8. Air Quality

Appendix 8.1

AIR QUALITY REPORT

Everton Stadium Development Ltd

Goodison Park Legacy Project, Merseyside

Air Quality Assessment

December 2020

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Issue	Date	Status
1	17th January 2020	First Issue
2	31st January 2020	Second Issue – Minor Amendments
3	1st December 2020	Third Issue – Updated Results Using Latest Emissions Factor Toolkit (EFT) Guidance, NO_x to NO_2 calculator and Background Maps
4	7th December 2020	Fourth Issue – Updated Proposed Receptor Locations
5	9th December 2020	Fifth Issue – Updated with Minor Amendments

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Executive Summary

This report presents the findings of an air quality assessment undertaken to support an outline planning application for a mixed-use development at Goodison Park, Goodison Road, Liverpool, on behalf of Everton Stadium Development Ltd (hereafter 'Everton'). The proposal includes demolition of the existing stadium and the construction of residential, retail and commercial units and community uses and forms part of The People's Project.

'The People's Project' comprises:

1. *The development of a new 52,888 seated capacity stadium predominantly for football use (with the ability to host other events) at Bramley-Moore Dock with associated facilities and infrastructure (applied for under a separate full planning application); and*
2. *Demolition of the existing Goodison Park stadium (post relocation) and redevelopment of the site for a mixed-use development, including housing, commercial space, community use and open space, referred to as the 'Goodison Park Legacy Project' (GPLP).*

The description of development is as follows:

"Application for Outline Planning Permission for the demolition of existing buildings and redevelopment of the site for a mix of uses, comprising residential units (Use Class C3); residential institution (Use Class C2); shops (Use Class A1); financial & professional services (Use Class A2); food and drink use (Use Class A3); drinking establishments (Use Class A4); hot food takeaways (Use Class A5); business use (Use Class B1); non-residential institutions (Use Class D1); and open space, with associated access, servicing, parking and landscaping. All matters (Access, Appearance, Landscaping, Layout and Scale) are reserved for future determination."

Construction Phase

During the construction phase, the potential impacts from construction on air quality will be managed through site-specific mitigation measures detailed within this assessment. With these mitigation measures in place, the effects from the construction phase are not predicted to be significant.

Traffic Emissions

Operational Phase

Detailed dispersion modelling of traffic pollutants has been undertaken for the proposed development. The impacts during the operational phase take into account exhaust emissions from additional road traffic generated due to the proposed development.

The long-term (annual) assessment of the effects associated with the proposed development with respect to Nitrogen Dioxide (NO_2) is determined to be 'negligible'. With respect to PM_{10} and $PM_{2.5}$ exposure, the effect is determined to be 'negligible' at all identified existing sensitive receptor locations.

Based on the assessment undertaken and data collected, there are no predicted exceedances of the relevant air quality objectives at the application site. No further mitigation is required to protect future occupants.

1. Introduction

This report presents the findings of an air quality assessment undertaken to support an outline planning application for a mixed-use development at Goodison Park, Goodison Road, Liverpool, on behalf of Everton Stadium Development Ltd (hereafter 'Everton') (application reference 20O/0997). The proposal includes demolition of the existing stadium and the construction of residential, retail and commercial units and community uses and forms part of The People's Project.

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1.1 Report History

This Air Quality Assessment has been produced to include updated results which have been calculated using the latest Emissions Factor Toolkit (EFT) v10.1, NO_x to NO_2 calculator v8.1 and DEFRA Backgrounds (2018 background year). Traffic flows used in the previous issue of this report are still considered to be valid and therefore there will be no change in traffic flows from the previous report. This has been agreed upon with Liverpool City Council (LCC).

1.2 Report Structure

Following this introductory section, the remainder of this report is structured as follows:

- Section 2: Policy and legislative context
- Section 3: Assessment methodology
- Section 4: Baseline conditions
- Section 5: Assessment of air quality impacts – Construction Phase
- Section 6: Assessment of Detailed Dispersion Modelling
- Section 7: Mitigation
- Section 8: Conclusions

All technical Appendices are included at the end of this report for information.

1.3 Updates for Revised Layout (Dec 2020 submission)

This air quality technical report has been reviewed against the following aspects and for each it has been confirmed that there are no amendments required to the content of the report:

- Baseline data validity: there have been changes to the baseline data in accordance with updates to the DEFRA toolkits and ADMS Roads 5.0, however, there are no significant changes to the conclusions; and
- Operational traffic data: no relevant changes have been made to operational traffic data, as confirmed by Mott MacDonald.

Further information on the changes to the operational traffic trip figures and distribution brought about by the December 2020 scheme changes is provided in Section 7.1.4 in Chapter 7: Transport, ES Volume II. The results demonstrate that the revised application quanta will generate 25 fewer traffic trips in the morning peak and 67 fewer trips in the evening peak hour than the March 2020 scheme, while the traffic distribution is expected to remain broadly the same. On this basis, it is considered that the previous March 2020 traffic data represents a robust, worst case scenario, and has therefore been retained for use in this revised technical report.

In accordance with the methodology outlined in Chapter 2 of ES Volume II, a Level 2 update has been undertaken due to the relevance and scale of the proposed development amendments (including amendments to the building locations and uses, and consequently, the proposed receptor locations).

The sections of this report that have been updated are:

- Section 4 Baseline Conditions – Table 4.3 Modelled Discrete Sensitive Receptor Locations.
- Section 6 Assessment of Tables 6.2 – 6.18. Following recent updates to the Defra produced background maps and emission factor toolkits in August 2020, Tables 6.2 – 6.18 have been updated to take these new toolkits into account.
- Appendix B – Updated following recent updates to the Defra produced background maps and emission factor toolkits in August 2020, Appendix B has been updated to take these new toolkits into account.

2. Policy and Legislative Context

2.1 Documents Consulted

The following documents were consulted during the undertaking of this assessment:

Legislation and Best Practice Guidance

- National Planning Policy Framework, Ministry for Housing, Communities and Local Government, Revised February 2019[1];
- Planning Practice Guidance: Air Quality, Ministry for Housing, Communities and Local Government, November 2019[2];
- The Air Quality Standards Regulations (Amendments), 2016[3];
- The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, 2007[4];
- The Environment Act, 1995[5];
- Local Air Quality Management Technical Guidance LAQM.TG16, Defra, 2018[6];
- Design Manual for Roads and Bridges, LA 105 Air quality, November 2019[7];
- Land-Use Planning & Development Control: Planning for Air Quality, EPUK & IAQM, 2017[8];
- Guidance on the Assessment of Dust from Demolition and Construction, IAQM, 2014[9];

[1] Ministry of Housing, Communities & Local Government, National Planning Policy Framework (NPPF), February 2019, from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/810197/NPPF_Feb_2019_revised.pdf
[2] National Planning Portal, from: https://www.gov.uk/guidance/air-quality--3#what-air-quality-considerations-does-planning-need-to-address
[3] The Air Quality Standards (Amendment) Regulations 2016, from: https://www.legislation.gov.uk/uksi/2016/1184/made#:~:text=The%20Air%20Quality%20Standards%20%28Amendment%29%20Regulations%202016.%20The,in%20relation%20to%20the%20environment%20%28%202%20%29.
[4] Department for Environment, Food and Rural Affairs (DEFRA) 2007. The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69336/pb12654-air-quality-strategy-vol1-070712.pdf
[5] The Environment Act 1995, from: https://www.legislation.gov.uk/ukpga/1995/25/part/IV
[6] Local Air Quality Management Technical Guidance LAQM.TG16, from: https://laqm.defra.gov.uk/technical-guidance/
[7] Highways England, Design Manual for Roads and Bridges (DMRB), , LA 105 Air quality, November 2019, from: https://www.standardsforhighways.co.uk/dmrb/
[8] Institute of Air Quality Management, Land Use Planning and Development Control: Planning for Air Quality v1.2, 2017, from: http://www.iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf
[9] Institute of Air Quality Management, Guidance on the Assessment of Dust from Demolition and Construction, version 1.1, 2014, from: http://iaqm.co.uk/text/guidance/construction-dust-2014.pdf

- A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites (Version 1.1), IAQM, May 2020[10];

Websites Consulted

- Google maps[11];
- The UK National Air Quality Archive[12];
- Department for Transport, Road Traffic Statistics[13] ;
- Emapsite[14];
- Multi-Agency Geographic Information for the Countryside[15];
- Liverpool City Council[16]; and,
- Sefton Metropolitan Borough Council[17].

Site Specific Reference Documents

- Liverpool City Council, Air Quality Annual Status Report 2018[18];
- Liverpool City Council: Liverpool Local Plan 2013-2033, Submission Draft May 2018[19];
- Liverpool City Council Unitary Development Plan, Adopted 2002[20]; and,
- Sefton Metropolitan Borough Council, 2018 Air Quality Annual Status Report (July 2018)[21].

2.2 Air Quality Legislative Framework

European Legislation

European air quality legislation is consolidated under Directive 2008/50/EC, which came into force on 11th June 2008. This Directive consolidates previous legislation which was designed to deal with specific pollutants in a consistent manner and provides new air quality objectives for fine particulates. The consolidated

[10] Institute of Air Quality Management, A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites (Version 1.1) May 2020, from: https://www.the-ies.org/sites/default/files/reports/air-quality-impacts-on-nature-sites-2020.pdf
[11] Google maps [online], from: https://www.google.co.uk/maps
[12] Department for Environment, Food and Rural Affairs, UK Air, from: https://uk-air.defra.gov.uk/
[13] Department for Transport, Road Traffic Statistics, from: https://roadtraffic.dft.gov.uk/
[14] Emapsite [online], from: https://www.emapsite.com/#
[15] Department for Environment, Food and Rural Affairs, MAGIC [online],from: https://magic.defra.gov.uk/MagicMap.aspx
[16] Liverpool City Council, from: https://www.liverpool.gov.uk/
[17] Sefton Metropolitan Borough Council, from: https://www.sefton.gov.uk/
[18] https://letscleartheairliverpool.co.uk/air-quality-in-liverpool/monitoring-air-quality-and-aqmas-in-liverpool/
[19] https://liverpool.gov.uk/planning-and-building-control/plan-making-in-liverpool/current-local-plan-documents/local-plan/
[20] https://liverpool.gov.uk/planning-and-building-control/plan-making-in-liverpool/current-local-plan-documents/unitary-development-plan/
[21] https://www.sefton.gov.uk/media/1632492/Annual-Air-Quality-Status-Report-2018.pdf

Directives include:

- **Directive 1999/30/EC** – the First Air Quality "Daughter" Directive – sets ambient air limit values for NO_2 and oxides of nitrogen, sulphur dioxide, lead and PM_{10}.
- **Directive 2000/69/EC** – the Second Air Quality "Daughter" Directive – sets ambient air limit values for benzene and carbon monoxide; and,
- **Directive 2002/3/EC** – the Third Air Quality "Daughter" Directive – seeks to establish long-term objectives, target values, an alert threshold and an information threshold for concentrations of ozone in ambient air.

The Fourth Daughter Directive was not included within the consolidation and is described as:

- **Directive 2004/107/EC** – sets health-based limits on polycyclic aromatic hydrocarbons, cadmium, arsenic, nickel and mercury, for which there is a requirement to reduce exposure to as low as reasonably achievable.

UK Legislation

The Air Quality Standards Regulations (Amendments 2016)[3] seek to simplify air quality regulation and provide a new transposition of the Air Quality Framework Directive, First, Second and Third Daughter Directives and also transpose the Fourth Daughter Directive into UK legislation. The air quality limit values are transposed into the updated Regulations as Air Quality Standards, with attainment dates in line with the European Directives. SI 2007 No. 64 Regulation 14 extends powers, under Section 85(5) of the Environment Act (1995), for the Secretary of State to give directions to Local Authorities (LAs) for the implementation of these Directives.

The UK Air Quality Strategy (2007)[4] is the method for implementation of the air quality limit values in England, Scotland, Wales and Northern Ireland and provides a framework for improving air quality and protecting human health from the effects of pollution.

For each nominated pollutant, the Air Quality Strategy sets clear, measurable, outdoor air quality standards and target dates by which these must be achieved; the combined standard and target date is referred to as the Air Quality Objective (AQO) for that pollutant. Adopted national standards are based on the recommendations of the Expert Panel on Air Quality Standards (EPAQS) and have been translated into a set of Statutory Objectives within the Air Quality (England) Regulations (2000) SI 928, and subsequent amendments.

The AQOs for pollutants included within the Air Quality Strategy and assessed as part of the scope of this report are presented in **Table 2.1** along with European Commission (EC) Directive Limits and World Health Organisation (WHO) Guidelines.

Table 2.1 Air Quality Standards, Objectives, Limit and Target Values

Pollutant	Applies	Objective	Concentration Measured as	Date to be achieved and maintained thereafter	European Obligations	Date to be achieved and maintained thereafter	New or existing
PM_{10}	UK	50µg/m³ by end of 2004 (max 35 exceedances a year)	24-hour mean	1st January 2005	50µg/m³ by end of 2004 (max 35 exceedances a year)	1st January 2005	Retain Existing
	UK	40µg/m³ by end of 2004	Annual mean	1st January 2005	40µg/m³	1st January 2005	
$PM_{2.5}$	UK	25µg/m³	Annual Mean	31st December 2010	25µg/m³	1st January 2010	Retain Existing
NO_2	UK	200µg/m³ not to be exceeded more than 18 times a year	1-Hour Mean	31st December 2005	200µg/m³ not to be exceeded more than 18 times a year	1st January 2010	Retain Existing
	UK	40µg/m³	Annual Mean	31st December 2005	40µg/m³	1st January 2010	

Within the context of this assessment, the annual mean objectives are those against which facades of residential receptors will be assessed and the short-term objectives apply to all other receptor locations, where people may be exposed over a short duration, both residential and non-residential such as using gardens, balconies, walking along streets, using playgrounds, footpaths or external areas of employment uses.

National Policy

The National Planning Policy Framework (NPPF)[1], revised February 2019, principally brings together and summarises the suite of Planning Policy Statements (PPS) and Planning Policy Guidance (PPG) which previously guided planning policy making. The NPPF states that (para. 181):

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

The Planning Practice Guidance (PPG)[2] web-based resource was updated by the Ministry for Housing, Communities and Local Government (MHCLG) on 1st November 2019 to support the National Planning Policy Framework and make it more accessible. A review of PPG: Air Quality identified the following guidance (Paragraph: 001 Reference ID: 32-001-20191101):

> *"The 2008 Ambient Air Quality Directive sets legally binding limits for concentrations in outdoor air of major air pollutants that affect public health such as particulate matter (PM_{10} and $PM_{2.5}$) and nitrogen dioxide (NO_2).*
>
> *The UK also has national emission reduction commitments for overall UK emissions of 5 damaging air pollutants:*
>
> - *fine particulate matter ($PM_{2.5}$);*
> - *ammonia (NH_3);*
> - *nitrogen oxides (NO_x);*
> - *sulphur dioxide (SO_2); and*
> - *non-methane volatile organic compounds (NMVOCs).*
>
> *As well as having direct effects on public health, habitats and biodiversity, these pollutants can combine in the atmosphere to form ozone, a harmful air pollutant (and potent greenhouse gas) which can be transported great distances by weather systems. Odour and dust can also be a planning concern, for example, because of the effect on local amenity.*"

Local Policy

LCC adopted the Liverpool Unitary Development Plan in 2002 which forms the statutory development plan for Liverpool. At present, a new Liverpool Local Plan is yet to be adopted, and therefore the information available in the 2018 submission draft has also been reviewed in relation to the proposed development and air quality. Following a review of policies within these plans, the following policies were identified as being relevant to the proposed development from an air quality perspective:

Liverpool Unitary Development Plan (2002): EP11: Pollution

1. *Planning permission will not be granted for development which has the potential to create unacceptable air, water, noise or other pollution or nuisance.*
2. *Where existing uses adversely affect the environment through noise, vibration, soot, grit, dust, smoke, fumes, smell, vehicle obstruction or other environmental problems, the City Council will:*
   - *i. Seek to reduce the problem on site;*
   - *ii. Refuse planning permission for development which would result in a consolidation or expansion of uses giving rise to environmental problems;*

iii. *Impose appropriate conditions on any permission which may be granted and/or obtain legal agreements in relation to such a permission, in order to regulate uses;*

iv. *Take enforcement action where appropriate; and*

v. *In appropriate circumstances, compulsorily acquire the premises whilst endeavouring to assist in the relocation of the firm, where resources permit.*

In the case of new development close to existing uses which are authorised or licensed under pollution control legislation, and which are a potential nuisance to the proposed development, planning permission will not be granted unless the City Council is satisfied that sufficient measures can and will be taken to protect amenity and environmental health.

Liverpool Local Plan (Submission Draft Liverpool Local Plan May 2018)

The Local Plan identifies a number of strategic priorities to deliver its Vision. Of relevance are the following strategic policies:

- *"Attractive and Safe City with A Strong Local Identity" which requires all new developments to avoid adverse environmental impacts, and*
- *"Use Resources Efficiently" which ensures that all new development avoids adverse environmental impact and is adaptive and resilient to climate change impacts.*

Liverpool Local Plan (Submission Draft Liverpool Local Plan May 2018): STP2: Sustainable Growth Principles and Managing Environmental Impact

1. *To ensure the sustainable growth of Liverpool, the City Council will support development proposals which address, as appropriate, the following strategic economic, social and environmental principles:*

   r. *Minimise adverse impacts on, and include measures to improve, air quality within the City.*

Liverpool Local Plan (Submission Draft Liverpool Local Plan May 2018): Policy R1 Pollution

1. *Development proposals which are likely to have a pollution impact should demonstrate that:*
   a. *Appropriate measures are incorporated to avoid pollution to air, water and soil;*
   b. *The impact of noise, vibration and lighting will not be significant;*
   c. *The proposal will not undermine the achievement of Air Quality Management Area (AQMA) objectives; and*
   d. *It will not lead to a significant decline in air quality*
2. *Where existing uses adversely affect the environment through noise, vibration, dust, smoke, fumes, smell, vehicle obstruction or other environmental problems the City Council will:*

   a) Refuse planning permission for proposals which would result in a consolidation or expansion of uses giving rise to environmental problems.

b) Impose appropriate conditions on any permission which may be granted and/or obtain legal agreements in relation to such a permission in order to regulate uses.

3. *New development proposals close to existing uses which are authorised or licenced under pollution control legislation, and which are a potential nuisance to the proposed development, will not be permitted unless the City Council is satisfied that sufficient measures will be taken by the developer to protect amenity and environmental health.*
4. *Where appropriate Major developments should incorporate measures to reduce and minimise air pollution.*

Other Local Policy

- **AQMA**

  As required under section 82 of the Environment Act 1995, Local Authorities undertake ongoing exercises to review and assess air quality within its area of jurisdiction. The assessments have indicated that concentrations of NO_2 are above the relevant AQOs at locations of relevant public exposure within the Liverpool City Council authority area.

- **Emerging Spatial Development Strategy, Liverpool City Region, 2019**

  Second Policy theme (Healthier, Safer and Resilient Homes and Communities) states that the Combined Authority has identified the quality of housing as a key determinant of our health and wellbeing. A Design Champion and an Air Quality Task Force has been appointed to tackle these two key matters.

- **Liverpool's Clean Air Plan, Liverpool City Council, 2019**

  In August 2019, LCC published their 'Clean Air Plan: Strategic Outline Case' which has been compiled to manage and reduce the pollutant concentration associated with NO_2 in the shortest timescales in line with the AQO's. The final 'Clean Air Plan' was submitted during October 2019. Further information on the 'Clean Air Plan' can be found at: https://letscleartheairliverpool.co.uk/.

3. Assessment Methodology

The potential environmental effects of the operational phase of the proposed development are identified so far as current knowledge of the site and development allows. The impact description of potential environmental effects is assessed according to the latest guidance produced by EPUK and IAQM in January 2017 '*Land-Use Planning & Development Control: Planning for Air Quality*' and June 2019 '*A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites*'.

The methodology used to determine the potential air quality effects of the construction phase of the proposed development has been derived from the IAQM 'Guidance on the Assessment of the Impacts of Dust from Demolition and Construction'**Error! Bookmark not defined.** document and is summarised in **Section 5**.

3.1 Determining Impact Description of the Air Quality Effects

The impact description of the effects during the operational phase of the development is based on the latest guidance produced by EPUK and IAQM in January 2017[8]. The guidance provides a basis for a consistent approach that could be used by all parties associated with the planning process to professionally judge the overall impact description of the air quality effects based on severity of air quality impacts.

The following rationale is used in determining the severity of the air quality effects at individual receptors:

1. The change in concentration of air pollutants, air quality effects, are quantified and evaluated in the context of AQOs. The effects are provided as a percentage of the Air Quality Assessment Level (AQO), which may be an AQO, EU limit or target value, or an Environment Agency 'Environmental Assessment Level (EAL)'.
2. The absolute concentrations are also considered in terms of the AQO and are divided into categories for long term concentration. The categories are based on the sensitivity of the individual receptor in terms of harm potential. The degree of harm potential to change increases as absolute concentrations are close to or above the AQO.
3. Severity of the effect is described as qualitative descriptors; negligible, slight, moderate or substantial, by taking into account in combination the harm potential and air quality effect. This means that a small increase at a receptor which is already close to or above the AQO will have higher severity compared to a relatively large change at a receptor which is significantly below the AQO.
4. The effects can be adverse when pollutant concentrations increase or beneficial when concentration decrease as a result of development.
5. The judgement of overall impact description of the effects is then based on severity of effects on all the individual receptors considered; and,
6. Where a development is not resulting in any change in emissions itself, the impact description of

effect is based on the effect of surrounding sources on new residents or users of the development, i.e., will they be exposed to levels above the AQO.

The assessment significance criteria has been undertaken in accordance with explanation note 2 of Table 6.3 of the EPUK & IAQM guidance. The Table is intended to be used by rounding the change in percentage pollutant concentration to whole numbers, which then makes it clearer which cell the impact falls within. The user is encouraged to treat the numbers with recognition of their likely accuracy and not assume a false level of precision. Changes of 0%, i.e. less than 0.5%, will be described as 'Negligible'.

Table 3.1 Impact Description of Effects Matrix

Long term average concentration at receptor in assessment year	% Change in concentration relative to AQO			
	1	2-5	6-10	>10
≤75% of AQO	Negligible	Negligible	Slight	Moderate
76-94% of AQO	Negligible	Slight	Moderate	Moderate
95-102% of AQO	Slight	Moderate	Moderate	Substantial
103-109 of AQO	Moderate	Moderate	Substantial	Substantial
≥110 of AQO	Moderate	Substantial	Substantial	Substantial

4. Baseline Conditions

4.1 Air Quality Review

This section provides a review of the existing air quality in the vicinity of the proposed development site in order to provide a benchmark against which to assess potential air quality impacts of the proposed development. Baseline air quality in the vicinity of the proposed development site has been defined from several sources, as described in the following sections.

Local Air Quality Management (LAQM)

Based upon the location of the application site, a review of the monitoring within LCC and Sefton Metropolitan Borough Council (SMBC) has been undertaken.

As required under section 82 of the Environment Act 1995, LCC has undertaken an ongoing exercise to review and assess air quality within its area of jurisdiction. The assessments have indicated that concentrations of NO_2 are above the relevant AQOs at locations of relevant public exposure within the authority area. LCC has one designated Air Quality Management Area (AQMA) for NO_2 that covers the entirety of the City of Liverpool:

- Liverpool City AQMA: An area encompassing the whole of the City of Liverpool.

The application site is within the Liverpool City AQMA, therefore receptors within the AQMA have been included within this assessment.

SMBC has four designated AQMA's for NO_2 and PM_{10} within its jurisdiction, the proposed development site is not within the boundary of any SMBC AQMA. These have been summarised below:

- AQMA 2: An area encompassing Princess Way A5036 from the Ewart Road flyover up to and including the Roundabout and flyover at the junction with Crosby Road South A565;
- AQMA 3: The area around the junction of Millers Bridge A5058 and Derby Road A565;
- AQMA 4: The area around the junction of Crosby Road North A565 and South Road, Waterloo; and,
- AQMA 5: The area around the junction of Hawthorne Road B5422 and Church Road A5036, Litherland.

A review of the provided traffic data (summarised within Table 6.1 of this report) has shown, that in accordance with the criteria outlined within Table 6.2 of the IAQM Guidance '*Land-Use Planning & Development Control: Planning for Air Quality*' (January 2017), an assessment of the SMBC AQMA 3 (located ~2km north west of the site boundary) is not required.

Air Quality Monitoring

Monitoring of air quality within LCC has been undertaken through both continuous and non-continuous monitoring methods. These have been reviewed in order to provide an indication of existing air quality in the

area surrounding the application site.

Continuous Monitoring

LCC operated one automatic monitoring station, AM1, in 2018. AM1 is located approximately 13 km south-east of the application site at NGR 343884, 383601. The representative data is shown below in **Table 4.1**.

Table 4.1 Monitored Annual Mean NO_2 Concentrations

Site ID	Site Name	Site Type	Inlet Height (m)	Distance from Kerb of Nearest Road (m)	NO_2 Annual Mean Concentration ($\mu g/m^3$)
					2018
AM1	Speke	Urban Background	1.5	12,531	18.0

As outlined in **Table 4.1**, automatic monitoring station AM1 monitored a concentration below the AQO for NO_2 in 2018. AM1 has not been used within the model verification to inform the background at the proposed site due to the distance resulting in AM1 not being representative of the proposed site.

Non - Continuous Monitoring

LCC operates a network of passive diffusion tubes. The closest diffusion tubes are diffusion tube N8 and N16, which are located on to Walton Lane and Walton Road at approximately 5,2 m south and west of the application site at NGR 3335579, 393170 and 335561, 393889. The most recently available diffusion tube data is from 2018 which is presented in Table 4.2.

Table 4.2 Monitored Annual Mean NO_2 Concentrations at Diffusion Tubes

Site ID	Location	Site Type	Distance from Kerb (m)	Inlet Height (m)	2018 Annual Mean NO_2 Concentration ($\mu g/m^3$)
N7	Walton Hall Avenue, Stanley Park Avenue junction. Central reservation lamppost kerbside	Kerbside	0.5	3.5	36.0
N8	Lamppost on corner of Walton Lane and Walton Breck Road next to pedestrian crossing	Roadside	3.0	3.5	47.0
N15	Queens Drive Monitoring Station	Roadside	2.0	3.5	30.0
N16	Walton Rd/Spellow Lane-Lp near Traffic C2222	Roadside	1.5	3.5	36.0

As indicated in Table 4.2, all diffusion tubes located within the Air Quality Assessment area monitored concentrations below the annual average NO_2 concentrations below the AQO for NO_2 (40 $\mu g/m^3$ annual mean) during 2018, with the exception of diffusion tube location N8 which monitored a concentration greater than the AQO for NO_2 (40 $\mu g/m^3$ annual mean) during 2018. This can be due to its location within the Liverpool City AQMA. All diffusion tubes identified within Table 4.2 were used as part of the model verification and assessment.

It should be noted that as part of the model verification a review of diffusion tubes locations and monitoring heights was undertaken. As part of this process, the locations and monitoring heights were adjusted following desk-based review using Google Maps.

4.2 Meteorology

Meteorological conditions have significant influence over air pollutant concentrations and dispersion. Pollutant levels can vary significantly from hour to hour as well as day to day, thus any air quality predictions need to be based on detailed meteorological data. The ADMS model calculates the dispersion of pollutants on an hourly basis using a year of local meteorological data.

The 2018 meteorological data used in the assessment is derived from Liverpool Airport Meteorological Station. This meteorological station is considered representative of the development site and provides a worst-case model output, with all the complete parameters necessary for the ADMS model. Reference should be made to **Figure 2** for an illustration of the prevalent wind conditions at the Liverpool Meteorological Station site.

4.3 Emission Sources

A desktop assessment has identified that traffic movements are likely to be the most significant local source of pollutants affecting the site and its surroundings. The principal traffic derived pollutants likely to impact local receptors are NO_2, PM_{10} and $PM_{2.5}$.

The assessment has therefore modelled all roads within the immediate vicinity of the proposed development site which are considered likely to experience changes in traffic flow as a result of the proposed development. Reference should be made to **Figure 1** for a graphical representation of the traffic data utilised within the ADMS Roads 5.0 model.

It should be noted that the pollutant contribution of minor roads and rail sources that are not included within the dispersion model is considered to be accounted for by using background air quality levels.

4.4 Sensitive Receptors

Receptors that are considered as part of the air quality assessment are primarily those existing receptors that are situated along routes predicted to experience changes in traffic flow as a result of the proposed development.
All existing receptor locations, committed development and proposed sensitive receptor locations assessed are shown in Tables 4.3.

Table 4.3 Modelled Discrete Sensitive Receptor Locations

Discrete Sensitive Receptor		Height of Receptors (m)
Existing Sensitive Receptors		
R1	Gwladys Street Primary and Nursery School West	1.5
R2	Gwladys Street Primary and Nursery School East	1.5
R3	3 Goodison Road	1.5
R4	69 Goodison Road	1.5
R5	Arnot St Mary Church of England Primary School	1.5
R6	Alsop High School	1.5
R7	258Walton Road	1.5
R8	120 Queens Road	1.5
R9	46 Country Road	1.5
R10	333 Walton lane	1.5
R11	Breeze Hill Neighbourhood Health Centre	1.5
R12	65 Breeze Hill	1.5
R13	281 Country Road	1.5
R14	204 Country Road	1.5
R15	4 Nimrod Street	1.5
R16	1 Andrew Street	1.5
R17	39 Diana Street	1.5
R18	46 Walton Hall Avenue	1.5
R19	82 Goodison Road	1.5
R20	10 City Road	1.5
R21	3 Goldie Street	1.5
R22	92 Walton Road	1.5
R23	Anfield Cemetery	1.5
R24	Anfield Cemetery	1.5
R25	Anfield Cemetery	1.5
R26	Anfield Cemetery	1.5
R27	Anfield Cemetery	1.5
R28	Anfield Cemetery	1.5
R29	Anfield Cemetery	1.5
R30	Anfield Cemetery	1.5
R31	Anfield Cemetery	1.5
R32	Stanley Park	1.5
R33	Stanley Park	1.5
R34	Stanley Park	1.5
R35	Stanley Park	1.5
R36	Stanley Park	1.5
R37	Stanley Park	1.5
R38	Stanley Park	1.5
R39	Stanley Park	1.5
R41	Stanley Park	1.5
R42	Stanley Park	1.5
R43	Stanley Park	1.5
Committed Sensitive Receptor Locations		
CR1	Bullens Road scheme	1.5
CR2	Bullens Road scheme	1.5

Discrete Sensitive Receptor		Height of Receptors (m)
Proposed Receptor Locations		
PR1	Plot B	1.5
PR2	Plot B	1.5
PR3	Plot A	1.5
PR4	Plot D	1.5
PR5	Plot F	1.5
PR6	Plot G	1.5
PR7	Plot G	1.5
PR8	Plot G	1.5
PR9	Plot E	1.5
PR10	Plot E	1.5
PR11	Plot A	1.5
PR12	Plot C	1.5

The locations of these receptors are displayed in **Figure 1**.

Both the existing receptors and proposed receptors assessed have are shown in **Table 4.3**. The locations of all receptors are shown in **Figure 1**.

4.5 Ecological Receptors

Air quality impacts associated with the proposed re-development have the potential to impact on receptors of ecological sensitivity within the vicinity of the site. The IAQM guidance on 'Air Quality Impacts on Designated Nature Conservation Sites' (2020)[10] document outlines the types of designated nature sites within 2 km of the proposed development which require air quality assessment. These are inclusive of:

- Sites of Special Scientific Interest (SSSIs).
- Special Areas of Conservation (SACs).
- Special Protection Areas (SPAs).
- Ramsar Sites.
- Areas of Special Scientific Interest (ASSIs).
- National Nature Reserves (NNRs).
- Local Nature Reserves (LNRs).
- Local Wildlife Sites (LWSs); and,
- Areas of Ancient Woodland (AW).

The Conservation of Habitats and Species Regulations (2019)[22] additionally requires competent authorities to review planning applications and consents that have the potential to impact on European designated sites (e.g. Special Protection Areas).

A study was undertaken to identify any statutory designated sites of ecological or nature conservation importance within the extents of the dispersion modelling assessment. This was completed using the Multi-Agency Geographic Information for the Countryside (MAGIC) web-based interactive mapping service, which draws together information on key environmental schemes and designations.

Following a search within a 2 km radius of the site boundary, no ecologically sensitive receptors were identified.

Additionally, WYG Air Quality Consultants have liaised with the WYG Project Ecologist to determine any additional ecologically sensitive sites which are required to be assessed as part of this assessment. All ecological sites are greater than 2km from the proposed site boundary and as a result have been screened out of the assessment.

[22] Conservation of Habitat and Species Regulation, from: https://www.legislation.gov.uk/ukdsi/2019/9780111176573

5. Assessment of Air Quality Impacts - Construction Phase

5.1 Pollutant Sources

The main emissions during construction are likely to be dust and particulate matter generated during earth moving (particularly during dry months) or from construction materials. The main potential effects of dust and particulate matter are:

- Visual - dust plume, reduced visibility, coating and soiling of surfaces leading to annoyance, loss of amenity, the need to clean surfaces.
- Physical and/or chemical contamination and corrosion of artefacts.
- Coating of vegetation and soil contamination; and,
- Health effects due to inhalation e.g. asthma or irritation of the eyes.

A number of other factors such as the amount of precipitation and other meteorological conditions will also greatly influence the amount of particulate matter generated.

Construction activities can give rise to short-term elevated dust/PM_{10} concentrations in neighbouring areas. This may arise from vehicle movements, soiling of the public highway or windblown stockpiles.

5.2 Particulate Matter (PM_{10})

The UK Air Quality Standards seek to control the health implications of respirable PM_{10}. However, the majority of particles released from construction will be greater than this in size.

Construction works on site have the potential to elevate localised PM_{10} concentrations in the area. On this basis, mitigation measures should still be taken to minimise these emissions as part of good site practice.

5.3 Construction Vehicle Movements

It is predicted that there will be ~114 vehicle movements per day travelling to the site during the construction phase. In line with the IAQM/EPUK guidance, the predicted construction vehicle movements are above the 25 daily movement screening thresholds for HGV traffic within an AQMA.

Although the pollutant concentrations as a result of the construction vehicles movements are not expected to be significant at existing sensitive receptors, a detailed dispersion model of the predicted construction movements has been undertaken.

The full detailed results for the Construction Phase Traffic Assessment are shown within Section 6.0 of this report.

5.4 Dust

Particles greater than 10µm are likely to settle out relatively quickly and may cause annoyance due to their soiling capability. Although there is no formal standards or criteria for nuisance caused by deposited particles, the IAQM 'Guidance on Monitoring in the Vicinity of Demolition and Construction Sites' (October 2018[23]) and the Environment Agency Technical Guidance Note (TGN) M17[24] states that dust is usually compared with a 'complaints likely' guideline of 200mg/m^2/day. Therefore, a deposition rate of 200mg/m^2/day is often presented as a threshold for serious nuisance though this is usually only applied to long term exposure as people are generally more tolerant of dust for a short or defined period. Significant nuisance is likely when the dust coverage of surfaces is visible in contrast with adjacent clean areas, especially when it happens regularly. Severe dust nuisance occurs when the dust is perceptible without a clean reference surface.

Construction activities have the potential to suspend dust, which could result in annoyance of residents surrounding the site. Measures will be taken to minimise the emissions of dust as part of good site practice. Recommended mitigation measures proportionate to the risk associated with the development and based on best practice guidance are discussed in the following sections.

5.5 Methodology

The construction phase assessment utilises the IAQM Guidance on the Assessment of Dust from Demolition and Construction document published in February 2014[9].

Four construction processes are considered; these are demolition, earthworks, construction and trackout. For each of these phases, the impact description of the potential dust impacts is derived following the determination of a dust emission magnitude and the distance of activities to the nearest sensitive receptor, therefore assessing worst case impacts. A full explanation of the methodology is contained in **Appendix A**.

5.6 Assessment Results

Based on the methodology detailed in **Appendix A**, the scale of the anticipated works has determined the potential dust emission magnitude for each process, as presented in the **Table 5.1** below.

Table 5.1 Dust Emission Magnitude

Construction Process	Site Criteria	Dust Emission Magnitude
Demolition	Total Building Volume: >50,000m^3	Large

[23] Institute of Air Quality Management, Guidance on Monitoring in the Vicinity of Demolition and Construction Sites, from: https://iaqm.co.uk/text/guidance/guidance_monitoring_dust_2018.pdf
[24] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/301206/TGN_M17_-_Monitoring_of_particulate_matter_in_ambient_air_around_waste_facilities.pdf

Construction Process	Site Criteria	Dust Emission Magnitude
Earthworks	Total Site Area: >10,000m^2	Large
Construction	Total Building Volume: >100,000m^3	Large
Trackout	~128 HDV Outward Movements	Large

The sensitivity of the surrounding area to each construction process has been determined following Table 4.2 and Table 4.3 of the SPG guidance. The assessment has determined the area sensitivities as shown in the **Table 5.2**.

The sensitivity of the ecological receptors is considered not applicable within the construction phase assessment due to the distance from the application site which is greater than 500m. This is in accordance with Table 4 of the IAQM Guidance.

Table 5.2 Sensitivity of the Area

Source	Area Sensitivity					
	Dust Soiling	Site Sensitivity Criteria	Health Effects of PM_{10}	Site Sensitivity Criteria	Ecological	Site Sensitivity Criteria
Demolition	High	1-10 receptors within 20m of the application site	Low	N/A Annual Mean of <24 ug/m^3 for PM_{10} 10-100 Highly Sensitive Receptors within 20m	N/A	>50 m from site boundary
Earthworks	High		Low		N/A	
Construction	High		Low		N/A	
Trackout	Medium		Low		N/A	>50 m from roads within 500 m from site boundary

The dust emission magnitude determined in **Table 5.1** has been combined with the sensitivity of the area determined in **Table 5.2**, to determine the risk of impacts prior to the implementation of appropriate mitigation measures. The potential impact description of dust emissions associated with the construction phase, without mitigation, is presented overleaf in **Table 5.3**.

Table 5.3 Impact Description of Construction Activities without Mitigation

Source	Summary Risk of Impacts Prior to Mitigation		
	Dust Soiling	Health Effects of PM_{10}	Ecological
Demolition	High	Low	N/A
Earthworks	High	Low	N/A
Construction	High	Low	N/A
Trackout	High	Low	N/A

Appropriate mitigation measures are detailed and presented in **Section 8**. Following the adoption of these measures, the subsequent impact description of the construction phase is not predicted to be significant.

6. Assessment of Detailed Dispersion Modelling

In the context of the proposed development, road traffic is identified as the dominant emission source that is likely to cause potential risk of exposure of air pollutants at receptors.

6.1 Air Quality Energy Centre Assessment

For the purposes of this assessment, at this stage of the design process it has been assumed that no Combined Heat & Power (CHP) is proposed.

6.2 Air Quality Traffic Assessment

In the context of the proposed development, road traffic is identified as the dominant emission source that is likely to cause potential risk of exposure of air pollutants at receptors.

The operational phase assessment therefore consists of the quantified predictions of the change in NO_2, PM_{10} and $PM_{2.5}$ for the operational phase of the development due to changes in traffic movement. Predictions of air quality at the site have been undertaken for the operational phase of the development using ADMS Roads.

In accordance with the provided traffic data, the operational phase assessment has been undertaken with an assumed operational opening year of 2028. The assessment scenarios are therefore:

- 2018 Baseline = Existing baseline conditions (2028 BASE TEMPRO down to 2018);
- 2028 "Do Minimum" = Baseline conditions + committed development flows; and,
- 2028 "Do Something" = Baseline conditions + committed development flows + proposed development flows.

6.3 Existing and Predicted Traffic Flows

Projected 2028 'do minimum' and 'do something' traffic data has been obtained for the operational phase assessment in the form of Annual Average Daily Traffic figures (AADT) for the roads immediately surrounding the application site by Mott Macdonald Transport Consultants.

To calculate the Baseline 2018 traffic data for the road network supplied by the Transport Consultants, a TEMPRO factor of 1.1357 was applied to the supplied 2028 Base traffic data.

Additional baseline traffic data for the remaining road network was sourced from the Department for Transport (DfT) road statistic database for 2018.

6.3.1 Construction Phase

For the purpose of the Construction Phase assessment, an assessment year of 2028 has been used.

To calculate the 2018 'Baseline' scenario, a TEMPro factor of 1.1357 was applied to the supplied 2028 Base traffic data. The 2028 'do minimum' and 'do something' traffic data was provided by the transport consultant. For the traffic flows sourced from the DfT database, an equal distribution at each junction has been considered.

Emission factors for the 2018 baseline and 2028 projected 'do minimum' and 'do something' scenarios have been calculated using the Emission Factor Toolkit (EFT) Version 10.1 (September 2020)[25].

6.3.2 Operational Phase

To calculate the 2028 'do minimum' scenario traffic flows for the links not provided by the Transport Consultants, a TEMPro factor of 1.1788 has been applied to the 2018 baseline traffic. To determine the 'do something' scenario traffic flows for the links not provided by the Transport Consultants, the trips associated with the proposed development have been added on to the 2028 'do minimum' scenario flows. As a worst-case, an equal distribution at each junction has been considered.

Emission factors for the 2018 baseline and 2028 projected 'do minimum' and 'do something' scenarios have been calculated using the Emission Factor Toolkit (EFT) Version 10.1 (September 2020)[25].

It is assumed the average vehicle speeds on the local road network in an opening year of 2028 will be broadly the same as the ones in 2018. A 50 m 20 km/hr slow down phase is included on each link at every junction and roundabout within the assessment. All of the roads within the dispersion model are illustrated in Figure 1 . Detailed traffic figures are provided in the Table 6.1 (Construction Phase) and Table 6.2 (Operational Phase).

Table 6.1 Construction Phase Traffic Data

Link	Speed (km/h)	2018		2028			
		AADT	HGV%	Do Minimum		Do Something	
				AADT	HGV%	AADT	HGV%
Walton Lane Cemetery	48	24355	3.0	27710	3.2	27824	3.5
Walton Lane E Park	48	28945	3.0	32923	3.1	33037	3.5
Walton Lane W Park	48	28426	3.3	32284	3.3	32341	3.5
Walton Lane S Park	48	24007	3.0	27265	3.0	27265	3.0
Priory Road	48	8917	2.0	10127	2.0	10127	2.0
Langham Street	32	3594	1.4	4082	1.4	4082	1.4
Spellow Lane (Dixie Dean)	48	10456	2.0	11875	2.0	11932	2.5

[25] Department for Environment, Food and Rural Affairs, Emissions Factor Toolkit, from: https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html

Link	Speed (km/h)	2018		2028			
		AADT	HGV%	Do Minimum		Do Something	
				AADT	HGV%	AADT	HGV%
Spellow Lane W	48	8204	2.4	9317	2.4	9317	2.4
Goodison Road S	48	4066	0.3	4617	0.3	4617	0.3
Goodison Road N	48	895	0.3	1016	0.3	1016	0.3
Andrew Street	48	987	1.1	1121	1.1	1121	1.1
Nimrod Street	48	567	0.9	644	0.9	644	0.9
City Road	48	2789	0.4	3167	0.4	3167	0.4
Gwladys Street W	48	1667	0.0	1893	0.0	1893	0.0
Gwladys Street E	48	1117	0.5	1269	0.5	1269	0.5
Bullens Road	48	692	0.7	811	3.7	868	10.1
Walton Hall Avenue	64	31827	5.2	36146	5.2	36184	5.3
A5058 Queens Drive East of A59	48	34650	5.5	39352	5.5	39390	5.6
A5058 Breeze Hill West of A59	48	26725	6.8	30352	6.8	30364	6.8
A59 North of Hale Road	48	17726	1.2	20131	1.2	20144	1.2
A59 South of Hale Road	48	16763	1.8	19038	1.8	19050	1.9
Walton Breck Road	48	8951	1.5	10166	1.5	10166	1.5

Table 6.2 Operational Phase Traffic Data

Link	Speed (km/h)	2018		2028			
		AADT	HGV%	Do Minimum		Do Something	
				AADT	HGV%	AADT	HGV%
Walton Lane Cemetery	48	24355	3.0	28861	3.0	30357	3.0
Walton Lane E Park	48	28945	3.0	34294	3.0	35978	3.0
Walton Lane W Park	48	28426	3.3	33705	3.3	34469	3.3
Walton Lane S Park	48	24007	3.0	28408	3.0	29793	3.0
Priory Road	48	8917	2.0	10541	2.0	10728	2.0
Langham Street	32	3594	1.4	4243	1.4	4243	1.4
Spellow Lane (Dixie Dean)	48	10456	2.0	12384	2.0	14583	2.0
Spellow Lane W	48	8204	2.4	9762	2.4	10137	2.4
Goodison Road S	48	4066	0.3	4799	0.3	6466	0.3
Goodison Road N	48	895	0.3	1056	0.3	1165	0.3
Andrew Street	48	987	1.1	1165	1.1	1165	1.1
Nimrod Street	48	567	0.9	688	0.9	1089	0.9
City Road	48	2789	0.4	3311	0.4	3501	0.4
Gwladys Street W	48	1667	0.0	2028	0.0	3166	0.0
Gwladys Street E	48	1117	0.5	1319	0.5	2551	0.5
Bullens Road	48	692	0.7	1007	0.7	2236	0.7
Walton Hall Avenue	64	31827	5.2	37518	5.2	38017	5.2
A5058 Queens Drive East of A59	48	34650	5.5	40845	5.5	41344	5.5
A5058 Breeze Hill West of A59	48	26725	6.8	31503	6.8	31670	6.8
A59 North of Hale Road	48	17726	1.2	20895	1.2	21062	1.2
A59 South of Hale Road	48	16763	1.8	19760	1.8	19927	1.8
Walton Breck Road	48	8951	1.5	10551	1.5	10551	1.5

6.4 Background Concentrations

The use of background concentrations within the modelling process ensures that pollutant sources other than traffic are represented appropriately. Background sources of pollutants include industrial, domestic and rail emissions within the vicinity of the study site. Several sources have been used to obtain representative background levels as discussed below.

The background concentrations used within the assessment have been determined with reference to the IAQM Guidance and TG (16).

The IAQM Guidance states[8]:

> "*A matter of judgement should take into account the background and future background air quality and whether it is likely to approach or exceed the value of the AQO.*"

Additionally, TG (16) states:

> "*Typically, only the process contributions from local sources are represented within and output by the dispersion model. In these circumstances, it is necessary to add an appropriate background concentration(s) to the modelled source contributions to derive the total pollutant concentrations.*"

Defra Published Background Concentrations for 2018

Background concentrations considered include the levels from the UK National Air Quality Information Archive database based on the National Grid Co-ordinates of 1 x 1 km grid squares nearest to the development site. In August 2020, Defra issued revised 2018 based background maps for nitrogen oxide (NO_X), NO_2, PM_{10} and $PM_{2.5}$ which incorporate updates to Defra's input data[26].

The published 2018 background maps predicted pollutant concentrations for the existing, committed and proposed receptors are listed in **Table 6.2** below, with background concentrations used in modelling shown in **Table 6.4**.

[26] Department for Environment, Food and Rural Affairs, Background Maps, from: https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html

Table 6.2 Published Background Air Quality Levels (µg/m³)

Receptor Location	2018			
	NO_2	NO_x	PM_{10}	$PM_{2.5}$
Monitoring Locations				
N15	19.39	27.68	15.15	10.77
N16	19.17	27.41	14.68	10.48
N8	19.17	27.41	14.68	10.48
Existing Sensitive Receptors				
R1	19.39	27.68	15.15	10.77
R2	17.10	24.00	13.78	9.84
R3	19.17	27.41	14.68	10.48
R4	20.91	30.48	16.79	12.24
R5	20.91	30.48	16.79	12.24
R6	19.39	27.68	15.15	10.77
R7	19.17	27.41	14.68	10.48
R8	19.39	27.68	15.15	10.77
R9	20.91	30.48	16.79	12.24
R10	19.39	27.68	15.15	10.77
R11	20.91	30.48	16.79	12.24
R12	20.91	30.48	16.79	12.24
R13	20.91	30.48	16.79	12.24
R14	20.91	30.48	16.79	12.24
R15	20.91	30.48	16.79	12.24
R16	20.91	30.48	16.79	12.24
R17	17.10	24.00	13.78	9.84
R18	19.39	27.68	15.15	10.77
R19	20.91	30.48	16.79	12.24
R20	20.91	30.48	16.79	12.24
R21	19.17	27.41	14.68	10.48
R22	19.17	27.41	14.68	10.48
R23	19.39	27.68	15.15	10.77
R24	19.39	27.68	15.15	10.77
R25	19.39	27.68	15.15	10.77
R26	17.10	24.00	13.78	9.84
R27	17.10	24.00	13.78	9.84
R28	17.10	24.00	13.78	9.84
R29	17.10	24.00	13.78	9.84
R30	17.10	24.00	13.78	9.84
R31	17.10	24.00	13.78	9.84
R32	17.10	24.00	13.78	9.84
R33	17.10	24.00	13.78	9.84
R34	17.10	24.00	13.78	9.84
R35	17.10	24.00	13.78	9.84
R36	17.10	24.00	13.78	9.84

Receptor Location	2018			
	NO_2	NO_x	PM_{10}	$PM_{2.5}$
R37	17.10	24.00	13.78	9.84
R38	19.17	27.41	14.68	10.48
R39	19.17	27.41	14.68	10.48
R40	19.17	27.41	14.68	10.48
R41	19.17	27.41	14.68	10.48
R42	19.17	27.41	14.68	10.48
R43	19.17	27.41	14.68	10.48
Committed Sensitive Receptor Locations				
CR1	17.10	24.00	13.78	9.84
CR2	19.17	27.41	14.68	10.48
Proposed Sensitive Receptors				
PR1	19.17	27.41	14.68	10.48
PR2	19.17	27.41	14.68	10.48
PR3	19.17	27.41	14.68	10.48
PR4	19.17	27.41	14.68	10.48
PR5	20.91	30.48	16.79	12.24
PR6	20.91	30.48	16.79	12.24
PR7	20.91	30.48	16.79	12.24
PR8	20.91	30.48	16.79	12.24
PR9	20.91	30.48	16.79	12.24
PR10	19.17	27.41	14.68	10.48
PR11	19.17	27.41	14.68	10.48
PR12	19.17	27.41	14.68	10.48

All the Defra background concentrations detailed in Table 6.2 for 2018, show that the background levels are predicted to be below the relevant AQO within the study area.

A breakdown of the background source apportionment of NO_X concentrations at each monitoring location and receptor is shown in Table 6.3.

Table 6.3 Pollutant Source Apportionment of NO_X (µg/m^3)

Receptor Location	2018						
	Total NO_x	% of NO_X from Road Sources	% of NO_X from Industrial Sources	% of NO_X from Domestic Sources	% of NO_X from Aircraft Sources	% of NO_X from Rail Sources	% of NO_X from Other Sources
Local Authority Monitoring Locations							
N7	27.68	47.02	5.11	13.39	0.05	0.52	33.91
N15	27.68	47.02	5.11	13.39	0.05	0.52	33.91
N16	27.41	42.50	5.57	12.79	0.05	0.43	38.64
N8	27.41	42.50	5.57	12.79	0.05	0.43	38.64
Modelled Receptor Locations							
R1	27.68	47.02	5.11	13.39	0.05	0.52	33.91
R2	24.00	39.05	5.79	16.06	0.06	0.58	38.46

Receptor Location	2018						
	Total NO_x	% of NO_x from Road Sources	% of NO_x from Industrial Sources	% of NO_x from Domestic Sources	% of NO_x from Aircraft Sources	% of NO_x from Rail Sources	% of NO_x from Other Sources
R3	27.41	42.50	5.57	12.79	0.05	0.43	38.64
R4	30.48	41.98	5.55	14.94	0.04	0.43	37.06
R5	30.48	41.98	5.55	14.94	0.04	0.43	37.06
R6	27.68	47.02	5.11	13.39	0.05	0.52	33.91
R7	27.41	42.50	5.57	12.79	0.05	0.43	38.64
R8	27.68	47.02	5.11	13.39	0.05	0.52	33.91
R9	30.48	41.98	5.55	14.94	0.04	0.43	37.06
R10	27.68	47.02	5.11	13.39	0.05	0.52	33.91
R11	30.48	41.98	5.55	14.94	0.04	0.43	37.06
R12	30.48	41.98	5.55	14.94	0.04	0.43	37.06
R13	30.48	41.98	5.55	14.94	0.04	0.43	37.06
R14	30.48	41.98	5.55	14.94	0.04	0.43	37.06
R15	30.48	41.98	5.55	14.94	0.04	0.43	37.06
R16	30.48	41.98	5.55	14.94	0.04	0.43	37.06
R17	24.00	39.05	5.79	16.06	0.06	0.58	38.46
R18	27.68	47.02	5.11	13.39	0.05	0.52	33.91
R19	30.48	41.98	5.55	14.94	0.04	0.43	37.06
R20	30.48	41.98	5.55	14.94	0.04	0.43	37.06
R21	27.41	42.50	5.57	12.79	0.05	0.43	38.64
R22	27.41	42.50	5.57	12.79	0.05	0.43	38.64
R23	27.68	47.02	5.11	13.39	0.05	0.52	33.91
R24	27.68	47.02	5.11	13.39	0.05	0.52	33.91
R25	27.68	47.02	5.11	13.39	0.05	0.52	33.91
R26	24.00	39.05	5.79	16.06	0.06	0.58	38.46
R27	24.00	39.05	5.79	16.06	0.06	0.58	38.46
R28	24.00	39.05	5.79	16.06	0.06	0.58	38.46
R29	24.00	39.05	5.79	16.06	0.06	0.58	38.46
R30	24.00	39.05	5.79	16.06	0.06	0.58	38.46
R31	24.00	39.05	5.79	16.06	0.06	0.58	38.46
R32	24.00	39.05	5.79	16.06	0.06	0.58	38.46
R33	24.00	39.05	5.79	16.06	0.06	0.58	38.46
R34	24.00	39.05	5.79	16.06	0.06	0.58	38.46
R35	24.00	39.05	5.79	16.06	0.06	0.58	38.46
R36	24.00	39.05	5.79	16.06	0.06	0.58	38.46
R37	24.00	39.05	5.79	16.06	0.06	0.58	38.46
R38	27.41	42.50	5.57	12.79	0.05	0.43	38.64
R39	27.41	42.50	5.57	12.79	0.05	0.43	38.64
R40	27.41	42.50	5.57	12.79	0.05	0.43	38.64
R41	27.41	42.50	5.57	12.79	0.05	0.43	38.64
R42	27.41	42.50	5.57	12.79	0.05	0.43	38.64
R43	27.41	42.50	5.57	12.79	0.05	0.43	38.64
Committed Sensitive Receptors							
CR1	24.00	39.05	5.79	16.06	0.06	0.58	38.46
CR2	27.41	42.50	5.57	12.79	0.05	0.43	38.64
Proposed Sensitive Receptors							
PR1	27.41	42.50	5.57	12.79	0.05	0.43	38.64

Receptor Location	2018						
	Total NO_x	% of NO_x from Road Sources	% of NO_x from Industrial Sources	% of NO_x from Domestic Sources	% of NO_x from Aircraft Sources	% of NO_x from Rail Sources	% of NO_x from Other Sources
PR2	27.41	42.50	5.57	12.79	0.05	0.43	38.64
PR3	27.41	42.50	5.57	12.79	0.05	0.43	38.64
PR4	27.41	42.50	5.57	12.79	0.05	0.43	38.64
PR5	30.48	41.98	5.55	14.94	0.04	0.43	37.06
PR6	30.48	41.98	5.55	14.94	0.04	0.43	37.06
PR7	30.48	41.98	5.55	14.94	0.04	0.43	37.06
PR8	30.48	41.98	5.55	14.94	0.04	0.43	37.06
PR9	30.48	41.98	5.55	14.94	0.04	0.43	37.06
PR10	27.41	42.50	5.57	12.79	0.05	0.43	38.64
PR11	27.41	42.50	5.57	12.79	0.05	0.43	38.64
PR12	27.41	42.50	5.57	12.79	0.05	0.43	38.64

Table 6.3 shows that the major background source of NO_x at the monitoring, sensitive receptor locations and proposed sensitive receptor locations and where sources have been identified is mainly comprised of road sources.

Table 6.4 Background Concentrations Used in Modelling Assessment

Receptor location	Background Source	Background Concentration Utilised	
		NO_2	NO_x
Monitoring Locations			
N15	Defra Background Maps	19.39	27.68
N16		19.17	27.41
N8		19.17	27.41
Existing Sensitive Receptors			
R1	Defra Background Maps	19.39	27.68
R2		17.10	24.00
R3		19.17	27.41
R4		20.91	30.48
R5		20.91	30.48
R6		19.39	27.68
R7		19.17	27.41
R8		19.39	27.68
R9		20.91	30.48
R10		19.39	27.68
R11		20.91	30.48
R12		20.91	30.48
R13		20.91	30.48
R14		20.91	30.48
R15		20.91	30.48
R16		20.91	30.48
R17		17.10	24.00
R18		19.39	27.68

Receptor location	Background Source	Background Concentration Utilised	
		NO_2	NO_x
R19		20.91	30.48
R20		20.91	30.48
R21		19.17	27.41
R22		19.17	27.41
R23		19.39	27.68
R24		19.39	27.68
R25		19.39	27.68
R26		17.10	24.00
R27		17.10	24.00
R28		17.10	24.00
R29		17.10	24.00
R30		17.10	24.00
R31		17.10	24.00
R32		17.10	24.00
R33		17.10	24.00
R34		17.10	24.00
R35		17.10	24.00
R36		17.10	24.00
R37		17.10	24.00
R38		19.17	27.41
R39		19.17	27.41
R40		19.17	27.41
R41		19.17	27.41
R42		19.17	27.41
R43		19.17	27.41
Committed Sensitive Receptor Locations			
CR1	Defra Background Maps	17.10	24.00
CR2		19.17	27.41
Proposed Sensitive Receptors			
PR1	Defra Background Maps	19.17	27.41
PR2		19.17	27.41
PR3		19.17	27.41
PR4		19.17	27.41
PR5		20.91	30.48
PR6		20.91	30.48
PR7		20.91	30.48
PR8		20.91	30.48
PR9		20.91	30.48
PR10		19.17	27.41
PR11		19.17	27.41
PR12		19.17	27.41

6.5 Model Verification

Model verification involves the comparison of modelled data to monitored data in order to gain the best possible representation of current pollutant concentrations for the assessment years. The verification process is in general accordance with that contained in Section 7 of the TG16 guidance note and uses the most recently available diffusion tube monitoring data to best represent this.

The verification process consists of using the monitoring data and the published background air quality data in the UK National Air Quality Information Archive to calculate the road traffic contribution of NO_X at the monitoring locations. Outputs from the ADMS Roads model are provided as predicted road traffic contribution NO_X emissions. These are converted into predicted roadside contribution NO_2 exposure at the relevant receptor locations based on the updated approach to deriving NO_2 from NO_X for road traffic sources published in Local Air Quality Management TG16. The calculation was derived using the NO_X to NO_2 worksheet in the online LAQM tools website hosted by Defra. **Table 6.5** summarises the final model/monitored data correlation following the application of the model correction factor.

Table 6.5 Comparison of Roadside Modelling & Monitoring Results for NO_2

Monitoring Location	NO_2 µg/m^3		
	Monitored NO_2	Modelled NO_2	Difference (%)
N7	36.00	36.73	2.01
N15	30.00	32.87	9.57
N16	36.00	33.67	-6.47
N8	47.00	46.36	-1.37

The final model produced data at the monitoring locations to within 10% of the monitoring results, as the recommended by TG16 guidance.

The final verification model correlation coefficient (representing the model uncertainty) is 1.00[27]. This figure demonstrates that the model predictions were in line with the road traffic emissions at the monitoring locations.

6.6 Summary of Model Inputs

Table 6.6 Summary of ADMS Roads Model Inputs

Parameter	Description	Input Value
Chemistry	A facility within ADMS-Roads to calculate the chemical reactions in the atmosphere between Nitric Oxide (NO), NO_2, Ozone (O_3) and Volatile organic compounds (VOCs).	No atmospheric chemistry parameters included

[27] This was achieved by applying a model correction factor of 3.00 to roadside predicted NO_X concentrations before converting to NO_2

Parameter	Description	Input Value
Meteorology	Representative meteorological data from a local source	**Liverpool 2018 Meteorological Station**, hourly sequential data
Surface Roughness	A setting to define the surface roughness of the model area based upon its location.	**1m** representing a typical surface roughness for **Cities & Woodlands** was used for the Site. With **0.5m** representing a typical surface roughness for **Parkland, Open Suburbia** was used for the met. Measurement site.
Latitude	Allows the location of the model area to be set	United Kingdom = **53.425**
Monin-Obukhov Length	This allows a measure of the stability of the atmosphere within the model area to be specified depending upon its character.	Large Conurbations= **100m** was used for the Site. With Cities & Large Towns= **30m** was used for the met. Measurement site.
Elevation of Road	Allows the height of the road link above ground level to be specified.	All road links were set at ground level = **0m**.
Road Width	Allows the width of the road link to be specified.	Road width used depended on data obtained from OS map data for the specific road link.
Topography	This enables complex terrain data to be included within the model in order to account for turbulence and plume spread effects of topography	No topographical information used
Time Varied Emissions	This enables daily, weekly or monthly variations in emissions to be applied to road sources	No time varied emissions used
Road Type	Allows the effect of different types of roads to be assessed.	**Urban (Not London)** settings were used for the relevant links
Road Speeds	Enables individual road speeds to be added for each road link	Based on Google Map observations
Canyon Height	Allows the model to take account turbulent flow patterns occurring inside a street with relatively tall buildings on both sides, known as a "street canyon".	No canyons used within the model
Road Source Emissions	Road source emission rates are calculated from traffic flow data using the in-built EFT database of traffic emission factors.	The **EFT** Version **10.1 (2020)** dataset was used.
Year	Predicted EFT emissions rates depend on the year of emission.	**2018** data for verification and baseline Operational Phase Assessment. **2028** data for the Construction Phase Traffic Assessment. **2028** data for the Operational Phase Assessment, using 2028 EFT.

6.7 ADMS Modelling Results

Traffic Assessment

The ADMS Model has predicted concentrations of NO_2, PM_{10} and $PM_{2.5}$ at relevant receptor locations adjacent to roads likely to be affected by the development, as summarised in the following tables. Only receptors close to roads where there is predicted to be a change in emissions have been assessed.

6.7.1 Assessment Scenarios – Construction Phase

For the construction year of 2028, assessment of the effects of emissions from the proposed traffic associated with the construction phase, has been undertaken using the Emissions Factor Toolkit (EFT) 2028 emissions rates which take into account of the rate of reduction in emission from road vehicles into the future with the following factors:

- 2018 Baseline = Existing baseline conditions (2028 Base TEMPro'd);

- 2028 "Do Minimum" = 2028 Base + Cumulative Developments
- 2028 "Do Something" = 2028 Base + Cumulative Developments + Construction Phase Traffic Flows.

Nitrogen Dioxide

Table 6.7 presents a summary of the predicted change in NO_2 concentrations at relevant receptor locations, due to changes in traffic flow associated with the construction phase, based on modelled 'do minimum' and 'do something' scenarios.

Table 6.7 Predicted Annual Average Concentrations of NO_2 at Receptor Locations

Receptor		NO_2 (µg/m^3)			
		2018 Baseline	2028 Do Minimum	2028 Do Something	Development Contribution
R1	Gwladys Street Primary and Nursery School West	25.48	23.63	23.66	0.03
R2	Gwladys Street Primary and Nursery School East	27.61	23.30	23.34	0.04
R3	3 Goodison Road	27.56	22.61	22.63	0.02
R4	69 Goodison Road	25.06	22.62	22.63	0.01
R5	Arnot St Mary Church of England Primary School	29.93	24.63	24.64	0.01
R6	Alsop High School	29.88	25.22	25.23	0.01
R7	258Walton Road	35.71	26.10	26.11	0.01
R8	120 Queens Road	38.77	27.03	27.11	0.08
R9	46 Country Road	33.24	26.04	26.06	0.02
R10	333 Walton Lane	29.94	23.66	23.71	0.05
R11	Breeze Hill Neighbourhood Health Centre	36.70	26.96	26.99	0.03
R12	65 Breeze Hill	30.74	24.60	24.61	0.01
R13	281 Country Road	31.45	25.16	25.16	0.00
R14	204 Country Road	27.97	23.85	23.85	0.00
R15	4 Nimrod Street	26.01	22.99	22.99	0.00
R16	1 Andrew Street	26.31	23.11	23.12	0.01
R17	39 Diana Street	32.91	25.50	25.56	0.06
R18	46 Walton Hall Avenue	29.18	23.13	23.14	0.01
R19	82 Goodison Road	24.98	22.59	22.60	0.01
R20	10 City Road	25.03	22.61	22.62	0.01
R21	3 Goldie Street	27.87	22.67	22.67	0.00
R22	92 Walton Road	28.53	23.02	23.04	0.02
R23	Anfield Cemetery	31.84	26.19	26.24	0.05
R24	Anfield Cemetery	32.67	26.54	26.59	0.05
R25	Anfield Cemetery	31.87	26.21	26.26	0.05
R26	Anfield Cemetery	32.47	26.46	26.51	0.05
R27	Anfield Cemetery	33.28	26.83	26.86	0.03
R28	Anfield Cemetery	28.74	24.97	24.97	0.00
R29	Anfield Cemetery	28.20	24.76	24.76	0.00

Receptor		NO_2 (µg/m³)			
		2018 Baseline	2028 Do Minimum	2028 Do Something	Development Contribution
R30	Anfield Cemetery	27.78	24.59	24.59	0.00
R31	Anfield Cemetery	27.98	24.68	24.68	0.00
R32	Stanley Park	26.18	23.93	23.93	0.00
R33	Stanley Park	26.17	23.92	23.92	0.00
R34	Stanley Park	26.64	24.12	24.12	0.00
R35	Stanley Park	21.59	18.92	18.92	0.00
R36	Stanley Park	22.96	19.47	19.48	0.01
R37	Stanley Park	26.71	21.00	21.02	0.02
R38	Stanley Park	30.16	23.63	23.67	0.04
R39	Stanley Park	29.80	23.45	23.47	0.02
R40	Stanley Park	32.71	24.68	24.70	0.02
R41	Stanley Park	28.35	22.86	22.87	0.01
R42	Stanley Park	28.00	22.72	22.72	0.00
R43	Stanley Park	28.65	22.99	22.99	0.00
Annual Average AQO		**40 µg/m³**			

All modelled existing receptors are predicted to be below the AQO for NO_2 in both the 'do minimum' and 'do something' scenarios.

As indicated in **Table 6.7**, the maximum predicted increase in annual average exposure to NO_2 at any existing receptor, due to changes in traffic movements associated with the construction phase is 0.08 µg/m³ at 120 Queens Road (R8).

The impact description of changes in traffic flow associated with the construction phase with respect to annual mean NO_2 exposure has been assessed with reference to the criteria in Section 3. The outcomes of the assessment are summarised in

Table 6.8.

Table 6.8 Significance of Effects at Key Receptors (NO_2)

NO_2 Significance Effects at Key Receptors					
Receptor	Change Due to Development (DS-DM) (µg/m³)	Change (% of AQO)	% Change in Concentration Relative to AQO	% Annual Mean Concentration in Assessment Year	Significance
R1	0.03	0.08	0%	≤75% of AQO	Negligible
R2	0.04	0.10	0%	≤75% of AQO	Negligible
R3	0.02	0.05	0%	≤75% of AQO	Negligible
R4	0.01	0.03	0%	≤75% of AQO	Negligible
R5	0.01	0.03	0%	≤75% of AQO	Negligible
R6	0.01	0.03	0%	≤75% of AQO	Negligible
R7	0.01	0.03	0%	≤75% of AQO	Negligible
R8	0.08	0.20	0%	≤75% of AQO	Negligible
R9	0.02	0.05	0%	≤75% of AQO	Negligible
R10	0.05	0.13	0%	≤75% of AQO	Negligible
R11	0.03	0.08	0%	≤75% of AQO	Negligible
R12	0.01	0.03	0%	≤75% of AQO	Negligible
R13	0.00	0.00	0%	≤75% of AQO	Negligible
R14	0.00	0.00	0%	≤75% of AQO	Negligible
R15	0.00	0.00	0%	≤75% of AQO	Negligible
R16	0.01	0.03	0%	≤75% of AQO	Negligible
R17	0.06	0.15	0%	≤75% of AQO	Negligible
R18	0.01	0.03	0%	≤75% of AQO	Negligible
R19	0.01	0.03	0%	≤75% of AQO	Negligible
R20	0.01	0.03	0%	≤75% of AQO	Negligible
R21	0.00	0.00	0%	≤75% of AQO	Negligible
R22	0.02	0.05	0%	≤75% of AQO	Negligible
R23	0.05	0.13	0%	≤75% of AQO	Negligible
R24	0.05	0.13	0%	≤75% of AQO	Negligible
R25	0.05	0.13	0%	≤75% of AQO	Negligible
R26	0.05	0.13	0%	≤75% of AQO	Negligible
R27	0.03	0.08	0%	≤75% of AQO	Negligible
R28	0.00	0.00	0%	≤75% of AQO	Negligible
R29	0.00	0.00	0%	≤75% of AQO	Negligible
R30	0.00	0.00	0%	≤75% of AQO	Negligible
R31	0.00	0.00	0%	≤75% of AQO	Negligible
R32	0.00	0.00	0%	≤75% of AQO	Negligible
R33	0.00	0.00	0%	≤75% of AQO	Negligible
R34	0.00	0.00	0%	≤75% of AQO	Negligible
R35	0.00	0.00	0%	≤75% of AQO	Negligible
R36	0.01	0.03	0%	≤75% of AQO	Negligible
R37	0.02	0.05	0%	≤75% of AQO	Negligible
R38	0.04	0.10	0%	≤75% of AQO	Negligible
R39	0.02	0.05	0%	≤75% of AQO	Negligible

NO_2 Significance Effects at Key Receptors					
Receptor	**Change Due to Development (DS-DM) (µg/m³)**	**Change (% of AQO)**	**% Change in Concentration Relative to AQO**	**% Annual Mean Concentration in Assessment Year**	**Significance**
R40	0.02	0.05	0%	≤75% of AQO	Negligible
R41	0.01	0.03	0%	≤75% of AQO	Negligible
R42	0.00	0.00	0%	≤75% of AQO	Negligible
R43	0.00	0.00	0%	≤75% of AQO	Negligible
*0% means a change of <0.5% as per explanatory note 2 of table 6.3 of the EPUK IAQM Guidance.					

The significance of the effects of changes in traffic flow as a result of the construction phase, with respect to NO_2 exposure is determined to be 'negligible' at all receptors, based on the methodology outlined in Section 3. Given the quantitative nature of the assessment and the verification of the air quality dispersion model, the confidence of the assessment is deemed to be 'high'.

Particulate Matter (PM_{10})

Table 6.9 presents a summary of the predicted change in annual mean PM_{10} concentrations at relevant receptor locations, due to changes in traffic flow associated with the construction phase, based on modelled 'do minimum' and 'do something' scenarios.

Table 6.9 Predicted Annual Average Concentrations of PM_{10} at Receptor Locations

Receptor		PM_{10} ($\mu g/m^3$)			
		Baseline 2018	Do Minimum 2028	Do Something 2028	Development Contribution
R1	Gwladys Street Primary and Nursery School West	14.94	14.97	14.98	0.01
R2	Gwladys Street Primary and Nursery School East	14.61	14.69	14.71	0.02
R3	3 Goodison Road	16.17	16.24	16.24	0.01
R4	69 Goodison Road	17.50	17.53	17.53	0.00
R5	Arnot St Mary Church of England Primary School	18.56	18.66	18.66	0.01
R6	Alsop High School	15.76	15.82	15.82	0.00
R7	258Walton Road	17.56	17.69	17.70	0.01
R8	120 Queens Road	18.21	18.29	18.31	0.02
R9	46 Country Road	19.23	19.38	19.38	0.01
R10	333 Walton Lane	17.19	17.32	17.35	0.03
R11	Breeze Hill Neighbourhood Health Centre	19.30	19.36	19.37	0.01
R12	65 Breeze Hill	18.63	18.71	18.71	0.00
R13	281 Country Road	18.55	18.62	18.63	0.01
R14	204 Country Road	18.16	18.24	18.25	0.00
R15	4 Nimrod Street	17.74	17.79	17.79	0.00
R16	1 Andrew Street	17.79	17.85	17.85	0.00
R17	39 Diana Street	15.65	15.79	15.82	0.03
R18	46 Walton Hall Avenue	16.93	17.01	17.02	0.01
R19	82 Goodison Road	17.48	17.51	17.52	0.00
R20	10 City Road	17.49	17.53	17.53	0.00
R21	3 Goldie Street	16.33	16.42	16.42	0.00
R22	92 Walton Road	16.50	16.60	16.61	0.00
R23	Anfield Cemetery	16.21	16.31	16.34	0.03
R24	Anfield Cemetery	16.38	16.50	16.53	0.03
R25	Anfield Cemetery	16.21	16.32	16.34	0.03
R26	Anfield Cemetery	16.32	16.44	16.47	0.03
R27	Anfield Cemetery	16.32	16.41	16.43	0.02
R28	Anfield Cemetery	15.57	15.64	15.64	0.00
R29	Anfield Cemetery	15.49	15.55	15.55	0.00
R30	Anfield Cemetery	15.41	15.47	15.47	0.00
R31	Anfield Cemetery	15.45	15.51	15.51	0.00
R32	Stanley Park	15.09	15.13	15.13	0.00
R33	Stanley Park	15.09	15.13	15.13	0.00
R34	Stanley Park	15.18	15.23	15.23	0.00
R35	Stanley Park	14.62	14.66	14.66	0.00
R36	Stanley Park	14.86	14.92	14.93	0.00
R37	Stanley Park	15.53	15.62	15.64	0.02

Receptor		PM_{10} ($\mu g/m^3$)			
		Baseline 2018	Do Minimum 2028	Do Something 2028	Development Contribution
R38	Stanley Park	16.80	16.93	16.95	0.03
R39	Stanley Park	16.71	16.81	16.82	0.01
R40	Stanley Park	17.26	17.39	17.40	0.01
R41	Stanley Park	16.44	16.54	16.54	0.00
R42	Stanley Park	16.38	16.47	16.47	0.00
R43	Stanley Park	16.51	16.60	16.61	0.00
Annual Mean AQO		**40 $\mu g/m^3$**			

As indicated in **Table 6.9**, the maximum predicted increase in annual average exposure to PM_{10} at any existing receptor, due to changes in traffic movements associated with the construction phase is 0.03 $\mu g/m^3$ at Anfield Cemetery (R23 – R26), Stanley Park (R38), 333 Walton Lane (R10) and 39 Diana Street (R17).

The impact description of changes in traffic flow associated with the construction phase with respect to annual mean PM_{10} exposure has been assessed with reference to the criteria in section 3. The outcomes of the assessment are summarised in **Table 6.10**.

Table 6.10 Impact Description of Effects at Key Receptors (PM_{10})

Impact Description of PM_{10} Effects at Key Receptors					
Receptor	Change Due to Development (DS-DM) ($\mu g/m^3$)	Change Due to Development (% of AQO)	% Change in Concentration Relative to AQO	% Annual Mean Concentration in Assessment Year	Impact Description
R1	0.01	0.02	0%	≤75% of AQO	Negligible
R2	0.02	0.05	0%	≤75% of AQO	Negligible
R3	0.01	0.02	0%	≤75% of AQO	Negligible
R4	0.00	0.01	0%	≤75% of AQO	Negligible
R5	0.01	0.01	0%	≤75% of AQO	Negligible
R6	0.00	0.01	0%	≤75% of AQO	Negligible
R7	0.01	0.02	0%	≤75% of AQO	Negligible
R8	0.02	0.06	0%	≤75% of AQO	Negligible
R9	0.01	0.02	0%	≤75% of AQO	Negligible
R10	0.03	0.07	0%	≤75% of AQO	Negligible
R11	0.01	0.02	0%	≤75% of AQO	Negligible
R12	0.00	0.01	0%	≤75% of AQO	Negligible
R13	0.01	0.01	0%	≤75% of AQO	Negligible
R14	0.00	0.01	0%	≤75% of AQO	Negligible
R15	0.00	0.01	0%	≤75% of AQO	Negligible
R16	0.00	0.01	0%	≤75% of AQO	Negligible
R17	0.03	0.08	0%	≤75% of AQO	Negligible
R18	0.01	0.02	0%	≤75% of AQO	Negligible
R19	0.00	0.01	0%	≤75% of AQO	Negligible
R20	0.00	0.01	0%	≤75% of AQO	Negligible
R21	0.00	0.00	0%	≤75% of AQO	Negligible
R22	0.00	0.01	0%	≤75% of AQO	Negligible
R23	0.03	0.07	0%	≤75% of AQO	Negligible
R24	0.03	0.07	0%	≤75% of AQO	Negligible

Impact Description of PM_{10} Effects at Key Receptors					
Receptor	Change Due to Development (DS-DM) (µg/m³)	Change Due to Development (% of AQO)	% Change in Concentration Relative to AQO	% Annual Mean Concentration in Assessment Year	Impact Description
R25	0.03	0.07	0%	≤75% of AQO	Negligible
R26	0.03	0.07	0%	≤75% of AQO	Negligible
R27	0.02	0.04	0%	≤75% of AQO	Negligible
R28	0.00	0.01	0%	≤75% of AQO	Negligible
R29	0.00	0.00	0%	≤75% of AQO	Negligible
R30	0.00	0.00	0%	≤75% of AQO	Negligible
R31	0.00	0.00	0%	≤75% of AQO	Negligible
R32	0.00	0.00	0%	≤75% of AQO	Negligible
R33	0.00	0.00	0%	≤75% of AQO	Negligible
R34	0.00	0.00	0%	≤75% of AQO	Negligible
R35	0.00	0.00	0%	≤75% of AQO	Negligible
R36	0.00	0.01	0%	≤75% of AQO	Negligible
R37	0.02	0.05	0%	≤75% of AQO	Negligible
R38	0.03	0.07	0%	≤75% of AQO	Negligible
R39	0.01	0.03	0%	≤75% of AQO	Negligible
R40	0.01	0.02	0%	≤75% of AQO	Negligible
R41	0.00	0.00	0%	≤75% of AQO	Negligible
R42	0.00	0.00	0%	≤75% of AQO	Negligible
R43	0.00	0.00	0%	≤75% of AQO	Negligible
*0% means a change of <0.5% as per explanatory note 2 of table 6.3 of the EPUK IAQM Guidance.					

The impact description of the effects of changes in traffic as a result of the construction phase, with respect to annual mean PM_{10} exposure for existing receptors is determined to be 'negligible' based on the methodology outlined in section 3. Given the quantitative nature of the assessment and the verification of the air quality dispersion model, the confidence of the assessment is deemed to be 'high'.

Particulate Matter ($PM_{2.5}$)

Table 6.11 presents a summary of the predicted change in annual mean $PM_{2.5}$ concentrations at relevant receptor locations, due to changes in traffic flow associated with the construction phase, based on modelled 'do minimum' and 'do something' scenarios.

Table 6.11 Predicted Annual Average Concentrations of $PM_{2.5}$ at Receptor Locations

Receptor		$PM_{2.5}$ (µg/m³)			
		Baseline 2018	Do Minimum 2028	Do Something 2028	Development Contribution
R1	Gwladys Street Primary and Nursery School West	10.90	10.90	10.91	0.01
R2	Gwladys Street Primary and Nursery School East	10.38	10.37	10.38	0.01
R3	3 Goodison Road	11.36	11.35	11.35	0.00
R4	69 Goodison Road	12.66	12.65	12.65	0.00
R5	Arnot St Mary Church of England Primary School	13.27	13.27	13.27	0.00
R6	Alsop High School	11.39	11.36	11.37	0.00

Receptor		$PM_{2.5}$ (µg/m³)			
		Baseline 2018	Do Minimum 2028	Do Something 2028	Development Contribution
R7	258Walton Road	12.20	12.16	12.16	0.00
R8	120 Queens Road	12.61	12.52	12.53	0.01
R9	46 Country Road	13.67	13.67	13.67	0.00
R10	333 Walton Lane	11.97	11.97	11.98	0.01
R11	Breeze Hill Neighbourhood Health Centre	13.74	13.67	13.67	0.00
R12	65 Breeze Hill	13.32	13.29	13.30	0.00
R13	281 Country Road	13.29	13.26	13.26	0.00
R14	204 Country Road	13.04	13.04	13.04	0.00
R15	4 Nimrod Street	12.80	12.79	12.79	0.00
R16	1 Andrew Street	12.83	12.82	12.82	0.00
R17	39 Diana Street	10.99	10.98	11.00	0.02
R18	46 Walton Hall Avenue	11.82	11.80	11.80	0.01
R19	82 Goodison Road	12.65	12.64	12.64	0.00
R20	10 City Road	12.66	12.65	12.65	0.00
R21	3 Goldie Street	11.45	11.44	11.44	0.00
R22	92 Walton Road	11.55	11.54	11.55	0.00
R23	Anfield Cemetery	11.64	11.64	11.66	0.01
R24	Anfield Cemetery	11.74	11.74	11.76	0.01
R25	Anfield Cemetery	11.65	11.64	11.66	0.01
R26	Anfield Cemetery	11.71	11.71	11.73	0.01
R27	Anfield Cemetery	11.72	11.70	11.71	0.01
R28	Anfield Cemetery	11.27	11.27	11.27	0.00
R29	Anfield Cemetery	11.22	11.22	11.22	0.00
R30	Anfield Cemetery	11.18	11.17	11.17	0.00
R31	Anfield Cemetery	11.20	11.20	11.20	0.00
R32	Stanley Park	10.99	10.99	10.99	0.00
R33	Stanley Park	10.99	10.99	10.99	0.00
R34	Stanley Park	11.04	11.04	11.04	0.00
R35	Stanley Park	10.34	10.33	10.33	0.00
R36	Stanley Park	10.48	10.48	10.48	0.00
R37	Stanley Park	10.88	10.87	10.87	0.01
R38	Stanley Park	11.73	11.72	11.73	0.01
R39	Stanley Park	11.67	11.66	11.67	0.01
R40	Stanley Park	12.00	11.98	11.99	0.00
R41	Stanley Park	11.52	11.51	11.51	0.00
R42	Stanley Park	11.48	11.47	11.47	0.00
R43	Stanley Park	11.55	11.55	11.55	0.00
Annual Mean AQO		**25 µg/m³**			

All modelled receptor locations are predicted to be below the AQO for $PM_{2.5}$ in both the 'do minimum' and 'do something' scenarios.

As indicated in **Table 6.11**, the maximum predicted increase in annual average exposure to $PM_{2.5}$ at any existing receptor, due to changes in traffic movements associated with the construction phase is 0.02 µg/m³ at 39 Diana Street (R17).

The impact description of changes in traffic flow associated with the construction phase, with respect to annual mean $PM_{2.5}$ exposure has been assessed with reference to the criteria in section 3. The outcomes of the assessment are summarised in **Table 6.12**.

Table 6.12 Impact Description of Effects at Key Receptors ($PM_{2.5}$)

Impact Description of $PM_{2.5}$ Effects at Key Receptors					
Receptor	**Change Due to Development (DS-DM) (µg/m³)**	**Change Due to Development (% of AQO)**	**% Change in Concentration Relative to AQO**	**% Annual Mean Concentration in Assessment Year**	**Impact Description**
R1	0.01	0.02	0%	≤75% of AQO	Negligible
R2	0.01	0.04	0%	≤75% of AQO	Negligible
R3	0.00	0.01	0%	≤75% of AQO	Negligible
R4	0.00	0.00	0%	≤75% of AQO	Negligible
R5	0.00	0.01	0%	≤75% of AQO	Negligible
R6	0.00	0.01	0%	≤75% of AQO	Negligible
R7	0.00	0.02	0%	≤75% of AQO	Negligible
R8	0.01	0.06	0%	≤75% of AQO	Negligible
R9	0.00	0.01	0%	≤75% of AQO	Negligible
R10	0.01	0.06	0%	≤75% of AQO	Negligible
R11	0.00	0.02	0%	≤75% of AQO	Negligible
R12	0.00	0.01	0%	≤75% of AQO	Negligible
R13	0.00	0.01	0%	≤75% of AQO	Negligible
R14	0.00	0.01	0%	≤75% of AQO	Negligible
R15	0.00	0.01	0%	≤75% of AQO	Negligible
R16	0.00	0.01	0%	≤75% of AQO	Negligible
R17	0.02	0.06	0%	≤75% of AQO	Negligible
R18	0.01	0.02	0%	≤75% of AQO	Negligible
R19	0.00	0.00	0%	≤75% of AQO	Negligible
R20	0.00	0.01	0%	≤75% of AQO	Negligible
R21	0.00	0.00	0%	≤75% of AQO	Negligible
R22	0.00	0.01	0%	≤75% of AQO	Negligible
R23	0.01	0.05	0%	≤75% of AQO	Negligible
R24	0.01	0.06	0%	≤75% of AQO	Negligible
R25	0.01	0.05	0%	≤75% of AQO	Negligible
R26	0.01	0.05	0%	≤75% of AQO	Negligible
R27	0.01	0.03	0%	≤75% of AQO	Negligible
R28	0.00	0.01	0%	≤75% of AQO	Negligible
R29	0.00	0.00	0%	≤75% of AQO	Negligible
R30	0.00	0.00	0%	≤75% of AQO	Negligible
R31	0.00	0.00	0%	≤75% of AQO	Negligible
R32	0.00	0.00	0%	≤75% of AQO	Negligible
R33	0.00	0.00	0%	≤75% of AQO	Negligible
R34	0.00	0.00	0%	≤75% of AQO	Negligible
R35	0.00	0.00	0%	≤75% of AQO	Negligible
R36	0.00	0.01	0%	≤75% of AQO	Negligible
R37	0.01	0.04	0%	≤75% of AQO	Negligible
R38	0.01	0.05	0%	≤75% of AQO	Negligible

Impact Description of $PM_{2.5}$ Effects at Key Receptors					
Receptor	Change Due to Development (DS-DM) (µg/m³)	Change Due to Development (% of AQO)	% Change in Concentration Relative to AQO	% Annual Mean Concentration in Assessment Year	Impact Description
R39	0.01	0.03	0%	≤75% of AQO	Negligible
R40	0.00	0.02	0%	≤75% of AQO	Negligible
R41	0.00	0.00	0%	≤75% of AQO	Negligible
R42	0.00	0.00	0%	≤75% of AQO	Negligible
R43	0.00	0.00	0%	≤75% of AQO	Negligible
*0% means a change of <0.5% as per explanatory note 2 of table 6.3 of the EPUK IAQM Guidance.					

The impact description of the effects of changes in traffic as a result of the construction phase, with respect to annual mean $PM_{2.5}$ exposure, for existing receptors, is determined to be 'negligible' based on the methodology outlined in section 3. Given the quantitative nature of the assessment and the verification of the air quality dispersion model, the confidence of the assessment is deemed to be 'high'.

6.7.2 Assessment Scenarios – Operational Phase

For the operational year of 2028, assessment of the effects of emissions from the proposed traffic associated with the scheme, has been undertaken using the EFT 2028 emissions rates which take into account of the rate of reduction in emission from road vehicles into the future with the following factors:

- 2018 Baseline = Existing baseline conditions (2028 Base TEMPro'd);
- 2028 "Do Minimum" = Baseline conditions + Cumulative Development flows and,
- 2028 "Do Something" = Baseline conditions + Cumulative development + The Proposed Development.

Additionally, for comparison, the following scenarios have been assessed for robustness:

- Scenario 3 – Theoretical Emissions Scenarios (Appendix B).

Nitrogen Dioxide

Table 6.13 presents a summary of the predicted change in NO_2 concentrations at relevant receptor locations, due to changes in traffic flow associated with the development, based on modelled 'do minimum' and 'do something' scenarios.

Table 6.13 Predicted Annual Average Concentrations of NO_2 at Receptor Locations

Receptor		NO_2 (µg/m³)			
		Baseline 2018	Do Minimum 2028	Do Something 2028	Development Contribution
R1	Gwladys Street Primary and Nursery School West	25.48	23.46	23.68	0.22
R2	Gwladys Street Primary and Nursery School East	27.61	22.89	23.05	0.16
R3	3 Goodison Road	27.56	22.12	22.52	0.40

Receptor		NO_2 (µg/m³)			
		Baseline 2018	Do Minimum 2028	Do Something 2028	Development Contribution
R4	69 Goodison Road	25.06	22.38	22.63	0.25
R5	Arnot St Mary Church of England Primary School	29.93	24.10	24.14	0.04
R6	Alsop High School	29.88	24.83	24.86	0.03
R7	258Walton Road	35.71	25.12	25.19	0.07
R8	120 Queens Road	38.77	26.00	26.19	0.19
R9	46 Country Road	33.24	25.31	25.37	0.06
R10	333 Walton lane	29.94	23.05	23.24	0.19
R11	Breeze Hill Neighbourhood Health Centre	36.70	26.16	26.22	0.06
R12	65 Breeze Hill	30.74	24.10	24.12	0.02
R13	281 Country Road	31.45	24.56	24.59	0.03
R14	204 Country Road	27.97	23.42	23.45	0.03
R15	4 Nimrod Street	26.01	22.69	22.79	0.10
R16	1 Andrew Street	26.31	22.79	22.85	0.06
R17	39 Diana Street	32.91	24.78	25.00	0.22
R18	46 Walton Hall Avenue	29.18	22.60	22.66	0.06
R19	82 Goodison Road	24.98	22.35	22.55	0.20
R20	10 City Rd	25.03	22.38	22.58	0.20
R21	3 Goldie Street	27.87	22.16	22.30	0.14
R22	92 Walton Road	28.53	22.47	22.51	0.04
R23	Anfield Cemetery	31.84	25.65	25.81	0.16
R24	Anfield Cemetery	32.67	25.95	26.13	0.18
R25	Anfield Cemetery	31.87	25.67	25.88	0.21
R26	Anfield Cemetery	32.47	25.89	26.07	0.18
R27	Anfield Cemetery	33.28	26.19	26.34	0.15
R28	Anfield Cemetery	28.74	24.60	24.66	0.06
R29	Anfield Cemetery	28.20	24.41	24.46	0.05
R30	Anfield Cemetery	27.78	24.27	24.31	0.04
R31	Anfield Cemetery	27.98	24.34	24.38	0.04
R32	Stanley Park	26.18	23.71	23.73	0.02
R33	Stanley Park	26.17	23.70	23.72	0.02
R34	Stanley Park	26.64	23.86	23.89	0.03
R35	Stanley Park	21.59	18.65	18.69	0.04
R36	Stanley Park	22.96	19.13	19.19	0.06
R37	Stanley Park	26.71	20.45	20.59	0.14
R38	Stanley Park	30.16	22.99	23.21	0.22
R39	Stanley Park	29.80	22.84	22.99	0.15
R40	Stanley Park	32.71	23.90	24.13	0.23
R41	Stanley Park	28.35	22.33	22.49	0.16
R42	Stanley Park	28.00	22.21	22.36	0.15
R43	Stanley Park	28.65	22.44	22.60	0.16
CR1	Bullens Road scheme	-	21.84	22.06	0.22
CR2	Bullens Road scheme	-	23.61	23.97	0.36
PR1	Plot B	-	-	23.13	-
PR2	Plot B	-	-	23.46	-
PR3	Plot A	-	-	24.19	-
PR4	Plot D	-	-	21.06	-
PR5	Plot F	-	-	22.16	-

Receptor		NO_2 (µg/m³)			
		Baseline 2018	Do Minimum 2028	Do Something 2028	Development Contribution
PR6	Plot G	-	-	22.20	-
PR7	Plot G	-	-	22.03	-
PR8	Plot G	-	-	21.94	-
PR9	Plot E	-	-	22.48	-
PR10	Plot E	-	-	20.86	-
PR11	Plot A	-	-	21.37	-
PR12	Plot C	-	-	20.95	-
Annual Mean AQO		**40 µg/m³**			

All modelled existing receptors are predicted to be below the AQO for NO_2 in both the 'do minimum' and 'do something' scenarios.

As indicated in **Table 6.13**, the maximum predicted increase in annual average exposure to NO_2 at any existing receptor, due to changes in traffic movements associated with the development is 0.40 µg/m³ at 3 Goodison Road (R3).

The impact description of changes in traffic flow associated with the development with respect to annual mean NO_2 exposure has been assessed with reference to the criteria in Section 3. The outcomes of the assessment are summarised in

Table 6.14.

Table 6.14 Impact Description of Effects at Key Receptors (NO_2)

Impact Description of NO_2 Effects at Key Receptors					
Receptor	Change Due to Development (DS-DM) (µg/m³)	Change due to Development (% of AQO)	% Change in Concentration Relative to AQO	% Annual Mean Concentration in Assessment Year	Impact Description
R1	0.22	0.55	1%	≤75% of AQO	Negligible
R2	0.16	0.40	0%	≤75% of AQO	Negligible
R3	0.40	1.00	1%	≤75% of AQO	Negligible
R4	0.25	0.63	1%	≤75% of AQO	Negligible
R5	0.04	0.10	0%	≤75% of AQO	Negligible
R6	0.03	0.08	0%	≤75% of AQO	Negligible
R7	0.07	0.18	0%	≤75% of AQO	Negligible
R8	0.19	0.48	0%	≤75% of AQO	Negligible
R9	0.06	0.15	0%	≤75% of AQO	Negligible
R10	0.19	0.48	0%	≤75% of AQO	Negligible
R11	0.06	0.15	0%	≤75% of AQO	Negligible
R12	0.02	0.05	0%	≤75% of AQO	Negligible
R13	0.03	0.08	0%	≤75% of AQO	Negligible
R14	0.03	0.08	0%	≤75% of AQO	Negligible
R15	0.10	0.25	0%	≤75% of AQO	Negligible
R16	0.06	0.15	0%	≤75% of AQO	Negligible
R17	0.22	0.55	1%	≤75% of AQO	Negligible
R18	0.06	0.15	0%	≤75% of AQO	Negligible
R19	0.20	0.50	1%	≤75% of AQO	Negligible
R20	0.20	0.50	1%	≤75% of AQO	Negligible
R21	0.14	0.35	0%	≤75% of AQO	Negligible
R22	0.04	0.10	0%	≤75% of AQO	Negligible
R23	0.16	0.40	0%	≤75% of AQO	Negligible
R24	0.18	0.45	0%	≤75% of AQO	Negligible
R25	0.21	0.53	1%	≤75% of AQO	Negligible
R26	0.18	0.45	0%	≤75% of AQO	Negligible
R27	0.15	0.38	0%	≤75% of AQO	Negligible
R28	0.06	0.15	0%	≤75% of AQO	Negligible
R29	0.05	0.13	0%	≤75% of AQO	Negligible
R30	0.04	0.10	0%	≤75% of AQO	Negligible
R31	0.04	0.10	0%	≤75% of AQO	Negligible
R32	0.02	0.05	0%	≤75% of AQO	Negligible
R33	0.02	0.05	0%	≤75% of AQO	Negligible
R34	0.03	0.08	0%	≤75% of AQO	Negligible
R35	0.04	0.10	0%	≤75% of AQO	Negligible
R36	0.06	0.15	0%	≤75% of AQO	Negligible
R37	0.14	0.35	0%	≤75% of AQO	Negligible
R38	0.22	0.55	1%	≤75% of AQO	Negligible
R39	0.15	0.38	0%	≤75% of AQO	Negligible
R40	0.23	0.58	1%	≤75% of AQO	Negligible
R41	0.16	0.40	0%	≤75% of AQO	Negligible
R42	0.15	0.38	0%	≤75% of AQO	Negligible

Impact Description of NO_2 Effects at Key Receptors					
Receptor	**Change Due to Development (DS-DM) (µg/m³)**	**Change due to Development (% of AQO)**	**% Change in Concentration Relative to AQO**	**% Annual Mean Concentration in Assessment Year**	**Impact Description**
R43	0.16	0.40	0%	≤75% of AQO	Negligible
*0% means a change of <0.5% as per explanatory note 2 of table 6.3 of the EPUK IAQM Guidance.					

The impact description of the effects of changes in traffic flow as a result of the proposed development, with respect to NO_2 exposure for existing receptors, is determined to be 'negligible' at all modelled receptors. This is based on the methodology outlined in section 3. Given the quantitative nature of the assessment and the verification of the air quality dispersion model, the confidence of the assessment is deemed to be 'high'.

Figure 6.1 Annual Average Long-Term Nitrogen Dioxide (NO_2) Contribution from Proposed Development (µg/m^3)

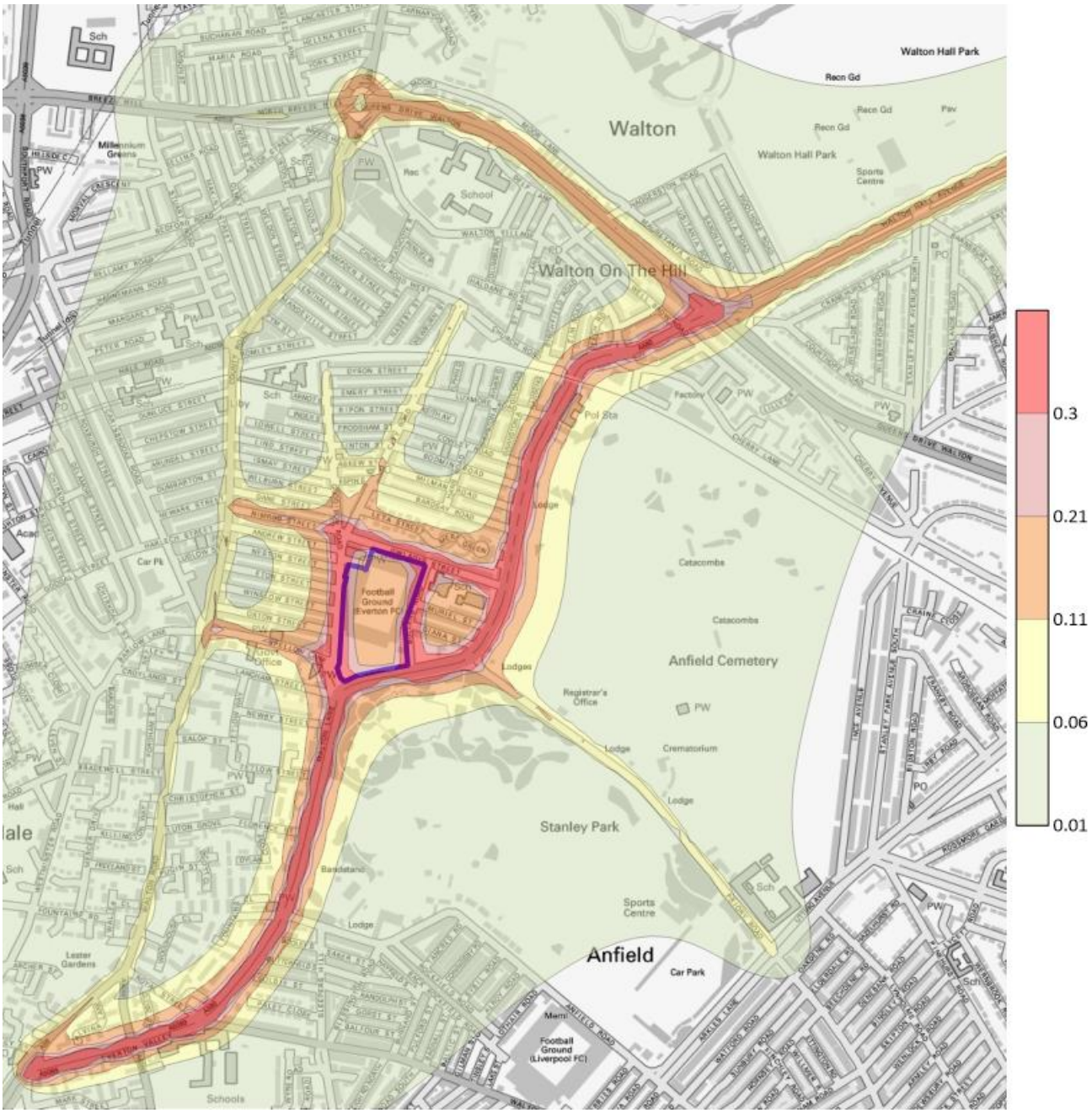
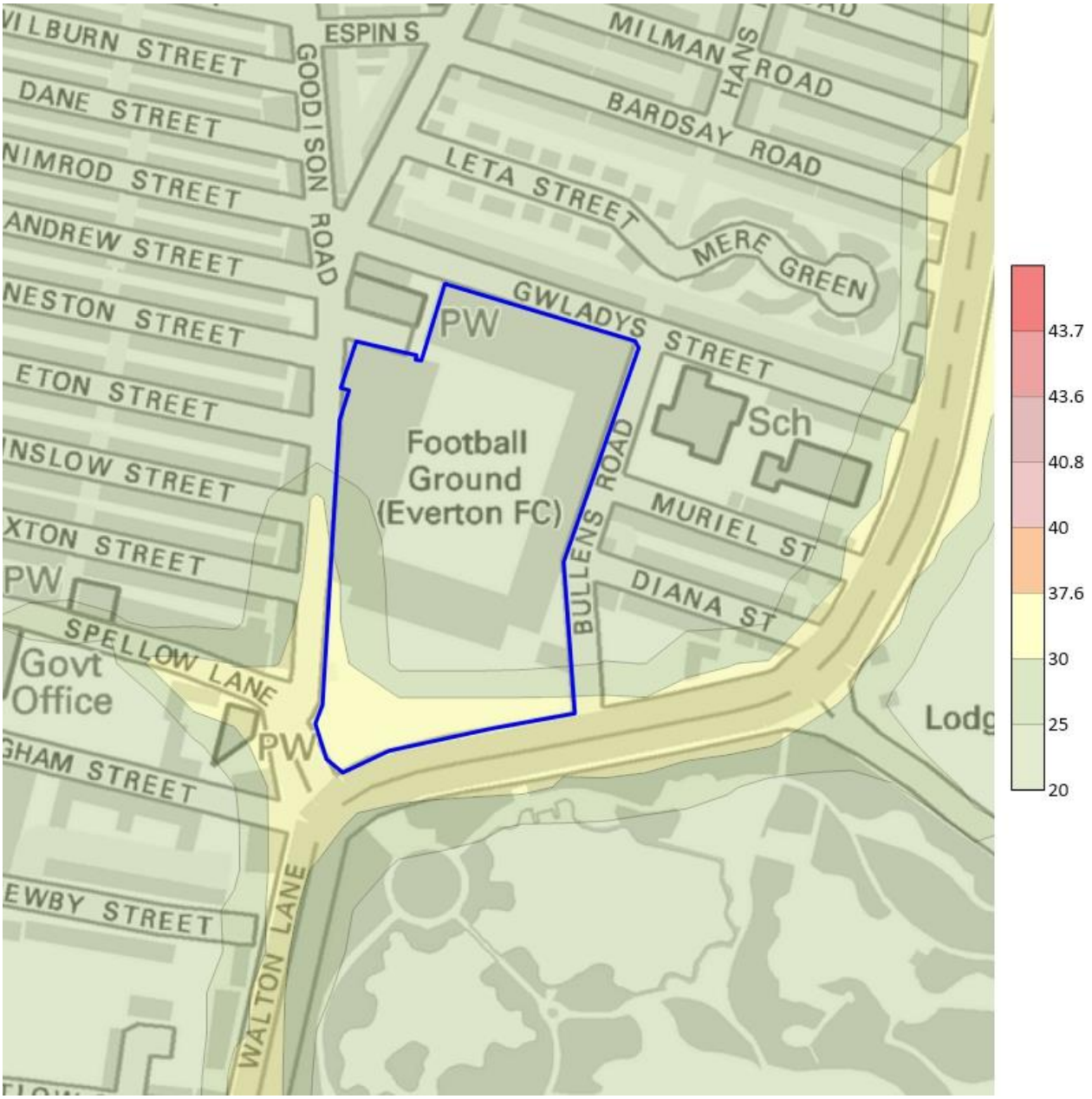


Figure 6.2 Total Long Term Annual Average Nitrogen Dioxide (NO_2) Concentration at Proposed Development (µg/m^3)



Particulate Matter (PM_{10})

Table 6.15 presents a summary of the annual mean PM_{10} concentrations at relevant proposed receptor locations, due to traffic flow associated with the development, based on modelled the 2028 opening year scenario.

Table 6.15 Predicted Annual Average Concentrations of PM_{10} at Receptor Locations

Receptor		PM_{10} ($\mu g/m^3$)			
		2018 Baseline	2028 Do Minimum	2028 Do Something	Development Contribution
R1	Gwladys Street Primary and Nursery School West	14.94	15.00	15.12	0.12
R2	Gwladys Street Primary and Nursery School East	14.61	14.74	14.84	0.10
R3	3 Goodison Road	16.17	16.30	16.49	0.19
R4	69 Goodison Road	17.50	17.56	17.68	0.12
R5	Arnot St Mary Church of England Primary School	18.56	18.73	18.75	0.02
R6	Alsop High School	15.76	15.87	15.89	0.02
R7	258Walton Road	17.56	17.80	17.84	0.04
R8	120 Queens Road	18.21	18.39	18.49	0.09
R9	46 Country Road	19.23	19.47	19.50	0.03
R10	333 Walton lane	17.19	17.39	17.51	0.11
R11	Breeze Hill Neighbourhood Health Centre	19.30	19.45	19.48	0.03
R12	65 Breeze Hill	18.63	18.78	18.79	0.02
R13	281 Country Road	18.55	18.68	18.70	0.02
R14	204 Country Road	18.16	18.30	18.31	0.02
R15	4 Nimrod Street	17.74	17.83	17.88	0.05
R16	1 Andrew Street	17.79	17.88	17.91	0.03
R17	39 Diana Street	15.65	15.88	16.01	0.14
R18	46 Walton Hall Avenue	16.93	17.08	17.11	0.03
R19	82 Goodison Road	17.48	17.54	17.64	0.10
R20	10 City Rd	17.49	17.56	17.66	0.10
R21	3 Goldie Street	16.33	16.48	16.57	0.08
R22	92 Walton Road	16.50	16.67	16.69	0.02
R23	Anfield Cemetery	16.21	16.38	16.48	0.10
R24	Anfield Cemetery	16.38	16.57	16.69	0.12
R25	Anfield Cemetery	16.21	16.38	16.51	0.13
R26	Anfield Cemetery	16.32	16.51	16.63	0.11
R27	Anfield Cemetery	16.32	16.49	16.58	0.09
R28	Anfield Cemetery	15.57	15.69	15.73	0.04
R29	Anfield Cemetery	15.49	15.60	15.63	0.03
R30	Anfield Cemetery	15.41	15.51	15.53	0.02
R31	Anfield Cemetery	15.45	15.55	15.58	0.02
R32	Stanley Park	15.09	15.16	15.17	0.02
R33	Stanley Park	15.09	15.16	15.17	0.02
R34	Stanley Park	15.18	15.26	15.28	0.02

Receptor		PM_{10} (µg/m³)			
		2018 Baseline	2028 Do Minimum	2028 Do Something	Development Contribution
R35	Stanley Park	14.62	14.70	14.72	0.02
R36	Stanley Park	14.86	14.97	15.00	0.04
R37	Stanley Park	15.53	15.69	15.78	0.09
R38	Stanley Park	16.80	17.01	17.13	0.13
R39	Stanley Park	16.71	16.90	16.98	0.08
R40	Stanley Park	17.26	17.50	17.63	0.13
R41	Stanley Park	16.44	16.61	16.70	0.09
R42	Stanley Park	16.38	16.54	16.62	0.09
R43	Stanley Park	16.51	16.68	16.77	0.09
CR1	Bullens Road scheme	-	16.54	16.68	0.14
CR2	Bullens Road scheme	-	17.38	17.58	0.20
PR1	Plot B	-	-	17.07	-
PR2	Plot B	-	-	17.29	-
PR3	Plot A	-	-	17.67	-
PR4	Plot D	-	-	15.80	-
PR5	Plot F	-	-	17.52	-
PR6	Plot G	-	-	17.52	-
PR7	Plot G	-	-	17.42	-
PR8	Plot G	-	-	17.38	-
PR9	Plot E	-	-	17.69	-
PR10	Plot E	-	-	15.67	-
PR11	Plot A	-	-	15.91	-
PR12	Plot C	-	-	15.70	-
Annual Average AQO		**40 µg/m³**			

All modelled receptor locations are not predicted to exceed the AQO for PM_{10} in both the 'do minimum' and 'do something' scenarios.

As indicated in **Table 6.15**, the maximum predicted increase in the annual average exposure to PM_{10} at any existing receptor, due to changes in traffic movements associated with the development, is 0.20 µg/m³ at Bullens Road Scheme (CR2).

The significance of changes in traffic flow associated with the development with respect to annual mean PM_{10} exposure has been assessed with reference to the criteria in Section 3. The outcomes of the assessment are summarised in **Table 6.16**.

Table 6.16 Significance of Effects at Key Receptors (PM_{10})

PM_{10} Significance Effects at Key Receptors					
Receptor	Change Due to Development (DS-DM) (µg/m³)	Change (% of AQO)	% Change in Concentration Relative to AQO	% Annual Mean Concentration in Assessment Year	Significance
R1	0.12	0.31	0%	≤75% of AQO	Negligible

PM_{10} Significance Effects at Key Receptors					
Receptor	Change Due to Development (DS-DM) (µg/m³)	Change (% of AQO)	% Change in Concentration Relative to AQO	% Annual Mean Concentration in Assessment Year	Significance
R2	0.10	0.24	0%	≤75% of AQO	Negligible
R3	0.19	0.49	0%	≤75% of AQO	Negligible
R4	0.12	0.31	0%	≤75% of AQO	Negligible
R5	0.02	0.06	0%	≤75% of AQO	Negligible
R6	0.02	0.05	0%	≤75% of AQO	Negligible
R7	0.04	0.10	0%	≤75% of AQO	Negligible
R8	0.09	0.24	0%	≤75% of AQO	Negligible
R9	0.03	0.08	0%	≤75% of AQO	Negligible
R10	0.11	0.29	0%	≤75% of AQO	Negligible
R11	0.03	0.07	0%	≤75% of AQO	Negligible
R12	0.02	0.04	0%	≤75% of AQO	Negligible
R13	0.02	0.05	0%	≤75% of AQO	Negligible
R14	0.02	0.04	0%	≤75% of AQO	Negligible
R15	0.05	0.12	0%	≤75% of AQO	Negligible
R16	0.03	0.07	0%	≤75% of AQO	Negligible
R17	0.14	0.34	0%	≤75% of AQO	Negligible
R18	0.03	0.08	0%	≤75% of AQO	Negligible
R19	0.10	0.24	0%	≤75% of AQO	Negligible
R20	0.10	0.26	0%	≤75% of AQO	Negligible
R21	0.08	0.20	0%	≤75% of AQO	Negligible
R22	0.02	0.06	0%	≤75% of AQO	Negligible
R23	0.10	0.25	0%	≤75% of AQO	Negligible
R24	0.12	0.29	0%	≤75% of AQO	Negligible
R25	0.13	0.32	0%	≤75% of AQO	Negligible
R26	0.11	0.28	0%	≤75% of AQO	Negligible
R27	0.09	0.22	0%	≤75% of AQO	Negligible
R28	0.04	0.10	0%	≤75% of AQO	Negligible
R29	0.03	0.07	0%	≤75% of AQO	Negligible
R30	0.02	0.06	0%	≤75% of AQO	Negligible
R31	0.02	0.06	0%	≤75% of AQO	Negligible
R32	0.02	0.04	0%	≤75% of AQO	Negligible
R33	0.02	0.04	0%	≤75% of AQO	Negligible
R34	0.02	0.05	0%	≤75% of AQO	Negligible
R35	0.02	0.06	0%	≤75% of AQO	Negligible
R36	0.04	0.09	0%	≤75% of AQO	Negligible
R37	0.09	0.22	0%	≤75% of AQO	Negligible
R38	0.13	0.31	0%	≤75% of AQO	Negligible
R39	0.08	0.20	0%	≤75% of AQO	Negligible
R40	0.13	0.31	0%	≤75% of AQO	Negligible
R41	0.09	0.23	0%	≤75% of AQO	Negligible
R42	0.09	0.22	0%	≤75% of AQO	Negligible

PM_{10} Significance Effects at Key Receptors					
Receptor	Change Due to Development (DS-DM) (µg/m³)	Change (% of AQO)	% Change in Concentration Relative to AQO	% Annual Mean Concentration in Assessment Year	Significance
R43	0.09	0.23	0%	≤75% of AQO	Negligible
*0% means a change of <0.5% as per explanatory note 2 of table 6.3 of the EPUK IAQM Guidance.					

The significance of the effects of changes in traffic as a result of the proposed development, with respect to annual mean PM_{10} exposure, is determined to be 'negligible' based on the methodology outlined in Section 3. Given the quantitative nature of the assessment and the verification of the air quality dispersion model, the confidence of the assessment is deemed to be 'high'.

Particulate Matter ($PM_{2.5}$)

Table 6.17 presents a summary of the annual mean $PM_{2.5}$ concentrations at relevant proposed receptor locations, due to traffic flow associated with the development, based on modelled the 2028 opening year scenario.

Table 6.17 Predicted Annual Average Concentrations of $PM_{2.5}$ at Receptor Locations

Receptor		$PM_{2.5}$ (µg/m³)			
		2018 Baseline	2028 Do Minimum	2028 Do Something	Development Contribution
R1	Gwladys Street Primary and Nursery School West	10.90	10.91	10.98	0.07
R2	Gwladys Street Primary and Nursery School East	10.38	10.40	10.45	0.05
R3	3 Goodison Road	11.36	11.38	11.49	0.11
R4	69 Goodison Road	12.66	12.66	12.73	0.07
R5	Arnot St Mary Church of England Primary School	13.27	13.31	13.32	0.01
R6	Alsop High School	11.39	11.39	11.40	0.01
R7	258Walton Road	12.20	12.21	12.24	0.02
R8	120 Queens Road	12.61	12.57	12.63	0.05
R9	46 Country Road	13.67	13.72	13.73	0.02
R10	333 Walton lane	11.97	12.01	12.07	0.06
R11	Breeze Hill Neighbourhood Health Centre	13.74	13.71	13.73	0.02
R12	65 Breeze Hill	13.32	13.33	13.34	0.01
R13	281 Country Road	13.29	13.29	13.30	0.01
R14	204 Country Road	13.04	13.07	13.08	0.01
R15	4 Nimrod Street	12.80	12.81	12.84	0.03
R16	1 Andrew Street	12.83	12.84	12.86	0.02
R17	39 Diana Street	10.99	11.03	11.10	0.08
R18	46 Walton Hall Avenue	11.82	11.83	11.85	0.02
R19	82 Goodison Road	12.65	12.66	12.71	0.05
R20	10 City Rd	12.66	12.66	12.72	0.06
R21	3 Goldie Street	11.45	11.48	11.52	0.05
R22	92 Walton Road	11.55	11.58	11.59	0.01

Receptor		$PM_{2.5}$ (µg/m³)			
		2018 Baseline	2028 Do Minimum	2028 Do Something	Development Contribution
R23	Anfield Cemetery	11.64	11.67	11.73	0.06
R24	Anfield Cemetery	11.74	11.78	11.84	0.06
R25	Anfield Cemetery	11.65	11.68	11.75	0.07
R26	Anfield Cemetery	11.71	11.75	11.81	0.06
R27	Anfield Cemetery	11.72	11.74	11.79	0.05
R28	Anfield Cemetery	11.27	11.29	11.32	0.02
R29	Anfield Cemetery	11.22	11.24	11.26	0.02
R30	Anfield Cemetery	11.18	11.20	11.21	0.01
R31	Anfield Cemetery	11.20	11.22	11.23	0.01
R32	Stanley Park	10.99	11.00	11.01	0.01
R33	Stanley Park	10.99	11.00	11.01	0.01
R34	Stanley Park	11.04	11.06	11.07	0.01
R35	Stanley Park	10.34	10.35	10.37	0.01
R36	Stanley Park	10.48	10.50	10.52	0.02
R37	Stanley Park	10.88	10.90	10.95	0.05
R38	Stanley Park	11.73	11.77	11.83	0.07
R39	Stanley Park	11.67	11.71	11.75	0.04
R40	Stanley Park	12.00	12.04	12.11	0.07
R41	Stanley Park	11.52	11.55	11.60	0.05
R42	Stanley Park	11.48	11.51	11.56	0.05
R43	Stanley Park	11.55	11.59	11.64	0.05
CR1	Bullens Road scheme	-	11.37	11.44	0.07
CR2	Bullens Road scheme	-	11.97	12.08	0.11
PR1	Plot B	-	-	11.80	-
PR2	Plot B	-	-	11.92	-
PR3	Plot A	-	-	12.13	-
PR4	Plot D	-	-	11.10	-
PR5	Plot F	-	-	12.64	-
PR6	Plot G	-	-	12.64	-
PR7	Plot G	-	-	12.59	-
PR8	Plot G	-	-	12.56	-
PR9	Plot E	-	-	12.74	-
PR10	Plot E	-	-	11.03	-
PR11	Plot A	-	-	11.16	-
PR12	Plot C	-	-	11.05	-
Annual Average AQO		**25 µg/m³**			

All modelled receptor locations are not predicted to exceed the AQO for $PM_{2.5}$ in both the 'do minimum' and 'do something' scenarios.

As indicated in **Table 6.17**, the maximum predicted increase in the annual average exposure to $PM_{2.5}$ at any existing receptor, due to changes in traffic movements associated with the development, is 0.11 µg/m³ at 3 Goodison Road (R3) and Bullens Road Scheme (CR2).

The significance of changes in traffic flow associated with the development with respect to annual mean $PM_{2.5}$ exposure has been assessed with reference to the criteria in Section 3. The outcomes of the assessment are summarised in **Table 6.18**.

Table 6.18 Significance of Effects at Key Receptors ($PM_{2.5}$)

$PM_{2.5}$ Significance Effects at Key Receptors					
Receptor	Change Due to Development (DS-DM) (µg/m³)	Change (% of AQO)	% Change in Concentration Relative to AQO	% Annual Mean Concentration in Assessment Year	Significance
R1	0.07	0.28	0%	≤75% of AQO	Negligible
R2	0.05	0.21	0%	≤75% of AQO	Negligible
R3	0.11	0.44	0%	≤75% of AQO	Negligible
R4	0.07	0.28	0%	≤75% of AQO	Negligible
R5	0.01	0.05	0%	≤75% of AQO	Negligible
R6	0.01	0.05	0%	≤75% of AQO	Negligible
R7	0.02	0.08	0%	≤75% of AQO	Negligible
R8	0.05	0.21	0%	≤75% of AQO	Negligible
R9	0.02	0.07	0%	≤75% of AQO	Negligible
R10	0.06	0.25	0%	≤75% of AQO	Negligible
R11	0.02	0.06	0%	≤75% of AQO	Negligible
R12	0.01	0.03	0%	≤75% of AQO	Negligible
R13	0.01	0.04	0%	≤75% of AQO	Negligible
R14	0.01	0.04	0%	≤75% of AQO	Negligible
R15	0.03	0.11	0%	≤75% of AQO	Negligible
R16	0.02	0.06	0%	≤75% of AQO	Negligible
R17	0.08	0.30	0%	≤75% of AQO	Negligible
R18	0.02	0.07	0%	≤75% of AQO	Negligible
R19	0.05	0.21	0%	≤75% of AQO	Negligible
R20	0.06	0.23	0%	≤75% of AQO	Negligible
R21	0.05	0.18	0%	≤75% of AQO	Negligible
R22	0.01	0.05	0%	≤75% of AQO	Negligible
R23	0.06	0.22	0%	≤75% of AQO	Negligible
R24	0.06	0.26	0%	≤75% of AQO	Negligible
R25	0.07	0.28	0%	≤75% of AQO	Negligible
R26	0.06	0.25	0%	≤75% of AQO	Negligible
R27	0.05	0.19	0%	≤75% of AQO	Negligible
R28	0.02	0.09	0%	≤75% of AQO	Negligible
R29	0.02	0.06	0%	≤75% of AQO	Negligible
R30	0.01	0.05	0%	≤75% of AQO	Negligible
R31	0.01	0.05	0%	≤75% of AQO	Negligible
R32	0.01	0.04	0%	≤75% of AQO	Negligible
R33	0.01	0.04	0%	≤75% of AQO	Negligible
R34	0.01	0.04	0%	≤75% of AQO	Negligible
R35	0.01	0.05	0%	≤75% of AQO	Negligible
R36	0.02	0.08	0%	≤75% of AQO	Negligible

$PM_{2.5}$ Significance Effects at Key Receptors					
Receptor	**Change Due to Development (DS-DM) (µg/m³)**	**Change (% of AQO)**	**% Change in Concentration Relative to AQO**	**% Annual Mean Concentration in Assessment Year**	**Significance**
R37	0.05	0.20	0%	≤75% of AQO	Negligible
R38	0.07	0.27	0%	≤75% of AQO	Negligible
R39	0.04	0.18	0%	≤75% of AQO	Negligible
R40	0.07	0.28	0%	≤75% of AQO	Negligible
R41	0.05	0.20	0%	≤75% of AQO	Negligible
R42	0.05	0.19	0%	≤75% of AQO	Negligible
R43	0.05	0.21	0%	≤75% of AQO	Negligible
*0% means a change of <0.5% as per explanatory note 2 of table 6.3 of the EPUK IAQM Guidance.					

The significance of the effects of changes in traffic as a result of the proposed development, with respect to annual mean $PM_{2.5}$ exposure, is determined to be 'negligible' based on the methodology outlined in Section 3. Given the quantitative nature of the assessment and the verification of the air quality dispersion model, the confidence of the assessment is deemed to be 'high'.

7. Mitigation

7.1 Construction Phase

The dust risk categories have been determined in Section 5 for each of the four construction activities. The assessment has determined that the potential impact description of dust emissions associated with the construction phase of the proposed development is 'high risk' at the worst affected receptors.

Using the methodology described in **Appendix A**, appropriate site-specific mitigation measures associated with the determined level of risk can be found in Section 8.2 of the IAQM Guidance on the Assessment of Dust from Demolition and Construction. The mitigation measures have been divided into general measures applicable to all sites and measures applicable specifically to demolition, earthworks, construction and trackout. They are categorised into 'highly recommended' and 'desirable' measures, however based on the IAQM methodology, for high risk sites no desirable measures are considered.

The mitigation measures for the proposed development are detailed in **Table 7.1** below.

Table 7.1 'Highly Recommended' Construction Phase Mitigation Measures

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.
Dust Management
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.
Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
Make the complaints log available to the local authority when asked.
Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log book.
Hold regular liaison meetings with other high-risk construction sites within 500m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/deliveries which might be using the same strategic road network routes.
Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of site boundary, with cleaning to be provided if necessary.
Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked.
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 PM10 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.
Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.

Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.
Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period.
Avoid site runoff of water or mud.
Keep site fencing, barriers and scaffolding clean using wet methods.
Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.
Cover, seed or fence stockpiles to prevent wind whipping.
Ensure all vehicles switch off engines when stationary - no idling vehicles.
Avoid the use of diesel- or petrol-powered generators and use mains electricity or battery powered equipment where practicable.
Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on un-surfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate).
Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.
Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing).
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.
Avoid bonfires and burning of waste materials.
Demolition
Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).
Ensure effective water suppression is used during demolition operations. Handheld 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.
Ensure water suppression will be used on the demolition machines to give dampening down at the point of source. This will also be enhanced with mist cannons dampening down areas where the materials are stacked prior to being removed from site.
Avoid explosive blasting, using appropriate manual or mechanical alternatives.
Bag and remove any biological debris or damp down such material before demolition.
Earthworks
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.
Construction
Avoid scabbling (roughening of concrete surfaces) if possible.
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.
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 powder materials ensure bags are sealed after use and stored appropriately to prevent dust.
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.

Following the implementation of the mitigation measures detailed in the tables above, the impact significance of the construction phase is not considered to be significant.

8. Conclusions

WYG have undertaken an Air Quality Assessment for the proposed demolition of the existing Everton Football Club Stadium (Goodison Park) and re-development of the site for a mix of uses.

Construction

Prior to the implementation of appropriate mitigation measures, the potential impact description of dust emissions associated with the construction phase of the proposed development has potential as 'high' at some worst affected receptors without mitigation. However, appropriate site-specific mitigation measures have been recommended based on Section 8.2 of the IAQM Guidance on the Assessment of Dust from Demolition, Earthworks, Construction and Trackout. It is anticipated that with these appropriate mitigation measures in place, the risk of adverse effects due to dust emissions from the construction phase will not be significant.

With respect to the detailed traffic modelling for the proposed construction flows, a 2028 assessment year has been undertaken. The impact description of effects is determined to be 'negligible' at all existing receptors for NO_2, PM_{10} and $PM_{2.5}$ exposure.

Traffic Emissions

Operational

The 2028 assessment of the effect of emissions from traffic associated with the scheme, has determined that the maximum predicted increase in the annual average exposure to NO_2 at any existing receptor is likely to be 0.40 µg/m^3 at 3 Goodison Road (R3).

All modelled receptors predict NO_2 concentrations of below 60 µg/m^3 in all scenarios. Therefore, it is unlikely for any exceedances of the short-term NO_2 AQO to occur as outlined in LAQM TG16 technical guidance.

For PM_{10}, the maximum predicted increase in the annual average exposure is likely to be 0.20 µg/m^3 at Bullens Road Scheme (CR2). For $PM_{2.5}$, the maximum predicted increase in the annual average exposure is likely to be 0.11 µg/m^3 at 3 Goodison Road (R3) and Bullens Road Scheme (CR2).

The impact description of the effects of changes in traffic flow as a result of the proposed development, with respect to NO_2, PM_{10} and $PM_{2.5}$ exposure, is determined to be 'negligible' at all existing receptors.

Given the quantitative nature of the assessment and the verification of the air quality dispersion model, the confidence of the assessment is deemed to be 'high'.

In conclusion, the development is not considered to be contrary to any of the national and local planning policies regarding air quality.

Figures

Figure 1 Air Quality Assessment Area

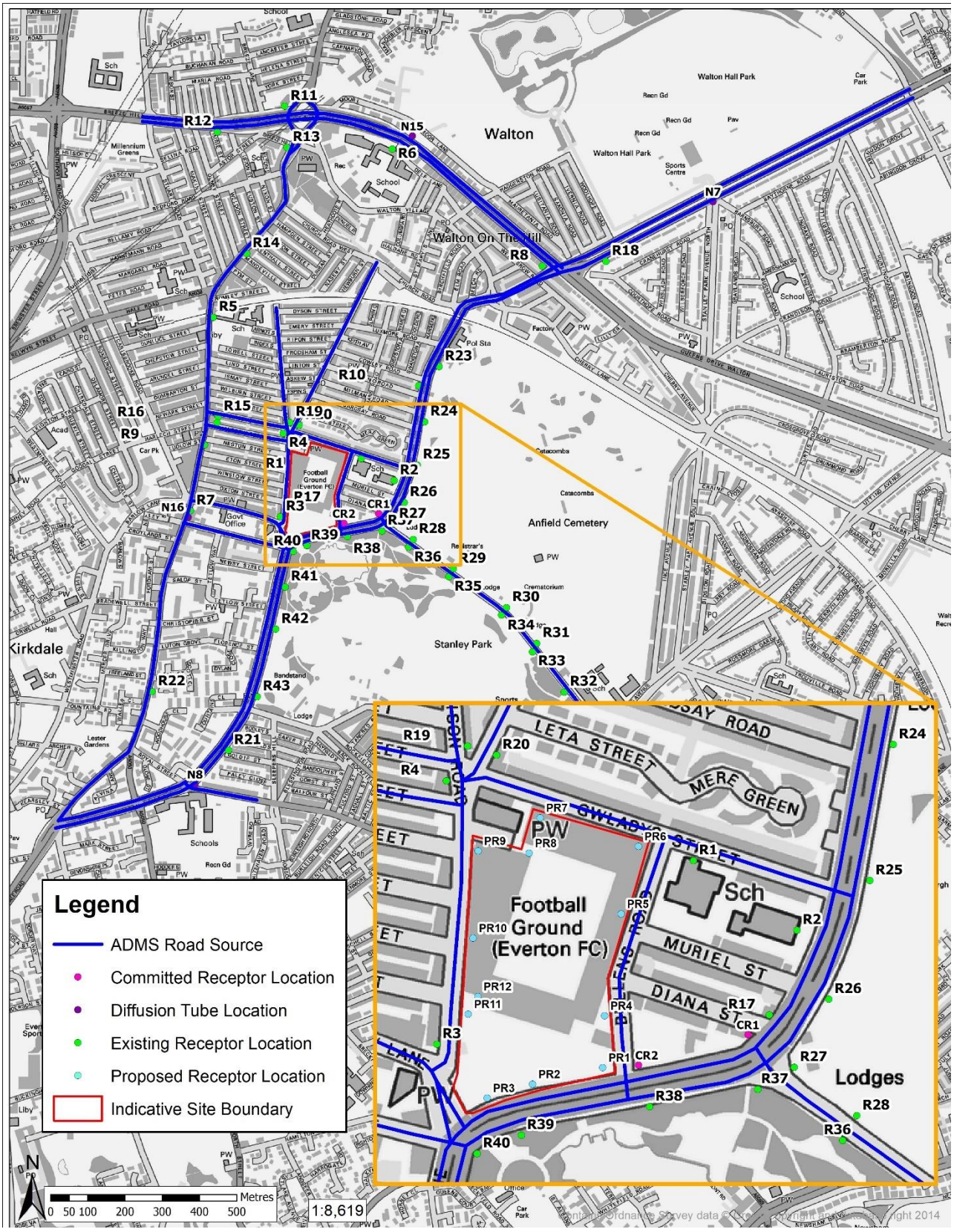
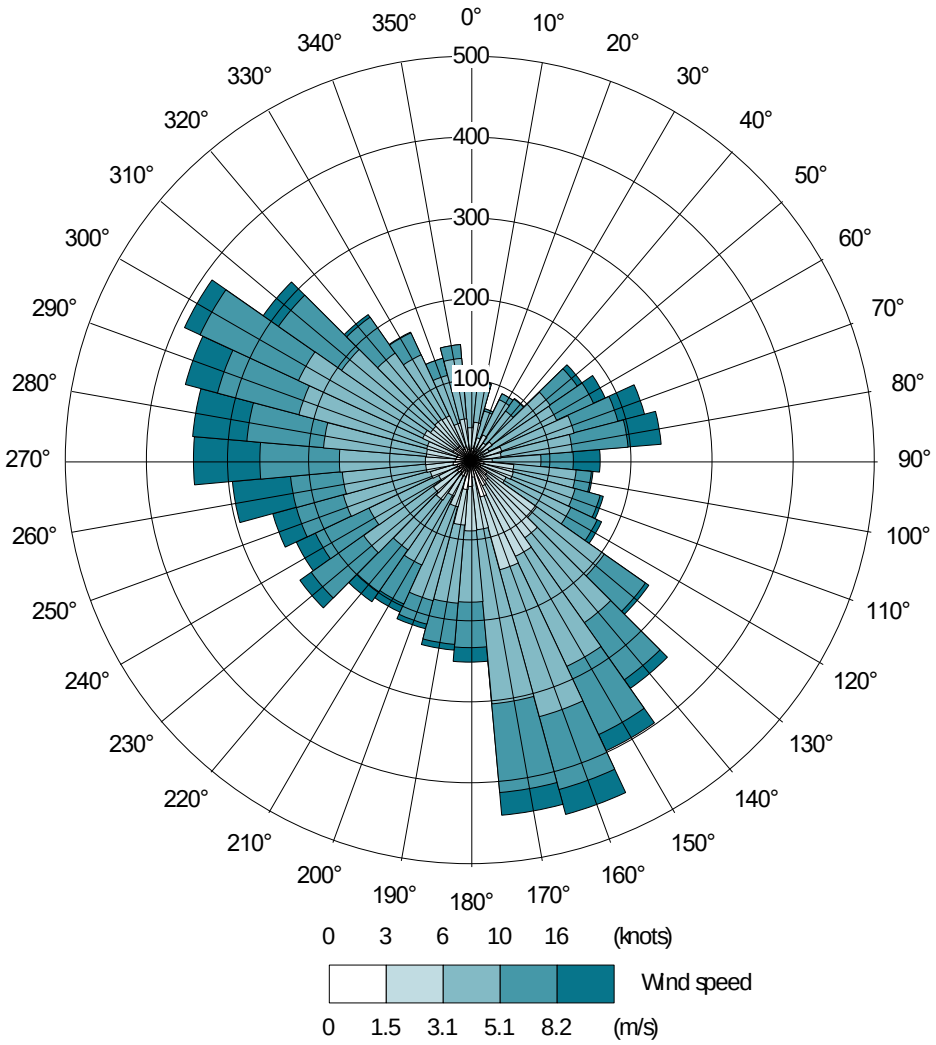


Figure 2 Liverpool City Airport 2018 Meteorological Station Wind Rose



Appendix A Construction Phase Assessment Methodology

The following information sets out the adopted approach to the construction phase impact assessment in accordance with the aforementioned IAQM guidance**Error! Bookmark not defined.**.

Step 1 – Screen the Requirement for a more Detailed Assessment

An assessment is required if there are sensitive receptors within 350m of the site boundary, within 50m of the route(s) used by construction vehicles on the surrounding road network, or within 500m from the site entrance. A detailed assessment is also required if there is an ecological receptor within 50m of the site boundary.

Step 2A – Define the Potential Dust Emission Magnitude

Demolition

The dust emission magnitude for the demolition phase has been determined based on the below criteria:

- *Large*: Total building volume >50 000m^3, potentially dusty construction (e.g. concrete), on-site crushing and screening, demolition activities >20m above ground level;
- *Medium*: Total building volume 20 000m^3 – 50 000m^3, potentially dusty construction material, demolition activities 10-20m above ground level; and,
- *Small*: Total building volume <20 000m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10m above ground, demolition during wetter months.

Earthworks

The dust emission magnitude for the planned earthworks has been determined based on the below criteria:

- *Large:* Total site area >10 000m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), > 10 heavy earth moving vehicles active at any one time, formation of bunds >8m in height, total material moved >100 000 tonnes;
- *Medium*: Total site area 2 500m^2 – 10 000m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4m-8m in height, total material moved 20 000 tonnes – 100 000 tonnes; and
- *Small:* Total site area <2 500 m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4 m in height, total material moved <10 000 tonnes, earthworks during wetter months.

Construction

The dust emission magnitude for the construction phase has been determined based on the below criteria:

- *Large:* Total building volume >100 000m^3, on site concrete batching; sandblasting
- *Medium:* Total building volume 25 000m^3 – 100 000m^3, potentially dusty construction material (e.g. concrete), on site concrete batching; and,
- *Small:* Total building volume <25 000m^3, construction material with low potential for dust release (e.g. metal cladding or timber).

Trackout

The dust emission magnitude for trackout has been determined based on the below criteria:

- *Large:* >50 HGV (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100m;
- *Medium:* 10-50 HGV (>3.5t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50m – 100m; and,

- *Small:* <10 HGV (>3.5t) outward movements in any one day, surface material with low potential for dust release, unpaved road length <50m.

Step 2B - Defining the Sensitivity of the Area

Sensitivities of People to Dust Soiling Effects

- *High:*
  - Users can reasonably expect an enjoyment of a high level of amenity;
  - The appearance, aesthetics or value of their property would be diminished by soiling; and the people or property would reasonably expect to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land; and,
  - Indicative examples include dwellings, museums and other culturally important collections, medium- and long-term car parks and car showrooms.
- *Medium:*
  - Users can reasonably expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home;
  - The appearance, aesthetics or value of their property could be diminished by soiling;
  - The people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land; and,
  - Indicative examples include parks and places of work.
- *Low:*
  - The enjoyment of amenity would not reasonably be expected;
  - Property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling;
  - There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land; and,
  - Indicative examples include playing fields, farmland (unless commercially sensitive horticultural), footpaths, short term car parks and roads.

The sensitivity of the area should be derived for each of the four activities: demolition, construction, earthworks and trackout, using the following table:

Table 19– Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Note - The likely routes the construction traffic will use should also be included to enable the presence of trackout receptors to be included in the assessment. As a general guidance, without site-specific mitigation, trackout may occur along the public highway up to 500 m from large sites (as defined in step 2A), 200 m from medium sites and 50 m from small sites, as measured from the site exit.

Sensitivities of People to the Health Effects of PM_{10}

- *High:*

- Locations where members of the public are exposed over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day);
- Indicative examples include residential properties. Hospitals, schools and residential care homes should also be considered as having equal sensitivity to residential areas for the purposes of this assessment.

- *Medium:*
  - Locations where the people exposed are workers, and exposure is over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day); and,
  - Indicative examples include office and shop workers but will generally not include workers occupationally exposed to PM_{10}, as protection is covered by Health and Safety at Work legislation.
- *Low:*
  - Locations where human exposure is transient; and,
  - Indicative examples include public footpaths, playing fields, parks and shopping streets.

The sensitivity of the area should be derived for each of the four activities: demolition, construction, earthworks and trackout, using the following table:

Table 20 - Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32 µg/m^3	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28 - 32 µg/m^3	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24 – 28 µg/m^3	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg/m^3	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	-	>10	High	Medium	Low	Low	Low
	-	1-10	Medium	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Note - The likely routes the construction traffic will use should also be included to enable the presence of trackout receptors to be included in the assessment. As a general guidance, without site-specific mitigation, trackout may occur along the public highway up to 500 m from large sites (as defined in step 2A), 200 m from medium sites and 50 m from small sites, as measured from the site exit.

Sensitivities of Receptors to Ecological Effects

- *High:*
  - Locations with an international or national designation and the designated features may be affected by dust soiling;
  - Locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data List for Great Britain; and,
  - Indicative examples include a Special Area of Conservation (SAC) designated for acid heathlands or a local site designated for lichens adjacent to the demolition of a large site containing concrete (alkali) buildings.

- *Medium:*
  - Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown;
  - Locations with a national designation where the features may be affected by dust deposition; and,
  - Indicative example is a Site of Special Scientific Interest (SSSI) with dust sensitive features.
- *Low:*
  - Locations with a local designation where the features may be affected by dust deposition; and,
  - Indicative example is a local Nature Reserve with dust sensitive features.

The sensitivity of the area should be derived for each of the four activities: demolition, construction, earthworks and trackout, using the following table:

Table 21 - Sensitivity of the Area to Ecological Impacts

Receptor Sensitivity	Distance from Source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Note - The likely routes the construction traffic will use should also be included to enable the presence of trackout receptors to be included in the assessment. As a general guidance, without site-specific mitigation, trackout may occur along the public highway up to 500 m from large sites (as defined in step 2A), 200 m from medium sites and 50 m from small sites, as measured from the site exit.

Step 2C - Defining the Risk of Impacts

The risk of impacts with no mitigation is determined by combining the dust emission magnitude determined in Step 2A and the sensitivity of the area determined in Step 2B.

The following tables provide a method of assigning the level of risk for each activity.

Demolition

Table 22 - Risk of Dust Impacts, Demolition

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

Earthworks

Table 23 - Risk of Dust Impacts, Earthworks

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Construction

Table 24 - Risk of Dust Impacts, Construction

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Trackout

Table 25 - Risk of Dust Impacts, Trackout

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

Step 3 – Site Specific Mitigation

The dust risk categories for each of the four activities determined in Step 2C should be used to define the appropriate, site-specific mitigation measures to be adopted.

These mitigation measures are contained within section 8.2 of the IAQM Guidance on the Assessment of Dust from Demolition and Construction.

Appendix B Theoretical Scenario Results

This additional theoretical scenario uses emission factors for 2018 for the 'do minimum' and 'do something' based on a recent appeal decision (planning reference no. APP/D3830/A/14/22269877) that favoured the uncertainty of emissions forecasts. It should be noted that this is a theoretical scenario which assumes that the government (Defra) predictions for reductions in emissions over the forthcoming years will not occur. This should not be considered as a 'more correct' scenario in accordance with the 2010 note [http://laqm.defra.gov.uk/laqm-faqs/faq5.html] which confirms that: '*There is no evidence to suggest that background concentrations associated with the other (non-traffic) source contributions should not behave as forecast. This disparity in the historical data highlights the uncertainty of future year projections of both NO_X and NO_2, but at this stage there is no robust evidence upon which to base any revised road traffic emissions projections*.

The two assessment scenarios are defined below:

- 2028 'Do Minimum' Theoretical Scenario = Baseline conditions + Liverpool Waters Permission + Cumulative Development flows (Scenario 6) (**using 2018 traffic emission factors**); and,
- 2028 'Do Something' Theoretical Scenario = Baseline conditions + Liverpool Waters Permission + cumulative development + The Proposed Development with event (Scenario 5) (**using 2018 traffic emission factors**).

Table B1 Predicted Annual Average Concentrations of NO_2 at Receptor Locations

Receptor		NO_2 (µg/m³)			
		2019 Baseline	2028 Do Minimum	2028 Do Something	Development Contribution
R1	Gwladys Street Primary and Nursery School West	25.48	26.07	26.80	0.72
R2	Gwladys Street Primary and Nursery School East	27.61	28.91	29.44	0.53
R3	3 Goodison Road	27.56	29.05	30.30	1.25
R4	69 Goodison Road	25.06	25.81	26.64	0.83
R5	Arnot St Mary Church of England Primary School	29.93	31.48	31.60	0.12
R6	Alsop High School	29.88	31.18	31.31	0.13
R7	258Walton Road	35.71	38.43	38.64	0.21
R8	120 Queens Road	38.77	**41.94**	**42.53**	0.59
R9	46 Country Road	33.24	35.30	35.48	0.18
R10	333 Walton lane	29.94	31.79	32.38	0.59
R11	Breeze Hill Neighbourhood Health Centre	36.70	39.26	39.46	0.20
R12	65 Breeze Hill	30.74	32.42	32.50	0.08
R13	281 Country Road	31.45	33.23	33.35	0.12
R14	204 Country Road	27.97	29.19	29.28	0.09
R15	4 Nimrod Street	26.01	26.92	27.24	0.32
R16	1 Andrew Street	26.31	27.26	27.44	0.18

Receptor		NO_2 (µg/m³)			
		2019 Baseline	2028 Do Minimum	2028 Do Something	Development Contribution
R17	39 Diana Street	32.91	35.09	35.78	0.69
R18	46 Walton Hall Avenue	29.18	30.85	31.02	0.17
R19	82 Goodison Road	24.98	25.72	26.35	0.63
R20	10 City Rd	25.03	25.79	26.46	0.67
R21	3 Goldie Street	27.87	29.40	29.84	0.44
R22	92 Walton Road	28.53	30.13	30.26	0.13
R23	Anfield Cemetery	31.84	33.51	34.03	0.52
R24	Anfield Cemetery	32.67	34.48	35.07	0.59
R25	Anfield Cemetery	31.87	33.55	34.25	0.70
R26	Anfield Cemetery	32.47	34.25	34.84	0.59
R27	Anfield Cemetery	33.28	35.18	35.65	0.47
R28	Anfield Cemetery	28.74	29.86	30.09	0.23
R29	Anfield Cemetery	28.20	29.22	29.38	0.16
R30	Anfield Cemetery	27.78	28.73	28.86	0.13
R31	Anfield Cemetery	27.98	28.97	29.10	0.13
R32	Stanley Park	26.18	26.87	26.97	0.10
R33	Stanley Park	26.17	26.85	26.95	0.10
R34	Stanley Park	26.64	27.41	27.52	0.11
R35	Stanley Park	21.59	22.39	22.53	0.14
R36	Stanley Park	22.96	24.00	24.21	0.21
R37	Stanley Park	26.71	28.40	28.89	0.49
R38	Stanley Park	30.16	32.09	32.78	0.69
R39	Stanley Park	29.80	31.66	32.11	0.45
R40	Stanley Park	32.71	35.04	35.72	0.68
R41	Stanley Park	28.35	29.97	30.45	0.48
R42	Stanley Park	28.00	29.55	30.02	0.47
R43	Stanley Park	28.65	30.31	30.80	0.49
CR1	Bullens Road scheme	-	32.89	33.60	0.71
CR2	Bullens Road scheme	-	34.06	35.20	1.14
PR1	Plot B	-	-	32.54	-
PR2	Plot B	-	-	33.65	-
PR3	Plot A	-	-	35.93	-
PR4	Plot D	-	-	25.66	-
PR5	Plot F	-	-	25.18	-
PR6	Plot G	-	-	25.26	-
PR7	Plot G	-	-	24.68	-
PR8	Plot G	-	-	24.42	-
PR9	Plot E	-	-	26.12	-
PR10	Plot E	-	-	24.85	-
PR11	Plot A	-	-	26.58	-
PR12	Plot C	-	-	25.19	-
Annual Average AQO		**40 µg/m³**			

As indicated in **Table B1**, the maximum predicted increase in the annual average exposure to NO_2 at any existing receptor, due to changes in traffic movements associated with the development, is 1.25 µg/m^3 at 3 Goodison Road (R3) for the theoretical scenario.

The significance of changes in traffic flow associated with the development with respect to annual mean NO_2 exposure has been assessed with reference to the criteria in Section 3. The outcomes of the assessment are summarised in **Table B2** below.

Table B2 Significance of Effects at Key Receptors (NO_2)

NO_2 Significance Effects at Key Receptors					
Receptor	Change Due to Development (DS-DM) (µg/m³)	Change (% of AQO)	% Change in Concentration Relative to AQO	% Annual Mean Concentration in Assessment Year	Significance
R1	0.72	1.80	2-5%	≤75% of AQO	Negligible
R2	0.53	1.33	1%	≤75% of AQO	Negligible
R3	1.25	3.13	2-5%	76-94% of AQO	Slight
R4	0.83	2.08	2-5%	≤75% of AQO	Negligible
R5	0.12	0.30	0%	76-94% of AQO	Negligible
R6	0.13	0.33	0%	76-94% of AQO	Negligible
R7	0.21	0.53	1%	95-102% of AQO	Slight
R8	0.59	1.48	1%	103-109 of AQO	Moderate
R9	0.18	0.45	0%	76-94% of AQO	Negligible
R10	0.59	1.48	1%	76-94% of AQO	Negligible
R11	0.20	0.50	1%	95-102% of AQO	Slight
R12	0.08	0.20	0%	76-94% of AQO	Negligible
R13	0.12	0.30	0%	76-94% of AQO	Negligible
R14	0.09	0.23	0%	≤75% of AQO	Negligible
R15	0.32	0.80	1%	≤75% of AQO	Negligible
R16	0.18	0.45	0%	≤75% of AQO	Negligible
R17	0.69	1.73	2-5%	76-94% of AQO	Slight
R18	0.17	0.43	0%	76-94% of AQO	Negligible
R19	0.63	1.58	2-5%	≤75% of AQO	Negligible
R20	0.67	1.68	2-5%	≤75% of AQO	Negligible
R21	0.44	1.10	1%	≤75% of AQO	Negligible
R22	0.13	0.33	0%	76-94% of AQO	Negligible
R23	0.52	1.30	1%	76-94% of AQO	Negligible
R24	0.59	1.48	1%	76-94% of AQO	Negligible
R25	0.70	1.75	2-5%	76-94% of AQO	Slight
R26	0.59	1.48	1%	76-94% of AQO	Negligible
R27	0.47	1.18	1%	76-94% of AQO	Negligible
R28	0.23	0.58	1%	≤75% of AQO	Negligible
R29	0.16	0.40	0%	≤75% of AQO	Negligible
R30	0.13	0.33	0%	≤75% of AQO	Negligible
R31	0.13	0.33	0%	≤75% of AQO	Negligible

NO_2 Significance Effects at Key Receptors					
Receptor	**Change Due to Development (DS-DM) (µg/m³)**	**Change (% of AQO)**	**% Change in Concentration Relative to AQO**	**% Annual Mean Concentration in Assessment Year**	**Significance**
R32	0.10	0.25	0%	≤75% of AQO	Negligible
R33	0.10	0.25	0%	≤75% of AQO	Negligible
R34	0.11	0.28	0%	≤75% of AQO	Negligible
R35	0.14	0.35	0%	≤75% of AQO	Negligible
R36	0.21	0.53	1%	≤75% of AQO	Negligible
R37	0.49	1.23	1%	≤75% of AQO	Negligible
R38	0.69	1.73	2-5%	76-94% of AQO	Slight
R39	0.45	1.13	1%	76-94% of AQO	Negligible
R40	0.68	1.70	2-5%	76-94% of AQO	Slight
R41	0.48	1.20	1%	76-94% of AQO	Negligible
R42	0.47	1.18	1%	≤75% of AQO	Negligible
R43	0.49	1.23	1%	76-94% of AQO	Negligible
*0% means a change of <0.5% as per explanatory note 2 of table 6.3 of the EPUK IAQM Guidance.					

The impact description of the effects of changes in traffic flow as a result of the proposed development, with respect to NO_2 exposure for existing receptors, is determined to be 'moderate' at one modelled receptor, 'slight' at seven modelled receptors and 'negligible' at the remaining receptor locations. This is based on the methodology outlined in section 3. However, is should be noted that the theoretical scenario is not considered the more correct scenario based on the 2010 note shown above.

All modelled receptors predict NO_2 concentrations of below 60 µg/m^3 in all scenarios. Therefore, it is unlikely for any exceedances of the short-term NO_2 AQO to occur as outlined in LAQM TG16 technical guidance.

Particulate Matter (PM_{10})

Table B3 presents a summary of the annual mean PM_{10} concentrations at relevant proposed receptor locations, due to traffic flow associated with the development, based on modelled the 2028 opening year scenario.

Table B3 Predicted Annual Average Concentrations of PM_{10} at Receptor Locations

Receptor		PM_{10} (µg/m^3)			
		2019 Baseline	**2028 Do Minimum**	**2028 Do Something**	**Development Contribution**
R1	Gwladys Street Primary and Nursery School West	14.94	15.05	15.18	0.13
R2	Gwladys Street Primary and Nursery School East	14.61	14.86	14.97	0.10
R3	3 Goodison Road	16.17	16.44	16.65	0.21
R4	69 Goodison Road	17.50	17.63	17.76	0.14
R5	Arnot St Mary Church of England Primary School	18.56	18.87	18.90	0.02
R6	Alsop High School	15.76	16.01	16.04	0.02
R7	258Walton Road	17.56	18.07	18.11	0.04
R8	120 Queens Road	18.21	18.77	18.87	0.10

Receptor		PM_{10} (µg/m^3)			
		2019 Baseline	2028 Do Minimum	2028 Do Something	Development Contribution
R9	46 Country Road	19.23	19.67	19.70	0.03
R10	333 Walton lane	17.19	17.57	17.69	0.12
R11	Breeze Hill Neighbourhood Health Centre	19.30	19.74	19.77	0.03
R12	65 Breeze Hill	18.63	18.96	18.98	0.02
R13	281 Country Road	18.55	18.87	18.89	0.02
R14	204 Country Road	18.16	18.41	18.43	0.02
R15	4 Nimrod Street	17.74	17.92	17.97	0.05
R16	1 Andrew Street	17.79	17.98	18.01	0.03
R17	39 Diana Street	15.65	16.09	16.24	0.15
R18	46 Walton Hall Avenue	16.93	17.26	17.29	0.03
R19	82 Goodison Road	17.48	17.61	17.72	0.10
R20	10 City Rd	17.49	17.63	17.74	0.11
R21	3 Goldie Street	16.33	16.63	16.72	0.09
R22	92 Walton Road	16.50	16.82	16.85	0.02
R23	Anfield Cemetery	16.21	16.55	16.66	0.11
R24	Anfield Cemetery	16.38	16.75	16.88	0.12
R25	Anfield Cemetery	16.21	16.55	16.69	0.14
R26	Anfield Cemetery	16.32	16.69	16.81	0.12
R27	Anfield Cemetery	16.32	16.68	16.77	0.09
R28	Anfield Cemetery	15.57	15.79	15.84	0.04
R29	Anfield Cemetery	15.49	15.69	15.72	0.03
R30	Anfield Cemetery	15.41	15.59	15.62	0.03
R31	Anfield Cemetery	15.45	15.64	15.67	0.03
R32	Stanley Park	15.09	15.22	15.24	0.02
R33	Stanley Park	15.09	15.22	15.24	0.02
R34	Stanley Park	15.18	15.33	15.35	0.02
R35	Stanley Park	14.62	14.77	14.80	0.03
R36	Stanley Park	14.86	15.06	15.10	0.04
R37	Stanley Park	15.53	15.85	15.95	0.10
R38	Stanley Park	16.80	17.20	17.33	0.13
R39	Stanley Park	16.71	17.08	17.17	0.09
R40	Stanley Park	17.26	17.74	17.88	0.14
R41	Stanley Park	16.44	16.77	16.87	0.10
R42	Stanley Park	16.38	16.69	16.79	0.10
R43	Stanley Park	16.51	16.84	16.95	0.10
CR1	Bullens Road scheme	-	16.77	16.91	0.15
CR2	Bullens Road scheme	-	17.60	17.81	0.22
PR1	Plot B	-	-	17.27	-
PR2	Plot B	-	-	17.50	-
PR3	Plot A	-	-	17.91	-
PR4	Plot D	-	-	15.89	-
PR5	Plot F	-	-	17.58	-
PR6	Plot G	-	-	17.58	-
PR7	Plot G	-	-	17.48	-

Receptor		PM_{10} (µg/m³)			
		2019 Baseline	2028 Do Minimum	2028 Do Something	Development Contribution
PR8	Plot G	-	-	17.43	-
PR9	Plot E	-	-	17.76	-
PR10	Plot E	-	-	15.75	-
PR11	Plot A	-	-	16.02	-
PR12	Plot C	-	-	15.79	-
Annual Average AQO		**40 µg/m³**			

All modelled receptor locations are not predicted to exceed the AQO for PM_{10} in both the 'do minimum' and 'do something' scenarios.

As indicated in **Table B3**, the maximum predicted increase in the annual average exposure to PM_{10} at any existing receptor, due to changes in traffic movements associated with the development, is 0.22 µg/m³ at Bullens Road Scheme (CR2).

The significance of changes in traffic flow associated with the development with respect to annual mean PM_{10} exposure has been assessed with reference to the criteria in Section 3. The outcomes of the assessment are summarised in **Table B4**.

Table B4 Significance of Effects at Key Receptors (PM_{10})

PM_{10} Significance Effects at Key Receptors					
Receptor	Change Due to Development (DS-DM) (µg/m³)	Change (% of AQO)	% Change in Concentration Relative to AQO	% Annual Mean Concentration in Assessment Year	Significance
R1	0.13	0.34	0%	≤75% of AQO	Negligible
R2	0.10	0.26	0%	≤75% of AQO	Negligible
R3	0.21	0.54	1%	≤75% of AQO	Negligible
R4	0.14	0.34	0%	≤75% of AQO	Negligible
R5	0.02	0.06	0%	≤75% of AQO	Negligible
R6	0.02	0.06	0%	≤75% of AQO	Negligible
R7	0.04	0.10	0%	≤75% of AQO	Negligible
R8	0.10	0.26	0%	≤75% of AQO	Negligible
R9	0.03	0.09	0%	≤75% of AQO	Negligible
R10	0.12	0.31	0%	≤75% of AQO	Negligible
R11	0.03	0.08	0%	≤75% of AQO	Negligible
R12	0.02	0.04	0%	≤75% of AQO	Negligible
R13	0.02	0.05	0%	≤75% of AQO	Negligible
R14	0.02	0.05	0%	≤75% of AQO	Negligible
R15	0.05	0.13	0%	≤75% of AQO	Negligible
R16	0.03	0.08	0%	≤75% of AQO	Negligible
R17	0.15	0.36	0%	≤75% of AQO	Negligible
R18	0.03	0.08	0%	≤75% of AQO	Negligible
R19	0.10	0.26	0%	≤75% of AQO	Negligible

PM_{10} Significance Effects at Key Receptors					
Receptor	Change Due to Development (DS-DM) (µg/m³)	Change (% of AQO)	% Change in Concentration Relative to AQO	% Annual Mean Concentration in Assessment Year	Significance
R20	0.11	0.28	0%	≤75% of AQO	Negligible
R21	0.09	0.22	0%	≤75% of AQO	Negligible
R22	0.02	0.06	0%	≤75% of AQO	Negligible
R23	0.11	0.27	0%	≤75% of AQO	Negligible
R24	0.12	0.31	0%	≤75% of AQO	Negligible
R25	0.14	0.35	0%	≤75% of AQO	Negligible
R26	0.12	0.30	0%	≤75% of AQO	Negligible
R27	0.09	0.23	0%	≤75% of AQO	Negligible
R28	0.04	0.11	0%	≤75% of AQO	Negligible
R29	0.03	0.08	0%	≤75% of AQO	Negligible
R30	0.03	0.07	0%	≤75% of AQO	Negligible
R31	0.03	0.07	0%	≤75% of AQO	Negligible
R32	0.02	0.04	0%	≤75% of AQO	Negligible
R33	0.02	0.05	0%	≤75% of AQO	Negligible
R34	0.02	0.05	0%	≤75% of AQO	Negligible
R35	0.03	0.06	0%	≤75% of AQO	Negligible
R36	0.04	0.10	0%	≤75% of AQO	Negligible
R37	0.10	0.24	0%	≤75% of AQO	Negligible
R38	0.13	0.34	0%	≤75% of AQO	Negligible
R39	0.09	0.23	0%	≤75% of AQO	Negligible
R40	0.14	0.35	0%	≤75% of AQO	Negligible
R41	0.10	0.25	0%	≤75% of AQO	Negligible
R42	0.10	0.24	0%	≤75% of AQO	Negligible
R43	0.10	0.26	0%	≤75% of AQO	Negligible
*0% means a change of <0.5% as per explanatory note 2 of table 6.3 of the EPUK IAQM Guidance.					

The significance of the effects of changes in traffic as a result of the proposed development, with respect to annual mean PM_{10} exposure, is determined to be 'negligible' based on the methodology outlined in Section 3. Given the quantitative nature of the assessment and the verification of the air quality dispersion model, the confidence of the assessment is deemed to be 'high'.

Particulate Matter ($PM_{2.5}$)

Table B5 presents a summary of the annual mean $PM_{2.5}$ concentrations at relevant proposed receptor locations, due to traffic flow associated with the development, based on modelled the 2028 opening year scenario.

Table B5 Predicted Annual Average Concentrations of $PM_{2.5}$ at Receptor Locations

Receptor		$PM_{2.5}$ (µg/m³)			
		2019 Baseline	2028 Do Minimum	2028 Do Something	Development Contribution
R1	Gwladys Street Primary and Nursery	10.90	10.97	11.05	0.08

Receptor		$PM_{2.5}$ (µg/m^3)			
		2019 Baseline	2028 Do Minimum	2028 Do Something	Development Contribution
	School West				
R2	Gwladys Street Primary and Nursery School East	10.38	10.53	10.59	0.06
R3	3 Goodison Road	11.36	11.53	11.65	0.13
R4	69 Goodison Road	12.66	12.74	12.82	0.08
R5	Arnot St Mary Church of England Primary School	13.27	13.46	13.47	0.01
R6	Alsop High School	11.39	11.53	11.55	0.01
R7	258Walton Road	12.20	12.50	12.52	0.02
R8	120 Queens Road	12.61	12.95	13.01	0.06
R9	46 Country Road	13.67	13.92	13.94	0.02
R10	333 Walton lane	11.97	12.19	12.26	0.07
R11	Breeze Hill Neighbourhood Health Centre	13.74	14.01	14.03	0.02
R12	65 Breeze Hill	13.32	13.51	13.52	0.01
R13	281 Country Road	13.29	13.48	13.49	0.01
R14	204 Country Road	13.04	13.18	13.20	0.01
R15	4 Nimrod Street	12.80	12.90	12.93	0.03
R16	1 Andrew Street	12.83	12.94	12.95	0.02
R17	39 Diana Street	10.99	11.25	11.34	0.09
R18	46 Walton Hall Avenue	11.82	12.01	12.03	0.02
R19	82 Goodison Road	12.65	12.73	12.79	0.06
R20	10 City Rd	12.66	12.73	12.80	0.07
R21	3 Goldie Street	11.45	11.63	11.68	0.05
R22	92 Walton Road	11.55	11.74	11.75	0.02
R23	Anfield Cemetery	11.64	11.84	11.91	0.06
R24	Anfield Cemetery	11.74	11.96	12.04	0.07
R25	Anfield Cemetery	11.65	11.85	11.93	0.08
R26	Anfield Cemetery	11.71	11.93	12.00	0.07
R27	Anfield Cemetery	11.72	11.93	11.99	0.06
R28	Anfield Cemetery	11.27	11.40	11.43	0.02
R29	Anfield Cemetery	11.22	11.34	11.36	0.02
R30	Anfield Cemetery	11.18	11.29	11.30	0.01
R31	Anfield Cemetery	11.20	11.31	11.33	0.01
R32	Stanley Park	10.99	11.07	11.08	0.01
R33	Stanley Park	10.99	11.07	11.08	0.01
R34	Stanley Park	11.04	11.13	11.14	0.01
R35	Stanley Park	10.34	10.43	10.44	0.01
R36	Stanley Park	10.48	10.60	10.62	0.02
R37	Stanley Park	10.88	11.07	11.12	0.06
R38	Stanley Park	11.73	11.96	12.04	0.08
R39	Stanley Park	11.67	11.89	11.95	0.05
R40	Stanley Park	12.00	12.28	12.36	0.08
R41	Stanley Park	11.52	11.71	11.77	0.06
R42	Stanley Park	11.48	11.66	11.72	0.06
R43	Stanley Park	11.55	11.75	11.81	0.06
CR1	Bullens Road scheme	-	11.60	11.69	0.09
CR2	Bullens Road scheme	-	12.19	12.32	0.13

Receptor		$PM_{2.5}$ (µg/m³)			
		2019 Baseline	2028 Do Minimum	2028 Do Something	Development Contribution
PR1	Plot B	-	-	12.00	-
PR2	Plot B	-	-	12.14	-
PR3	Plot A	-	-	12.38	-
PR4	Plot D	-	-	11.20	-
PR5	Plot F	-	-	12.70	-
PR6	Plot G	-	-	12.71	-
PR7	Plot G	-	-	12.64	-
PR8	Plot G	-	-	12.61	-
PR9	Plot E	-	-	12.81	-
PR10	Plot E	-	-	11.11	-
PR11	Plot A	-	-	11.27	-
PR12	Plot C	-	-	11.13	-
Annual Average AQO		**25 µg/m³**			

All modelled receptor locations are not predicted to exceed the AQO for $PM_{2.5}$ in both the 'do minimum' and 'do something' scenarios.

As indicated in **Table B5**, the maximum predicted increase in the annual average exposure to PM2.5 at any existing receptor, due to changes in traffic movements associated with the development, is 0.13 µg/m³ at 3 Goodison Road (R3) and Bullens Road Scheme (CR2).

The significance of changes in traffic flow associated with the development with respect to annual mean $PM_{2.5}$ exposure has been assessed with reference to the criteria in Section 3. The outcomes of the assessment are summarised in **Table B6**.

Table B6 Significance of Effects at Key Receptors ($PM_{2.5}$)

$PM_{2.5}$ Significance Effects at Key Receptors					
Receptor	Change Due to Development (DS-DM) (µg/m³)	Change (% of AQO)	% Change in Concentration Relative to AQO	% Annual Mean Concentration in Assessment Year	Significance
R1	0.08	0.32	0%	≤75% of AQO	Negligible
R2	0.06	0.24	0%	≤75% of AQO	Negligible
R3	0.13	0.51	1%	≤75% of AQO	Negligible
R4	0.08	0.33	0%	≤75% of AQO	Negligible
R5	0.01	0.06	0%	≤75% of AQO	Negligible
R6	0.01	0.06	0%	≤75% of AQO	Negligible
R7	0.02	0.10	0%	≤75% of AQO	Negligible
R8	0.06	0.25	0%	≤75% of AQO	Negligible
R9	0.02	0.09	0%	≤75% of AQO	Negligible
R10	0.07	0.28	0%	≤75% of AQO	Negligible
R11	0.02	0.07	0%	≤75% of AQO	Negligible
R12	0.01	0.03	0%	≤75% of AQO	Negligible
R13	0.01	0.05	0%	≤75% of AQO	Negligible
R14	0.01	0.05	0%	≤75% of AQO	Negligible

$PM_{2.5}$ Significance Effects at Key Receptors					
Receptor	**Change Due to Development (DS-DM) (µg/m³)**	**Change (% of AQO)**	**% Change in Concentration Relative to AQO**	**% Annual Mean Concentration in Assessment Year**	**Significance**
R15	0.03	0.13	0%	≤75% of AQO	Negligible
R16	0.02	0.08	0%	≤75% of AQO	Negligible
R17	0.09	0.34	0%	≤75% of AQO	Negligible
R18	0.02	0.07	0%	≤75% of AQO	Negligible
R19	0.06	0.25	0%	≤75% of AQO	Negligible
R20	0.07	0.27	0%	≤75% of AQO	Negligible
R21	0.05	0.20	0%	≤75% of AQO	Negligible
R22	0.02	0.06	0%	≤75% of AQO	Negligible
R23	0.06	0.25	0%	≤75% of AQO	Negligible
R24	0.07	0.29	0%	≤75% of AQO	Negligible
R25	0.08	0.32	0%	≤75% of AQO	Negligible
R26	0.07	0.28	0%	≤75% of AQO	Negligible
R27	0.06	0.22	0%	≤75% of AQO	Negligible
R28	0.02	0.10	0%	≤75% of AQO	Negligible
R29	0.02	0.07	0%	≤75% of AQO	Negligible
R30	0.01	0.06	0%	≤75% of AQO	Negligible
R31	0.01	0.05	0%	≤75% of AQO	Negligible
R32	0.01	0.04	0%	≤75% of AQO	Negligible
R33	0.01	0.04	0%	≤75% of AQO	Negligible
R34	0.01	0.05	0%	≤75% of AQO	Negligible
R35	0.01	0.06	0%	≤75% of AQO	Negligible
R36	0.02	0.09	0%	≤75% of AQO	Negligible
R37	0.06	0.23	0%	≤75% of AQO	Negligible
R38	0.08	0.32	0%	≤75% of AQO	Negligible
R39	0.05	0.21	0%	≤75% of AQO	Negligible
R40	0.08	0.33	0%	≤75% of AQO	Negligible
R41	0.06	0.23	0%	≤75% of AQO	Negligible
R42	0.06	0.22	0%	≤75% of AQO	Negligible
R43	0.06	0.24	0%	≤75% of AQO	Negligible
*0% means a change of <0.5% as per explanatory note 2 of table 6.3 of the EPUK IAQM Guidance.					

The significance of the effects of changes in traffic as a result of the proposed development, with respect to annual mean $PM_{2.5}$ exposure, is determined to be 'negligible' based on the methodology outlined in Section 3. Given the quantitative nature of the assessment and the verification of the air quality dispersion model, the confidence of the assessment is deemed to be 'high'.

Appendix C Report Terms & Conditions

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