Appendix 10

Borough Council of Kings Lynn & West Norfolk

Air Quality Technical Note – Local Plan Assessment

May 2023

Move Forward with Confidence

BUREAU VERITAS

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Document Control Sheet

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Company Name	Bureau Veritas UK Limited	Borough Council of King's Lynn & West Norfolk
Contact Name	Hannah Broomfield Payne	Claire May
Position	Principal Air Quality Consultant	Planning Policy Manager
Address	5th Floor 66 Prescot Street London E1 8HG	King's Court Chapel Street King's Lynn Norfolk PE30 1EX

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	Name	Job Title	Signature
Prepared By	A Dale	Senior Consultant	
Approved By	H Broomfield-Payne	Principal Consultant	

1 Introduction

Bureau Veritas UK Ltd has been commissioned by the Borough of King's Lynn and West Norfolk ('the Council') to complete a detailed dispersion modelling assessment to inform the Council's New Local Plan for development across the district.

In the Policy E2.1 of the Council's current Local Plan, the West Winch Growth Area (WWGA) has been identified as an appropriate area for growth through the adopted Core Strategy and allocation of at least 1,600 dwellings up to the period 2026. The proposals within the proposed Local Plan are for an additional 2,400 dwellings, to provide a total of up to 4,000 dwellings.

As such, this Technical Note has been produced to provide evidence to inform the Local Plan for the WWGA and to assess the key road links around King's Lynn which have the potential to be affected by traffic emissions associated with the proposed dwellings in the Growth Area. Impacts associated with the construction phase of the scheme have also been assessed using standard screening methodologies.

Reference should be made to **Figure 1.1** below for details of the Site Location.

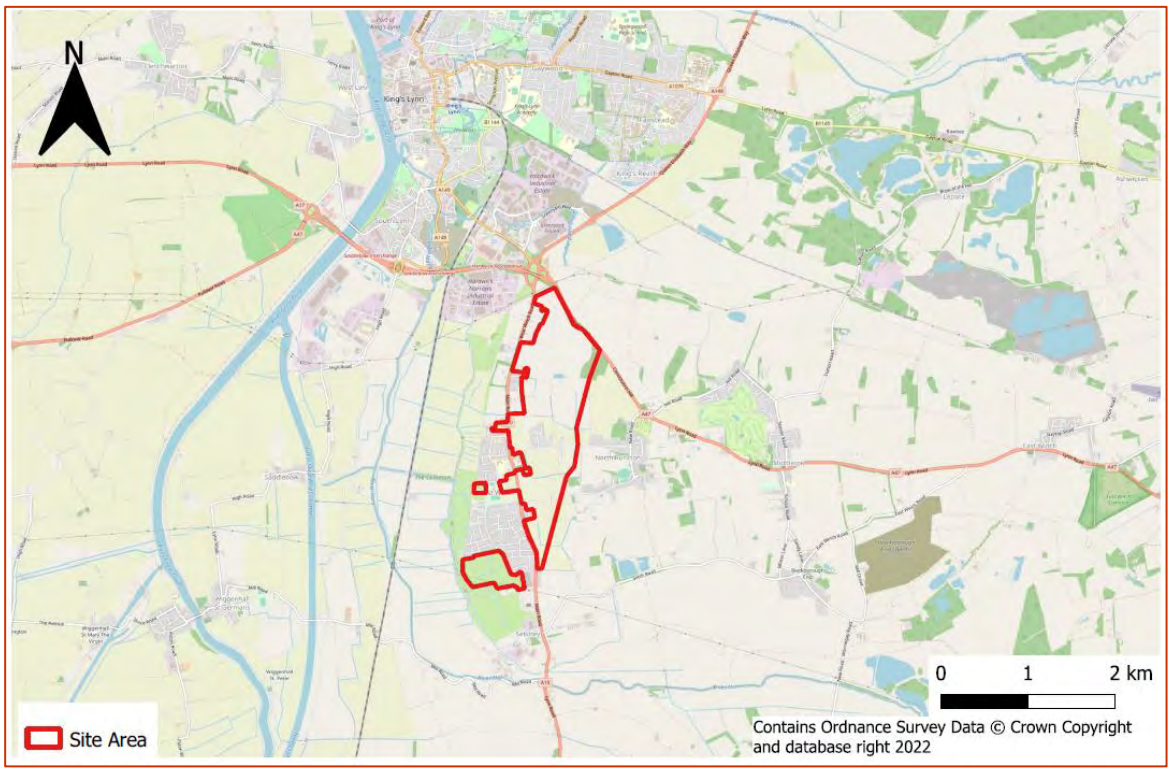

Figure 1.1 – Site Location

1.1 Scope of Assessment

The air quality assessment will assess the impacts upon air pollutant concentrations in the area surrounding the WWGA, during the construction phase and operational phase of the proposed development.

The main aims of the assessment are:

- To assess, qualitatively, the short-term construction dust impacts during the construction phase of the proposed development and review the mitigation measures available to reduce these impacts to an acceptable level (where required);
- To assess, quantitatively, the air quality impacts of the proposed development during the operational phase, including the potential traffic generated from the Site and the existing air quality conditions; and
- To review options for mitigation for the operational phase.

The approach adopted in this assessment to assess the impact of dust and particulates during the construction phase of the proposed development was based on the IAQM Guidance on the Assessment of Dust from Demolition and Construction[1]. The approach adopted to assess the impact of road traffic on air quality was based on the EPUK/IAQM Guidance for Land-Use Planning and Development[2].

The assessment covers both the impact on air quality during the construction phase of the development through the emissions of dust and particulate matter (PM), particularly PM_{10}, as well as the operational phase whereby the development may lead to changes in the existing traffic flow and consequently changes in nitrogen oxide (NOx) and PM emissions to the local area.

The guiding principles for air quality assessments, as set out in the latest guidance provided by Defra for air quality assessment (LAQM.TG(22))[3], have been used.

[1] IAQM (2014). Guidance on the assessment of dust from demolition and construction (v1.1) https://iaqm.co.uk/text/guidance/construction-dust-2014.pdf

[2] Environmental Protection UK (EPUK) and Institute of Air Quality Management (IAQM) (2017). Land-Use Planning & Development Control: Planning for Air Quality (v1.1). http://www.iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf

[3] LAQM Technical Guidance LAQM.TG(22) – August 2022. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.

2 Air Quality – Legislative Context

The Air Quality Standards (AQS) objectives apply at locations outside buildings or other natural or man-made structures above or below ground, where members of the public are regularly present and might reasonably be expected to be exposed to pollutant concentrations over the relevant averaging period. Typically these include residential properties and schools/care homes for long-term (i.e. annual mean) pollutant objectives and high streets for short-term (i.e. 1-hour) pollutant objectives. Table 2.1 taken from LAQM.TG(22)[1] provides examples of such locations that may or may not be relevant for each averaging period.

The AQS objectives, also referred to as Air Quality Objectives (AQO), are presented in Table 2.2.

Table 2.1 - Examples of where the Air Quality Objectives 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 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 objectives would apply, together with hotels Gardens or residential properties[1]	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
1-hour mean	All locations where the annual mean and 24 and 8-hour mean objectives would apply. Kerbside sites (e.g. pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where the public might reasonably be expected to spend one hour or more. Any outdoor locations at which the public may be expected 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 members of the public might reasonably be expected to spend a period of 15 minutes or longer.	

Note [1] For gardens and playgrounds, such locations should represent parts of the garden where relevant public exposure is likely, for example where there is seating or play areas. It is unlikely that relevant public exposure would occur at the extremities of the garden boundary, or in front gardens, although local judgement should always be applied

Table 2.2 - Relevant AQS Objectives for the Assessed Pollutants in England

Pollutant	AQS Objective / AQO	Concentration Measured as:	Date for Achievement
Nitrogen dioxide (NO_2)	200µg/m³ not to be exceeded more than 18 times per year	1-hour mean	31 December 2005
	40µg/m³	Annual mean	31 December 2005
Particles (PM_{10})	50 µg/m³ not to be exceeded more than 35 times a year	24-hour mean	31 December 2004
	40µg/m³	Annual mean	31 December 2004
Particles ($PM_{2.5}$)	20 µg/m³	Annual mean	2020
	10 µg/m³	*Annual mean (35% exposure reduction compared to 2018 levels)*	*31 December 2040*
	12 µg/m³	*Annual mean interim target (22% exposure reduction compared to 2018 levels) as detailed within the Environmental Improvement Plan*	*31 January 2028*

Italics denotes air quality objectives that will come into force in the future.

3 Assessment Methodology

The approach to be applied to this assessment has been based on the following:

- Qualitative assessment of impacts from the proposed development's construction phase on air quality through emission of dust and particulates;
- Quantitative assessment of ambient NO_2, PM_{10} and $PM_{2.5}$ concentrations to which existing receptors may be exposed to upon completion of the development, based on a review of current pollutant concentrations and the expected traffic generated from the development, and comparison with the relevant guidance.

3.1 Construction Phase Dust / PM_{10} Emissions

The assessment of potential dust/PM_{10} effects in relation to the development's construction phase has been undertaken qualitatively in accordance with IAQM Guidance[1]. The guidance proposes a method to assess the significance of construction dust impacts by considering the annoyance due to dust soiling, as well as harm to ecological receptors and the risk of health effects due to significant increases in dust/PM_{10} concentrations.

Construction site activities are divided into four types to reflect their different potential impacts. These activities are:

- Demolition – an activity involved with the removal of an existing structure or structures;
- Earthworks – the processes of soil-stripping, ground-levelling, excavation, and landscaping;
- Construction – an activity involved in the provision of a new structure; and
- Trackout – the transport of dust and dirt from the development site onto the public road network. This arises when lorries leave site with dusty materials or transfer dust and dirt onto the road having travelled over muddy ground on-site.

A detailed assessment is required where a sensitive human receptor is located within 350 m from the development site boundary and/or within 50 m of the route(s) used by vehicles on the public highway, up to 500 m from the development site entrance(s).

The first step of the detailed assessment is to assess the risk of dust impacts. This is undertaken separately for each of the four activities (demolition, earthworks, construction and trackout) and takes account of:

- The scale and nature of the works, which determines the potential dust emission magnitude; and
- The sensitivity of the area.

These factors are combined to give an estimate of the risk of dust impacts occurring. Risks are described in terms of there being a "Low", "Medium" or "High" risk of dust impact for each of the four separate potential activities. Where there are low, medium, or high risks of an impact, then site specific mitigation will be required, proportionate to the level of risk.

Based on the threshold criteria and professional judgment, one or more of the groups of activities may be assigned a "Negligible" risk. Such cases could arise, for example, because the scale is very small and there are no receptors near to the activity.

Site-specific mitigation for each of the four potential activities is then determined based on the risk of dust impacts identified. Where a local authority has issued guidance on measures to be adopted at demolition/construction sites, these should also be taken into account. Professional judgment is

then employed to examine the residual dust effects assuming mitigation to determine whether or not they are significant.

3.2 Operational Phase - Road Traffic Emissions

Atmospheric dispersion modelling using ADMS Roads version 5.0.1.3 has been undertaken to assess the air quality impact resulting from the proposed homes within the WWGA upon existing sensitive locations in the vicinity of the site. Consideration was also made to road traffic emissions within the Town Centre Air Quality Management Area (AQMA) and Gaywood Clock AQMA.

Reference should be made to Figure 3.1 below for details of the AQMAs.

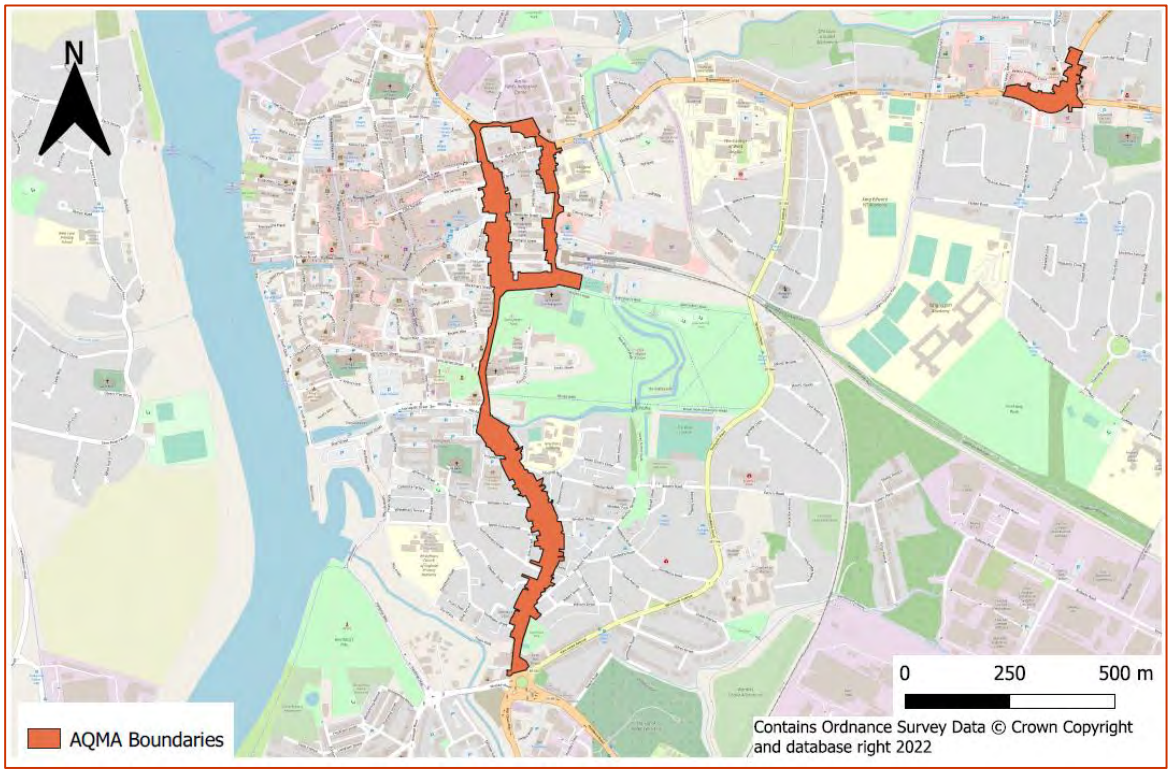

Figure 3.1 – Town Centre AQMA (centre) and Gaywood Clock AQMA (east)

Modelling of traffic derived NO_2, PM_{10} and $PM_{2.5}$ from the surrounding roads, including from the Growth Area, was completed for the following years/scenarios:

- 2018 – Baseline / Model Verification;
- 2039 – Future Do-Minimum (DM) to take into account forecast traffic growth with the existing site use in place; and,
- 2039 – Future Do-Something (DS) to take into account forecast traffic growth and additional traffic generated and/or redistributed, associated with committed developments and the WWGA. The proposed Access Road has also been included as an infrastructure change at the development site.

Reference should be made to Figure 3.2 below for details for the modelled road domain. It should be noted that the assessment has not considered the impact associated with the wider infrastructure changes to the A10 and A47 bordering the site.

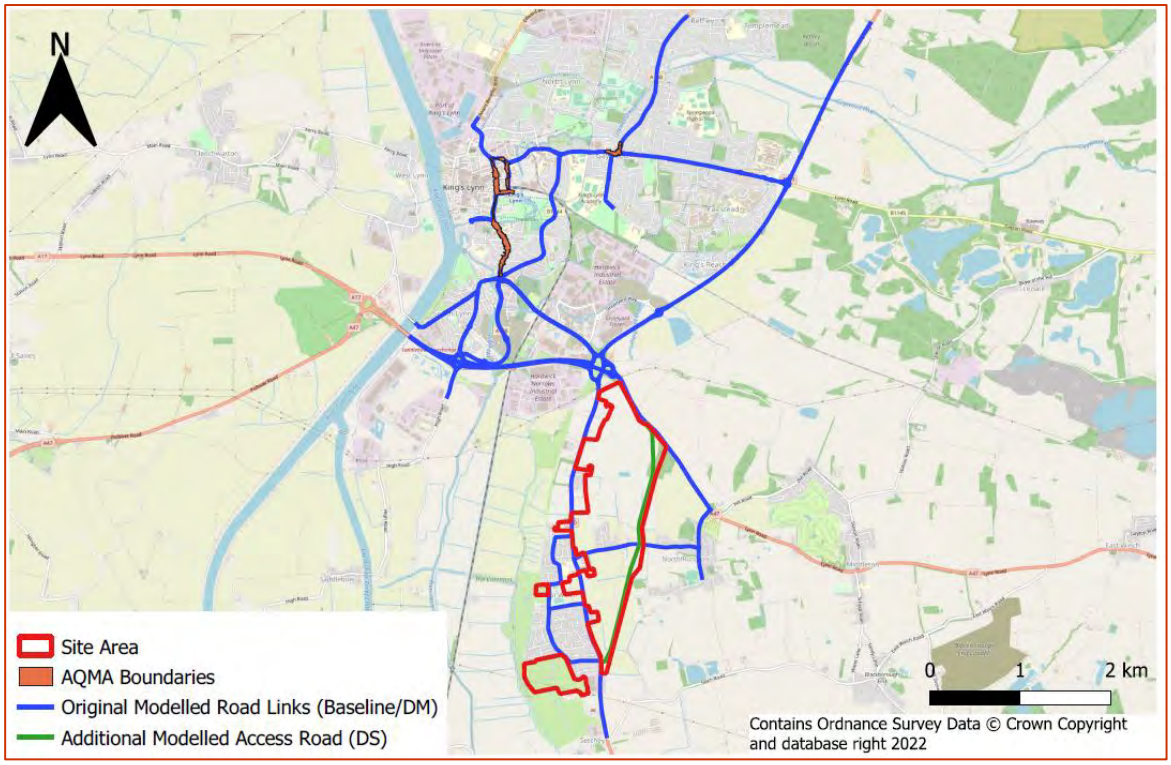

Figure 3.2 - Modelled domain with reference to the additional Access Road in the DS Scenario

A comparison of the two future modelled scenarios will assess the impact of the additional road traffic emissions from the WWGA upon air quality at specified receptor locations across the modelled domain. Reference should be made to Figure 3.3 below and Table 4.4 for details of the receptor locations.

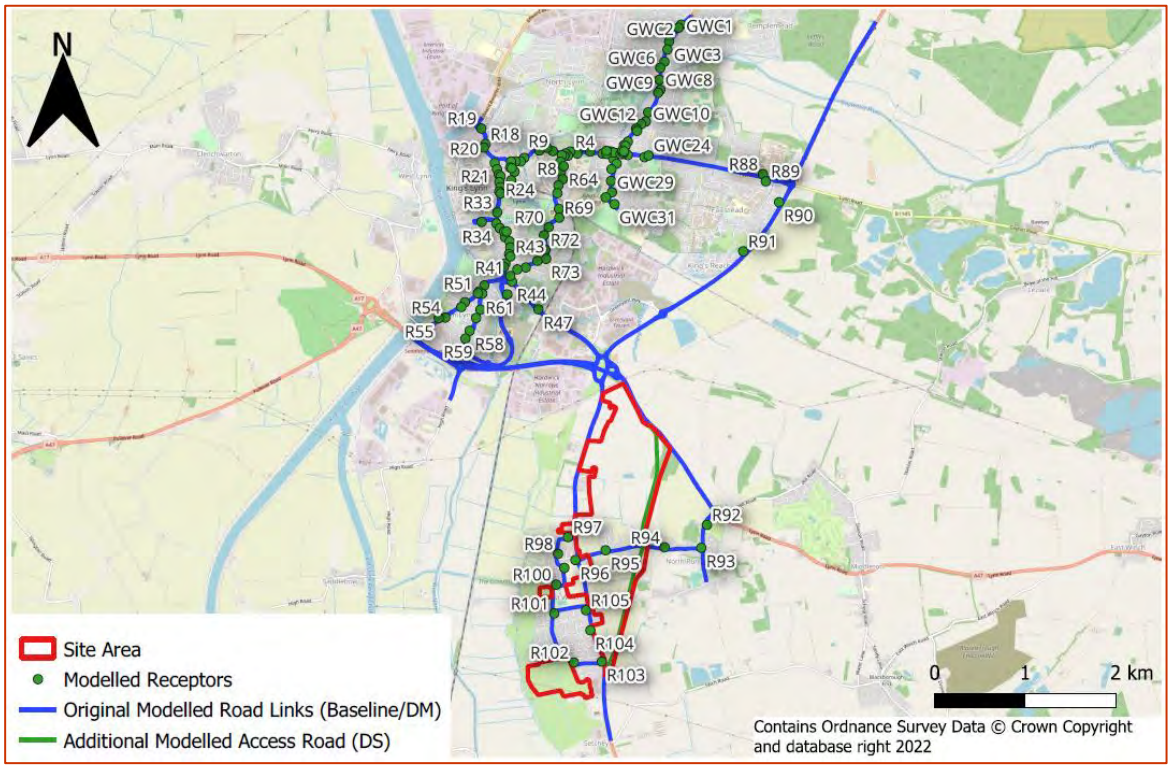

Figure 3.3 Modelled Receptor Locations

The traffic data used for the baseline and DS scenario has been obtained from the traffic consultant, WSP. In the absence of suitable traffic data for the DM scenario, baseline data was uplifted to the relevant assessment year utilising factors obtained from TEMPro. This software package has been developed by the DfT to calculate traffic growth throughout the UK.

Road traffic emissions were obtained from the latest publicly available Emission Factor Toolkit (EFT). Background pollutant concentrations were be determined from the latest pollution maps available from Defra's Local Air Quality Management (LAQM) Support Website. Additionally, local monitoring was be used for model verification.

NO_2, PM_{10} and $PM_{2.5}$ concentrations were predicted at identified existing receptor locations in the vicinity of the development site, adjoining roads and around the two AQMAs.

Meteorological data used in the assessment was from Marham from 2018.

4 Assessment Results

4.1 Construction Phase – Dust/PM_{10} Emissions

This assessment of dust/PM_{10} presents the effects which are likely to be relevant both prior to and following the use of the appropriate mitigation measures on-site. As per the IAQM guidance[1], the risk associated with the site to potentially generate dust/PM_{10} is identified. Potential unmitigated effects at receptor locations are determined, and site-specific recommendations are then made to ensure residual dust/PM_{10} effects associated with the construction phase are not significant.

The assessment of construction dust will focus on dust arising from four dust producing construction activities outlined in the IAQM guidance[1] (demolition, earthworks, construction and trackout).

Demolition

There are no standing building/structures within the development area. No demolition works are proposed to take place as part of this development, therefore impacts associated with demolition have not been considered.

Earthworks

Potential sources of impacts associated with earthworks/ground preparation activities include fugitive dust/PM_{10}/$PM_{2.5}$ emissions resulting from disturbance of dusty materials by construction plant, the construction materials used, vehicle movements and wind action. The total site area is greater than 10,000m^2. The dust emission magnitude for earthworks is therefore considered to be **large**.

Construction

Potential sources of impacts associated with construction activities include fugitive dust/PM_{10} emissions resulting from disturbance of dusty materials by construction plant, the construction materials used, vehicle movements and wind action. Construction activities at the development site will include a total building volume greater than 100,000 m^3. The dust emission magnitude for construction is therefore considered to be **large**.

Trackout

Dust emissions during trackout from the site may occur from the transport of dust and dirt from the construction site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network. The number of predicted outward HDV (i.e., >3.5 tonne) movements in any one day is not likely to be between 10 and 50, and the unpaved on-site road length is likely to be greater than 100 m. This estimation is based on the fact that there are no demolition works planned to take place and the size of the site. The dust emission magnitude for trackout is therefore considered to be **large**.

Summary

A summary of the dust emission magnitude for the three activities is detailed in Table 4.1.

Table 4.1 – Construct Dust Emission Magnitude

Activity	Dust Emission Magnitude
Earthworks	Large
Construction	Large
Trackout	Large

Sensitivity of the Area

There are currently residential properties located near the development on the eastern and western boundaries of the site. There are also commercial buildings and an educational facility on the western boundary of the site. More than 10 residential properties on A10 Main Road are located less than 20 m from the main road within 200 m from the Site entrance. The sensitivity of the area with respect to dust soiling effects on people and property is **high** in relation to earthworks, construction and trackout.

The existing background PM_{10} concentration is 9.0 µg/m^3, which is well below the annual objective of 40 µg/m^3. Given the above information regarding the closest receptors within site, the sensitivity of the area with respect to human health impacts in relation to construction and trackout is therefore **low**.

Ecological receptors are defined in accordance with IAQM methodology[1], which namely consider areas protected by legislation, such as Sites of Special Scientific Interest, Special Protected Areas and Special Areas of Conservation. There are no nearby ecologically sensitive protected areas within 1 km of the development site. Therefore, the sensitivity of ecological receptors has been classified as '**Not Applicable**' due to there being no nearby sensitive ecological receptors within 50m of the Site.

A summary of the sensitivity of the surrounding area is detailed in Table 4.4.

Table 4.2 – Sensitivity of Surrounding Area

Potential Impact	Sensitivity Of The Surrounding Area		
	Earthworks	Construction	Trackout
Dust Soiling	High	High	High
Human Health	Low	Low	Low
Ecological	N/A	N/A	N/A

Risk of Dust Impacts

The risk of dust impacts is defined using Tables 7, 8 and 9 in the IAQM guidance for demolition, earthworks, construction and trackout respectively. The dust emission magnitude classes in Table 4.1 combined with the sensitivity of surrounding area classes in Table 4.2, result in the development site risk categories as shown in Table 4.3.

Table 4.3 – Construct Dust Emission Magnitude

Potential Impact	Risk		
	Earthworks	Construction	Trackout
Dust Soiling	High	High	High
Human Health	Low Risk	Low	Low
Ecological	N/A	N/A	N/A

Following the construction dust assessment, the development site is found to be **high risk** in relation to dust soiling effects on people and property, and **low risk** to human health impacts and ecological impacts. However, providing effective mitigation measures are implemented, such as those outlined in Short-term Impacts during Construction – Dust / PM_{10} Emissions , it is anticipated that construction dust impacts will be **not significant**.

4.2 Operational Phase – Road Traffic Emissions

This assessment has considered emissions of PM_{10} and $PM_{2.5}$, and NO_x/NO_2 from road traffic and the associated impact on NO_2 concentrations at existing receptor locations and across a generic

output grid. It was found that no existing receptor locations across both AQMA model domains predicted exceedances in the DM or the DS scenarios.

Nitrogen Dioxide (NO_2)

Table 4.4 presents the predicted NO_2 concentrations at all modelled receptors for each scenario and the percentage change relative to the AQS. There were no exceedances of the annual mean NO_2 AQS Objective (40µg/m^3) in either the DM or DS scenarios, although two receptors reported within 10% of the objective in the DS scenario. These receptors (R22 - 38.0µg/m^3 and R35 – 39.4µg/m^3) are located in the Town Centre AQMA, near junctions on Railway Road and London Road, respectively.

Table 4.4 – Predicted NO_2 concentrations at all Receptors for DM and DS Scenarios

Receptor ID	Location	OS Grid X	OS Grid Y	Height (m)	AQS (µg/m^3)	Annual Mean NO_2 (µg/m^3)		% Change relative to AQS
						DM 2039	DS 2039	
GWC1	Gaywood Clock	564065	321920	1.5	40	14.9	15.3	1.0%
GWC2	Gaywood Clock	564037	321885	1.5	40	14.7	15.1	1.0%
GWC3	Gaywood Clock	563938	321731	1.5	40	19.2	19.8	1.3%
GWC4	Gaywood Clock	563923	321642	1.5	40	15.3	15.7	1.0%
GWC5	Gaywood Clock	563894	321506	1.5	40	14.5	14.9	0.9%
GWC6	Gaywood Clock	563850	321437	1.5	40	16.1	16.5	1.1%
GWC7	Gaywood Clock	563846	321306	1.5	40	18.2	18.7	1.3%
GWC8	Gaywood Clock	563859	321196	1.5	40	17.4	17.9	1.2%
GWC9	Gaywood Clock	563836	321163	1.5	40	17.9	18.4	1.3%
GWC10	Gaywood Clock	563733	320943	1.5	40	17.1	17.5	1.2%
GWC11	Gaywood Clock	563711	320842	1.5	40	15.7	16.1	1.1%
GWC12	Gaywood Clock	563661	320811	1.5	40	17.7	18.2	1.3%
GWC13	Gaywood Clock	563607	320760	1.5	40	17.1	17.6	1.3%
GWC14	Gaywood Clock	563618	320736	1.5	40	15.9	16.3	1.2%
GWC15	Gaywood Clock	563520	320614	1.5	40	16.3	16.8	1.2%
GWC16	Gaywood Clock	563478	320572	1.5	40	21.3	22.0	1.7%
GWC17	Gaywood Clock	563496	320566	1.5	40	19.0	19.6	1.5%
GWC18	Gaywood Clock	563325	320468	1.5	40	20.3	20.5	0.5%
GWC19	Gaywood Clock	563396	320482	3.5	40	21.7	21.9	0.6%
GWC20	Gaywood Clock	563245	320473	1.5	40	19.9	20.1	0.5%
GWC21	Gaywood Clock	563496	320491	1.5	40	25.2	26.3	2.8%
GWC22	Gaywood Clock	563524	320466	1.5	40	20.8	21.8	2.4%
GWC23	Gaywood Clock	563709	320449	1.5	40	15.2	15.9	1.6%
GWC24	Gaywood Clock	563754	320469	1.5	40	20.7	21.8	2.6%
GWC25	Gaywood Clock	563367	320417	1.5	40	17.7	18.0	0.6%
GWC26	Gaywood Clock	563405	320367	1.5	40	14.7	15.0	0.7%
GWC27	Gaywood Clock	563350	320305	1.5	40	15.2	15.5	0.6%
GWC28	Gaywood Clock	563349	320175	1.5	40	17.3	17.6	0.6%
GWC29	Gaywood Clock	563363	320051	1.5	40	14.5	14.7	0.7%
GWC30	Gaywood Clock	563297	319993	1.5	40	13.7	14.0	0.8%
GWC31	Gaywood Clock	563396	319922	1.5	40	15.9	16.2	0.7%
GWC32	Gaywood Clock	563323	320499	3.5	40	21.3	21.5	0.5%
GWC33	Gaywood Clock	563342	320496	3.5	40	21.0	21.2	0.5%
GWC34	Gaywood Clock	563367	320489	3.5	40	20.8	21.1	0.6%
GWC35	Gaywood Clock	563288	320471	3.5	40	17.1	17.4	0.6%
GWC36	Gaywood Clock	563287	320505	3.5	40	20.3	20.5	0.5%
GWC37	Gaywood Clock	563470	320475	1.5	40	29.1	30.0	2.2%
GWC38	Gaywood Clock	563476	320492	3.5	40	23.7	24.5	2.1%
GWC39	Gaywood Clock	563444	320475	1.5	40	30.8	31.1	0.9%

Receptor ID	Location	OS Grid X	OS Grid Y	Height (m)	AQS ($\mu g/m^3$)	Annual Mean NO_2 ($\mu g/m^3$)		% Change relative to AQS
						DM 2039	DS 2039	
GWC40	Gaywood Clock	563478	320499	3.5	40	22.5	23.3	2.0%
GWC41	Gaywood Clock	563461	320499	1.5	40	32.2	24.8	-18.6%
GWC42	Gaywood Clock	563463	320515	1.5	40	27.9	23.0	-12.2%
GWC43	Gaywood Clock	563481	320506	1.5	40	25.4	22.0	-8.6%
R1	Town Centre	563108	320491	1.5	40	22.8	23.0	0.5%
R2	Town Centre	562971	320498	1.5	40	19.5	19.8	0.6%
R3	Town Centre	562967	320464	1.5	40	19.0	19.2	0.6%
R4	Town Centre	562888	320484	1.5	40	19.7	19.9	0.7%
R5	Town Centre	562864	320437	1.5	40	18.5	18.8	0.9%
R6	Town Centre	562835	320461	1.5	40	22.7	23.1	1.0%
R7	Town Centre	562822	320432	1.5	40	24.5	25.4	2.3%
R8	Town Centre	562796	320439	1.5	40	23.0	23.8	2.0%
R9	Town Centre	562696	320481	1.5	40	17.8	18.1	0.7%
R10	Town Centre	562631	320515	1.5	40	17.3	17.5	0.6%
R11	Town Centre	562547	320483	1.5	40	17.8	18.0	0.6%
R12	Town Centre	562382	320396	1.5	40	19.8	20.0	0.6%
R13	Town Centre	562345	320356	1.5	40	18.9	19.2	0.6%
R14	Town Centre	562281	320241	1.5	40	17.1	17.5	1.1%
R15	Town Centre	562290	320354	1.5	40	24.9	25.2	0.6%
R16	Town Centre	562244	320311	1.5	40	28.3	28.6	0.7%
R17	Town Centre	562238	320352	1.5	40	25.4	25.7	0.7%
R18	Town Centre	561951	320536	1.5	40	21.1	21.5	1.0%
R19	Town Centre	561898	320705	1.5	40	16.4	16.7	0.7%
R20	Town Centre	561933	320495	1.5	40	20.4	20.8	0.9%
R21	Town Centre	562058	320330	1.5	40	21.1	21.6	1.2%
R22	Town Centre	562086	320262	1.5	40	37.6	38.0	1.1%
R23	Town Centre	562108	320203	1.5	40	29.1	29.6	1.1%
R24	Town Centre	562128	320186	1.5	40	24.5	24.9	1.1%
R25	Town Centre	562116	320122	1.5	40	30.1	30.6	1.2%
R26	Town Centre	562130	320066	1.5	40	28.4	29.0	1.4%
R27	Town Centre	562118	320018	1.5	40	31.5	32.3	1.9%
R28	Town Centre	562231	320286	1.5	40	30.8	31.1	0.9%
R29	Town Centre	562249	320280	1.5	40	23.8	24.3	1.1%
R30	Town Centre	562133	319997	1.5	40	30.7	31.9	3.1%
R31	Town Centre	562247	320145	1.5	40	27.4	28.0	1.6%
R32	Town Centre	562225	320008	1.5	40	26.0	26.7	1.8%
R33	Town Centre	562104	319787	1.5	40	26.9	29.1	5.6%
R34	Town Centre	562099	319666	1.5	40	24.6	26.9	5.9%
R35	Town Centre	562138	319615	1.5	40	35.6	39.4	9.5%
R36	Town Centre	562200	319517	1.5	40	24.0	26.5	6.4%
R37	Town Centre	562252	319473	1.5	40	31.9	35.6	9.4%
R38	Town Centre	562262	319406	1.5	40	31.8	35.5	9.2%
R39	Town Centre	562187	319580	1.5	40	31.5	34.9	8.3%
R40	Town Centre	562214	319581	1.5	40	19.1	20.7	4.2%
R41	Town Centre	562251	319333	1.5	40	27.6	30.5	7.4%
R42	Town Centre	562213	319229	1.5	40	32.0	35.5	8.7%
R43	Town Centre	562266	319308	1.5	40	28.0	31.1	7.8%
R44	Town Centre	562293	319031	1.5	40	26.4	29.9	8.8%
R45	Town Centre	562197	319190	1.5	40	27.7	30.6	7.3%
R46	Town Centre	562418	318927	1.5	40	25.1	28.5	8.6%
R47	Town Centre	562595	318737	1.5	40	25.2	28.6	8.6%
R48	Town Centre	561988	318979	1.5	40	19.3	20.1	2.1%
R49	Town Centre	561933	318911	1.5	40	20.3	21.1	2.1%

Receptor ID	Location	OS Grid X	OS Grid Y	Height (m)	AQS (µg/m^3)	Annual Mean NO_2 (µg/m^3)		% Change relative to AQS
						DM 2039	DS 2039	
R50	Town Centre	561968	318888	1.5	40	20.1	21.0	2.3%
R51	Town Centre	561920	318891	1.5	40	22.5	23.3	2.1%
R52	Town Centre	561780	318788	1.5	40	18.6	19.3	1.7%
R53	Town Centre	561742	318733	1.5	40	17.0	17.7	1.7%
R54	Town Centre	561569	318611	1.5	40	17.1	17.8	1.7%
R55	Town Centre	561498	318602	1.5	40	16.1	16.7	1.7%
R56	Town Centre	561955	318711	1.5	40	18.2	19.2	2.5%
R57	Town Centre	561910	318618	1.5	40	18.2	19.2	2.4%
R58	Town Centre	561844	318475	1.5	40	18.9	19.9	2.6%
R59	Town Centre	561799	318387	1.5	40	18.2	19.3	2.7%
R60	Town Centre	561936	319676	1.5	40	13.1	14.1	2.4%
R61	Town Centre	562246	318889	1.5	40	15.8	17.4	4.0%
R62	Town Centre	562782	320368	1.5	40	15.6	16.3	1.8%
R63	Town Centre	562792	320258	1.5	40	17.4	18.5	2.7%
R64	Town Centre	562821	320320	1.5	40	17.1	18.1	2.5%
R65	Town Centre	562815	320176	1.5	40	16.6	17.6	2.5%
R66	Town Centre	562770	320107	1.5	40	17.9	19.1	3.0%
R67	Town Centre	562761	320021	1.5	40	17.2	18.3	2.8%
R68	Town Centre	562784	319850	1.5	40	17.0	18.2	2.9%
R69	Town Centre	562791	319751	1.5	40	15.9	16.9	2.6%
R70	Town Centre	562678	319644	1.5	40	16.9	18.1	3.0%
R71	Town Centre	562629	319553	1.5	40	17.9	19.4	3.7%
R72	Town Centre	562650	319395	1.5	40	17.4	19.3	4.8%
R73	Town Centre	562661	319295	1.5	40	16.4	18.1	4.2%
R74	Town Centre	562566	319269	1.5	40	19.1	21.5	5.8%
R75	Town Centre	562440	319192	1.5	40	17.7	19.7	4.9%
R76	Town Centre	562347	319168	1.5	40	20.1	22.6	6.1%
R77	Town Centre	562272	319093	1.5	40	21.8	24.5	6.7%
R88	Queen Elizabeth Hospital	565024	320306	1.5	40	13.7	14.4	1.9%
R89	Gayton Road	565057	320229	1.5	40	12.9	13.6	1.8%
R90	Queen Elizabeth Way	565211	320004	1.5	40	16.9	18.9	5.1%
R91	Queen Elizabeth Way	564834	319450	1.5	40	16.1	18.2	5.1%
R92	New Road	564536	316428	1.5	40	8.0	9.4	3.5%
R93	New Road	564481	316172	1.5	40	8.4	9.9	3.9%
R94	Rectory Lane	564077	316164	1.5	40	7.4	9.6	5.4%
R95	Rectory Lane	563425	316110	1.5	40	8.4	10.1	4.2%
R96	Main Road	563096	315991	1.5	40	16.3	13.3	-7.4%
R97	Chapel Lane	563005	316241	1.5	40	11.6	11.5	-0.3%
R98	Back Lane	562901	316052	1.5	40	9.1	9.6	1.2%
R99	Back Lane	562976	315900	1.5	40	9.3	9.6	0.8%
R100	Watering Lane	562893	315713	1.5	40	8.6	9.3	1.8%
R101	Hall Lane	562882	315396	1.5	40	8.2	8.9	1.7%
R102	Gravehill Lane	563116	314863	1.5	40	8.0	8.7	1.7%
R103	Gravehill Lane	563425	314882	1.5	40	16.9	17.8	2.1%
R104	Main Road	563287	315223	1.5	40	18.7	13.9	-11.9%
R105	Main Road	563231	315443	1.5	40	16.6	12.8	-9.4%

The greatest concentration change associated with implementing the WWGA is predicted to be at R35 and R37, located on London Road, within the Town Centre AQMA boundary. An increase of 3.8µg/m^3 is predicted at this location. Although most receptor locations are predicted to have increased NO_2 concentrations associated with the WWGA, improvements in concentrations were noted at receptors in the Gaywood Clock AQMA.

Particulate Matter (PM_{10})

Table 4.5 presents the predicted PM_{10} concentrations at all modelled receptors for each scenario and the percentage change relative to the AQS. There were no exceedances of the annual mean PM_{10} AQS Objective (40µg/m^3) in either the DM or DS scenario. The greatest concentration reported in the DS scenario was 20.3µg/m^3, which is well below the AQS Objective of 40µg/m^3. This is reported at R35, located in the Town Centre AQMA near a junction on London Road.

Table 4.5 - Predicted PM_{10} concentrations at all Receptors for DM and DS Scenarios

Receptor ID	Location	OS Grid X	OS Grid Y	Height (m)	AQS (µg/m^3)	Annual Mean PM_{10} (µg/m^3)		% Change relative to AQS
						DM 2039	DS 2039	
GWC1	Gaywood Clock	564065	321920	1.5	40	15.4	15.5	0.2%
GWC2	Gaywood Clock	564037	321885	1.5	40	15.4	15.5	0.2%
GWC3	Gaywood Clock	563938	321731	1.5	40	16.2	16.3	0.3%
GWC4	Gaywood Clock	563923	321642	1.5	40	15.4	15.5	0.2%
GWC5	Gaywood Clock	563894	321506	1.5	40	15.3	15.3	0.2%
GWC6	Gaywood Clock	563850	321437	1.5	40	15.6	15.7	0.2%
GWC7	Gaywood Clock	563846	321306	1.5	40	16.0	16.1	0.2%
GWC8	Gaywood Clock	563859	321196	1.5	40	15.8	15.9	0.2%
GWC9	Gaywood Clock	563836	321163	1.5	40	16.0	16.0	0.2%
GWC10	Gaywood Clock	563733	320943	1.5	40	15.6	15.7	0.2%
GWC11	Gaywood Clock	563711	320842	1.5	40	15.3	15.4	0.2%
GWC12	Gaywood Clock	563661	320811	1.5	40	15.7	15.8	0.2%
GWC13	Gaywood Clock	563607	320760	1.5	40	15.6	15.7	0.2%
GWC14	Gaywood Clock	563618	320736	1.5	40	15.3	15.4	0.2%
GWC15	Gaywood Clock	563520	320614	1.5	40	15.3	15.4	0.2%
GWC16	Gaywood Clock	563478	320572	1.5	40	16.0	16.1	0.3%
GWC17	Gaywood Clock	563496	320566	1.5	40	15.6	15.7	0.3%
GWC18	Gaywood Clock	563325	320468	1.5	40	15.8	15.8	<0.1%
GWC19	Gaywood Clock	563396	320482	3.5	40	16.0	16.0	0.1%
GWC20	Gaywood Clock	563245	320473	1.5	40	15.8	15.8	<0.1%
GWC21	Gaywood Clock	563496	320491	1.5	40	16.4	16.6	0.5%
GWC22	Gaywood Clock	563524	320466	1.5	40	15.8	15.9	0.4%
GWC23	Gaywood Clock	563709	320449	1.5	40	15.2	15.3	0.3%
GWC24	Gaywood Clock	563754	320469	1.5	40	16.3	16.5	0.5%
GWC25	Gaywood Clock	563367	320417	1.5	40	15.4	15.5	0.1%
GWC26	Gaywood Clock	563405	320367	1.5	40	15.0	15.0	0.1%
GWC27	Gaywood Clock	563350	320305	1.5	40	15.1	15.1	0.1%
GWC28	Gaywood Clock	563349	320175	1.5	40	15.4	15.5	0.1%
GWC29	Gaywood Clock	563363	320051	1.5	40	14.9	15.0	0.1%
GWC30	Gaywood Clock	563297	319993	1.5	40	14.9	15.0	0.1%
GWC31	Gaywood Clock	563396	319922	1.5	40	15.3	15.4	0.1%
GWC32	Gaywood Clock	563323	320499	3.5	40	15.9	15.9	<0.1%
GWC33	Gaywood Clock	563342	320496	3.5	40	15.9	15.9	<0.1%
GWC34	Gaywood Clock	563367	320489	3.5	40	15.8	15.9	0.1%
GWC35	Gaywood Clock	563288	320471	3.5	40	15.3	15.3	<0.1%
GWC36	Gaywood Clock	563287	320505	3.5	40	15.8	15.8	<0.1%
GWC37	Gaywood Clock	563470	320475	1.5	40	17.1	17.2	0.4%
GWC38	Gaywood Clock	563476	320492	3.5	40	16.2	16.3	0.3%
GWC39	Gaywood Clock	563444	320475	1.5	40	17.4	17.5	0.2%
GWC40	Gaywood Clock	563478	320499	3.5	40	16.0	16.1	0.3%
GWC41	Gaywood Clock	563461	320499	1.5	40	17.5	16.4	-2.9%
GWC42	Gaywood Clock	563463	320515	1.5	40	16.8	16.1	-1.8%
GWC43	Gaywood Clock	563481	320506	1.5	40	16.4	15.9	-1.2%

Receptor ID	Location	OS Grid X	OS Grid Y	Height (m)	AQS (µg/m^3)	Annual Mean PM_{10} (µg/m^3)		% Change relative to AQS
						DM 2039	DS 2039	
R1	Town Centre	563108	320491	1.5	40	16.7	16.7	<0.1%
R2	Town Centre	562971	320498	1.5	40	16.0	16.1	0.1%
R3	Town Centre	562967	320464	1.5	40	15.9	16.0	0.1%
R4	Town Centre	562888	320484	1.5	40	16.0	16.1	0.1%
R5	Town Centre	562864	320437	1.5	40	15.8	15.8	0.2%
R6	Town Centre	562835	320461	1.5	40	16.4	16.5	0.2%
R7	Town Centre	562822	320432	1.5	40	16.6	16.8	0.4%
R8	Town Centre	562796	320439	1.5	40	16.3	16.5	0.3%
R9	Town Centre	562696	320481	1.5	40	15.6	15.6	0.1%
R10	Town Centre	562631	320515	1.5	40	15.5	15.5	0.1%
R11	Town Centre	562547	320483	1.5	40	15.5	15.5	0.1%
R12	Town Centre	562382	320396	1.5	40	16.0	16.1	0.1%
R13	Town Centre	562345	320356	1.5	40	15.6	15.7	0.1%
R14	Town Centre	562281	320241	1.5	40	15.3	15.4	0.2%
R15	Town Centre	562290	320354	1.5	40	16.6	16.7	0.1%
R16	Town Centre	562244	320311	1.5	40	17.0	17.0	0.1%
R17	Town Centre	562238	320352	1.5	40	16.5	16.6	0.1%
R18	Town Centre	561951	320536	1.5	40	15.4	15.4	0.2%
R19	Town Centre	561898	320705	1.5	40	14.8	14.9	0.1%
R20	Town Centre	561933	320495	1.5	40	15.3	15.3	0.2%
R21	Town Centre	562058	320330	1.5	40	15.8	15.9	0.2%
R22	Town Centre	562086	320262	1.5	40	18.4	18.5	0.2%
R23	Town Centre	562108	320203	1.5	40	17.0	17.1	0.2%
R24	Town Centre	562128	320186	1.5	40	16.3	16.4	0.2%
R25	Town Centre	562116	320122	1.5	40	17.2	17.3	0.2%
R26	Town Centre	562130	320066	1.5	40	17.1	17.2	0.3%
R27	Town Centre	562118	320018	1.5	40	17.7	17.8	0.4%
R28	Town Centre	562231	320286	1.5	40	17.5	17.6	0.2%
R29	Town Centre	562249	320280	1.5	40	16.4	16.4	0.2%
R30	Town Centre	562133	319997	1.5	40	18.1	18.4	0.6%
R31	Town Centre	562247	320145	1.5	40	16.9	17.0	0.3%
R32	Town Centre	562225	320008	1.5	40	16.7	16.9	0.3%
R33	Town Centre	562104	319787	1.5	40	17.7	18.1	1.0%
R34	Town Centre	562099	319666	1.5	40	17.3	17.7	1.1%
R35	Town Centre	562138	319615	1.5	40	19.5	20.3	2.0%
R36	Town Centre	562200	319517	1.5	40	17.2	17.7	1.2%
R37	Town Centre	562252	319473	1.5	40	18.4	19.1	1.7%
R38	Town Centre	562262	319406	1.5	40	18.4	19.1	1.7%
R39	Town Centre	562187	319580	1.5	40	18.5	19.2	1.6%
R40	Town Centre	562214	319581	1.5	40	16.3	16.6	0.7%
R41	Town Centre	562251	319333	1.5	40	17.7	18.3	1.3%
R42	Town Centre	562213	319229	1.5	40	18.7	19.4	1.8%
R43	Town Centre	562266	319308	1.5	40	17.8	18.3	1.4%
R44	Town Centre	562293	319031	1.5	40	17.6	18.3	1.6%
R45	Town Centre	562197	319190	1.5	40	17.9	18.4	1.4%
R46	Town Centre	562418	318927	1.5	40	17.9	18.6	1.6%
R47	Town Centre	562595	318737	1.5	40	17.9	18.6	1.6%
R48	Town Centre	561988	318979	1.5	40	17.0	17.1	0.4%
R49	Town Centre	561933	318911	1.5	40	17.1	17.3	0.4%
R50	Town Centre	561968	318888	1.5	40	17.1	17.2	0.4%
R51	Town Centre	561920	318891	1.5	40	17.5	17.6	0.4%
R52	Town Centre	561780	318788	1.5	40	17.1	17.2	0.3%
R53	Town Centre	561742	318733	1.5	40	16.8	16.9	0.3%

Receptor ID	Location	OS Grid X	OS Grid Y	Height (m)	AQS (µg/m³)	Annual Mean PM_{10} (µg/m³)		% Change relative to AQS
						DM 2039	DS 2039	
R54	Town Centre	561569	318611	1.5	40	16.8	16.9	0.3%
R55	Town Centre	561498	318602	1.5	40	16.6	16.7	0.3%
R56	Town Centre	561955	318711	1.5	40	16.9	17.0	0.4%
R57	Town Centre	561910	318618	1.5	40	16.9	17.0	0.4%
R58	Town Centre	561844	318475	1.5	40	16.9	17.1	0.5%
R59	Town Centre	561799	318387	1.5	40	16.9	17.1	0.5%
R60	Town Centre	561936	319676	1.5	40	15.0	15.1	0.4%
R61	Town Centre	562246	318889	1.5	40	16.2	16.5	0.7%
R62	Town Centre	562782	320368	1.5	40	15.2	15.4	0.3%
R63	Town Centre	562792	320258	1.5	40	15.6	15.9	0.5%
R64	Town Centre	562821	320320	1.5	40	15.6	15.8	0.5%
R65	Town Centre	562815	320176	1.5	40	15.5	15.7	0.5%
R66	Town Centre	562770	320107	1.5	40	15.7	16.0	0.6%
R67	Town Centre	562761	320021	1.5	40	15.4	15.6	0.5%
R68	Town Centre	562784	319850	1.5	40	16.2	16.4	0.6%
R69	Town Centre	562791	319751	1.5	40	16.0	16.2	0.5%
R70	Town Centre	562678	319644	1.5	40	16.2	16.4	0.6%
R71	Town Centre	562629	319553	1.5	40	16.3	16.6	0.7%
R72	Town Centre	562650	319395	1.5	40	16.2	16.6	0.9%
R73	Town Centre	562661	319295	1.5	40	15.9	16.2	0.7%
R74	Town Centre	562566	319269	1.5	40	16.6	17.0	1.1%
R75	Town Centre	562440	319192	1.5	40	16.3	16.6	0.9%
R76	Town Centre	562347	319168	1.5	40	16.7	17.2	1.2%
R77	Town Centre	562272	319093	1.5	40	16.9	17.4	1.2%
R88	Queen Elizabeth Hospital	565024	320306	1.5	40	16.4	16.5	0.3%
R89	Gayton Road	565057	320229	1.5	40	16.2	16.3	0.3%
R90	Queen Elizabeth Way	565211	320004	1.5	40	17.0	17.4	1.0%
R91	Queen Elizabeth Way	564834	319450	1.5	40	17.1	17.5	1.0%
R92	New Road	564536	316428	1.5	40	15.6	15.9	0.6%
R93	New Road	564481	316172	1.5	40	15.7	15.9	0.6%
R94	Rectory Lane	564077	316164	1.5	40	15.5	15.8	0.8%
R95	Rectory Lane	563425	316110	1.5	40	15.1	15.3	0.6%
R96	Main Road	563096	315991	1.5	40	16.2	15.7	-1.2%
R97	Chapel Lane	563005	316241	1.5	40	15.7	15.6	-0.1%
R98	Back Lane	562901	316052	1.5	40	15.3	15.3	0.2%
R99	Back Lane	562976	315900	1.5	40	15.6	15.7	0.1%
R100	Watering Lane	562893	315713	1.5	40	15.5	15.7	0.3%
R101	Hall Lane	562882	315396	1.5	40	15.5	15.6	0.3%
R102	Gravehill Lane	563116	314863	1.5	40	15.3	15.4	0.3%
R103	Gravehill Lane	563425	314882	1.5	40	16.7	16.8	0.3%
R104	Main Road	563287	315223	1.5	40	16.4	15.7	-1.8%
R105	Main Road	563231	315443	1.5	40	16.1	15.6	-1.4%

In both the DM and DS scenarios, the percentage change relative to the AQS is below 2%, with the smallest changes reported in the Gaywood Clock AQMA.

Particulate Matter ($PM_{2.5}$)

Table 4.6 presents the predicted $PM_{2.5}$ concentrations at all modelled receptors for each scenario and the percentage change relative to the AQS. There were no exceedances of the annual mean $PM_{2.5}$ AQS Objective (20µg/m³) in either the DM or DS scenario The greatest concentration reported for the DS Scenario was 12.5µg/m³. This is reported at R35, located in the Town Centre AQMA

near a junction on London Road. This location also experienced the largest increase in concentration (0.5µg/m^3) in the DS scenario, associated with the WWGA.

Table 4.6 - Predicted $PM_{2.5}$ concentrations at all Receptors for DM and DS Scenarios

Receptor ID	Location	OS Grid X	OS Grid Y	Height (m)	AQS (µg/m^3)	Annual Mean $PM_{2.5}$ (µg/m^3)		% Change relative to AQS
						DM 2039	DS 2039	
GWC1	Gaywood Clock	564065	321920	1.5	20	9.5	9.6	0.2%
GWC2	Gaywood Clock	564037	321885	1.5	20	9.5	9.6	0.2%
GWC3	Gaywood Clock	563938	321731	1.5	20	10.1	10.2	0.2%
GWC4	Gaywood Clock	563923	321642	1.5	20	9.7	9.7	0.2%
GWC5	Gaywood Clock	563894	321506	1.5	20	9.6	9.6	0.2%
GWC6	Gaywood Clock	563850	321437	1.5	20	9.8	9.8	0.2%
GWC7	Gaywood Clock	563846	321306	1.5	20	10.0	10.1	0.2%
GWC8	Gaywood Clock	563859	321196	1.5	20	9.9	10.0	0.2%
GWC9	Gaywood Clock	563836	321163	1.5	20	10.0	10.0	0.2%
GWC10	Gaywood Clock	563733	320943	1.5	20	9.8	9.9	0.2%
GWC11	Gaywood Clock	563711	320842	1.5	20	9.7	9.7	0.2%
GWC12	Gaywood Clock	563661	320811	1.5	20	9.9	10.0	0.2%
GWC13	Gaywood Clock	563607	320760	1.5	20	9.8	9.9	0.2%
GWC14	Gaywood Clock	563618	320736	1.5	20	9.7	9.7	0.2%
GWC15	Gaywood Clock	563520	320614	1.5	20	9.7	9.7	0.2%
GWC16	Gaywood Clock	563478	320572	1.5	20	10.1	10.2	0.3%
GWC17	Gaywood Clock	563496	320566	1.5	20	9.9	9.9	0.2%
GWC18	Gaywood Clock	563325	320468	1.5	20	10.0	10.0	<0.1%
GWC19	Gaywood Clock	563396	320482	3.5	20	10.1	10.1	0.1%
GWC20	Gaywood Clock	563245	320473	1.5	20	10.0	10.0	<0.1%
GWC21	Gaywood Clock	563496	320491	1.5	20	10.4	10.5	0.4%
GWC22	Gaywood Clock	563524	320466	1.5	20	10.0	10.1	0.4%
GWC23	Gaywood Clock	563709	320449	1.5	20	9.6	9.7	0.3%
GWC24	Gaywood Clock	563754	320469	1.5	20	10.3	10.4	0.5%
GWC25	Gaywood Clock	563367	320417	1.5	20	9.7	9.8	0.1%
GWC26	Gaywood Clock	563405	320367	1.5	20	9.5	9.5	0.1%
GWC27	Gaywood Clock	563350	320305	1.5	20	9.5	9.6	0.1%
GWC28	Gaywood Clock	563349	320175	1.5	20	9.7	9.8	0.1%
GWC29	Gaywood Clock	563363	320051	1.5	20	9.5	9.5	0.1%
GWC30	Gaywood Clock	563297	319993	1.5	20	9.2	9.3	0.1%
GWC31	Gaywood Clock	563396	319922	1.5	20	9.4	9.5	0.1%
GWC32	Gaywood Clock	563323	320499	3.5	20	10.1	10.1	<0.1%
GWC33	Gaywood Clock	563342	320496	3.5	20	10.0	10.0	<0.1%
GWC34	Gaywood Clock	563367	320489	3.5	20	10.0	10.0	<0.1%
GWC35	Gaywood Clock	563288	320471	3.5	20	9.7	9.7	<0.1%
GWC36	Gaywood Clock	563287	320505	3.5	20	10.0	10.0	<0.1%
GWC37	Gaywood Clock	563470	320475	1.5	20	10.8	10.9	0.4%
GWC38	Gaywood Clock	563476	320492	3.5	20	10.2	10.3	0.3%
GWC39	Gaywood Clock	563444	320475	1.5	20	11.0	11.0	0.2%
GWC40	Gaywood Clock	563478	320499	3.5	20	10.1	10.2	0.3%
GWC41	Gaywood Clock	563461	320499	1.5	20	11.0	10.3	-2.8%
GWC42	Gaywood Clock	563463	320515	1.5	20	10.6	10.2	-1.8%
GWC43	Gaywood Clock	563481	320506	1.5	20	10.4	10.1	-1.2%
R1	Town Centre	563108	320491	1.5	20	10.5	10.5	<0.1%
R2	Town Centre	562971	320498	1.5	20	10.2	10.2	<0.1%
R3	Town Centre	562967	320464	1.5	20	10.1	10.2	0.1%
R4	Town Centre	562888	320484	1.5	20	10.2	10.2	0.1%
R5	Town Centre	562864	320437	1.5	20	10.1	10.1	0.2%

Receptor ID	Location	OS Grid X	OS Grid Y	Height (m)	AQS (µg/m^3)	Annual Mean $PM_{2.5}$ (µg/m^3)		% Change relative to AQS
						DM 2039	DS 2039	
R6	Town Centre	562835	320461	1.5	20	10.4	10.5	0.2%
R7	Town Centre	562822	320432	1.5	20	10.6	10.7	0.4%
R8	Town Centre	562796	320439	1.5	20	10.4	10.5	0.3%
R9	Town Centre	562696	320481	1.5	20	9.9	10.0	0.1%
R10	Town Centre	562631	320515	1.5	20	9.9	9.9	<0.1%
R11	Town Centre	562547	320483	1.5	20	9.9	9.9	<0.1%
R12	Town Centre	562382	320396	1.5	20	10.2	10.2	<0.1%
R13	Town Centre	562345	320356	1.5	20	10.0	10.0	0.1%
R14	Town Centre	562281	320241	1.5	20	9.8	9.8	0.2%
R15	Town Centre	562290	320354	1.5	20	10.6	10.6	0.1%
R16	Town Centre	562244	320311	1.5	20	10.8	10.9	0.1%
R17	Town Centre	562238	320352	1.5	20	10.5	10.6	0.1%
R18	Town Centre	561951	320536	1.5	20	9.6	9.6	0.2%
R19	Town Centre	561898	320705	1.5	20	9.2	9.3	0.1%
R20	Town Centre	561933	320495	1.5	20	9.5	9.6	0.2%
R21	Town Centre	562058	320330	1.5	20	10.1	10.2	0.2%
R22	Town Centre	562086	320262	1.5	20	11.7	11.7	0.2%
R23	Town Centre	562108	320203	1.5	20	10.8	10.9	0.2%
R24	Town Centre	562128	320186	1.5	20	10.4	10.5	0.2%
R25	Town Centre	562116	320122	1.5	20	11.0	11.0	0.2%
R26	Town Centre	562130	320066	1.5	20	10.9	10.9	0.2%
R27	Town Centre	562118	320018	1.5	20	11.2	11.3	0.3%
R28	Town Centre	562231	320286	1.5	20	11.1	11.2	0.2%
R29	Town Centre	562249	320280	1.5	20	10.4	10.5	0.2%
R30	Town Centre	562133	319997	1.5	20	11.3	11.4	0.5%
R31	Town Centre	562247	320145	1.5	20	10.8	10.8	0.3%
R32	Town Centre	562225	320008	1.5	20	10.7	10.7	0.3%
R33	Town Centre	562104	319787	1.5	20	11.0	11.3	1.0%
R34	Town Centre	562099	319666	1.5	20	10.8	11.0	1.0%
R35	Town Centre	562138	319615	1.5	20	12.1	12.5	1.9%
R36	Town Centre	562200	319517	1.5	20	10.7	11.0	1.1%
R37	Town Centre	562252	319473	1.5	20	11.4	11.8	1.7%
R38	Town Centre	562262	319406	1.5	20	11.4	11.9	1.7%
R39	Town Centre	562187	319580	1.5	20	11.5	11.9	1.6%
R40	Town Centre	562214	319581	1.5	20	10.2	10.3	0.7%
R41	Town Centre	562251	319333	1.5	20	11.0	11.3	1.3%
R42	Town Centre	562213	319229	1.5	20	11.6	12.0	1.7%
R43	Town Centre	562266	319308	1.5	20	11.0	11.4	1.4%
R44	Town Centre	562293	319031	1.5	20	10.9	11.3	1.6%
R45	Town Centre	562197	319190	1.5	20	11.1	11.4	1.3%
R46	Town Centre	562418	318927	1.5	20	10.8	11.2	1.5%
R47	Town Centre	562595	318737	1.5	20	10.8	11.2	1.6%
R48	Town Centre	561988	318979	1.5	20	10.4	10.5	0.3%
R49	Town Centre	561933	318911	1.5	20	10.5	10.6	0.3%
R50	Town Centre	561968	318888	1.5	20	10.5	10.6	0.4%
R51	Town Centre	561920	318891	1.5	20	10.7	10.8	0.4%
R52	Town Centre	561780	318788	1.5	20	10.5	10.5	0.3%
R53	Town Centre	561742	318733	1.5	20	10.3	10.3	0.3%
R54	Town Centre	561569	318611	1.5	20	10.3	10.4	0.3%
R55	Town Centre	561498	318602	1.5	20	10.2	10.3	0.3%
R56	Town Centre	561955	318711	1.5	20	10.3	10.4	0.4%
R57	Town Centre	561910	318618	1.5	20	10.3	10.4	0.4%
R58	Town Centre	561844	318475	1.5	20	10.4	10.5	0.4%

Receptor ID	Location	OS Grid X	OS Grid Y	Height (m)	AQS (µg/m^3)	Annual Mean $PM_{2.5}$ (µg/m^3)		% Change relative to AQS
						DM 2039	DS 2039	
R59	Town Centre	561799	318387	1.5	20	10.3	10.5	0.5%
R60	Town Centre	561936	319676	1.5	20	9.2	9.3	0.4%
R61	Town Centre	562246	318889	1.5	20	9.8	9.9	0.6%
R62	Town Centre	562782	320368	1.5	20	9.7	9.8	0.3%
R63	Town Centre	562792	320258	1.5	20	10.0	10.1	0.5%
R64	Town Centre	562821	320320	1.5	20	9.9	10.0	0.5%
R65	Town Centre	562815	320176	1.5	20	9.9	10.0	0.5%
R66	Town Centre	562770	320107	1.5	20	10.0	10.2	0.5%
R67	Town Centre	562761	320021	1.5	20	9.9	10.0	0.5%
R68	Town Centre	562784	319850	1.5	20	10.1	10.2	0.5%
R69	Town Centre	562791	319751	1.5	20	9.9	10.0	0.5%
R70	Town Centre	562678	319644	1.5	20	10.0	10.2	0.5%
R71	Town Centre	562629	319553	1.5	20	10.2	10.3	0.7%
R72	Town Centre	562650	319395	1.5	20	10.1	10.3	0.9%
R73	Town Centre	562661	319295	1.5	20	9.9	10.1	0.7%
R74	Town Centre	562566	319269	1.5	20	10.3	10.6	1.1%
R75	Town Centre	562440	319192	1.5	20	10.1	10.3	0.9%
R76	Town Centre	562347	319168	1.5	20	10.4	10.7	1.1%
R77	Town Centre	562272	319093	1.5	20	10.5	10.8	1.2%
R88	Queen Elizabeth Hospital	565024	320306	1.5	20	9.5	9.6	0.3%
R89	Gayton Road	565057	320229	1.5	20	9.4	9.5	0.3%
R90	Queen Elizabeth Way	565211	320004	1.5	20	9.9	10.1	1.0%
R91	Queen Elizabeth Way	564834	319450	1.5	20	10.2	10.4	0.9%
R92	New Road	564536	316428	1.5	20	8.9	9.0	0.6%
R93	New Road	564481	316172	1.5	20	8.9	9.1	0.6%
R94	Rectory Lane	564077	316164	1.5	20	8.8	9.0	0.8%
R95	Rectory Lane	563425	316110	1.5	20	8.8	9.0	0.6%
R96	Main Road	563096	315991	1.5	20	9.5	9.2	-1.2%
R97	Chapel Lane	563005	316241	1.5	20	9.2	9.1	-0.1%
R98	Back Lane	562901	316052	1.5	20	8.8	8.8	0.2%
R99	Back Lane	562976	315900	1.5	20	8.9	8.9	0.1%
R100	Watering Lane	562893	315713	1.5	20	8.8	8.9	0.3%
R101	Hall Lane	562882	315396	1.5	20	8.8	8.9	0.3%
R102	Gravehill Lane	563116	314863	1.5	20	8.9	8.9	0.3%
R103	Gravehill Lane	563425	314882	1.5	20	9.7	9.8	0.3%
R104	Main Road	563287	315223	1.5	20	9.7	9.2	-1.7%
R105	Main Road	563231	315443	1.5	20	9.5	9.2	-1.3%

5 Recommended Mitigation Measures

5.1 Short-term Impacts during Construction – Dust / PM_{10} Emissions

The IAQM guidance[1] outlines a number of site-specific mitigation measures based on the assessed site risk. Mitigation measures are recommended in relation to the principles of good practice and the implementation of these measures is dependent on their site-specific practicality. The measures are grouped into those which are highly recommended and those which are desirable.

As the Site is classed as **large risk** concerning dust soiling effects and **low risk** concerning impacts on human health, the following mitigation measures are **highly recommended**:

- Develop With respect to communications:
    - Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.
    - Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.
    - Display the head or regional office contact information.
    - Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk, and should include as a minimum the highly recommended measures in this document. The desirable measures should be included as appropriate for the site. The DMP may include monitoring of dust deposition, dust flux, real time PM_{10} continuous monitoring and/or visual inspections.
- With respect to site management:
    - Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
    - Make the complaints log available to the local authority when asked.
    - Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log book.
- With respect to monitoring:
    - Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100 m of site boundary, with cleaning to be provided if necessary.
    - 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 before work commences on site. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction.

- With respect to 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.

- With respect to operating vehicle/machinery and sustainable travel:
  - Ensure all vehicles switch off engines when stationary - no idling vehicles.
  - Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.
  - Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.
  - Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate.
  - Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing

- With respect to 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.

- With respect to waste management
  - Avoid bonfires and burning of waste materials.

As the Site is classed as **Large Risk** for Earthworks the following mitigation measures are **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.

As the Site is classed as **Large Risk** for Construction the following mitigation measures are **desirable**:

- Avoid scabbling (roughening of concrete surfaces) if possible.
- Ensure sand and other aggregates are stored in bunded areas and are not allowed todry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.
- Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery
- For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust

As the Site is classed as **Large Risk** for Trackout the following mitigation measures are **desirable**:

- Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use
- 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

5.2 Operational Phase – Road Traffic Emissions

The IAQM issued a position statement in relation to the mitigation of development air quality impacts. Based on this statement, the IAQM recommends that the following basic hierarchy be used for mitigating the operational air quality impacts associated with the WWGA:

1. Preference should be given to **preventing or avoiding** exposure/impacts to the pollutant in the first place by eliminating or isolating potential sources or by replacing sources or activities with alternatives;

2. **Reduction and minimisation** of exposure/impacts should next be considered, once all options for prevention/avoidance have been implemented so far as is reasonably practicable (both technically and economically). To achieve this reduction/ minimisation, preference should be given first to:
    a. Mitigation measures that act on the source; before
    b. Mitigation measures that act on the pathway; which in turn should take preference over
    c. Mitigation measures at or close to the point of receptor exposure all subject to the efficacy, cost and practicability of the available solutions. In each case, measures that are designed or engineered to operate passively are preferred to active measures that require continual intervention, management or a change in people's behaviours.

3. **Off-setting** a new development's air quality impact by proportionately contributing to air quality improvements elsewhere (including those identified in air quality action plans and low emission strategies) should only be considered once the solutions for preventing/avoiding, and then for reducing/minimising, impacts have been exhausted.

6 Conclusions

Bureau Veritas UK Ltd has undertaken an assessment to inform the Council's New Local Plan for development across the Borough of King's Lynn and West Norfolk across the district. This Technical Note has considered the impacts upon air pollutant concentrations during the construction phase of the WWGA and predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations at discrete modelled receptor locations across Borough as a result of the operational phase. The following section provides the conclusions of this assessment.

6.1 Construction Effects – Dust / PM_{10} Emissions

The assessment of dust and PM_{10} effects from the construction phase of the development was subject to a qualitative assessment following IAQM guidance[1]. During the construction phase dust mitigation measures will be implemented at the Site in accordance with best practice measures outlined in Section 5 of this assessment.

With such mitigation in place, the assessment carried out has shown that any off-site impacts from dust emissions during the construction phase would be **not significant**.

6.2 Operational Effects – Road Traffic Emissions

When considering NO_2, PM_{10} and $PM_{2.5}$ concentrations, the Institute of Air Quality Management (IAQM) Impact Descriptors have been applied to define the impact of the proposed WWGA. The impacts of the proposed scheme are therefore summarised in Table 6.1 below.

Table 6.1 - IAQM Impact Descriptors relating to the significance of implementing the proposed West Winch Growth Area at all receptor locations

IAQM Impact Descriptor	NO_2	PM_{10}	$PM_{2.5}$
Substantial Adverse	0	0	0
Moderate Adverse	8	0	0
Slight Adverse	12	0	0
Negligible	112	138	138
Slight Beneficial	3	0	0
Moderate Beneficial	3	0	0
Substantial Beneficial	0	0	0
Total	**138**	**138**	**138**

The conclusions drawn from the results of the air quality dispersion modelling are as follows:

- All modelled receptors were below the AQS Objective for NO_2, PM_{10} and $PM_{2.5}$ in both DM and DS scenarios.
- The implementation of the WWGA has a "negligible" impact upon all receptor locations for PM_{10} and $PM_{2.5}$ (Table 6.1).
- The implementation of the WWGA has a "negligible" or "slight" impact upon most receptor locations (124 out of 138 receptors) for NO_2 (Table 6.1).
- When comparing DM Scenario with the DS Scenario, annual mean NO_2 concentrations are predicted to increase at most locations, with the greatest increase seen along London

Road at receptor locations R35 and R37, which increased by 3.8 µg/m^3. It is worth noting that these locations were still reporting below the AQS Objective in the DS scenario, this impact is defined as "Moderate Adverse" under the IAQM Impact Descriptors.

- The implementation of the WWGA is predicted to result in a "moderate adverse" impact on NO_2 concentrations at eight modelled receptor locations (Table 6.1). R35, R37, R38, R39, R41, R42, R43 and R45 are all located on London Road. Seven of these locations remained below 10% of the AQS Objective.

- R22 and R35, reported within 10% of the annual mean NO_2 AQS Objective in the DS Scenario (Table 4.4). These receptors located in the Town Centre AQMA, near junctions on Railway Road and London Road, respectively.

- There were improvements in NO_2 concentrations along Main Road; the most notable reduction in concentration was at R104, which reduced by 4.8µg/m^3.This may be attributable to infrastructure changes associated with the WWGA, and the rerouting of traffic in the DS scenario.

- PM_{10} and $PM_{2.5}$ followed similar trends to NO_2, predicting reductions in concentrations along Main Road, and increases in concentrations across the remainder of the modelled domain.