Land at Thakeham Tiles, Storrington

Air Quality Assessment for Planning

Stantec

Prepared for:
Thakeham Tiles Ltd

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1 Introduction

Stantec have been commissioned by Thakeham Tiles Ltd (the Client) to prepare an Air Quality Assessment (AQA) to support the outline planning application (OPA) for a residential development (the 'Proposed Development'), at Thakeham Tiles Ltd, Rock Road, Storrington, Pulborough RH20 3AD (the 'Site'). The Site is located within the administrative council of Horsham District Council (HDC).

The Site is approximately centred on the National Grid Reference (NGR); x510445, y114885 and is shown below in Figure 1. The Site is located on the east side of Storrington town and is south of Rock Road. The Site consists of the Thakeham Tiles concrete supplier site. The surrounding land use is largely residential, interspersed with woodland areas. Thakeham Primary school is also located approximately 250m to the west of the Site. To the north of the Site, across Rock Road, is existing green space.

Figure 1: Site Location Plan

1.1 Proposed Development

The proposals seek permission for Outline application with all matters reserved except for access from Rock Road for the development of up to 108no. dwellings (including a mix of private and affordable housing units), together with associated infrastructure including vehicular, cycle and pedestrian access, parking, landscaping, open space and play provision, and sustainable drainage.

1.2 Purpose of the Air Quality Assessment

The AQA describes the scope, relevant legislation, assessment methodology and the baseline conditions currently existing in the area. It then presents an assessment of potential impacts during the construction and operational phases of the Proposed Development, and an evaluation of the significance of these effects with respect to air quality.

2 Legislation and Policy

2.1 Air Quality Regulations and Objectives

The Air Quality (England) Regulations 2000 (AQR) defined National Air Quality Objectives (NAQOs, a combination of concentration-based thresholds, averaging periods and compliance dates) for a limited range of pollutants. Subsequent amendments were made to the AQR in 2001 and 2002 to incorporate 'limit values' and 'target values' for a wider range of pollutants as defined in European Union (EU) Directives.

These amendments were consolidated by the Air Quality Standards Regulations 2010 (AQSR) (with subsequent amendments most notably in 2016 and for the devolved administrations), which transposed the EU's Directive on ambient air quality and cleaner air for Europe (2008/50/EC)[1].

Following the Transition Period after the UK's departure from the EU in January 2020, the Air Quality (Amendment of Domestic Regulations) (EU Exit) Regulations 2019 (and subsequent amendments for the devolved administrations) have amended the Air Quality Standards Regulations 2010 to reflect the fact that the UK has left the EU. The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020 amended the $PM_{2.5}$ limit value in the AQSR to 20µg/m^3. The relevant Air Quality Assessment Levels (AQALs) to this assessment are provided below, in Table 1:

Table 1: National AQALs

Pollutant	Averaging Period	AQALs	
NO_2	1 Hour Mean	200 µg/m^3	Not to be exceeded more than 18 times in a year.
	Annual Mean	40 µg/m^3	
PM_{10}	24 Hour Mean	50 µg/m^3	Not to be exceeded more than 35 times in a year.
	Annual Mean	40 µg/m^3	
$PM_{2.5}$	Annual Mean	20µg/m^3	
	Annual Mean Concentration Target ('AMCT')	10µg/m^3	To be met across England by 2040
	-	Population Exposure Reduction Target ('PERT')	35% reduction in population exposure by 2040 (compared to a base year of 2018).

The AQALs for NO_2 and PM_{10} required achievement by 2005 and 2004 respectively but also continue to apply in all future years thereafter.

Two $PM_{2.5}$ targets were published via The Environmental Targets (Fine Particulate Matter) (England) Regulations 2023 and are set out below:

[1] Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe

- an annual mean concentration target (AMCT) for $PM_{2.5}$ levels in England to be 10 µg/m^3 or below by 2040; and
- a population exposure reduction target for a reduction in $PM_{2.5}$ population exposure of 35% compared to 2018 to be achieved by 2040.

The Government has published an Environmental Improvement Plan 2023[2] which sets out the following interim $PM_{2.5}$ targets to be met by the end of January 2028:

- the highest annual mean concentration in the most recent full calendar year must not exceed 12 µg/m^3 of $PM_{2.5}$; and
- compared to 2018, the reduction in population exposure to $PM_{2.5}$ in the most recent full calendar year must be 22% or greater.

DEFRA is developing guidance to ensure that the above $PM_{2.5}$ targets are appropriately considered in planning applications and planning decisions. Interim guidance[3] has been published, requiring applicants to evidence that key sources of air pollution have been identified within their schemes and appropriate action taken to minimise exposure to and emissions of $PM_{2.5}$ as far as reasonably practicable.

2.2 National Air Quality Plan for NO_2 in the UK

The National Air Quality Plan for NO_2[4] sets out how the Government plans to deliver reductions in NO_2 throughout the UK, with a focus on reducing concentrations to below the EU limit values throughout the UK within the "*shortest possible time*".

The Plan requires all local authorities in England which DEFRA identified as having exceedances of the limit values in their areas past 2020 to develop local plans to improve air quality and identify measures to deliver reduced emissions, with the aim of meeting the limit values within their area within 'the shortest possible time'. Potential measures include changing road layouts, encouraging public and private ultra-low emission vehicle (ULEV) uptake, the use of retrofitting technologies and new fuels and encouraging public transport. In cases where these measures are not sufficient to bring about the required change within 'the shortest possible time' then local authorities may consider implementing access restrictions on more polluting vehicles (e.g. Clean Air Zones (CAZs)).

2.3 Air Quality Management

2.3.1 The Air Quality Strategy

Part IV of the Environment Act 1995[5] required the Secretary of State to prepare and publish a 'strategy' regarding air quality.

[2] HM Government, Environmental Improvement Plan 2023 https://assets.publishing.service.gov.uk/media/64a6d9c1c531eb000c64fffa/environmental-improvement-plan-2023.pdf
[3] UK-AIR, Interim Planning Guidance on the consideration of the Environment Act PM2.5 targets in planning decisions, 2024 https://uk-air.defra.gov.uk/pm25targets/planning
[4] UK Plan for tackling Roadside Nitrogen Dioxide Concentrations: Detailed Plan https://www.gov.uk/government/publications/air-quality-plan-for-nitrogen-dioxide-no2-in-uk-2017
[5] Statutory Instrument. (1995). c. 25, 'Environment Act 1995'. London: HMSO

The Air Quality Strategy (2023)[6] establishes the policy framework for ambient air quality management and assessment in the England. The primary objective of the Air Quality Strategy is to ensure that everyone can enjoy a level of ambient air quality which poses no significant risk to health or quality of life. The Air Quality Strategy sets out the Government policy on achieving the NAQOs, including the new targets for $PM_{2.5}$.

The Clean Air Strategy (2019)[7] aims to lower national emissions of pollutants, thereby reducing background pollution and minimising human exposure to harmful concentrations of pollution. The Strategy aims to create a stronger and more coherent framework for action to tackle air pollution.

2.3.2 Local Air Quality Management

Obligations under the Environment Act 2021[8] (which provides an amendment to the Environment Act 1995[9]) requires local authorities to review and assess air quality in their administrative boundaries. Where AQALs are predicted to be exceeded, the local authority must declare an Air Quality Management Area (AQMA) at sensitive receptor locations and formulate an Air Quality Action Plan (AQAP) to reduce pollution concentrations to values below AQALs.

HDC declared AQMAs, CAZ, and published AQAP are discussed in Section 4.1.

Defra's Local Air Quality Management Technical Guidance 2022 (LAQM.TG(22))[10] provides guidance on where the above AQAL's should apply. This is summarised below, in Table 2.

Table 2: Summary of where AQALs should apply

Averaging Period	Objectives should apply at:	Objectives should generally NOT apply at:
Annual Mean	All locations where members of the public might be regularly exposed. Building facades of residential properties, schools, hospitals, care homes etc.	Building facades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to other locations at the building façade) or any other location where public exposure is expected to be short term.
24 Hour Mean and 8 Hour Mean	All locations where the annual mean objective would apply, together with hotels. Gardens of residential properties	Kerbside sites (as opposed to other locations at the building façade) or any other location where public exposure is expected to be short term.

[6] DEFRA, 2023, The Air Quality Strategy for England. https://www.gov.uk/government/publications/the-air-quality-strategy-for-england/air-quality-strategy-framework-for-local-authority-delivery
[7] Clean Air Strategy 2019 https://www.gov.uk/government/publications/clean-air-strategy-2019
[8] https://bills.parliament.uk/bills/2593/publications
[9] Environment Agency, "Environment Act 1995" (The Environment Agency, 2002), http://www.legislation.gov.uk/ukpga/1995/25/contents.
[10] Defra, "LAQM Technical Guidance (TG22)" (Department for Food, Environment and Rural Affairs (Defra), August 2022), https://laqm.defra.gov.uk/wp-content/uploads/2022/08/LAQM-TG22-August-22-v1.0.pdf

Averaging Period	Objectives should apply at:	Objectives should generally NOT apply at:
1 Hour Mean	All locations where the annual Mean and: 24 and 8-hour mean objectives apply. Kerbside site (for example, pavements of busy shopping streets). Those parts of car parks, bus stations and railways stations etc. which are not fully enclosed, where members of the public might be expected to spend one hour or more. Any outdoor locations where members of the public might reasonably expect to spend one hour or longer.	Kerbside sites where the public would not be expected to have regular access.
15 Minute Mean	All locations where member of the public might reasonably be exposed for a period of 15 minutes	

2.4 Planning Policy

2.4.1 National Planning Policy Framework

The National Planning Policy Framework (NPPF)[11] sets out the Government's planning policy for England. It requires planning decisions for any new development to prevent new and existing development from contributing to, or being put at risk from, unacceptable levels of air pollution (paragraph 187). It also states that planning decisions should sustain and contribute towards compliance with relevant limit values or national objectives for air pollutants, taking into account the presence of AQMAs and Clean Air Zones (CAZ)s (paragraph 199), and the cumulative impacts from other sites (paragraph 198).

Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. Furthermore, planning decisions should ensure that any new development in AQMAs and CAZs is consistent with the local air quality action plan.

Also, to help reduce congestion and emissions, to improve air quality and public health, significant development should be focused on locations which are / can be made sustainable through limiting the need to travel (paragraph 110).

2.4.2 Planning Practice Guidance

Reference ID 32 (Air Quality) of the National Planning Practice Guidance (NPPG)[12] provides guiding principles on how planning can take account of the impact of new development on air quality. The NPPG summarises the importance of air quality in planning and the key legislation relating to it.

[11] Department for Levelling Up, Housing & Communities. National Planning Policy Framework (December, 2024). [online] Available: https://assets.publishing.service.gov.uk/media/675abd214cbda57cacd3476e/NPPF-December-2024.pdf

[12] Ministry of Housing, Communities & Local Government, "Reference ID (32) Air Quality" (Ministry of Housing, Communities & Local Government, 2019), https://www.gov.uk/guidance/air-quality--3.

2.4.3 Local Planning Policy

The current Local Plan is called the Horsham District Planning Framework[13]. This has been reviewed for policies that are relevant to air quality. The identified policies are set out below:

> ***"Policy 24 Strategic Policy: Environmental Protection***
>
> *The high quality of the district's environment will be protected through the planning process and the provision of local guidance documents. Taking into account any relevant Planning Guidance Documents, developments will be expected to minimise exposure to and the emission of pollutants including noise, odour, air and light pollution and ensure that they:*
>
> *1. Address land contamination by promoting the appropriate re-use of sites and requiring the delivery of appropriate remediation;*
>
> *2. Are appropriate to their location, taking account of ground conditions and land instability;*
>
> *3. Maintain or improve the environmental quality of any watercourses, groundwater and drinking water supplies, and prevents contaminated run-off to surface water sewers;*
>
> *4. Minimise the air pollution and greenhouse gas emissions in order to protect human health and the environment;*
>
> *5. Contribute to the implementation of local Air Quality Action Plans and do not conflict with its objectives;*
>
> *6. Maintain or reduce the number of people exposed to poor air quality including odour. Consideration should be given to development that will result in new public exposure, particularly where vulnerable people (e.g. the elderly, care homes or schools) would be exposed to the areas of poor air quality; and*
>
> *7. Ensure that the cumulative impact of all relevant committed developments is appropriately assessed."*

The Storrington Sullington and Washington Neighbourhood Plan 2018-2031[14] has also been reviewed. Within this air quality is dealt with via Policy 17:

> *"Traffic & Transport Development proposals will be supported provided they can demonstrate that their residual traffic impacts on the local road network are not severe."*

The accompanying explanatory notes for the above policy states the following:

> *"The A283 is too often used as an alternative road solution by drivers seeking to avoid congestion on the A27 to the south. This has created the air quality problems that Policy 17 of the SSWNP addresses within Storrington Village Centre."*

[13] https://www.horsham.gov.uk/__data/assets/pdf_file/0016/60190/Horsham-District-Planning-Framework-November-2015.pdf
[14] https://www.horsham.gov.uk/__data/assets/pdf_file/0019/71353/SSW-NP-adopted-September-2019.pdf

HDC are progressing a local plan update. HDC formally submitted the Horsham District Local Plan 2023 - 2040 (Regulation 19)[15] to the Planning Inspectorate on Friday 26 July 2024. Within this air quality is dealt with via the below.

> *"**Strategic Policy 11: Environmental Protection***
>
> *The high quality of the District's environment will be protected through the planning process and the provision of local guidance documents. Taking into account any relevant Planning and Technical Guidance Documents, developments will be expected to minimise exposure to, and the emission of, pollutants including noise, odour, vibration, air and light pollution arising from all stages of development. Development proposals must ensure that they:*
>
> *[…]*
>
> *6. Minimise air pollution and greenhouse gas emissions in order to protect human health and the natural environment.*
>
> *7. Contribute to the implementation of local Air Quality Action Plans and do not conflict with their objectives.*
>
> *8. Maintain or reduce human exposure to odour and poor air quality, with specific consideration given to development that will result in new public exposure, particularly vulnerable people (e.g. the elderly, care homes or schools); and*
>
> *9. Ensure that the cumulative impact of all relevant permitted and allocated developments, is appropriately assessed. Proposals for new development within the vicinity of an existing business or community facility will not be supported where it is considered that the current use could have a significant adverse environment impact on the new development, unless it can be demonstrated that suitable mitigation will be implemented prior to the occupation or use of the new proposal.*
>
> ***Strategic Policy 12: Air Quality***
>
> *The Council recognises the direct effects air quality has on public health, natural habitats and biodiversity, including its contribution to climate change, and the importance of the management of air quality. Taking into account any relevant Planning Guidance Documents and / or policies within this Plan, proposals will be required to:*
>
> *1. Adhere to the Air Quality and Emissions Mitigation Guidance for Sussex (2021), or any future updates, to identify if an Air Quality Impact Assessment and / or an Emissions Mitigation Statement is required;*
>
> *2. Contribute to the implementation of local Air Quality Action Plans, and not conflict with the set objectives;*
>
> *3. Minimise traffic generation and congestion through access to sustainable transport modes, maximising the provision for cycling and pedestrian facilities;*
>
> *4. Encourage the use of cleaner transport fuels, including through the provision of electric car charging points.*
>
> *5. Take into account habitats or biodiversity designations that are sensitive to air quality changes, including ancient woodland. Habitats identified as sensitive to such changes, including proposals*

[15] https://strategicplanning.horsham.gov.uk/gf2.ti/-/1583938/192184357.1/PDF/-/Horsham%20District%20Local%20Plan%20Regulation%2019.pdf

within 7km of The Mens, will require a relevant impact assessment and appropriate mitigation measures to be put in place.

6. Mitigate the impact on the amenities of users of the site and surrounding land to an appropriate level, during both construction and operation where development creates or results in pollution including particulates, dust, smoke, pollutant gases or odour, as outlined in the Air Quality and Emissions Mitigation Guidance for Sussex (2021), or any future updates; and

7. Ensure that the cumulative impact of all relevant permitted and allocated developments, including associated traffic impacts, is appropriately assessed."

3 Methodology

3.1 Consultation

Full details of the AQA approach were sent via email to HDC in February 2025 with a request for further comment / guidance. A response was received on 26/2/2025 from HDC with the following comments:

> *"An Interim Planning Guidance on the consideration of the Environmental Act PM2.5 target in planning decisions was published in October 2024. Applicants are advised to provide evidence in their planning applications that they have identified key sources of air pollution within their schemes and taken appropriate action to minimise emissions of PM2.5 and its precursors as far as is reasonably practicable.*
>
> ***Damage Cost Calculation and Mitigation Plan***
>
> *Although Storrington has a population < 10,000, because an AQMA has been declared in the town centre and the main source of air pollution in Horsham District is road traffic emissions from major roads that intersects the district, such as A283 at Storrington, "Road Transport Urban Small" should be used.*
>
> *The mitigation measures for the proposed development should be in line with the Sussex Air (2021) Air Quality and Emissions Mitigation Guidance for Sussex. The guidance takes a low-emission strategies' approach to avoid health impacts of cumulative development, by seeking to mitigate or offset emissions from the additional traffic and buildings. It is recommended that the emission mitigation statement contain itemised costing for each proposed mitigation option and total value of all proposed emissions' mitigation. This should be equal to the value from Emissions calculation and total calculated value of emissions' health damage cost. Sussex Air quality guidance aims to avoid the duplication of measures that would normally be required through other regimes."*

3.2 Guidance

The following guidance has been used to undertake this AQA:

- Defra's LAQM.TG(22)[10];
- Environmental Protection UK (EPUK) & Institute of Air Quality Management (IAQM) Land-use Planning & Development Control: Planning for Air Quality[16];
- The IAQM's guidance on assessing impacts from construction[17];
- The Sussex Air Quality Partnerships' Air quality and emissions mitigation guidance for Sussex (2021)[18], and
- Natural England's Guidance - Approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations[19].

[16] EPUK & IAQM, "Land-Use Planning & Development Control: Planning for Air Quality" (Institute for Air Quality Management (IAQM), January 2017), http://www.iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf.
[17] IAQM, "Guidance on the Assessment of Dust from Demolition and Construction" (Institute of Air Quality Management (IAQM)), January 2024), https://iaqm.co.uk/wp-content/uploads/2013/02/Construction-Dust-Guidance-Jan-2024.pdf.
[18] https://sussex-air.net/wp-content/uploads/2022/09/Sussex-AQ-Guidance-V.1.2-2021.pdf
[19] Natural England, NE Internal Guidance – Approach to Advising Competent Authorities on Road Traffic Emissions and HRAs V1.4 Final - June 2018

3.3 Baseline Air Quality

The baseline air quality conditions in the vicinity of the Site have been established through the compilation and review of the following sources. The baseline assessment can be found in Section 4.

- Data from the National Atmospheric Emissions Inventory (NAEI)[20], Environment Agency (EA)[21] and Defra's Pollutant Release and Transfer Register (PRTR) data[22];
- Defra's modelled background concentrations of pollutants (UK-AIR)[23]. These estimates are produced using detailed modelling tools and are available as concentrations at central 1km^2 National Grid square locations across the UK. Mapped background concentrations have been obtained based upon the 2021 base year Defra update (November 2024 publication);
- Multi Agency Geographic Information for the Countryside (MAGIC)[24] which incorporates Natural England's interactive maps; and,
- HDC's latest available air quality monitoring data, derived from the latest available air quality annual status report published in 2025[25].

3.4 Construction Phase Assessment

3.4.1 Dust Risk Assessment

The construction dust risk assessment is provided in Section 5 and has been undertaken in line with IAQM guidance[17]. This considers the risk of impacts during the construction phase in terms of nuisance dust, human health (PM_{10} exposure) and ecological impacts.

With regard to ecological receptors, risk assessment should be taken where high-sensitivity receptors are located within 50m of a Site boundary, or within 50m of any routes used by construction vehicles on the public highway, up to 250m from the Site entrance. The MAGIC website[24] has been reviewed to identify whether any statutory ecological sensitive receptors present in the area. No receptors were identified within 50m of the Site boundary or expected Trackout route and therefore no further consideration of ecological receptors is required.

Sensitive receptors were identified within 250m of the Site boundary. Based on the IAQM guidance residential dwellings, museums, car parks and car show room are indicative examples of high sensitivity receptors in relation to both dust soiling and health effects of PM_{10}. Indicative examples of medium sensitivity receptors include places of work and parks.

The IAQM guidance states that the potential dust emission magnitude from Demolition, Earthworks, Construction and Trackout should all be assessed individually. In addition, the sensitivity of the area to adverse dust impacts should also be defined. The risks of impact of each stage of the construction phase

[20] National Atmospheric Emissions Inventory, UK Emissions Interactive Map (beis.gov.uk).
[21] https://data.gov.uk/dataset/cfd94301-a2f2-48a2-9915-e477ca6d8b7e/pollution-inventory
[22] UK Pollutant Release and Transfer Register (PRTR) https://prtr.defra.gov.uk/map-search
[23] UK-AIR, "Background Mapping Data for Local Authorities - 2021," n.d., https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2021.
[24] https://magic.defra.gov.uk/MagicMap.aspx
[25] HDC, 2025 Air Quality Annual Status Report (ASR), In fulfilment of Part IV of the Environment Act 1995 Local Air Quality Management, June 2025

is classified as Negligible, Low, Medium or High, determined against a matrix which considers the distance from source, receptor sensitivity, background pollution concentrations and the potential dust emission magnitude of the works.

The overall significance of the risk of adverse impacts during the construction phase can then be defined using the 'risk of impacts matrix' for each stage of the construction phase described above.

3.4.2 Construction Traffic Emissions

The IAQM guidance[17] states that from experience of assessing exhaust emissions from site traffic, it is unlikely that any significant adverse impacts on local air quality would be caused and in the vast majority of cases, quantitative assessment is not needed. As such, short term effects of construction traffic emissions have not been assessed, as they are also likely to be well below the EPUK & IAQM guidance[16] traffic criteria outlined in Table 4.

3.5 Operational Phase Assessment

3.5.1 Scope of Assessment

The scope of assessment has been determined against the Air quality and emissions mitigation guidance for Sussex (2021)[18] screening checklist, which is shown below in Table 3:

Table 3 Sussex guidance Screening Checklist

Questions to be answered by the developer:	Action required dependant on the answer(s):
Is the proposed development: ▪ a MAJOR development, as defined by Town and Country Planning (Development Management Procedure) Order (England) 2015 [1]. ▪ within an Air Quality Management Area. Look this up at: https://uk-air.defra.gov.uk/aqma/maps or contact the relevant Local Authority Air Quality Officer; ▪ in relevant proximity to an Air Quality Management Area. Contact the relevant Local Authority Air Quality Officer; ▪ in an area close to exceeding the Air Quality Objectives. Contact the relevant Local Authority Air Quality Officer; ▪ B8 storage and distribution use class with a floorspace of 500m^2 or more. This is included due to the transport-related movements usually associated with this Use Class.	▪ if **NO to all**, then advise LPA. No further action is required. ▪ if **YES** to **ANY**, then the following are required, **unless agreed in writing with the Air Quality Officer:** 1) an air quality assessment and 2) an emissions mitigation assessment. See **Sections 2 and 3** for guidance.

It is considered that the Proposed Development meets the criteria of "in relevant proximity to an AQMA", as the generated traffic from the Proposed Development has the potential to cause air quality impacts in this area.

Therefore, in accordance with the above screening criteria an air quality assessment has been undertaken in accordance with the EPUK & IAQM guidance[16], and an emission mitigation assessment in line with the Sussex guidance.

The EPUK & IAQM's guidance[16] follows a two-step approach, whereby if the Proposed Development meets the Stage 1 Criteria (more than 10 parking spaces proposed and more than 1,000m^2 of floor space

for the combined proposed uses) then an air quality assessment should be prepared and consideration of Stage 2 criteria is required. Accordingly, the Proposed Development has been considered against the relevant Stage 2 checklist criteria shown in Table 4, which identifies whether a detailed assessment of potential air quality impacts is required.

Stage 2 includes some criteria which are not directly relevant to the Proposed Development, such as those related to the realignment of roads within an AQMA, new road junctions and underground car parks. These have been excluded from this assessment and only relevant screening criteria have been included, as presented in Table 4.

Table 4: EPUK & IAQM Stage 2 criteria

Criteria	The development will:	Indicative Criteria to Proceed to an Air Quality Assessment
1	Cause a significant change in Light Duty Vehicle (LDV) traffic flows on local roads with relevant receptors. (LDV - cars and small vans <3.5t gross vehicle weight)	A change of LDV flows of: - more than 100 AADT within or adjacent to an AQMA -more than 500 AADT elsewhere.
2	Cause a significant change in Heavy Duty (HDV) flows on local roads with relevant receptors (HDV = goods vehicles + buses >3.5t gross vehicle weight).	A change of HDV flows of: - more than 25 AADT within or adjacent to an AQMA - more than 100 AADT elsewhere.
3	Have one of more substantial combustion processes, where there is a risk of impacts at relevant receptors. NB. This includes combustion plant associated with standby emergency generators (typically associated with centralised energy centres) and shipping.	Typically, any combustion plant where the single or combined NO_x emission rate is less than 5mg/sec is unlikely to give rise to impacts, provided that the emissions are released from a vent stack in a location and at a height that provides adequate dispersion. In situations where the emissions are released close to buildings with relevant receptors, or where the dispersion of the plume may be adversely affected by the size and/or height of adjacent buildings (including situation where the stack height is lower than the receptor) then consideration will need to be given to potential impacts at much lower emissions rates. Conversely, where existing nitrogen dioxide concentrations are low, and where the dispersion conditions are favourable, a much higher emission rate may be acceptable.

The final details of the energy strategy are unknown at this stage, however, it is understood the preferred options include sustainable energy measures such as Air Source Heat Pumps and Photovoltaic Panels and that gas boilers will be avoided. Therefore, it has been assumed that the Proposed Development will not introduce additional sources of stationary/plant combustion and no further assessment has been undertaken.

The Site is located approximately 1.4km from Horsham AQMA No.1 in Storrington. The Transport Consultants, Calibro, have provided the proposed vehicle trip and likely distribution on the local road network, as shown in the table below.

Table 5: Trip Generation and Distribution

ID	Road Link	In AQMA	EPUK & IAQM Threshold (AADT)	LDV AADT	HDV AADT
1	**High Street West (A283)**	Yes	100 LDV and/or 25 HDV	94	2
2	**Washington Road (A283)**	Yes		-	-
3	**School Hill (B2139)**	Yes		94	2
4	**Fryern Road**	No	500 LDV and/or 100 HDV	16	-
5	**Thakeham Road (west of Water Lane)**	No		110	2
6	**Storrington Road**	No		62	2
7	**Rock Road (west of Site access)**	No		331	4
8	**Road Road (east of Site access)**	No		195	2
9	**Water Lane**	No		157	2

Table 5 shows that the proposed trip generation is below the relevant screening thresholds. However, the EHO has requested that a detailed assessment is undertaken:

> *"Thank you for sharing the AADT data. Although the traffic will be less than 100 within the AQMA, the IAQM guidance mentions a change of flows within or adjacent an AQMA. The road links you mentioned are adjacent to the AQMA, and the road link going into the AQMA is very close to 100 (94 at School Hill - near our worst location). We have seen improvements in the AQMA in the past few years, and in 2024 it was compliant for the first time to the current air quality objective and we need to work to keep improving the AQ to be able to revoke the AQMA. We need to make sure concentrations don't increase.*
>
> *Due to the above, I would recommend that a detailed assessment is carried out, and that you should liaise with the planning department for information on any other schemes that should be included in a cumulative impacts scenario."*

Therefore, a detailed dispersion modelling assessment of traffic related air quality impacts has been undertaken, according to the methodology outlined below.

3.6 ADMS-Urban Dispersion Model

A detailed AQA has been undertaken using the air dispersion model ADMS-Urban v5.1 to establish the current and future air quality conditions in the area. The software is commercially available, has been validated for this type of assessment by Defra and is used extensively for AQA's.

ADMS-Urban is able to provide an estimate of air quality both before and after development, considering important input data such as background pollutant concentrations, variable emissions, meteorological data, and traffic flows.

3.6.1 Assessment Scenarios

The following scenarios have been modelled:

- Baseline/verification 2023
- 2031 Do-Minimum (2031 DM) – opening year traffic plus relevant committed developments; and
- 2031 Do Something (2031 DS) – opening year traffic, in addition to proposed development traffic.

3.6.2 Model Inputs

3.6.2.1 Traffic Data

The trip generation for the dispersion modelling has been provided by the appointed Transport Consultants on the project, Calibro.

The traffic data comprises AADT flows with traffic split by Heavy Duty Vehicles (HDVs) and Light Duty Vehicles (LDVs). The modelled road links are shown in Figure 2 below, with full details provided in Appendix A.

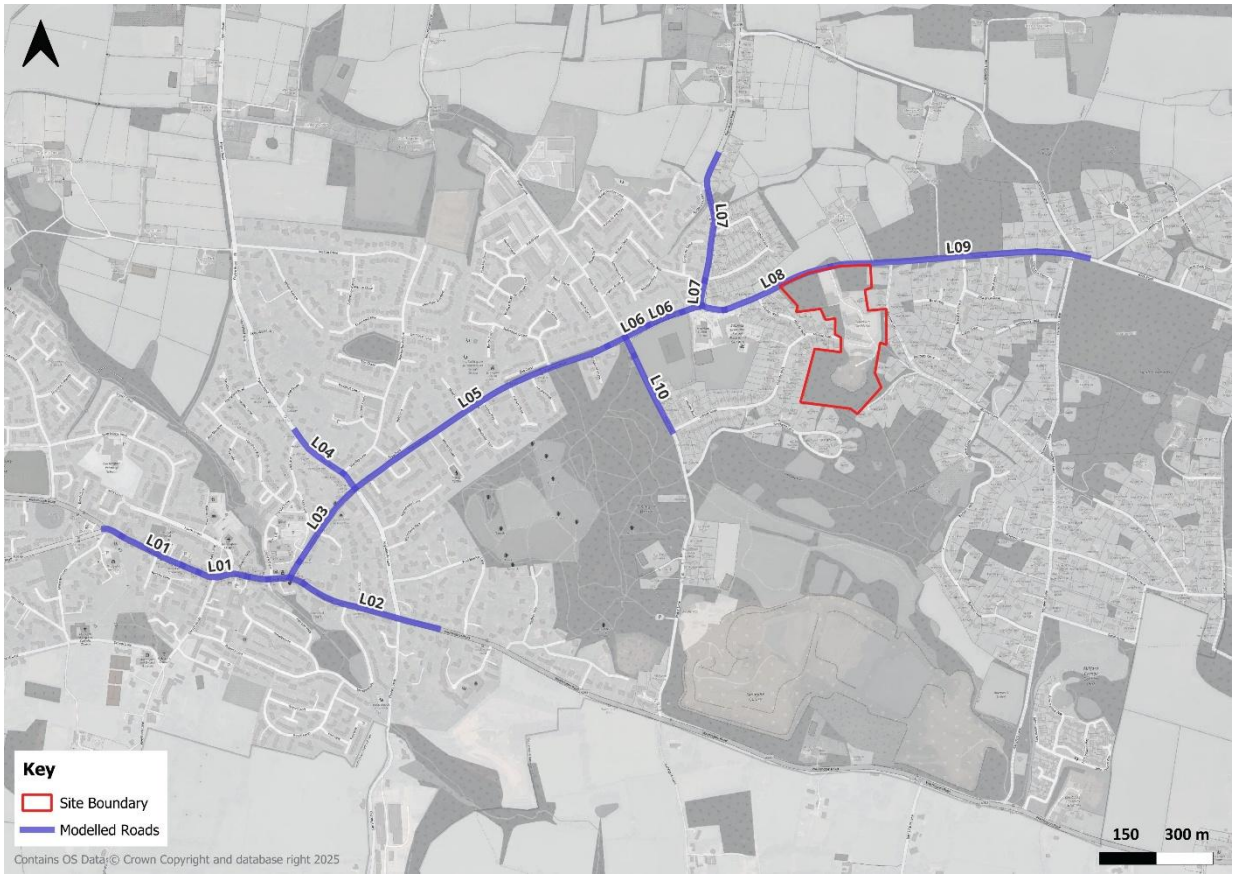

Figure 2: Links Modelled

For each road link, vehicle speeds were obtained from the speed limit for each road derived from the OpenStreet Browser v4.10[26], which has been used as a proxy for average speeds on the network. Vehicle speeds were reduced within approximately 50m of junctions relative to the speed limit to account for queuing, pedestrian crossings and congestion in the average speed profile, in accordance with LAQM.TG (22), and based on professional judgement.

[26] https://www.openstreetbrowser.org/#map=15/53.7033/-1.2698&categories=car_maxspeed

3.6.2.2 Street canyon

To account for the street canyon characteristics in the Storrington area, the advanced street canyon input has been utilised within the dispersion model.

The advanced street canyon module in ADMS-Urban modifies the dispersion of pollutants from a road source and can account for the presence and properties of canyon walls on either one or both sides of the road and can take account of canyon asymmetry. The concentrations predicted by the model also vary with height within the canyon.

3.6.2.3 Gradients

To account for the hills within the study area, gradients have been included within the dispersion model. The gradient for Manleys Hill (A283) and School Hill were calculated using google earth and the gradient % was input into the model to account for the increased emissions when vehicles travel uphill.

3.6.2.4 Emission Factors

Emission rates for NO_x, PM_{10} and $PM_{2.5}$ used for the dispersion modelling assessment were calculated from the latest Emissions Factor Toolkit (EFT)(v.13.1)[27].

Most modern vehicles on the road in the UK meet a particular Euro emissions standard from 1 – 6, with 6 being the newest. Different parts of the country have newer or older vehicles than others. This is defined as the “fleet”. The EFT estimates this primarily based on whether the location is within or outside London or in England, Wales or Scotland. In the case of this model the vehicle fleet used was “England (rural)” in line with census data[28].

When predicting future year emissions, the toolkit includes forecasts such as anticipated advances in vehicle technology and changes in vehicle fleet composition, which assumes that vehicle emissions will reduce over time. However, there is some uncertainty over the accuracy of the future predictions.

3.6.2.5 Temporal Variation (Diurnal Traffic Profile)

Temporal variation in traffic flows along roads have been included in the dispersion model to account for the realistic differences that would occur between weekdays and weekends. Accordingly, a time varying profile was included in the model.

[27] https://laqm.defra.gov.uk/air-quality/air-quality-assessment/emissions-factors-toolkit/
[28] https://www.gov.uk/government/collections/rural-urban-classification#census-rural-urban-classification

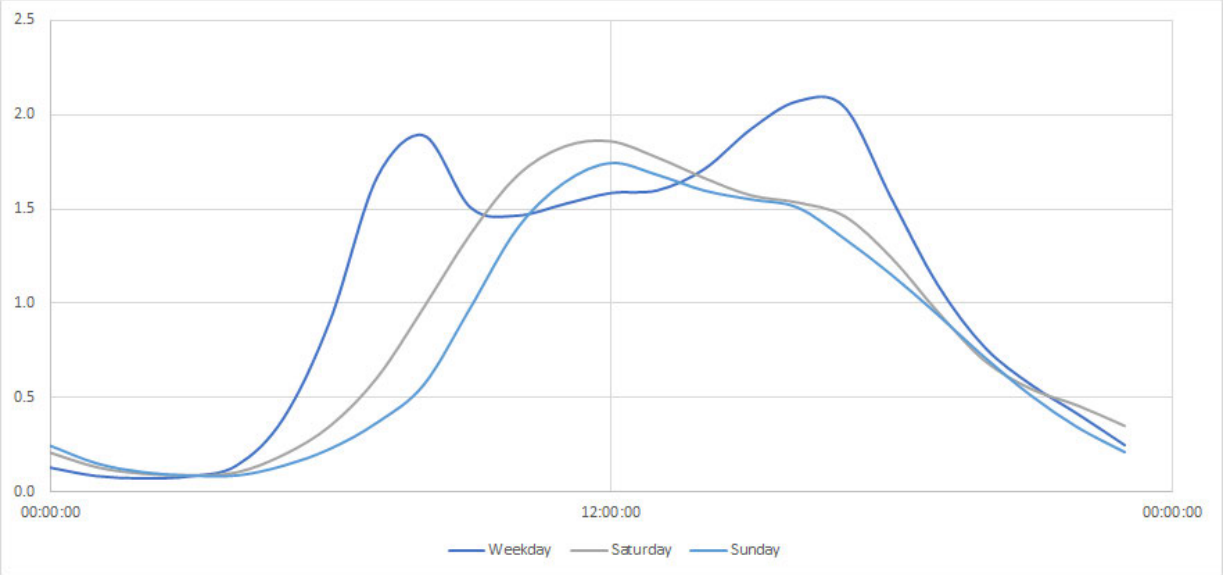

Figure 3: Diurnal traffic profile included in the dispersion model

The diurnal profile used in the model has been calculated based on DfT Road traffic statistics (TRA) dataset. TRA0307 provides 'Motor vehicle traffic distribution by time of day and day of the week on all roads, Great Britain: 2023[29], which shows the average hourly traffic flow in each combination of weekday, weekend and hour, relative to the average hour across the whole year for main roads in England. Figure 3 shows the diurnal traffic profile included in the model.

3.6.2.6 Meteorological Parameters

To calculate pollutant concentrations at identified sensitive receptor locations the dispersion model uses hourly sequential 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 2023 data from Gatwick Airport Meteorological station which is located approximately 28km northeast of the Site. It is the most relevant meteorological station that records all of the parameters necessary for dispersion modelling. Missing data has been infilled using Charlwood Meteorological station. A wind rose is presented in Appendix B.

3.6.2.7 Surface Characteristics

The following surface roughness parameters have been applied in the model:

- Dispersion site surface roughness = 0.75m (Between ADMS pre-set ‘cities, woodland’ and ‘Parkland, Open Suburbia’); and
- Met site surface roughness = 0.02m (ADMS pre-set ‘open grassland’).

The following Minimum Monin-Obukhov (MO) lengths were applied:

[29] DfT, “Average Annual Daily Flow and Temporal Traffic Distributions (TRA03) - Statistical Data Sets - GOV.UK,” 2015, https://www.gov.uk/government/statistical-data-sets/tra03-motor-vehicle-flow.

- Dispersion site = 10m (ADMS pre-set 'small towns <50,000'); and
- Met site = 10m (ADMS pre-set 'small towns <50,000').

3.6.3 Receptors Included in the Dispersion Model

3.6.3.1 Human Receptors

Sensitive receptor locations included in the dispersion model are shown below in Figure 4 and Table 6. These are worst-case locations based upon their proximity to the modelled road network.

Receptors have been modelled at 1.5m; the relative breathing height above ground level to represent exposure relevant to the modelled receptors.

Table 6: Receptor Locations

Receptor ID	Location	NGR (m)		Z (m)
		X	Y	
R1	Rosewood House, Rock Road	510688	115115	1.5
R2	Meadowside House, Rock Road	510135	115018	1.5
R3	Longshaw House, Rock Road	510181	115016	1.5
R4	1 Storrington Road	510022	115030	1.5
R5	Ninian House, Thakeham Road	509919	114984	1.5
R6	Leather Bottle Cottage, Thakeham Road	509796	114915	1.5
R7	Barford House, Thakeham Road	509735	114861	1.5
R8	Marley Way House, Thakeham Road	509449	114747	1.5
R9	Oak Lodge, Thakeham Road	509370	114708	1.5
R10	19 School Hill, Storrington	508987	114378	1.5
R11	14 School Hill, Storrington	508994	114375	1.5
R12	1 School Hill, Storrington	508933	114296	1.5
R13	4 School Hill, Storrington	508944	114279	1.5
R14	5 Manley's Hill, Storrington	508943	114272	1.5
R15	20 High Street, Storrington	508822	114276	4.5
R16	17 West Street, Storrington	508696	114286	1.5
R17	12 West Street, Storrington	508691	114298	1.5
R18	21 West Street, Storrington	508662	114301	1.5

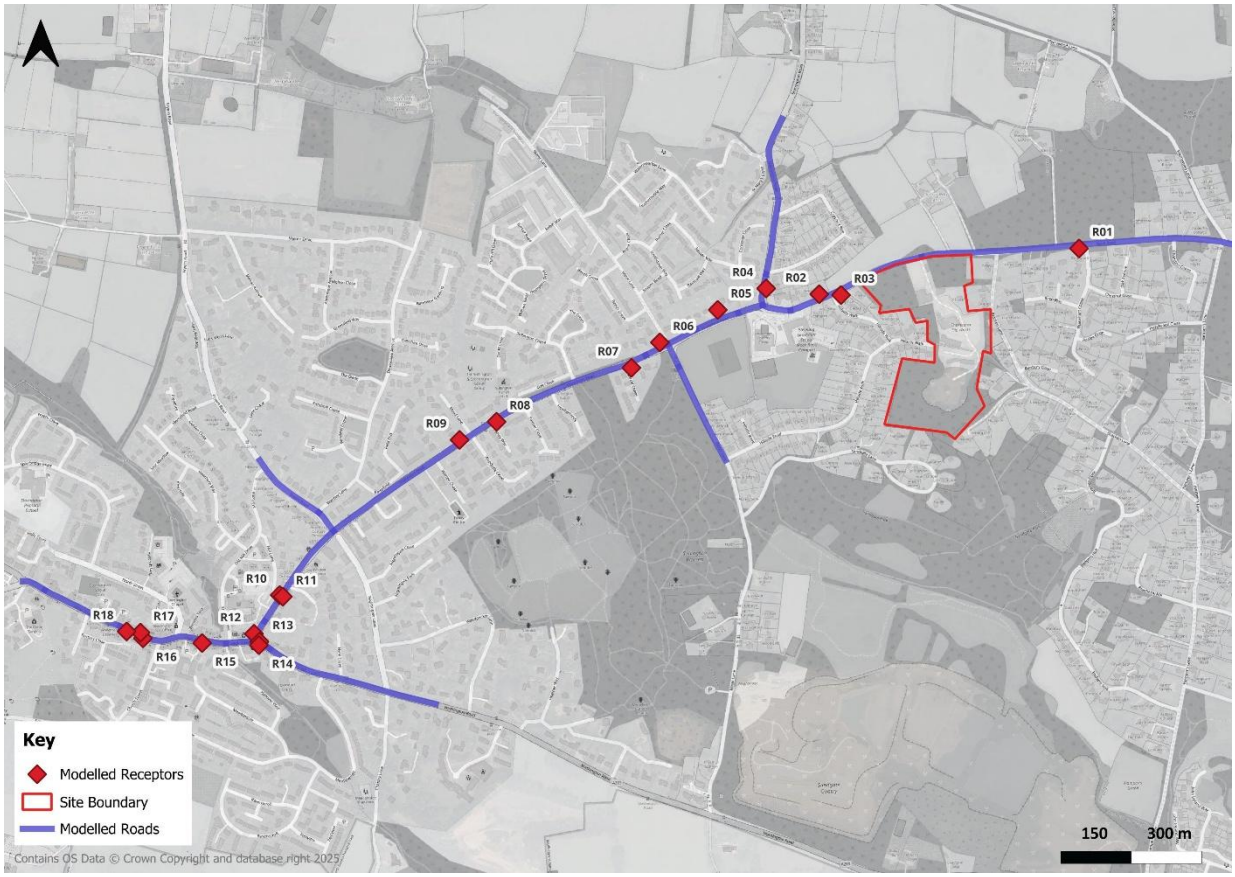

Figure 4: Receptor Locations

3.6.3.2 Ecological Receptors

Sullington Warren SSSI lies within 200m of Thakeham Road and Water Lane. Therefore, the requirement for detailed assessment of potential air quality impacts at ecological receptors has been considered against the screening criteria in Natural England's air quality guidance[19] (i.e., a change of 1,000 AADT both due to the project alone, and in-combination with relevant committed developments).

As demonstrated in Appendix A, the Proposed Development will generate additional trips on the relevant road link in proximity to the Sullington Warren SSSI (Water Lane and Thakeham Road), which are below the 1,000 AADT threshold. Furthermore, the change 'in-combination' AADT including trips from relevant committed developments is also well below the 1,000 AADT threshold.

Based on the above, no further consideration is required as potential effects are likely to be not significant.

3.6.4 Model Verification

A verification study has been undertaken in accordance with LAQM.TG(22) using HDC monitoring data. An adjustment factor of **2.450** was applied to modelled road NO_x concentrations.

PM_{10} and $PM_{2.5}$ monitoring is undertaken at automatic monitor HO4. However, give only one monitoring site is available for PM verification it was deemed more robust to apply the NO_2 adjustment factor to PM_{10} and $PM_{2.5}$ model results as this has been calculated utilising several monitoring sites across the study area.

Root Mean Square Error (RMSE) is used to define the average error or uncertainty of the model. LAQM.TG(22) states that the RMSE is acceptable where it is within 25% and ideal within 10%. The model verification process calculated a post-adjusted RMSE of 3.4µg/m^3, which equates to 8.5% of the annual mean AQAL for NO_2 and is therefore considered to be acceptable.

Full details of the model verification procedure are included in Appendix C.

3.6.5 NO_x to NO_2 Conversion

Ambient NO_x concentrations have been predicted through dispersion modelling. Annual NO_x concentrations have been converted using Defra's NO_x to NO_2 conversion tool[30] version 9.1.

3.7 Background Concentrations

Background concentrations used in the assessment are discussed further in Section 4.3 and presented in Appendix D.

3.8 Comparison with AQALs

3.8.1 Nitrogen Dioxide

Annual mean road NO_x predicted by the model was converted to annual mean NO_2 using the Defra NO_x to NO_2 calculator[30]. To determine short term (1 hour mean) concentrations, reference was made to LAQM.TG(22)[10], which states if annual mean concentrations of NO_2 do not exceed 60µg/m³, it is unlikely hourly mean concentrations would exceed the relevant AQAL, which allows for 18 exceedances of the hourly standard (200µg/m^3) in a calendar year.

3.8.2 Particulate Matter

To determine total annual mean concentrations of PM_{10} and $PM_{2.5}$, the modelled road contribution was added to the background concentration to give the total concentration for comparison with the AQALs.

Annual mean PM_{10} concentrations were used to derive the potential number of exceedances of the 24-hour mean PM_{10} AQAL, of which 35 are allowed per year. The method described in LAQM.TG(22) was applied, which is based on the relationship between the number of 24-hour exceedances of 50µg/m^3 and the annual mean concentration. This relationship is described in Equation 1 below:

Equation 1:

Number of exceedances of 24-hour mean of 50µg/m^3 = -18.5 + 0.00145 * a^3 + (206/a)

where 'a' = total annual mean PM_{10} concentration.

[30] https://laqm.defra.gov.uk/air-quality/air-quality-assessment/nox-to-no2-calculator/

3.9 Assessment of Significance

The long-term annual average for NO_2, PM_{10} and $PM_{2.5}$ have been compared against the applicable AQALs and the magnitude of impacts has been determined against the following threshold criteria, from the EPUK & IAQM guidance.

Table 7: Impact descriptors for individual receptors

Long term average concentration at receptor in assessment year	**% Changes in concentration with development in relation to AQAL**			
	1	**2-5**	**6-10**	**>10**
> 110 %	Moderate	Substantial	Substantial	Substantial
>102% - ≤110%	Moderate	Moderate	Substantial	Substantial
>95% - ≤102%	Slight	Moderate	Moderate	Substantial
>75% - ≤95%	Negligible	Slight	Moderate	Moderate
≤75%	Negligible	Negligible	Slight	Moderate

Where concentrations increase the impact is described as adverse, and where it decreases as beneficial.

% change rounded to nearest whole number.

Where the % change is 0 (i.e. less than 0.5%) the impact will be 'negligible'.

For the purposes of this assessment, impacts of >Slight Adverse are considered to potentially be significant, whereas impacts <Slight Adverse are considered not significant. Additional factors are also included in the assessment of significance, including the spatial extent of adverse impacts, in accordance with IAQM guidance, which states:

> *"An individual property exposed to a moderately adverse impact might not be considered significant, but many hundreds of properties exposed to a slight adverse impact could be."*

Professional judgement has been applied to determine whether exposure to air pollution is significant or not, based on the following criteria:

- Annual mean concentrations within 10% below or exceeding relevant AQAL = potential for significant exposure; and
- Annual mean concentrations more than 10% below relevant AQAL = not significant.

The 10% threshold around an AQAL is generally considered to be the range at which a 'risk of exceedance' is present, according to LAQM.TG(22).

3.10 Model Limitations

There are inherent uncertainties associated with the model (ADMS-Urban) used in this assessment, including the uncertainties associated with the input data such as predicted traffic flows. The model itself simplifies complex physical systems into a range of algorithms. In addition, local micro-climatic conditions may affect the concentrations of pollutants that the ADMS model will not take into account.

To account for uncertainty in future emission factors and pollutant concentrations, a precautionary principle has been undertaken in the assessment, whereby background pollutant concentrations held at

2023 (no future improvements assumed). These assumptions ensure a conservative approach in the assessment.

3.11 Damage Costs

In line with the HDC guidance it is considered good practice that a Damage Cost Calculation is undertaken, otherwise known as an Emissions Mitigation Assessment. This can be found in Section 7.

4 Baseline Air Quality Conditions

4.1 Local Air Quality Management

As stated above, the AQMA relevant to this assessment is the HDC Horsham AQMA No 1, which is located approximately 1.4km to the southwest of the Site in the centre of Storrington. This AQMA was declared in 2010 for exceedances of the annual mean NO_2 AQAL. There are no other AQMAs within over 5km of the Site.

The location of the Horsham AQMA No 1 in relation to the Site is shown in Figure 5.

The relevant AQAP is the Storrington Air Quality Action Plan published in December 2020[31]. This outlines the action that HDC are taking to reduce concentrations of air pollution within the AQMA. This includes the implementation of the Air Quality and Emissions Mitigation Guidance for Sussex (2021)[18].

4.2 Local Emission Sources

The main source of air pollution in the Site locale are vehicles using the local road network.

A review of the NAEI[20], EA[21] and Defra's PRTR[22] data indicates that there are no major industrial pollution sources in the immediate vicinity of the Site that will influence local air quality.

4.3 DEFRA Mapped Background Concentrations

Mapped background concentrations of NO_2, PM_{10} and $PM_{2.5}$ were downloaded for the grid squares containing the Site. Background pollutant concentrations for 2023 (baseline year) 2025 (year of assessment) and 2031 (proposed opening year) are displayed in Table 8. As the Site is located over multiple 1km grid squares, the concentrations in the table below are an average.

Table 8: Defra Mapped Background Concentrations

Grid Square (x,y)	Pollutant	AQAL (µg/m^3)	Annual Mean Concentration (µg/m^3)		
			2023	2025	2031
510500, 114500 510500, 115500	NO_2	40	7.5	7.0	5.7
	PM_{10}	40	10.4	10.2	9.8
	$PM_{2.5}$	20	6.1	5.9	5.5

The data show that annual mean background concentrations of NO_2, PM_{10} and $PM_{2.5}$ at the grid squares within which the Site is located are below the AQALs.

[31] https://www.horsham.gov.uk/__data/assets/pdf_file/0007/137941/Storrington_AQAP_2020.pdf

Concentrations of all pollutants are predicted to decline incrementally each year. These reductions are principally due to the forecast effect of the roll out of cleaner vehicles and strategies to reduce emissions across all sectors.

Defra PM_{10} and $PM_{2.5}$ background concentrations have been used within the model. Appendix D provides details of the background concentrations used at each modelled receptor.

4.4 Air Quality Monitoring Data

4.4.1 Automatic Monitoring

The UK Automatic Urban and Rural Network (AURN) is a countrywide network of air quality monitoring stations operated on behalf of the Defra. Monitoring data for AURN sites is available from the UK Air website[32].

Storrington AURN (HDC ASR ID: HO4) is in the centre of Storrington approximately 1.3km to the southwest of the Site. It is noted this monitoring site is also used in the assessment of the AMCT under the Environmental Target (Fine Particulate Matter) (England) Regulations 2023. It is located at a Roadside location.

The data from monitoring site HO4 has been taken from the HDC 2024 ASR and is shown below in Table 9.

Table 9: Automatic Monitoring Data

X, Y (m)	Pollutant and Averaging Period	AQAL (µg/m^3)	Results					
			2019	2020	2021	2022	2023	2024
509083, 114198	NO_2 annual mean (µg/m^3)	40	22.0	17.4	20.1	17.6	17.4	16.6
	NO_2 1-Hour mean(A)	200	0	0	0	0 (77.2)	0	0
	PM_{10} annual mean (µg/m^3)	40	-	-	-	14.0	13.7	12.6
	PM_{10} 24-hour mean(B)	50	-	-	-	0 (21.5)	0	0
	$PM_{2.5}$ annual mean	20 (10 AMCT)	-	-	-	7.3	7.7	7.7

(A) Results show the Number of 1-Hour Means > 200µg/m^3. If the period of valid data is less than 85%, the 99.8th percentile of 1-hour means is provided in brackets.
(B) Results show the Number of 24-Hour Means > 50µg/m^3. If the period of valid data is less than 85%, the 90.4th percentile of 1-hour means is provided in brackets.

From the table above concentrations of NO_2, PM_{10}, and $PM_{2.5}$ have not exceeded relevant annual mean or short term AQALs at HO4 in recent years. In addition to this, the AMCT of 10µg/m^3 for $PM_{2.5}$ is currently achieved at HO4.

[32] Automatic Urban and Rural Network (AURN) - Defra, UK

4.4.2 Passive Monitoring

Passive NO_2 diffusion tube monitoring was undertaken at numerous locations within the HDC area in 2023. The location of these monitoring sites in relation to the Site are shown in Figure 5 with data reported in Table 10.

Figure 5: Local Authority Monitoring

Table 10: Passive Diffusion Tube Monitoring Concentrations

Site ID	X (m)	Y (m)	Type	Annual Mean Concentration (µg/m³)					
				2019	2020	2021	2022	2023	2024
13	508960	114270	Roadside	38.9	31.6	34.3	32.9	32.9	28.6
15	508935	114297	Roadside	28.3	23.3	24.8	23.7	21.8	19.3
16	508832	114272	Roadside	29.7	25.5	25.9	26.7	24.5	23.3
17	508742	114288	Roadside	23.3	18.7	19.9	19.0	19.2	16.4
18	508396	114449	Roadside	18.8	14.8	17.1	17.4	17.9	15.9
19	508338	114374	Roadside	18.4	15.6	17.6	17.7	18.8	15.9
29, 30, 31	509083	114198	Roadside	22.9	20.5	21.7	21.7	19.8	17.3
32	508675	114306	Roadside	25.6	21.4	23.1	23.0	21.1	20.7
33	508598	114323	Roadside	26.0	20.0	23.0	22.4	20.9	-
34	508511	114365	Roadside	29.8	25.0	26.5	25.9	24.8	18.4
38	509319	114160	Roadside	33.4	27.8	25.8	26.3	23.5	-
39	508966	114356	Roadside	21.6	18.9	19.2	18.4	17.5	15.1

Site ID	X (m)	Y (m)	Type	Annual Mean Concentration (µg/m^3)					
				2019	**2020**	**2021**	**2022**	**2023**	**2024**
40	509103	114532	Roadside	16.9	14.9	15.4	14.6	14.7	-
41	508677	114149	Urban Background	11.2	9.8	10.0	9.6	8.2	7.6
42	508215	114348	Roadside	16.0	13.4	18.1	15.4	13.7	-
47	508945	114268	Roadside	**47.7**	38.4	39.6	38.1	37.0	32.7

Bold values denote exceedance of the annual mean AQAL.

Site 47 (labelled Storrington 19n in the 2025 ASR) located in the centre of Storrington, was the only reported monitoring site to exceed the annual mean AQAL in 2019, where the concentration was 47.7µg/m^3. Since 2019, concentrations at this monitoring site have been below the AQAL, but it is recognised they are within 10% of the AQAL from 2020 to 2023, which indicates a risk of exceedance of the AQAL in line with LAQM.TG(22) guidance.

No other reported monitoring site recorded exceedances of the annual mean AQAL for the years reported. Concentrations at all monitoring locations, with the exception of diffusion tube 13 in 2019, were greater than 10% below the AQAL for all years reported.

The overall trend in the reported concentration is a decreasing concentration of annual mean NO_2 from 2019 to 2024. The only exception to this is monitoring site 19, where concentration have increased slightly from 2019 to 2023, but have remained below the AQAL for all years reported.

Site 41 is located at Urban Background and shows a decreasing trend in annual mean NO_2 from 2019 to 2024. This diffusion tube has been used for the background concentration in the dispersion modelling assessment.

With regard to wider HDC monitoring trends, the 2025 ASR states:

> *"All the long-term sites show a continuing overall downward trend in measured concentrations of NO_2 over the last five years, which applies both to roadside and background locations. This can be attributed to decreasing background concentrations and is also indicative of a gradual improvement in fleet emissions.*
>
> *Storrington sites showed an average decrease of 12.1% in 2024 in relation to 2023, the same decrease was measured in sites located within the AQMA. Whilst the AQMA encompasses the whole High Street in the town centre, in recent years the only area within 10% of exceedance of the annual mean objective for NO2 has been the mini roundabout of Manley's Hill and School Hill, as shown by the results at Storrington 19n.*
>
> *Technically, HDC could proceed to revoking the West Street/High Street part of the Storrington AQMA, which has for several years been in compliance with the annual mean objective for NO_2. However, continued action aimed at reducing traffic flows and congestion on the High Street has benefited the air quality within the whole of the AQMA. As such, no changes are proposed at present and the boundaries of the Storrington AQMA can remain unchanged."*

5 Construction Phase Assessment

5.1 Overview

The construction phase of the Proposed Development will involve activities that will release polluting emissions to air. Predominantly, these will be emissions of dust. As such, a qualitative construction dust risk assessment has been carried out in accordance with IAQM guidance[17].

Construction activities will include:

- material export and import;
- temporary stockpiling of materials;
- groundwork for foundations and services;
- construction of buildings;
- landscaping works; and
- vehicle movements (with the potential to track-out material from site).

Information relating to potential dust emission magnitude was provided by the design team. Where information was unknown, assumptions using professional judgement were made by Stantec.

5.2 Potential Dust Emission Magnitude

A summary of the potential dust emission magnitude for each activity is presented in the Table below.

Table 11: Potential Dust Emission Magnitude

Activity	Potential Dust Emission Magnitude	Justification
Demolition	Small	The existing buildings will be demolished as part of the proposals. The total volume of buildings to be demolished is estimated to fall within the IAQM 'Small' criteria (<12,000m^3). Materials will comprise stone, metal, concrete with demolition activities taking place up to 12m.
Earthworks	Medium	The total area of the Site is c,65,000m^2 and subsequently falls into the IAQM 'Medium' criteria. The prevailing soil-type at the Site is described as 'Sandy and Loamy' following review of Soilscapes[33]. Loamy soils have a moderate potential for dust as they are composed of almost equal amounts of sand and silt with less clay content. Less than 10 heavy earth moving vehicles are expected to be active at any one time.
Construction	Medium	The total volume of the completed built form of the Proposed Development is estimated to be between 12,000m^3 and 75,000m^3 which falls within the IAQM's 'Medium' criteria. The construction materials will likely comprise concrete, timber and masonry. No concrete batching will occur on-site during construction.

[33] https://www.landis.org.uk/soilscapes/

Activity	Potential Dust Emission Magnitude	Justification
Trackout	Small	The expected unpaved road length required for Trackout will be <50m. Vehicles will access via the existing road network. In addition, the number of site vehicles is unlikely to exceed the IAQM's 'Small' threshold of <20 HDV (>3.5t) outward movements per day

5.3 Sensitivity of Area

The prevailing wind direction for the closest regionally representative meteorological measurement station to the Site, at Gatwick Airport, is shown for 2023 in Appendix B. The wind rose shows that the prevailing winds are from the south-west.

Figure 6 shows the construction phase distance buffers (20m, 50m, 100m and 250m) around the Site boundary, as well as identified high and medium sensitivity receptor locations within these buffers.

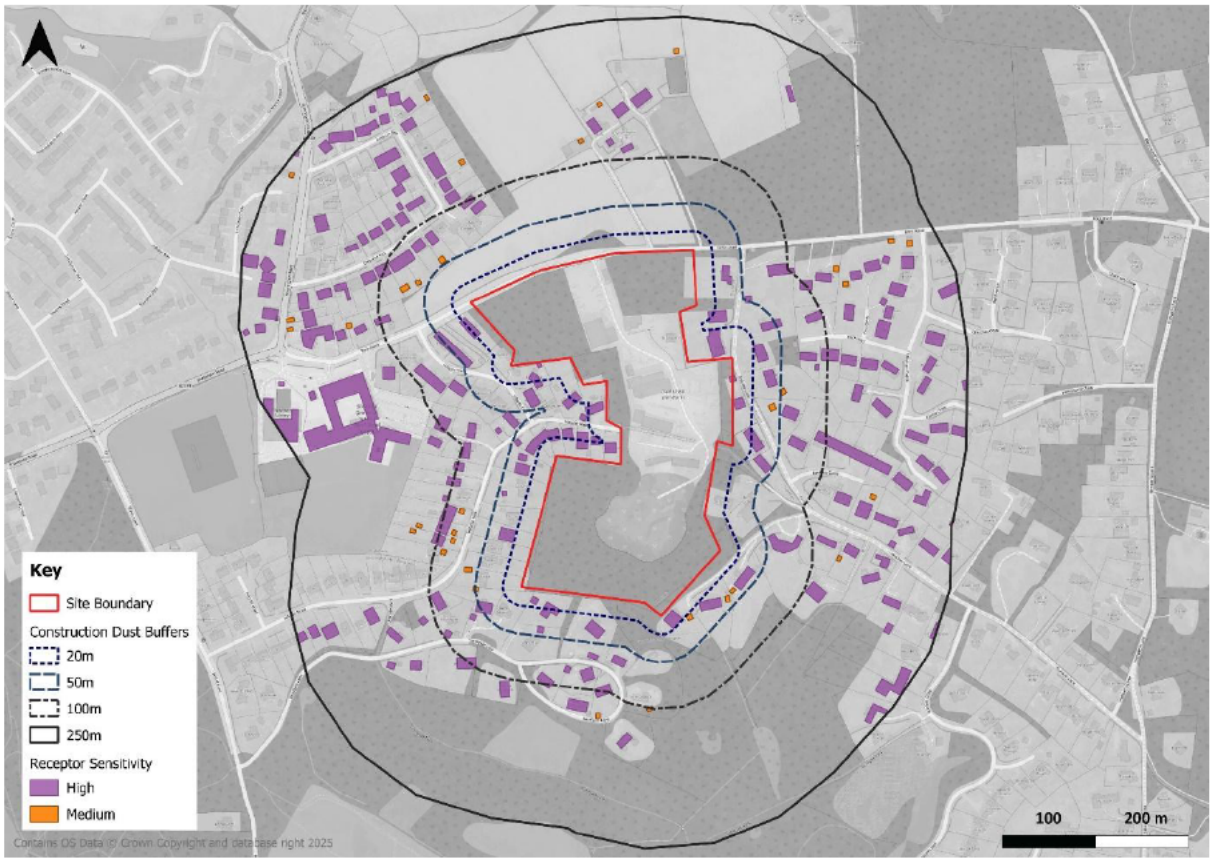

Figure 6: Construction Phase Receptors

5.3.1 Dust Soiling Impacts

Figure 6 illustrates there are over 10 high sensitivity receptors within 20m. As such, the overall sensitivity of the surrounding area to nuisance dust soiling effects during Demolition, Earthworks and Construction, according to IAQM guidance, is defined as '**High**'.

The sensitivity for Trackout is assessed where receptors are located within 50m of Trackout routes up to 250m from the Site. All potential Trackout routes have been considered. There are more than 10 high-sensitivity receptors within 20m of potential Trackout routes from the Site and as such, the sensitivity to dust soiling impacts from Trackout is defined as '**High**'.

5.3.2 Human Health Impacts

Defra mapped background predictions (Table 8) show that annual mean concentrations of PM_{10} are not likely to exceed 24µg/m^3 in the vicinity of the Site based on 2025 estimates. According to IAQM guidance, where PM_{10} concentrations are <24µg/m^3 and there are less than 100 high sensitivity receptors within 20m of construction works, the overall sensitivity of the surrounding area to human health impacts is defined as '**Low**' for Demolition, Earthworks, Construction and Trackout.

5.4 Risk of impacts

Using the methodology prescribed in the IAQM guidance, the overall risk of impacts can be defined by combining the sensitivity of the area with the potential dust emission magnitude of each stage of the construction phase as described above. Table 12 below provides a summary of the construction dust risk assessment. Overall, the Proposed Development is **Medium Risk** for nuisance dust soiling effects and **Low Risk** for PM_{10} health effect, in the absence of mitigation.

Table 12: Risk of Adverse Impacts During Construction Phase

Potential Impact	Sensitivity of Area	Dust Impact Risk			
		Demolition	Earthworks	Construction	Trackout
Dust Soiling	High	Medium Risk	Medium Risk	Medium Risk	Low Risk
Human Health	Low	Negligible	Low Risk	Low Risk	Negligible

6 Operational Phase Assessment

6.1 Impact Assessment

The results presented below are for the proposed 2031 opening year and utilise 2031 emissions factors and 2023 background concentrations.

6.1.1 Annual Mean NO_2

Predicted annual mean NO_2 concentrations were assessed against the AQAL of 40µg/m^3 as presented in Table 13.

Table 13: Modelled Annual Mean NO_2 Concentrations

Receptor	DM 2031 (µg/m^3)	DS 2031 (µg/m^3)	Concentration Change (µg/m^3)	% Change Relative to AQAL	EPUK & IAQM Impact Descriptor
R1	8.8	8.8	<0.1	0%	Negligible
R2	9.3	9.3	<0.1	0%	Negligible
R3	8.9	8.9	<0.1	0%	Negligible
R4	11.3	11.3	<0.1	0%	Negligible
R5	10.1	10.1	<0.1	0%	Negligible
R6	11.9	11.9	<0.1	0%	Negligible
R7	9.9	9.9	<0.1	0%	Negligible
R8	11.1	11.1	<0.1	0%	Negligible
R9	11.9	11.9	<0.1	0%	Negligible
R10	12.5	12.5	<0.1	0%	Negligible
R11	12.2	12.3	<0.1	0%	Negligible
R12	15.5	15.5	<0.1	0%	Negligible
R13	20.2	20.2	<0.1	0%	Negligible
R14	27.4	27.4	<0.1	0%	Negligible
R15	10.5	10.5	<0.1	0%	Negligible
R16	14.7	14.7	<0.1	0%	Negligible
R17	18.8	18.8	<0.1	0%	Negligible
R18	14.5	14.5	<0.1	0%	Negligible

% Change has been rounded to the nearest whole number in line with the EPUK/IAQM guidance

Table 13 shows that there are no predicted exceedances of the annual mean NO_2 AQAL at any receptor in either the DM or DS scenarios associated with the 2031 opening year. The highest concentration is at Receptor R14, where a concentration of 27.4µg/m^3 is predicted.

The maximum increase in annual mean NO_2 is <0.1µg/m^3 at a number of receptors in the Site locale. The predicted changes in annual mean NO_2 at all existing receptors were <1% of the relevant AQAL, with total concentrations below 75% of the objective. Therefore, in accordance with the EPUK & IAQM guidance, the impact of the emissions is considered to be negligible.

6.1.2 1 Hour Mean NO_2

With regard to the 1-hour NO_2 objective, Defra's LAQM.TG(22) states where the annual means are below 60µg/m^3, it is unlikely that exceedances of the 1-hour mean will occur. All modelled results are below this threshold, and therefore it is considered unlikely that the 1-hour NO_2 AQAL will be exceeded at any of the receptor locations modelled. The impact of the Proposed Development on short term NO_2 concentrations is considered to be negligible.

6.1.3 Annual Mean PM_{10}

Predicted annual mean PM_{10} concentrations were assessed against the AQAL of 40µg/m^3 as presented in Table 14.

Table 14: Modelled PM_{10} Concentrations

Receptor	DM 2031 (µg/m^3)	DS 2031 (µg/m^3)	Concentration Change (µg/m^3)	% Change Relative to AQAL	EPUK & IAQM Impact Descriptor
R1	10.5	10.5	<0.1	0%	Negligible
R2	10.9	10.9	<0.1	0%	Negligible
R3	10.6	10.6	<0.1	0%	Negligible
R4	11.9	11.9	<0.1	0%	Negligible
R5	11.5	11.5	<0.1	0%	Negligible
R6	12.3	12.3	<0.1	0%	Negligible
R7	11.3	11.3	<0.1	0%	Negligible
R8	12.3	12.3	<0.1	0%	Negligible
R9	12.9	12.9	<0.1	0%	Negligible
R10	13.2	13.2	<0.1	0%	Negligible
R11	13.0	13.0	<0.1	0%	Negligible
R12	14.5	14.5	<0.1	0%	Negligible
R13	17.5	17.6	<0.1	0%	Negligible
R14	22.7	22.7	<0.1	0%	Negligible
R15	11.5	11.5	<0.1	0%	Negligible
R16	14.7	14.7	<0.1	0%	Negligible
R17	17.9	17.9	<0.1	0%	Negligible
R18	14.5	14.6	<0.1	0%	Negligible

% Change has been rounded to the nearest whole number in line with the EPUK/IAQM guidance

Table 14 shows that there are no predicted exceedances of the annual mean PM_{10} AQAL at any receptor in either the DM or DS scenarios associated with the 2031 opening year.

The highest concentration is at Receptor R14, where a concentration of 22.7µg/m^3 is predicted in the DM and DS scenario. The predicted changes in annual mean PM_{10} concentrations are all <1% of the relevant AQAL. Based on the EPUK & IAQM guidance, the impact of the Proposed Development on annual mean PM_{10} concentrations is considered to be negligible.

6.1.4 24-hour Mean PM_{10}

Using equation 1, there were no predicted exceedances of the 24-hour mean AQAL at any of the receptors included in the dispersion model in either the DM or DS scenario; therefore, in accordance with the guidance there is no predicted risk of exceedances of the 24-hour mean PM_{10} AQAL as a result of increased traffic generation associated with the Proposed Development.

6.1.5 Annual Mean $PM_{2.5}$

Predicted annual mean $PM_{2.5}$ concentrations were assessed against the AQAL of 20µg/m^3 as presented in Table 15.

Table 15: Modelled Annual Mean $PM_{2.5}$ Concentrations

Receptor	DM 2031 (µg/m^3)	DS 2031 (µg/m^3)	Concentration Change (µg/m^3)	% Change Relative to AQAL	EPUK & IAQM Impact Descriptor
R1	6.2	6.2	<0.1	0%	Negligible
R2	6.4	6.4	<0.1	0%	Negligible
R3	6.3	6.3	<0.1	0%	Negligible
R4	7.0	7.0	<0.1	0%	Negligible
R5	6.9	6.9	<0.1	0%	Negligible
R6	7.4	7.4	<0.1	0%	Negligible
R7	6.9	6.9	<0.1	0%	Negligible
R8	7.4	7.4	<0.1	0%	Negligible
R9	7.7	7.7	<0.1	0%	Negligible
R10	7.9	7.9	<0.1	0%	Negligible
R11	7.8	7.8	<0.1	0%	Negligible
R12	8.6	8.6	<0.1	0%	Negligible
R13	10.2	10.2	<0.1	0%	Negligible
R14	12.9	13.0	<0.1	0%	Negligible
R15	7.0	7.0	<0.1	0%	Negligible
R16	8.7	8.7	<0.1	0%	Negligible
R17	10.4	10.4	<0.1	0%	Negligible
R18	8.6	8.7	<0.1	0%	Negligible

% Change has been rounded to the nearest whole number in line with the EPUK/IAQM guidance

Table 15 shows that there are no predicted exceedances of the annual mean $PM_{2.5}$ AQAL at any receptor in either the DM or DS scenarios associated with the 2031 opening year. The highest concentration is at Receptor R14, where a concentration of 13.0µg/m^3 is predicted in the DS scenario. This is above the January 2028 annual mean target 12µg/m^3 and the 2040 AMCT of 10µg/m^3. However, it should be highlighted that this is a conversative assessment whereby background concentrations are held at 2023. Furthermore, the predicted concentrations at R14 are above the interim and AMCT in the Do Minimum (DM 2031) scenario as well as the Do Something (DS 2031). This is likely due to the proximity to the A283 and School Hill (B2139) junction and local characteristics such as positioning within a street canyon.

R13 is also marginally above the AMCT of 10µg/m^3 but below the interim target in both scenarios.

The predicted changes in annual mean $PM_{2.5}$ concentrations are all <1% of the relevant AQAL. Based on the EPUK & IAQM guidance, the impact the Proposed Development on annual mean $PM_{2.5}$ concentrations is considered to be negligible.

6.1.6 Site Suitability Assessment

The baseline data presented in Section 4 illustrates modelled background concentrations at the Site are well below the relevant AQALs for NO_2, PM_{10} and $PM_{2.5}$. Recent monitoring in the local area has also demonstrated concentrations below the AQALs and suggests a declining trend. Furthermore, the modelled concentrations within the proposed opening year (DS 2031) are below the AQALs for NO_2, PM_{10} and $PM_{2.5}$ at all modelled receptors, including residential properties R01 and R03 which are situated closest to the Site along Rock Road.

Based on the information presented within this assessment, the Site is considered acceptable for its proposed use and future occupants should not be exposed to poor air quality.

6.2 Significance of Air Quality Impacts

The unmitigated air quality impact associated with the Proposed Development has been predicted in accordance with the stated assessment methodology. The following factors have been considered:

- The modelling has been undertaken using conservative background concentration from 2023.
- There are no predicted exceedances of the annual mean NO_2, PM_{10} or $PM_{2.5}$ AQALs as a result of the Proposed Development
- A negligible impact on annual mean NO_2, PM_{10} or $PM_{2.5}$ concentrations has been predicted at all considered sensitive receptor locations
- Exceedances of the 1-hour mean NO_2 and 24-hour mean PM_{10} AQALs are considered unlikely, based upon the marginal change in concentrations and absolute concentrations predicted through the dispersion modelling study
- The Proposed Development will not introduce any new receptors into an area of exceedance of any relevant AQAL; and
- All modelled concentrations have been verified against HDC monitoring data.

Based on the above, the overall effect on air quality as a result of the additional development trips on sensitive receptors is ‘not significant’. In addition to this, the risk of exposure of future receptors at the Site to poor air quality is not significant

7 Emissions Mitigation Statement

Defra's Air quality appraisal: damage cost guidance[34] has been used to undertake a damage costs assessment.

Increases in pollutant emissions (NO_X and $PM_{2.5}$) caused by the Proposed Development traffic over a 5-year appraisal period are estimated, using traffic data provided by Calibro, Defra's EFT (v.13.1)[35] and Damage Cost Appraisal Toolkit. The appraisal period is taken as the first 5 year of operation, which is 2031 to 2035.

Calibro, the appointed transport consultants on the project, have confirmed that the traffic generation from the Proposed Development is expected to be 457 Annual Average Daily Traffic (AADT) of which 8.5% would be Heavy Duty Vehicles (HDVs).

These emissions from the Proposed Development are then input to the Defra's Air Quality Appraisal: Damage Costs Toolkit (last updated March 2023) to apply the 'damage costs', which are a set of impact values, defined per tonne of emission by pollutant. The result is an indicative value to be spent on mitigation measures to reduce incremental worsening in local ambient air quality from new development.

The central base damage costs for 'Road Transport Urban Small'[36] have been used at the request of the EHO and these are provided below in £/tonne:

- NO_x: [redacted]
- $PM_{2.5}$: [redacted]

The damage cost calculation applies inflationary uplift factors of 2% cumulatively per annum to the central damage cost from Defra's damage cost valuations (2022) and assumes a health discount rate of 1.5% per year.

The calculation used in this assessment is summarised in the below general formula:

- EFT output x Damage Cost x 5 years = 5 year air quality damage costs (in £)

It is noted that emissions were calculated by assuming a reduction in emissions, in line with the EFT, for each year in the appraisal. This was accounted for as an input into Defra's EFT. Table 16 below, shows the inputs used for the damage cost calculation.

[34] Defra, "Air quality appraisal: damage cost guidance", March 2023.
[35] https://laqm.defra.gov.uk/air-quality/air-quality-assessment/emissions-factors-toolkit/
[36] https://www.gov.uk/government/publications/assess-the-impact-of-air-quality/air-quality-appraisal-damage-cost-guidance

Table 16: Damage Costs Inputs

Input	Value	Unit	Source / Explanation
Trip Length	10	Km	EPUK & IAQM guidance & National Travel Survey UK Average.
Traffic Flow	457 (8.5% HDV)	AADT	Calibro
EFT Road Type	Rural (not London)	-	Local Enterprise Partnership Rural Urban Classification[37]
Appraisal Years	2031 to 2035	-	The first 5 years from the earliest expected opening year.
Average Speed	50	kph	EPUK & IAQM guidance

Using the above inputs, road traffic emissions associated with the Proposed Development are calculated for the years 2031 to 2035, which are the five years following the estimated proposed opening of the development. The emissions per annum are shown below in

Table 17: Increase in Emissions (Tonnes)

Pollutant	2030	2031	2032	2033	2034
NO_x	0.177	0.155	0.135	0.120	0.108
$PM_{2.5}$	0.035	0.035	0.035	0.034	0.034

The above emissions have been converted to the cost of damage to human health using the Air Quality Appraisal Damage Costs Toolkit. For this the price base year of 2025 (i.e., the year of appraisal) was used. The pollutant sector used was 'Road Transport Urban Small'. The results of this are shown below in Table 18

Table 18: Damage Cost Summary

Pollutant	Low Value	Central Value	High Value
NO_x	[redacted]	[redacted]	[redacted]
$PM_{2.5}$	[redacted]	[redacted]	[redacted]
Total	[redacted]	[redacted]	[redacted]

Based on the outputs in Table 3, the total central emissions 'damage costs' (sum of NO_x and $PM_{2.5}$) = [redacted] which is the indicative value of damage caused to society (human health).

[37] https://www.gov.uk/government/statistical-data-sets/local-enterprise-partnerships-leps-rural-urban-gis-shapefiles

8 Consideration of $PM_{2.5}$

In terms of how $PM_{2.5}$ has influenced the selection of the Site, the DEFRA background $PM_{2.5}$ concentration at the Site in the assessment year (2025) is 5.9µg/m^3 and drops to 5.5 µg/m^3 in the opening year (2031). Background concentrations of $PM_{2.5}$ within the Site are therefore below the annual mean concentration target of 10µg/m^3 which is to be achieved by 2040.

Furthermore, traffic movements resulting from the Proposed Development have been assessed through dispersion modelling. The maximum predicted $PM_{2.5}$ concentration is 13 µg/m^3, which is above the AMCT. However, as discussed in section 6.1.5, this concentration is also predicted within the DM scenario. Furthermore, the dispersion modelling has been based on a conservative approach whereby background concentrations are held at 2023. If the 2031 Defra background concentrations were utilised, predicted concentrations would be below the AMCT.

The proposed energy strategy is unknown at this stage but will not comprise any combustions sources. It is likely to utilise measures such as Air Source Heat Pumps and Photovoltaic Panels.

On this basis, there are considered to be no significant sources of $PM_{2.5}$ emissions or precursors from the Proposed Development.

9 Mitigation Measures

9.1 Construction Phase

The qualitative construction dust risk assessment shows that the works are **Medium Risk** for adverse impacts during construction, in the absence of mitigation.

To effectively reduce the risk of impacts to Negligible, appropriate mitigation measures should be adopted. The IAQM's highly recommended mitigation measures for Medium-Risk sites are provided at Appendix E of this report. Implementing these measures, such as within a Construction Environment Management Plan (CEMP), should effectively reduce the risk of impacts to Negligible during the construction phase.

9.2 Operational Phase

9.2.1 Electric Vehicle Charging Infrastructure

Electric vehicle charging points for residential dwellings should be provided in line with the UK Government's Approved Document Part S (Adopted 2022)[38].

9.2.2 Travel Plan Measures

The measures outlined in the Travel Plan (TP), Calibro, will seek to encourage sustainable modes of transport and discourage the use of car travel, such as;

- Appoint Travel Plan Coordinators
- Disincentivise car travel
- Initiatives to promote walking and cycling;
- Initiatives to promote public transport
- Initiatives to promote smarter driving and car sharing
- Community website

These measures provide an opportunity to promote and establish sustainable modes of transport which will help to reduce potential air quality impacts.

9.2.3 Sussex Guidance Mitigation Measures

The following measures are not an exhaustive list nor in order of preference:

[38] The Building Regulations 2010, Approved Document S: Infrastructure for the charging of electric vehicles, HM Government, 15 June 2022.

Table 19: Sussex Mitigation Measures

Residential Measures
Invest in EV charging infrastructure within the development over and above the current recommended parking standards
Provide vouchers for alternatives to private car use
Provide public transport subsidy for residents
Set up a car club within the development or contribute to the cost of a local car club
Set up or join an existing car sharing scheme for residents
Designate parking spaces for car club/car sharing vehicles
Designate parking spaces for low emission vehicles
Provide electric bikes
Improve cycle paths to link to the existing local cycle network
Provide secure cycle storage
Invest in additional evergreen infrastructure to reduce particulates and other pollutants
Additional Mitigation
Contribute to local low or zero emission vehicle refuelling/recharging infrastructure
Contribute to low emission bus service provision or waste collection services
Contribute to local bike/e-bike hire schemes
Contribute to renewable fuel and energy generation projects
Fund incentives for the take-up of low emission technologies and fuels

It is recognised that the LPA "*recommend that the emission mitigation statement contain itemised costing for each proposed mitigation option and total value of all proposed emissions' mitigation. This should be equal to the value from Emissions calculation and total calculated value of emissions' health damage cost."* However, as the planning application is at outline stage, detailed design of the Proposed Development is not currently known. It is therefore recommended that mitigation options equal to the value of the emissions calculation are determined at reserved matters stage. This could be secured through a planning condition.

10 Discussion and Conclusion

Stantec were commissioned by Thakeham Tiles Ltd to prepare an AQA for a residential development at Thakeham Tiles, Storrington.

Modelled UK-AIR background concentrations, and local air quality monitoring data have been used to establish baseline air quality at the Site and surrounding locale. Predicted background concentrations of NO_2, PM_{10} and $PM_{2.5}$ at the Site and surrounding locale are all below the relevant AQALs. Local air quality monitoring has shown no exceedances of the annual mean AQAL for NO_2 in recent years, except for one diffusion tube in 2019, diffusion tube 47. Furthermore, measured concentrations of PM_{10} and $PM_{2.5}$ in Storrington have been below the relevant AQALs.

A qualitative construction dust risk assessment has been undertaken in line with IAQM guidance[17]. Through implementation of appropriate mitigation measures as outlined at Appendix E of this report, it is expected that the release of dust would be effectively controlled and mitigated, with residual effects considered to be 'not significant'. All dust impacts would be temporary and short-term in nature.

At the request of the EHO, a detailed assessment of traffic related impacts has been undertaken to assess the significance of potential impacts of the Proposed Development on local air quality. The modelling assessment has shown that the impact of the Proposed Development on local air quality, including within the Horsham AQMA is Negligible for NO_2, PM_{10} and $PM_{2.5}$. No exceedances of the relevant AQALs were identified. As such, the overall effect arising from change in operational phase trips is 'not significant'.

In line with HDC local guidance, the total emission 'damage costs' of the Proposed Development (sum of NO_x and $PM_{2.5}$ emissions) have been calculated as based on the Proposed Development generated traffic. Using Defra's Air Quality Appraisal Damage Costs Toolkit, the emissions generated have been applied to the damage costs spreadsheet resulting in the indicative sum of £14,705. This is the indicative value of a package of air quality mitigation measures to offset the real-world impact of emissions from the Site.

From the evidence presented, the Proposed Development is expected to comply with all relevant air quality policy. As such, air quality should not pose any significant obstacles to the planning process.

Appendix A Traffic Data

The traffic data, comprising AADT flows is shown in below in Table 20. A Temrpo factor was applied to obtain the opening year traffic flows (DM and DS scenarios), which accounts for local growth. Data was sourced for the following scenarios based on 2025 traffic surveys:

- 2023 Baseline
- 2031 DM (including relevant committed developments); and
- 2031 DS (this scenario includes generated traffic associated with the Proposed Development).

Table 20: Traffic Data

Road Link		Speed (kph)	2023 Verification		2031 DM		2031 DS	
			Total AADT	HDV AADT	Total AADT	HDV AADT	Total AADT	HDV AADT
L1	High Street	48	20374	2.9%	21790	2.8%	21844	2.8%
L2	A283	48	16411	2.8%	17677	2.7%	17671	2.7%
L3	B2139	48	6223	2.8%	6878	2.7%	6926	2.5%
L4	Fryern Road	48	2572	3.3%	3085	2.9%	3079	2.8%
L5	B2319 (W)	48	7705	2.8%	8350	2.7%	8433	2.5%
L6	B2319 (W)	48	7959	2.8%	8560	2.7%	8641	2.0%
L7	Storrington Road B2139 (N)	48	3898	3.0%	4200	2.9%	4253	2.9%
L8	Rock Road West	48	2499	4.2%	2704	4.1%	2836	2.1%
L9	Rock Road East	64	2463	3.9%	2666	3.9%	2871	3.0%
L10	Water Lane (N)	48	4014	2.8%	4285	2.8%	4349	2.5%

Appendix B Windrose

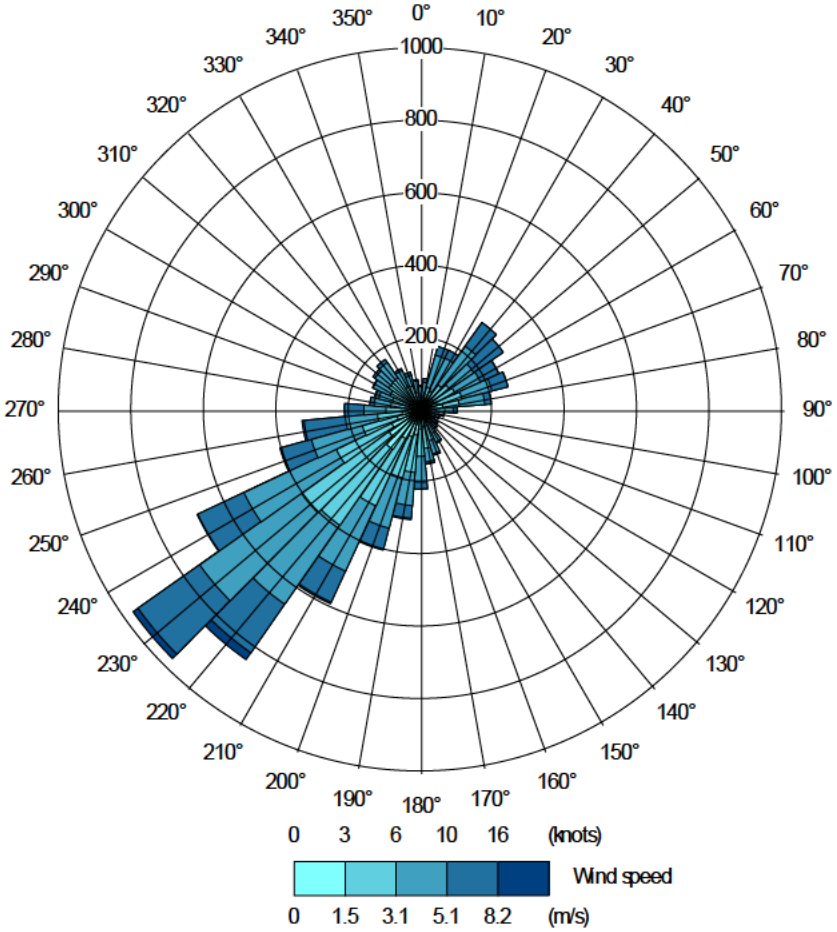

Figure 7 Wind Rose Gatwick Airport 2023[39]

- Data capture for wind speed: 99.6 %
- Data capture for wind direction: 98.7%
- Data capture for temperature: 99.6%
- Data capture for cloud cover: 98.6 %

[39] Missing data infilled with data from Charlwood Meteorological site

Appendix C Model Verification

An important stage in the modelling process is model verification, which involves comparing the model output with measured concentrations in order to increase confidence in modelled predictions.

According to LAQM.TG (22), the difference between modelled results and monitored concentrations is acceptable where it is within 25% and ideal where it is within 10%.

Monitoring Locations used for Verification

The following monitoring locations were selected for model verification due to being representative of the study area, available traffic data and having more than 85% data collection for 2023:

- 40
- 39
- 15
- 13
- HO4
- 16
- 17
- 32, and
- 33.

Model Verification

It is most appropriate to verify the model in terms of primary pollutant emissions of nitrogen oxides (NO_x = NO + NO_2). The model output of road-NO_x (i.e., the component of total NO_x coming from road traffic) has been compared with the 'measured' road-NO_x. Measured road-NO_x has been calculated from the measured NO_2 concentrations using the NOx from NO_2 calculator (Version 9.1) available on the Defra LAQM Support website[30].

A comparison of modelled and monitored concentrations prior to adjustment are given in Table 21.

Table 21: 2023 Modelled and Monitored Concentrations Before Adjustment

Monitoring ID	Modelled Road NO_x ($\mu g/m^3$)	Monitored Road NO_x ($\mu g/m^3$)	Ratio Monitored/ Modelled	Modelled Total NO_2 ($\mu g/m^3$)	Monitored Total NO_2 ($\mu g/m^3$)	Difference (%)
40	8.1	13.8	1.7	12.1	15	-18
39	7.4	20.1	2.7	11.8	18	-33
15	14.6	30.5	2.1	15.1	22	-31
13	21.6	61.5	2.8	18.1	33	-45
HO4	5.2	19.9	3.8	10.7	17	-38
16	9.6	37.4	3.9	12.8	25	-48
17	10.2	24.1	2.4	13.1	19	-32
32	18.2	28.8	1.6	16.7	21	-21
33	9.1	28.3	3.1	12.5	21	-40

As shown, the model was underpredicting concentrations of NO_x at all diffusion tubes. As such, an adjustment factor of **2.259** has been determined, as the equation of the slope of the best-fit line between the 'measured' road contribution and the model derived road contribution of NO_x, as shown below:

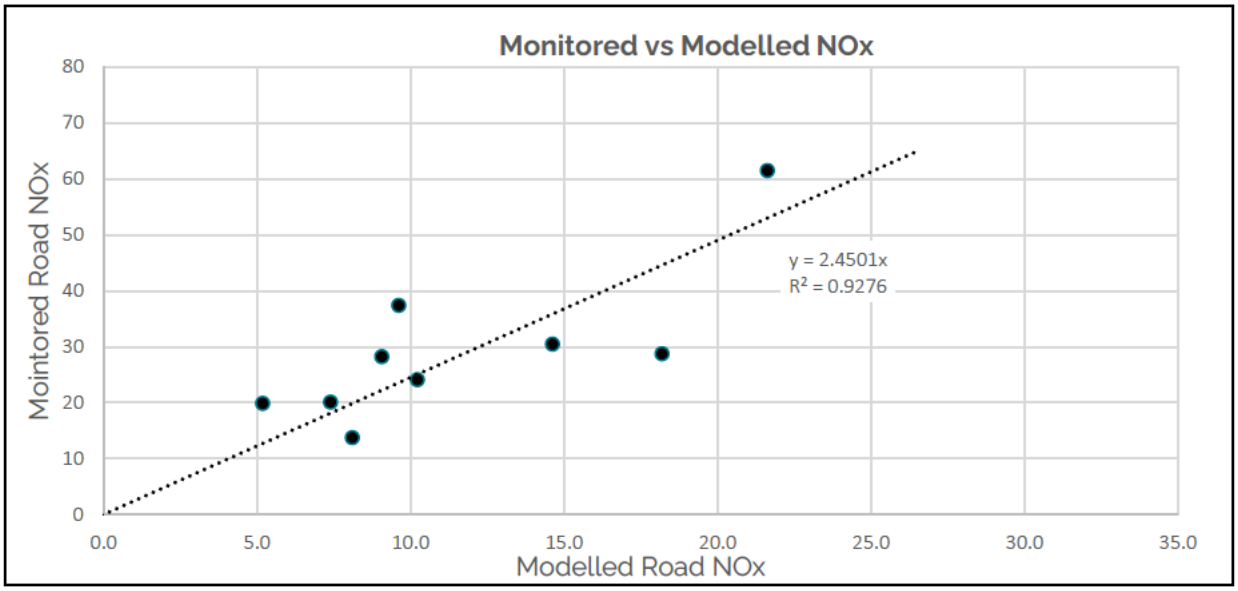

Figure 8: Model Adjustment Factor

Table 22 shows total monitored versus modelled NO_2 following the adjustment of the road contribution of NO_x by this factor. The total NO_2 concentration was determined by adding the calculated background NO_2 concentration to the modelled road contribution.

Table 22: Post-adjusted 2023 Modelled and monitored results

Monitoring ID	Adjusted Modelled NO_2 ($\mu g/m^3$)	Monitored NO_2 ($\mu g/m^3$)	Difference (%)
40	17.4	14.7	18%
39	16.6	17.5	-5%
15	23.9	21.8	10%
13	30.1	32.9	-9%
HO4	14.2	17.4	-18%
16	19.0	24.5	-23%
17	19.6	19.2	2%
32	27.2	21.1	29%
33	18.4	20.9	-12%

Following adjustment of NO_x by a factor of **2.450**, the majority of modelled concentrations of NO_2, at eight of the nine modelled monitoring locations, were within the acceptable range +/-25% range of monitored concentrations:

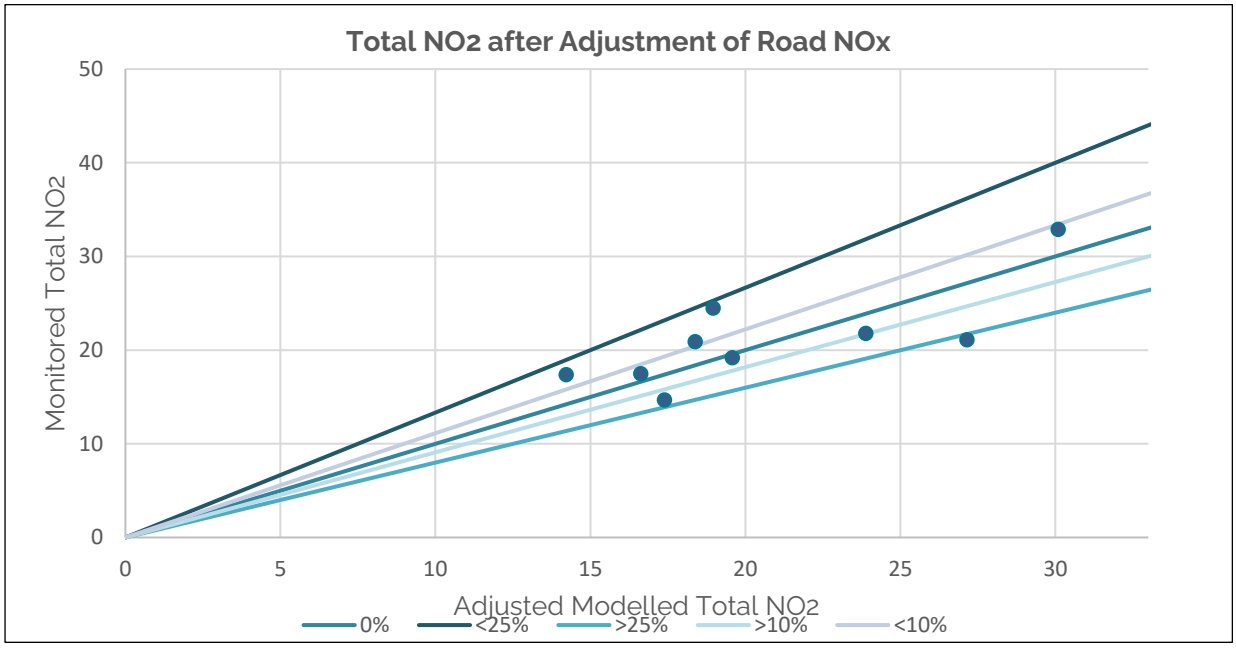

Figure 9: Post-adjusted Monitored vs Modelled NO_2

In addition, the overall post-adjusted uncertainty (RMSE) for annual mean NO_2 was 8.5%, which is within ideal 10% range of uncertainty. As such, the factor was considered to be acceptable.

PM_{10} and $PM_{2.5}$ monitoring is undertaken at automatic monitor HO4. However, give only one monitoring site is available for PM verification it was deemed more robust to apply the NO_2 adjustment factor to PM_{10} and $PM_{2.5}$ model results as this has been calculated utilising several monitoring sites across the study area.

Appendix D Background Concentrations

Receptor	X Coordinate	Y Coordinate	NO_2 Background ($\mu g/m^3$)	PM_{10} Background ($\mu g/m^3$)	$PM_{2.5}$ Background ($\mu g/m^3$)
R01	318500	672500	8.2	10.1	6.0
R02	318500	671500	8.2	10.1	6.0
R03	318500	672500	8.2	10.1	6.0
R04	318500	672500	8.2	10.1	6.0
R05	318500	672500	8.2	10.1	6.2
R06	318500	672500	8.2	10.1	6.2
R07	318500	672500	8.2	10.1	6.2
R08	319500	672500	8.2	10.1	6.2
R09	319500	672500	8.2	10.1	6.2
R10	319500	672500	8.2	10.1	6.3
R11	320500	672500	8.2	10.1	6.3
R12	320500	672500	8.2	10.1	6.3
R13	319500	672500	8.2	10.1	6.3
R14	320500	672500	8.2	10.1	6.3
R15	320500	672500	8.2	10.1	6.3
R16	320500	672500	8.2	10.1	6.3
R17	320500	672500	8.2	10.1	6.3
R18	320500	672500	8.2	10.1	6.3
40	319500	672500	8.2	10.1	6.2
39	319500	672500	8.2	10.1	6.3
15	319500	672500	8.2	10.1	6.3
13	319500	672500	8.2	10.1	6.3
HO4	319500	672500	8.2	10.1	6.2
16	319500	672500	8.2	10.1	6.3
17	319500	672500	8.2	10.1	6.3
32	319500	672500	8.2	10.1	6.3
33	319500	672500	8.2	10.1	6.3

Appendix E Construction Dust Mitigation

In order to mitigate the worst-case dust impacts the following general mitigation measures are highly recommended by the IAQM for Medium Risk construction sites.

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. 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, real time PM_{10} continuous monitoring and/or visual inspections.

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 off-site, and the action taken to resolve the situation in the log book.

Monitoring

- 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.
- 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.

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 actives 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.

Operating vehicle / machinery and sustainable travel

- Ensure all vehicles switch off engines when stationary - no idling vehicles.
- All construction plant and equipment should be maintained in good working order and not left running when not in use.
- Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.

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

Waste management

- No bonfires and burning of waste materials.

Measures Specific to Demolition

- 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

Measures Specific to Earthworks (Desirable)

- Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.
- Use Hessian, mulches or trackifiers 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

Measures Specific to 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.

Measures Specific to 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 10 m from receptors where possible.

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