 in table1.
- and (in conjunction with the above) within 20m of roads with >10,000 AADT.

In consideration of the above criterion:

- the Site is not located within or adjacent (i.e. within 200m) to an AQMA, as discussed within Section 4.1.1;
- the Site is not located within 20m of a road above the annual mean roadside NO_2 AQAL as presented within Section 4.2;
- the Site is a C3 use-class Proposed Development; and
- Storthes Hall Road does not have flows >10,000 AADT, as shown in Appendix A Table A-1 .

Therefore, based upon the above there is no requirement to quantify air pollutant concentrations at the Site and no requirement for mitigation measures to make the scheme acceptable.

6.2 Significance of Air Quality Impacts

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

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

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

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

7.0 OPERATIONAL PHASE ASSESSMENT

This section presents the potential air quality impacts and effects associated with the operation of the Proposed Development.

As discussed in Section 3.4.1, impacts on air quality associated with change in development trips and the assessment of absolute concentrations against the AQALs are based upon a previous iteration of the Proposed Development for 300 dwellings. As Proposed Development now seeks permission for 261 dwellings, impacts on air quality will be correspondingly lower than that presented herein.

7.1 NO_2 Modelling Results

Table 7-1 presents the annual mean NO_2 concentrations predicted at all assessed receptor locations for the 2019 BC, 2032 DM and 2032 DS scenarios.

Table 7-1
Predicted Annual Mean NO_2 Concentrations – 2032 Development Opening Year

Receptors	Predicted Annual Mean NO_2 Concentration (µg/m³)			% Change of AQAL	% of 2032 DS Relative to AQAL	EPUK & IAQM Impact Descriptor
	2019 BC	2032 DM	2032 DS			
R1	10.7	7.0	7.2	+0.5	18.0	Negligible
R2	10.8	7.0	7.3	+0.5	18.3	Negligible
R3	9.3	6.5	6.6	+0.2	16.5	Negligible
R4	10.6	7.0	7.2	+0.6	18.0	Negligible
R5	9.9	6.8	7.1	+0.9	17.8	Negligible
R6	9.9	6.8	7.1	+0.8	17.8	Negligible
R7	8.7	6.3	6.4	+0.2	16.0	Negligible
R8	11.0	7.3	7.4	+0.3	18.5	Negligible
R9	17.1	9.7	10.5	+2.0	26.3	Negligible
R10	26.0	13.0	13.3	+0.8	33.3	Negligible
R11	23.8	12.1	12.4	+0.6	31.0	Negligible
R12	18.0	10.0	10.1	+0.3	25.3	Negligible
R13	21.9	11.7	11.9	+0.4	29.8	Negligible
R14	21.9	11.8	12.0	+0.5	30.0	Negligible
R15	22.3	11.6	11.8	+0.5	29.5	Negligible
R16	21.9	11.7	11.8	+0.4	29.5	Negligible
R17	22.9	12.3	12.5	+0.5	31.3	N/A
R18	33.6	16.6	16.9	+0.6	42.3	N/A
R19	29.1	14.7	14.9	+0.5	37.3	Negligible
R20	20.8	11.6	11.7	+0.3	29.3	Negligible
R21	26.2	13.6	13.8	+0.4	34.5	Negligible
R22	23.2	13.2	13.3	+0.3	33.3	Negligible
R23	24.7	13.8	14.0	+0.3	35.0	Negligible
R24	27.0	13.7	13.9	+0.6	34.8	Negligible
R25	24.8	13.9	14.0	+0.3	35.0	Negligible

The maximum predicted annual mean NO_2 concentration at all existing receptors (of relevant exposure) during the 2019 BC scenario was at receptor R19 with a predicted concentration of 29.1µg/m³; this represents 72.8% of the AQAL. Receptor R19 is located on the façade of a residential premises roadside of A629 – Penistone Road.

The maximum predicted annual mean NO_2 concentration at existing receptors (of relevant exposure) with the development in place (2032 DS) was at receptor R19 with a predicted concentration of 14.9µg/m^3; this represents 37.3% of the AQAL – therefore 'well-below'. The change in the annual mean NO_2 concentrations at this location, due to the Proposed Development (2032 DS vs. 2032 DM) relative to the AQAL was 0.5%.

The maximum observed increase in annual mean NO_2 concentrations at all existing receptors (of relevant exposure) as a result of the Proposed Development (2032 DS vs. 2032 DM) was2.0% at R9. Receptor R9 is located on the façade of a property roadside of Storthes Hall Lane.

In accordance with EPUK & IAQM guidance, the impact of the development on annual mean NO_2 concentrations at all relevant existing receptors is considered to be 'negligible'. Given the marginal increase in annual mean NO_2 concentrations associated with the Proposed Development, and that there are no predicted exceedences of the annual mean NO_2 AQAL, unmitigated effects associated with annual mean NO_2 concentrations at all assessed receptor locations are therefore considered to be 'not significant'.

The empirical relationship given in LAQM.TG(22) states that exceedences of the 1-hour mean NO_2 AQAL are unlikely to occur where annual mean concentrations are <60µg/m^3. Annual mean NO_2 concentrations predicted at all receptor locations, including R17 and R18 at which only short-term exposure applies, are well below this limit. Therefore, it is unlikely that an exceedance of the 1-hour mean AQAL will occur. Effects associated with likely 1-hour mean NO_2 concentrations at all assessed receptor locations are therefore considered to be 'not significant'.

7.2 PM_{10} Modelling Results

Table 7-2 presents the annual mean PM_{10} concentrations predicted at all assessed receptor locations for the 2019 BC, 2032 DM and 2032 DS scenarios.

Table 7-2
Predicted Annual Mean PM_{10} Concentrations – 2032 Development Opening Year

Receptors	Predicted Annual Mean PM_{10} Concentration (µg/m^3)			% Change of AQAL	% of 2032 DS Relative to AQAL	EPUK & IAQM Impact Descriptor
	2019 BC	2032 DM	2032 DS			
R1	10.0	9.4	9.5	+0.3	23.8	Negligible
R2	10.1	9.4	9.5	+0.3	23.8	Negligible
R3	9.8	9.1	9.1	+0.1	22.8	Negligible
R4	10.0	9.3	9.5	+0.4	23.8	Negligible
R5	9.9	9.2	9.4	+0.5	23.5	Negligible
R6	9.9	9.2	9.4	+0.5	23.5	Negligible
R7	9.4	8.7	8.7	+<0.1	21.8	Negligible
R8	10.0	9.3	9.4	+0.2	23.5	Negligible
R9	11.3	10.8	11.3	+1.3	28.3	Negligible
R10	13.3	12.8	13.0	+0.5	32.5	Negligible
R11	12.8	12.2	12.4	+0.4	31.0	Negligible
R12	11.5	10.9	11.0	+0.2	27.5	Negligible
R13	12.7	12.1	12.2	+0.3	30.5	Negligible
R14	12.7	12.1	12.2	+0.3	30.5	Negligible
R15	12.8	12.2	12.3	+0.3	30.8	Negligible
R16	14.9	14.1	14.2	+0.3	35.5	Negligible
R17	15.1	14.3	14.4	+0.3	36.0	N/A
R18	17.7	17.0	17.2	+0.4	43.0	N/A
R19	16.6	15.9	16.0	+0.3	40.0	Negligible
R20	13.1	12.4	12.5	+0.2	31.3	Negligible

Receptors	Predicted Annual Mean PM_{10} Concentration ($\mu g/m^3$)			% Change of AQAL	% of 2032 DS Relative to AQAL	EPUK & IAQM Impact Descriptor
	2019 BC	2032 DM	2032 DS			
R21	14.4	13.7	13.8	+0.2	34.5	Negligible
R22	14.2	13.5	13.6	+0.2	34.0	Negligible
R23	14.4	13.7	13.8	+0.2	34.5	Negligible
R24	13.8	13.3	13.5	+0.4	33.8	Negligible
R25	14.3	13.6	13.7	+0.2	34.3	Negligible

The maximum predicted annual mean PM_{10} concentration at all existing receptors (of relevant exposure) during the 2019 BC scenario was at receptor R19 with a predicted concentration of 16.6µg/m^3; this represents 41.5% of the AQAL – therefore 'well-below'.

The maximum predicted annual mean PM_{10} concentration at existing receptors (of relevant exposure) with the development in place (2032 DS) was at receptor R19 with predicted concentrations of 16.0µg/m^3 this represents 40.0% of the AQAL. The change in the annual mean PM_{10} concentrations at these locations, due to the Proposed Development (2032 DS vs. 2032 DM) relative to the AQAL was 0.3%.

The maximum observed increase in annual mean PM_{10} concentrations at all existing receptors (of relevant exposure) as a result of the Proposed Development (2032 DS vs. 2032 DM) was 0.5% at Receptors R5 and R6.

In accordance with EPUK & IAQM guidance, the impact of the development on annual mean PM_{10} concentrations at all assessed existing receptors is considered to be 'negligible'. Given the marginal increase in annual mean PM_{10} concentrations associated with the Proposed Development, and that there are no predicted exceedences of the annual mean PM_{10} AQAL, unmitigated effects associated with annual mean PM_{10} concentrations at all assessed receptor locations are therefore considered to be 'not significant'.

Based upon the maximum predicted annual mean PM_{10} concentration of 16.6µg/m^3 (predicted at Receptor R19 – 2032 DS), this equates to less than 1 day where 24-hour mean PM_{10} concentrations are predicted to be greater than 50µg/m^3. This is well below the 35 permitted 24-hour mean concentrations in excess of 50µg/m^3, and therefore the number of maximum exceedences is in compliance with the 24-hour mean AQAL. Effects associated with likely 24-hour mean PM_{10} concentrations at all assessed receptor locations (including those on Site) are therefore considered to be 'not significant'.

7.3 $PM_{2.5}$ Modelling Results

Table 7-3 presents the annual mean $PM_{2.5}$ concentrations predicted at all assessed receptor locations for the 2019 BC, 2032 DM and 2032 DS scenarios.

Table 7-3
Predicted Annual Mean $PM_{2.5}$ Concentrations – 2032 Development Opening Year

Receptors	Predicted Annual Mean $PM_{2.5}$ Concentration ($\mu g/m^3$)			% Change of AQAL	% of 2032 DS Relative to AQAL	EPUK & IAQM Impact Descriptor
	2019 BC	2032 DM	2032 DS			
R1	6.6	6.0	6.1	+0.3	30.5	Negligible
R2	6.6	6.1	6.1	+0.3	30.5	Negligible
R3	6.4	5.9	5.9	+0.2	29.5	Negligible
R4	6.6	6.0	6.1	+0.4	30.5	Negligible
R5	6.5	6.0	6.1	+0.6	30.5	Negligible
R6	6.5	6.0	6.1	+0.5	30.5	Negligible
R7	6.3	5.8	5.8	+0.1	29.0	Negligible

Receptors	Predicted Annual Mean $PM_{2.5}$ Concentration (µg/m^3)			% Change of AQAL	% of 2032 DS Relative to AQAL	EPUK & IAQM Impact Descriptor
	2019 BC	2032 DM	2032 DS			
R8	6.7	6.1	6.2	+0.2	31.0	Negligible
R9	7.4	6.9	7.2	+1.4	36.0	Negligible
R10	8.6	8.0	8.1	+0.5	40.5	Negligible
R11	8.3	7.7	7.8	+0.4	39.0	Negligible
R12	7.5	7.0	7.0	+0.2	35.0	Negligible
R13	8.2	7.6	7.7	+0.3	38.5	Negligible
R14	8.2	7.6	7.7	+0.3	38.5	Negligible
R15	8.3	7.7	7.8	+0.3	39.0	Negligible
R16	8.8	8.2	8.2	+0.3	41.0	Negligible
R17	8.9	8.3	8.4	+0.3	42.0	N/A
R18	10.4	9.8	9.9	+0.5	49.5	N/A
R19	9.7	9.2	9.2	+0.4	46.0	Negligible
R20	8.6	8.0	8.1	+0.2	40.5	Negligible
R21	9.3	8.7	8.8	+0.3	44.0	Negligible
R22	9.4	8.8	8.9	+0.2	44.5	Negligible
R23	9.5	8.9	9.0	+0.2	45.0	Negligible
R24	8.8	8.3	8.4	+0.4	42.0	Negligible
R25	9.5	8.9	8.9	+0.2	44.5	Negligible

The maximum predicted annual mean $PM_{2.5}$ concentration at existing receptors (of relevant exposure) during the 2019 BC scenario was at receptor R19 with predicted concentrations of 9.7µg/m^3; this represents 48.5% of the AQAL – therefore 'well-below'.

The maximum predicted annual mean $PM_{2.5}$ concentration at existing receptors (of relevant exposure) with the development in place (2032 DS) was at receptor R19 with a predicted concentration of 9.2µg/m^3 this represents 46.0% of the AQAL. The change in the annual mean $PM_{2.5}$ concentrations at this location, due to the Proposed Development (2032 DS vs. 2032 DM) relative to the AQAL was 0.4%.

The maximum observed increase in annual mean $PM_{2.5}$ concentrations as a result of the Proposed Development at all existing receptors (of relevant exposure) (2032 DS vs. 2032 DM) was 1.4% at receptor R9.

In accordance with EPUK & IAQM guidance, the impact of the development on annual mean $PM_{2.5}$ concentrations at all assessed existing receptors (of relevant exposure) is considered to be 'negligible'. Given the marginal increase in annual mean $PM_{2.5}$ concentrations associated with the Proposed Development, and that there are no predicted exceedences of the annual mean $PM_{2.5}$ AQAL, unmitigated effects associated with annual mean $PM_{2.5}$ concentrations at all assessed receptor locations are therefore considered to be 'not significant'.

8.0 MITIGATION MEASURES

This section presents any mitigation measures required during the construction and operational phase of the Proposed Development.

8.1 Construction Phase Dust

As discussed in Section 5.1, construction impacts associated to the Proposed Development would result in the generation of dust and PM_{10}.

The IAQM guidance outlines a number of Site-specific mitigation measures based on the assessed risks. The measures are grouped into those which are highly recommended and those which are desirable. With the effective application of the dust mitigation measures, as detailed in Table 8-1, it is considered that residual effects at all receptors will be 'not significant'.

Table 8-1
Construction Dust Mitigation Measures

Site Application	Mitigation Measures
Highly Recommended	
Communications	Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.
	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.
	Display the head or regional office contact information.
	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. The DMP may include monitoring of dust deposition, dust flux, real time PM_{10} continuous monitoring and/or visual inspections.
Construction	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.
Demolition	Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).
	Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground.
	Avoid explosive blasting, using appropriate manual or mechanical alternatives.
	Bag and remove any biological debris or damp down such material before demolition.
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 100m of site boundary, with cleaning to be provided if necessary.
	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.

Site Application	Mitigation Measures
	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.
	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.
Operating Vehicle / Machinery and Sustainable Travel	Ensure all vehicles switch off engines when stationary - no idling vehicles.
	Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.
	Impose and signpost a maximum-speed-limit of 15mph on surfaced and 10mph 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).
	Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.
	Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing).
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.
	Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
	Use enclosed chutes and conveyors and covered skips.
	Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
	Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.
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.
	Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.
	Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period.
	Avoid site runoff of water or mud.
	Keep site fencing, barriers and scaffolding clean using wet methods.
	Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.
	Cover, seed or fence stockpiles to prevent wind whipping.
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.
	Make the complaints log available to the local authority when asked.
	Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log book.
	Hold regular liaison meetings with other high risk construction sites within 500m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions

Site Application	Mitigation Measures
	are minimised. It is important to understand the interactions of the off-site transport deliveries which might be using the same strategic road network routes.
Trackout	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.
	Avoid dry sweeping of large areas.
	Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.
	Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.
	Record all inspections of haul routes and any subsequent action in a site log book.
	Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.
	Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).
	Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.
	Access gates to be located at least 10m from receptors where possible.
Waste Management	Avoid bonfires and burning of waste materials.
Desirable	
Construction	Avoid scabbling (roughening of concrete surfaces) if possible.
	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.
	For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust.
Earthworks	Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.
	Use Hessian, mulches or tackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable
	Only remove the cover in small areas during work and not all at once.

8.2 Operational Phase

In accordance with EPUK & IAQM guidance, the overall effect of the development on NO_2, PM_{10} and $PM_{2.5}$ concentrations at all assessed receptor locations is considered to be 'not significant'.

Nonetheless, as stipulated within the *West Yorkshire Air Quality and Emissions Technical Planning Guidance*[12] for 'medium' developments Type 1 and Type 2 mitigation measures should be included as part of the development, these measures are displayed in Table 8-2.

Table 8-2
WYLES Guidance Medium Development Mitigation Measures

Mitigation Measure	
Type 1	Charging infrastructure to facilitate 1 charging point per unit (dwelling with dedicated parking) or 1 charging point per 10 spaces (unallocated parking)

Mitigation Measure	
Type 2	Travel plan
	Support for free or reduced membership of the West Yorkshire car club and travel network
	Improved pedestrian links to public transport stops.
	Provision of bus infrastructure including stands, shelters, bus gates, information displays
	Provision of free ticketing with time limited uptake targets
	Provision of resident Low Emissions Vehicle (LEV) purchase support as an alternative to Metrocard with time limited uptake
	Supporting the extended provision of sustainable school travel into the development
	Site layout to include improved pedestrian pathways to encourage walking
	Improved convenient and segregated cycle paths to link to local cycle networks
	Provision of storage and support for cycle purchase or hire

9.0 CONCLUSIONS

SLR Consulting Ltd has been commissioned by Ubrique Investments Ltd to undertake an air quality assessment to support the planning application for a proposed residential development of up to 261 units at Storthes Hall, Kirkburton.

9.1 Construction Phase

A qualitative assessment of the potential dust impacts during the construction of the Proposed Development has been undertaken following IAQM guidance.

Following the construction dust assessment, the Site is found to be at worst 'High Risk' in relation to dust soiling effects on people and property, 'Medium' in relation to human health and 'Medium Risk' in relation to construction dust impacts on ecological receptors. Providing mitigation measures are implemented, such as those outlined in Section 8.1 of this report, residual effects from dust emissions arising during the construction phase are considered to be 'not significant'.

9.2 Exposure Assessment

An 'Exposure Assessment' has been undertaken in accordance with the *West Yorkshire Air Quality and Emissions Technical Planning Guidance*. The 'Exposure Assessment' has found that the Proposed Development is not likely to introduce relevant exposure into an area with existing levels of poor air quality. Effects associated with likely exposure of future occupants are considered to be 'not significant' and therefore is no requirement to quantify air pollutant concentrations at the Site and no requirement for mitigation measures to make the scheme acceptable.

9.3 Operational Phase

The assessment of operational phase effects considered impacts on all relevant existing receptors from road traffic emissions associated with the Proposed Development, based upon an earlier iteration of the Proposed Development for 300 dwellings. Trip generation and impacts on air quality associated with 261 will be correspondingly lower.

The ADMS-Roads dispersion model (version 5.0.0.1) was used to determine the likely NO_2, PM_{10} and $PM_{2.5}$ concentrations at all assessed receptor locations for a series of scenarios, in accordance with technical guidance presented in LAQM.TG(22). Predicted pollutant concentration changes at existing receptor locations as a result of the Proposed Development were assessed using the EPUK & IAQM significance criteria.

In accordance with EPUK & IAQM guidance, the impacts of the Proposed Development on NO_2, PM_{10} and $PM_{2.5}$ concentrations at all assessed existing receptor locations are considered to be 'negligible'. Unmitigated effects associated with NO_2, PM_{10} and $PM_{2.5}$ concentrations at all assessed receptor locations are therefore considered 'not significant'.

APPENDIX A – Model Inputs and Verification

Traffic Data

Table A-1 details the traffic data used within the assessment.

Table A-1
Traffic Data Used Within the Assessment

Link	2019 BC		2032 DM		2032 DS		Speed (kph)
	AADT	% HDV	AADT	% HDV	AADT	% HDV	
1-A629 Penistone Road – north of Station Road	21,022	2.2	23,367	2.2	24,054	2.1	64.4
8-A629 Penistone Road – south of Station Road	14,045	4.3	15,808	4.1	16,160	4.0	64.4
2-A629 Wakefield Road	36,067	1.3	39,380	1.3	39,715	1.3	48.3
3-A642 Wakefield Road	10,230	2.8	11,371	2.7	11,525	2.7	48.3
4-A629 Penistone Road (South)	14,866	4.4	16,429	4.4	16,926	4.2	64.4
5-Farnley Road (North)	1,790	2.5	2,066	2.3	2,273	2.1	64.4
6-Farnley Road (South)	925	5.9	1,058	5.7	2,264	2.7	64.4
7-Storthes Hall Road (east of Site)	1,603	6.1	2,099	5.0	2,099	5.0	64.4
9-Storthes Hall Road (west of Site)	2,715	3.6	3,124	3.4	3,829	2.8	64.4

Note:
A) Speeds based upon posted Speed Limits. Traffic speeds have been adjusted to take into account queues and congestion in accordance with LAQM.TG(22).

Table A-2 details the trips (as AADT) generated by the development, based upon the 300-dwelling previous iteration of the Proposed Development.

Table A-2
Development Generated Trips

Link	Development Trips
	LDV
1-A629 Penistone Road – north of Station Road	687
8-A629 Penistone Road – South of Station Road	352
2-A629 Wakefield Road	335
3-A642 Wakefield Road	154
4-A629 Penistone Road (South)	497
5-Farnley Road (North)	207
6-Farnley Road (South)	1,206
7-Storthes Hall Road (east of Site)	687
9-Storthes Hall Road (west of Site)	352

Model Verification

The ADMS-Roads dispersion model has been widely validated for this type of assessment and is specifically listed in the Defra's LAQM.TG(22) guidance as an accepted dispersion model.

Model validation undertaken by the software developer (CERC) will not have included validation in the vicinity of the Site. It is therefore necessary to perform a comparison of modelled results with local monitoring data at relevant locations. This process of verification attempts to minimise modelling uncertainty and systematic error by correcting modelled results by an adjustment factor to gain greater confidence in the final results.

Prior to undertaking model verification, model setup parameters and input data were reviewed to maximise the performance of the dispersion model in relation to the real-world conditions.

Consistent with advice provided by Defra to local authorities across England, 2019 has been used for the purposes of model verification as relates to the most recent year of monitoring data available which hasn't been impacted by the COVID-19 pandemic. Use of monitoring data recorded in 2020 for the purposes of model verification introduces an element of uncertainty into the final adjusted modelled predictions, as monitoring conditions experienced for the majority of 2020 are not deemed to be representative of long-term baseline conditions and could lead to a systematic underprediction at modelled receptor locations.

NOx / NO_2 Verification

NOx / NO_2 verification relates to the comparison and adjustment of modelled road-NO_x (as output from the ADMS-Roads dispersion model), relative to monitored road-NO_x.

For NOx / NO_2 model verification, 2019 LAQM KC monitoring data has been used for a roadside location which is situated adjacent to a modelled link i.e. where traffic data exists (Table A-3).

Table A-3
Local Monitoring Data Used for Model Verification

Site ID	X	Y	2019 Monitored NO_2 Concentration (µg/m^3)	2019 Data Capture (%)
K52	417627	416472	30.67	100.0

As NO_2 concentrations are solely reported using diffusion tubes, NO_x was back calculated using the latest version of Defra's NO_x to NO_2 Calculator (v8.1). The NO_x to NO_2 Calculator was also used to facilitate the conversion of modelled road-NO_x (as output from the ADMS-Roads dispersion model) into road-NO_2.

Verification was completed using the 2019 Defra background mapped concentrations (2018 base year) for the relevant 1km x 1km grid squares (i.e. those within which the model verification locations are located), as discussed in Section 3.4.3.

Comparison of the unadjusted modelled vs. monitored road NO_x is provided in Table A-4. An adjustment factor of 2.649 has been derived. No further improvement to the ADMS-Roads dispersion model could be achieved.

Table A-4
NO_x / NO_2 Model Verification (2.649)

Site ID	Monitored Total NO_2 (µg/m^3)	Monitored Road NOx (µg/m^3)	Modelled Road NOx (µg/m^3)	Adjustment Factor
K52	30.7	36.5	13.8	2.649

Only one monitoring location (K52) has been used for verification purposes, in the absence of other suitable monitoring locations (reflecting the extent of the traffic data provided). In the absence of further suitable verification locations, this approach was considered acceptable. On this basis, the derived verification factor (2.649) was considered acceptable and was subsequently applied to all road-NOx concentrations predicted (as output of the ADMS Roads dispersion model).

PM_{10} / $PM_{2.5}$ Verification

The adjustment factor of 2.649 was also applied to road-PM_{10} and $PM_{2.5}$ concentrations (as output of the ADMS Roads dispersion model), following the recommendations of LAQM.TG(22), in the absence of local particulate monitoring.

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