8. Air Quality

Appendix 8.1

AIR QUALITY ASSESSMENT

Everton Stadium Development Ltd

The People's Project

Air Quality Assessment

August 2020

Executive Park, Avalon Way, Anstey, Leicester, LE7 7GR
Tel: +44 (0)116 234 8115
Email: nigel.mann@wyg.com

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Document Checking:

Prepared by:	Viral Patel *Environmental Consultant*	Initialled:	VP

Checked by:	Matthew Smith *Senior Environmental Consultant*	Initialled:	MCS

Verified by:	Nigel Mann *Director*	Initialled:	NM

Person to Contact:	Matthew Smith *Senior Environmental Consultant*	Telephone: Email:	0116 234 8030 matthew.smith@wyg.com

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1	25th October 2019	First Issue
2	21st December 2019	Second Issue
3	22nd December 2019	Third Issue – Updated with Minor Amendments
4	23rd December 2019	Fourth Issue – Inclusion of Additional Ecological Receptors
5	20th January 2020	Fifth Issue – Updated with Minor Amendments
6	17th July 2020	Sixth Issue – Updated Following Design Changes and Comments from LCC
7	11th August 2020	Seventh Issue – Updated Following Comments
8	21st August 2020	Eighth Issue – Updated Following Comments
9	26th August 2020	Ninth Issue – Updated Following Comments

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Executive Summary

WYG have undertaken an Air Quality Assessment on behalf of Everton Stadium Development Limited in support of a full planning application for the development of a 52,888-seat stadium with associated facilities and infrastructure at Bramley-Moore Dock, Liverpool.

The report has been updated following the recent design changes to the submitted scheme and to respond to statutory consultation comments (dated 24th March 2020) made by Liverpool City Council (LCC) Environmental Protection Unit regarding the Air Quality Assessment submitted as part of the initial planning application (LPA ref. 20F/0001).

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.

Detailed dispersion modelling of the additional HGV movements during the construction phase has been undertaken, which have been updated following the changes to the construction methodology. The impacts during the construction phase take into account exhaust emissions from additional HGV's generated during the construction of the development.

The long-term (annual) assessment of the impact description 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.

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 proposed vehicle operations are associated with the operation of the Stadium are detailed in Section 1.2 of the report.

The long-term (annual) assessment of the impact description 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.

A short-term (hourly) air quality assessment has been undertaken at sensitive receptors to determine the predicted exposure at the residential properties adjacent to the proposed taxi rank at Boundary Street during

an event. The assessment has shown that there is not predicted to be any exceedances of the short-term AQO with respect to NO_2 during a pre and post-match event.

Based on the assessment undertaken and data, methodology and assumptions used within this assessment it is concluded that the development is not considered to be contrary to the statutory development plan or other relevant material considerations including the National Planning Policy Framework (NPPF) and the emerging Liverpool Local Plan (not full weight given it is pending formal examination).

Boiler Emissions

An assessment of the proposed centralised heating system to be installed at the proposed Stadium development has been undertaken.

The long-term and short-term predicted environmental concentrations of pollutant emissions of NO_2 are all below the relevant air quality objectives (AQO) at each of the modelled sensitive receptor locations.

The percentage changes in long-term process contribution of NO_2 are all less than 1.0% of the relative AQO as a result of the operations at all sensitive receptor locations. The impact on the sensitive receptors is determined to be 'negligible'.

Buro Happold have confirmed (within the Energy Statement submitted with the application) that the outdoor broadcasting compound (OBC) will be powered through battery storage technology and not diesel generators. As such there are no emissions associated with the OBC.

1. Introduction

WYG Environment Planning Transport (WYG) have been commissioned by Everton Stadium Development Ltd to prepare an update to the Air Quality Assessment prepared in support of a full planning application for the development of a 52,888 seat stadium with associated facilities and infrastructure at Bramley-Moore Dock, Liverpool. The Proposed Development is known as The People's Project. The planning application (LPA ref. 20F/0001) was submitted in December 2019 and has been subject to statutory consultation.

In accordance with the methodology outlined in Chapter 2, 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 construction methodology);
- Addition of new cumulative schemes; LPA ref. 20F/0217 – proposed hotel adjacent to Bramley-Moore Dock referred to as the Regent Road Hotel and LPA ref. 20L/1948 – Proposed residential development at Lightbody Street for 210 residential units;
- Interim updates in legislation, policy, or guidance; and
- Statutory consultee comments received to the initial planning application submission (LPA ref. 20F/0001) and the appropriateness of the previously identified mitigation measures.

Limited technical assessment has been undertaken to confirm the validity of the previous air quality assessment conclusions. The relevant assessment information is presented/discussed within this appendix and therefore this report has been revised to reflect these updates.

The sections that have been updated are detailed below:

- Updated reference to the Liverpool Local Plan Draft Schedule of Main Modification (ver. 9th April 2020)
- Following cumulative scheme LPA ref. 20L/1948 becoming live, an addition committed receptor has been assessed at Lightbody Street (R14).
- Updated monitoring data was obtained from Sefton Council, therefore the verification model shown in Section 6.5 has been updated with 2018 data.

On the 24th March 2020 Keith Dooley of Environmental Protection Unit at Liverpool City Council ('LCC') reviewed the Air Quality Assessment (dated December 2019) submitted with the initial planning application (LPA ref. 20F/0001). The following areas have been discussed within this updated report.

1. Supporter Coach Parking
2. Outside Broadcasting Compound
3. Fixed Plant within the stadium

4. Electric Vehicle Parking
5. Shuttle Buses
6. Disable Support Shuttle Buses

This revised Air Quality Assessment addresses the impacts associated with the fixed plant within the stadium. The remaining comments received in the initial consultation response have been addressed in Section 1 below.

The comments have been resolved within this updated report and are summarised below:

1. Supporter Coach Parking – The appointed transport consultants (Mott MacDonald) have confirmed that publicly available facilities are nearby to the proposed coach parking location(s) to encourage drivers to switch off engines to avoided idling where possible.
2. Outside Broadcasting Compound – Buro Happold have confirmed (within the Energy Statement submitted with the application) that the outdoor broadcasting compound (OBC) will be powered through battery storage technology and not diesel generators. As such there are no emissions associate with the OBC.
3. Fixed Plant within the stadium – This Air Quality Assessment covers the air quality impacts associated with the proposed boiler system to be installed within the stadium. Details of the boilers and locations have been provided by Buro Happold and are in-line with the Energy Statement submitted with the application.
4. Electric Vehicle Parking – This has been considered by Mott MacDonald within the updated Transport Assessment. The location of the parking bays are also summarised in the Design & Access Statement prepared by Pattern Architects and the updated planning/landscaping drawings associated with the revised scheme.
5. Shuttle Buses – Shuttle Buses are to be run on a commercial basis and are not within the club's control in terms of specification of vehicle.
6. Disabled Supporter Shuttle Buses – Pre-booked shuttle services for disabled supporters which will run between the stadium, a park & ride facility at Stanley Park (existing surface car park owned by LCC) and Sandhills train station.

This Air Quality Assessment takes into account the impacts associated with the fixed plant within the stadium.

The Energy Statement and Ventilation and Refrigeration Statement, produced by Buro Happold, have been reviewed and provided input into the Air Quality Assessment.

This report has also 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 are no relevant changes to the baseline data, and assessment;

- Legislation/policy revisions: Although there have been updates to legislation/policy these have no effect on either the methodology or findings of this assessment;
- Operational traffic assessment: There are no changes to the assessment of the operational phase traffic assessment.

After discussions with Mott Macdonald (transport consultants) it has been confirmed that there are no changes to the operational phase traffic data provided previously in association with the initial planning application submission. It is considered that the assessment therefore presents a worst-case assessment as the recent changes to the proposed scheme will result in a net decrease in the traffic assessed within this Air Quality Assessment; this is a result of the reduction in car parking spaces (omission of the proposed multi-storey car park 'MSCP' which was to be integral to the proposed stadium west stand) and committed development trips.

Following the inclusion of the LPA ref. 20L/1948 – Proposed residential development at Lightbody Street for 210 residential units; the committed development traffic has been analysed by Mott Macdonald who have determined the change in traffic would not have a material impact on traffic on the existing network.

1.1 Site Location

The application site is located at Bramley-Moore Dock (BMD) in Liverpool, National Grid Reference SJ3345292491. Extending to 8.67 hectares, the application site is bounded to the north by a United Utilities wastewater treatment facility (former Wellington Dock), to the east by Regent Road, to the south by Nelson Dock, and to the west by the River Mersey.

Reference should be made to Figure 1 for a map of the proposed application site and surrounding area.

1.2 Application Proposal

The following changes have been made to the submitted scheme (LPA ref. 20F/0001):

- Removal of multi-storey carpark (MSCP) – redesign of western elevation to incorporate a new elevated stepped amenity area / public realm, with sheltered access / egress to the west stand turnstiles below;
- Removal of surface carpark PV canopy to the west of the water channel;
- Photovoltaic (PV) panels previously forming a canopy to surface car park have been relocated to stadium roof on the south stand (2,050 sq. m of panels to be structurally integrated with roof so not visible from street level);

- Relocation of Outside Broadcasting (OB) compound and sub-station to northern extent of west quay. As a result of relocation of OB compound and sub-station, surface carparking has been relocated to the south of the west quay;
- Roof optimisation – reduction in building height by 2m (to below 45m height); and
- Internal stadium layout changes – relocation of plant areas and inclusion of battery storage areas.

The proposed stadium will primarily cater for football and it is anticipated that a total of 28 games (19 of which are league home fixtures) would be played per season (total games subject to progress in Domestic and European cup competitions). A further 4 no. non-football major events (at full capacity), such as concerts or non-football sporting events (boxing, rugby etc.) are also proposed.

The stadium also will accommodate the club's ticket office and club shop. The hospitality areas proposed in the east stand (to be used as a café on non-football / major event days) and west stand (to be used as a restaurant on non-football / major event days) will also have public access. In addition, the following events may also take place throughout the year:

- Meetings/Conferences – potential for up to 261 days per year
- Exhibitions/Conventions – potential for up to 339 days per year
- Weddings – potential for up to 79 days per year
- Funerals – potential for up to 261 days per year
- Banqueting – potential for up to 339 days per year
- Christmas Parties – potential for up to 27 days per year
- Stadium Tours – potential for up to 339 days per year

1.3 Context

Vehicular Movements / Strategy (Construction / Operational Phase)

The primary source of the Air Quality associated with the proposed scheme is from the proposed operational phase (vehicles entering the site to the allocated car parking provision and taxis; both of which have been included within this assessment) and construction phase vehicle movements, arriving and departing the proposed stadium. The revisions to the submitted scheme have included the removal of the MSCP; this updated Air Quality Assessment is therefore considered to represent a worst-case as it still includes the air quality impacts associated with the vehicle movements associated with the MSCP. The level of parking and subsequent vehicle development trips is consequently expected to be considerably lower than reported in this assessment.

In terms of minimising the impact arising from the operational phase of the stadium, a detailed match-day / major event transport strategy prepared by Mott MacDonald is set out in the Transport Assessment (Appendix 7 of the ES Chapter) submitted with the planning application and identifies a series of measures which are intended to minimise vehicular access to the proposed stadium, including:

- **Traffic restrictions and road closures**: a series of road closures and traffic restrictions will be set in place to support pedestrian safety and deter vehicle traffic entering the area. These measures are also critical to the stadium security strategy and crowd safety. The measures include
  - Temporary soft road closures where local businesses and residents will be granted access.
  - Hard road closures in the immediate vicinity of the stadium to protect the streets that will be busiest with footfall on match day / major events.
  - Temporary post-match traffic restrictions on the A565 to reduce traffic speed and provide more space for pedestrian egress.

- **Parking restrictions and car parking**: there is limited parking on site and this will be managed. In terms of the areas outside of the application site, parking restrictions will be enforced in residential and industrial areas to prevent parking and congestion constraining local access (extension of existing Football Parking Management Zones – 'FPMZs'). There will also be electric vehicle charging points within the stadium car parking area.
- **Shuttle buses**: commercial shuttle buses (to be run on a commercial basis by existing operators) are proposed to serve Liverpool City Centre and Bootle Town Centre where there is existing parking provision / capacity, onward public transport travel and pre/post-match activities.
- **Disabled supporter shuttle buses**; pre-booked shuttle services for disabled supporters which will run between the stadium, a park & ride facility at Stanley Park (existing surface car park owned by LCC) and Sandhills train station.
- **Existing commercial bus routes**: existing commercial bus services within walking distance of the application site present a realistic choice of travel for some supporters.
- **Train travel**: Sandhills station (located on the Merseyrail Northern Line) is the closest train station to the stadium (1 km distance) and is well located for use by supporters given it serves three northern branch lines (Ormskirk, Kirkby and Southport) as well as Liverpool City Centre (connections to Wirral Line services via Moorfields and Liverpool Central; national and suburban services via Liverpool Lime Street) and southern branch line to Hunts Cross (via Liverpool South Parkway – a major park & ride interchange).
- **Match day taxi ranks**: a series of taxi ranks are proposed for match days at Dublin Street, Boundary Street and Sandhills Lane.

- **Walking**: with traffic restrictions in place, streets in the vicinity of the stadium will be safety for pedestrians. Routes through to Sandhills station, taxi ranks, bus stops and Liverpool city centre will be safe and legible with signage directing supporters to key destinations via foot.
- **Cycling:** cycle stands will be provided within the stadium plaza area within a secure environment. This provision will mean that cycling to games becomes attractive mode for some supporters.
- **Coach parking**: coaches will park on-street on match days, mostly on streets closed to general traffic due to match day road closures. This will ensure coaches will not significantly impact on the traffic flow on open roads.

The traffic data generated by the development (provided by Mott MacDonald) has been assessed at the surrounding sensitive receptors.

Sustainability / Energy Measures

Following a review of the Energy and Sustainability Assessments (prepared by Buro Happold Engineering), it is confirmed that no CHP (Combined Heat and Power Plant) is proposed as part of the scheme. However, an assessment of the proposed boiler system to be installed has been undertaken in this assessment following consultation comments from LCC in respect of the original submitted planning application.

The energy statement also covers key areas of sustainability such as:

- The installation of 2,050 sq. m of Photovoltaic array on the stadium south stand roof which will generate 305 MWh/yr of renewable energy.
- Battery Storage Technology is proposed to be installed, this will help in reducing localised emission.
- A Centralised heating plan is proposed to allow for ease of future connection to a district heat network ('Mersey Heat'), as well as improvements to heat, thermal and glazing efficiencies.

The following assessment stages have been undertaken as part of this assessment:

- Baseline evaluation;
- Assessment of potential air quality impacts during the construction phase;
- Assessment of potential air quality impacts during the operational phase; and
- Identification of mitigation measures (as required).

The results of the assessment are detailed in the following sections of this report.

The construction phase assessment considers the potential effects of dust and particulate emissions from site activities and materials movement based on a qualitative risk assessment method based on the Institute of Air Quality Management's (IAQM) 'Guidance on the Assessment of Dust from Demolition and Construction' document, published in 2014.

The assessment of the potential air quality impacts that are associated with the operational phase has focused on the predicted impact of changes in ambient nitrogen dioxide (NO_2) and particulate matter with an aerodynamic diameter of less than 10 µm (PM_{10}) and less than 2.5 µm ($PM_{2.5}$) as a result of the development at key local receptor locations. The changes have been referenced to EU air quality limits and UK air quality objectives and the magnitude and impact description of the changes have been referenced to non-statutory guidance issued by the IAQM and Environmental Protection UK (EPUK).

1.4 Consultees & Scoping

The Air Quality Assessment methodology within the EIA scoping report was submitted to Liverpool City Council (LCC) and relevant parties (including the Merseyside Environmental Advisory Service (MEAS) and Marine Management Organisation (MMO)) on 15th May 2017. The formal scoping opinion was received on 8th November 2017, no comments were raised with respect to Air Quality and the methodology put forward was deemed appropriate.

1.5 Liverpool Waters (Future Baseline)

The application site is located within a wider regeneration scheme known as Liverpool Waters. Peel Land & Property secured outline planning permission in 2013 (LPA ref. 10O/2424 – latest non-material amendment being ref. 19NM/1121) for a mixed-use development comprising a maximum of 1,690,000m² of mixed use including 9,000 dwellings and 310,000m² of office space (figures rounded). The site stretches from Princes Dock in the south to Bramley-Moore Dock to the north. The timeframe for full delivery of the scheme at the time of planning application was 2041.

Developments which have been consented at Princes Dock and the Liverpool Waters site since planning approval include the standalone applications. The Lexington (16F/1370 304 apartments), Quay Central and Park Central (17F/1628 2 blocks of 237 apartments), Liverpool Cruise Liner Terminal (17O/3230) and Isle of Man Ferry Terminal (18F/323).

Since planning permission was granted, Peel Land & Property has submitted a series of discharge of conditions applications, reserved matters and non-material amendment applications. A neighbourhood masterplan for the Central Docks has recently been submitted (ref:19DIS/1315) in accordance with the requirements of the planning conditions attached to the outline planning permission. At time of writing this application is still to be determined.

Reserved matters applications have been submitted in the Princes Dock area for the William Jessop House, a 6-storey office development which is in planning terms part of Liverpool Waters (18RM/1554 & 19RM/1817).

Bramley-Moore Dock

The application site is located within the Northern Docks (comprising Nelson Dock and Bramley-Moore Dock) area of the approved Liverpool Waters scheme with the following mix of uses proposed for the 2036-2041 time period:

- C3 Dwellings- 219,500 m².
- A1 Retail- 5,000m².
- A2 Financial & Professional services- 300m².
- A3 Food & drink- 2,200m².
- A4 Drinking establishments- 1,200 m².
- B1 Business- 1,800m²
- D1 Non-Residential Institutions- 6,600m².
- D2 Assembly and Leisure-1,000 m².

The amount of the development listed above which relates to Bramley-Moore Dock (excluding Nelson Dock) is not specified in the permission, which details the amount of development per neighbourhood only.

1.6 Blackstone Street Hotel proposal (LPA ref. 20F/0217 (Future Baseline)

In addition to the Liverpool Waters Future Baseline receptor, the Blackstone Street Hotel has also been included as a future baseline receptor. The site is located on Regent Road to the east of application site boundary.

The application seeks full planning consent for the demolition of existing structures and the construction of a nine-storey building for hotel use, and a nine-storey multi-storey parking structure. The hotel will provide 167 bedrooms along with ancillary restaurant, kitchen, lobby and back of house, with associated access from Blackstone Street and servicing from Fulton Street.

Details of the modelling results at the Blackstone Street Hotel Proposal is shown in Sections 6 and 7 below.

1.7 LPA ref. 20L/1948 – Proposed residential development at Lightbody Street

In addition to the Liverpool Waters Future Baseline receptor and the Blackstone Street Hotel, the proposed residential led scheme at Lightbody Street has also been included as a future baseline receptor. The site is located on Lightbody Street East of the application site boundary.

The applications is for the demolition vacant buildings and erect 210 residential units, 716 sq.m of flexible commercial use A1, A2, A3, B1 and B8, 2 x 550 kva sub-stations with associated landscaping.

Details of the modelling results at the Lightbody Street is shown in Sections 6 and 7 below.

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;
- Planning Practice Guidance: Air Quality, Ministry for Housing, Communities and Local Government, November 2019;
- The Air Quality Standards Regulations (Amendments), 2016;
- The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, 2007;
- The Environment Act, 1995;
- Local Air Quality Management Technical Guidance LAQM.TG16, Defra, 2018;
- Design Manual for Roads and Bridges, Volume 11, Section 3, Part 1, LA 105 Air quality, November 2019;
- Land-Use Planning & Development Control: Planning for Air Quality, EPUK & IAQM, 2017;
- Guidance on the Assessment of Dust from Demolition and Construction, IAQM, 2014; and,
- A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites (Version 1.0), IAQM, June 2019.

Websites Consulted

- Google maps (maps.google.co.uk);
- The UK National Air Quality Archive (www.airquality.co.uk);
- Department for Transport Matrix (www.dft.go.uk/matrix);
- emapsite.com;
- Multi-Agency Geographic Information for the Countryside (http://magic.defra.gov.uk/);
- Planning Practice Guidance (http://planningguidance.planningportal.gov.uk/);
- Liverpool City Council (http://www.liverpool.gov.uk); and,
- Sefton Metropolitan Borough Council (https://www.sefton.gov.uk/).

Site Specific Reference Documents

- Liverpool City Council, Air Quality Annual Status Report 2018;
- Emerging Local Plan (Submission Draft, Schedule of Main Modification 9th April 2020)
- Liverpool City Council Unitary Development Plan, Adopted 2002;
- Liverpool City Council Clean Air Plan (Strategic Outline Case), 31st January 2019;
- Sefton Clean Air Zone Feasibility Study, May 2019;
- Sefton Metropolitan Borough Council, 2018 Air Quality Annual Status Report (July 2018); and,
- Sefton Metropolitan Borough Council, 2019 Air Quality Annual Status Report.

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 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) 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 within the UK. 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 2010 No. 1001, Part 7 Regulation 31 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 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 and Table 2.2 along with European Commission (EC) Directive Limits and World Health Organisation (WHO) Guidelines. The ecological levels are based on WHO and CLRTAP guidance.

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

Pollutant	Applies	Objective	Concentration Measured as[10]	Date to be achieved and maintained thereafter	European Obligations	Date to be achieved and maintained thereafter	New or existing
PM_{10}	UK	50µg/m^3 by end of 2004 (max 35 exceedances a year)	24-hour Mean	1st January 2005	50µg/m^3 by end of 2004 (max 35 exceedances a year)	1st January 2005	Retain Existing
	UK	40µg/m^3 by end of 2004	Annual Mean	1st January 2005	40µg/m^3	1st January 2005	
$PM_{2.5}$	UK	25µg/m^3	Annual Mean	31st December 2010	25µg/m^3	1st January 2010	Retain Existing
NO_2	UK	200µg/m^3 not to be exceeded more than 18 times a year	1-Hour Mean	31st December 2005	200µg/m^3 not to be exceeded more than 18 times a year	1st January 2010	Retain Existing
	UK	40µg/m^3	Annual Mean	31st December 2005	40µg/m^3	1st January 2010	

Table 2.2 Ecological Air Quality Standards, Objectives, Limit and Target Values

Pollutant	Applies	Objective	Concentration Measured as
NO_X	UK	30µg/m^3	Annual Mean

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.

Local Air Quality Management

Under Section 82 of the Environment Act (1995) (Part IV) Local Authorities (LAs) are required to periodically review and assess air quality within their area of jurisdiction under the system of Local Air Quality Management (LAQM). This review and assessment of air quality involves assessing present and likely future air quality against the AQOs. If it is predicted that levels at the façade of buildings where members of the public are regularly present (normally residential properties) are likely to be exceeded, the LA is required to declare an Air Quality Management Area (AQMA). For each AQMA, the LA is required to produce an Air Quality Action Plan (AQAP), the objective of which is to reduce pollutant concentrations in pursuit of the AQOs.

The Liverpool City Council and Sefton Metropolitan Borough Council Air Quality Plans have been reviewed. These documents outline the methods which will be followed to achieve the AQO's within the boroughs.

2.3 Planning and Policy Guidance

Section 38(6) of the Planning and Compulsory Purchase Act 2004 and Section 70(2) of the Town & Country Planning Act 1990 require that planning applications be determined in accordance with the statutory development plan unless material considerations indicate otherwise.

The statutory development plan for the City of Liverpool currently comprises the Unitary Development Plan (UDP) which was adopted in 2002.

Relevant materials considerations include:

- National Planning Policy Framework (NPPF) (2019);
- Planning Practice Guidance (as updated);
- Emerging Liverpool Local Plan (Submission Version, May 2018); and
- Other local policy/guidance.

Statutory Development Plan

The adopted Unitary Development Plan (UDP) policy of relevance to the air quality assessment is policy EP11 (Pollution) which details that:

a. Planning permission will not be granted for development which has the potential to create unacceptable air, water, noise or other pollution or nuisance.

b. 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:

1. Seek to reduce the problem on site;
2. refuse planning permission for development which would result in a consolidation or expansion of uses giving rise to environmental problems;
3. 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;
4. Take enforcement action where appropriate; and
5. 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, the policy advises that 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.

National Planning Policy Framework (NPPF)

The National Planning Policy Framework (NPPF), revised February 2019. In relational to air quality, the NPPF states that:

- Paragraph 170(e) – planning decisions should contribute to and enhance the natural and local environment by preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of air pollution (amongst others).

- Paragraph 181 - planning 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 or 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 or 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'

Planning Practice Guidance (PPG): Air Quality

The (PPG) details: '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:

a) fine particulate matter ($PM_{2.5}$)
b) ammonia (NH_3)
c) nitrogen oxides (NO_x)
d) sulphur dioxide (SO_2)
e) 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."

Emerging Local Plan (Submission Draft, Schedule of Main Modification 9th April 2020)

In accordance with NPPF paragraph 48, the submission version plan has substantial but not full weight in decision taking as it has yet to be examined. 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.

In terms of detailed air quality policies, policy STP2 (Sustainable Growth Principles and Managing Environmental Impacts) states:

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: New developments should (under part r of the Policy) minimise adverse impacts on, and include measures to improve, air quality within the City.

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 / Guidance

Liverpool's Clean Air Plan; 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 in October 2019.

3. Assessment Methodology

The potential environmental effects of the operational phase of the proposed development have been identified as proposed vehicle movements. The significance 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'* 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. 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 Objective (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 concentrations 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.

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

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.

4. Baseline Conditions

4.1 Air Quality Review

This section provides a review of the existing air quality in the vicinity of the proposed application 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 application 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) administrative areas 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 Council. 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. 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 ~1.8km north of the application site boundary) is required. Therefore, receptors within the SMBC AQMA 3 have been included within this assessment.

Both LCC and SMBC have published Air Quality Actions Plans. These documents outline the methods which will be followed to achieve the AQO's within the boroughs as quickly as possible.

Air Quality Monitoring

Monitoring of air quality within LCC and SMBC 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 proposed application site.

Continuous Monitoring

LCC operated one automatic monitoring station, AM1, in 2018. AM1 is located approximately 13 km south-east of the Proposed Development Site. Whereas, SMBC operated four automatic monitoring stations during 2018. The closest automatic monitoring station is, CM3, which is located approximately 2.0 km north of the application site boundary. The most recently available automatic monitoring data is from 2018, which is presented in Table 4.1.

Table 4.1 Monitored Annual Mean NO_2 Concentrations at Automatic Monitoring Stations

Site ID	Location	Site Type	Distance from Kerb (m)	Inlet Height (m)	2017 Annual Mean NO_2 Concentration ($\mu g/m^3$)	2018 Annual Mean NO_2 Concentration ($\mu g/m^3$)
AM1	Speke	Urban Background	N/A	1.5	23.6	18.0
CM3	Millers Bridge	Roadside	9.5	1.8	40.6	41.5

As indicated in Table 4.1, automatic monitoring station AM1 monitored a concentration below the AQO for NO_2 (40 $\mu g/m^3$ annual mean) during 2018. Due to the distance from the application site, automatic monitoring station AM1, was not used as part of the model verification.

Whereas, automatic monitoring station CM3 monitored a concentration above the AQO for NO_2 (40 $\mu g/m^3$ annual mean) during 2018. Automatic monitoring station CM3 has been included as part of the model verification.

Non - Continuous Monitoring

LCC operates a network of passive diffusion tubes. The closest diffusion tube is diffusion tube N20, which is located adjacent to Blackstone Street, located approximately 221 m east of the application site. 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 ($\mu g/m^3$)
T2	Leeds Street/Pall Mall Road Sign	Roadside	1.0	3.5	32.0
N9	Kirkdale Rd approaching Marwood Towers. Lamppost kerbside. Right of anchor	Roadside	2.0	3.5	36.0
N10	Scotland Road Service Station. Lamppost outside.	Kerbside	1.0	3.5	44.0

Site ID	Location	Site Type	Distance from Kerb (m)	Inlet Height (m)	2018 Annual Mean NO_2 Concentration ($\mu g/m^3$)
N18	Commercial Road. Knowsley PH. Lamppost with bike lane sign	Kerbside	0.5	3.5	32.0
N19	Commercial Road. Lamppost before junction with Boundary Road. Opposite Lawtons.	Roadside	1	3.5	32.0
N20	Blackstone St./Gt. Howard St. Thai Pan/Supermarket L3 LTS 2202	Roadside	2	3.5	34.0
N21	Great Howard St / Bulington St junction on T light nr phone box	Kerbside	1	3.5	27.0

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 N10 which monitored a concentration greater than the AQO for NO_2 (40 $\mu g/m^3$ annual mean) during 2018.

Due to the distance from the application site, diffusion tubes N9 and N10 were excluded from the model verification and assessment. All other diffusion tubes identified within Table 4.2 were used as part of the model verification and assessment.

SMBC operated a network of diffusion tubes with SMBC during 2018. The closest diffusion tube is diffusion tube NBO, which is located adjacent to Douglas Place, located approximately 1.8km north of the application site. The most recently available diffusion tube data is from 2018 which is presented in Table 4.3.

Table 4.3 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 ($\mu g/m^3$)
BM	Millers Bridge	Roadside	2.5	2.6	45.0
BO	Douglas Place	Roadside	1.5	2.7	32.0
BQ	Douglas Place/Millers Bridge, Bootle	Roadside	1.5	2.8	34.0
BR	Derby Road, Bootle	Roadside	2.2	2.6	57.0
BS	Derby Road, Bootle	Roadside	3.0	2.5	43.0
EM	Millers Bridge, Bootle	Roadside	3.0	2.6	47.0

As indicated in Table 4.3, all diffusion tubes located within the SMBC AQMA 3 area monitored concentrations above 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 NBO and NBQ which monitored a concentration greater below than the AQO for NO_2 (40 $\mu g/m^3$ annual mean) during 2018.

Due to the distance from the application site and the availability of the monitoring data, a zoned verification has been undertaken to assess SMBC AQMA 3. All diffusion tubes identified in Table 4.3 have been included within the model verification.

A worst-case assessment has been undertaken using the latest available air quality data for both the LCC and SMBC.

It should be noted that as part of the model verification a review of diffusion tubes locations and monitoring heights were reviewed. 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 is the nearest meteorological station, which is considered representative of the development site, with all the complete parameters necessary for the ADMS model. Reference should be made to Figure 4 for an illustration of the prevalent wind conditions at the Liverpool Airport 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 significant 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 via the use of 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 significant changes in traffic flow as a result of the proposed development.

The sensitive receptor locations assessed as part of the long-term (annual) assessment are summarised in Table 4.4. With the existing receptor locations assessed as part of the short-term (hourly) assessment are summarised in Table 4.5. The spatial locations of all receptors are illustrated in Figure 1 and Figure 3.

Table 4.4 Long-Term Modelled Sensitive Receptor Locations

Discrete Sensitive Receptor		Receptor Height (m)
R1	223 Derby Road	1.5
R2	227a Derby Road	1.5
R3	62 Regent Road	1.5
R4	76 Boundary Street	1.5
R5	154 Commercial Road	1.5
R6	12 St Stephens Place	1.5
R7	5 Stockdale Close	1.5
R8	41 Westmorland Drive	1.5
R9	Flat 1 Blackstock Street	4.0
R10	Flat above Riverside Diner, Waterloo Road	4.0
R11	Liverpool Waters Committed Development	1.5
R12	Liverpool Waters Committed Development	1.5
R13	Proposed Hotel – Regent Road (LPA ref. 20F/0217)	1.5
R14	Lightbody Street (LPA ref. 20L/1948)	1.5
R15	234 Millers Bridge	

Table 4.5 Short-Term Modelled Existing Sensitive Receptor Locations

Discrete Sensitive Receptor		Receptor Height (m)
ST1	76 Boundary Street	1.5
ST2	94 Boundary Street	1.5
ST3	1 Barmouth Way	1.5
ST4	98 Boundary Street	1.5
ST5	1 Steel Court	1.5
ST6	35 New Hedley Grove	1.5

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' (2019) 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 (2017) 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, the following ecological receptors were identified. The location of these ecological receptors is illustrated in Figure 2 of this report.

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.

Table 4.6 Ecological Receptors

Site ID	Site	Designation	UK NGR (m)		Distance from Site (km)	Distance from Nearest Modelled Road (km)
			X	Y		
E1	Mersey Narrows	SSSI	332017	392426	1.2	1.2
E2	North Wirral Foreshore	SSSI	331159	394312	2.7	2.7
E3	Mersey Narrows & North Wirral Foreshore	SPA & Ramsar	332017	392426	1.2	1.2
E4			331836	397101	4.7	3.9
E5	Mersey Estuary	SPA	331498	396707	4.4	3.8
E6	Liverpool Bay	SPA	333238	392476	0.0	<0.1
E7	Ribble & Alt Estuaries	SPA & Ramsar	330955	397156	5.1	4.5
E8	Sefton Coast	SAC	330955	397156	5.1	4.5

It should be noted that the IAQM Guidance only requires the assessment of ecological receptors which are located within 200m of the road network. Due to the distance from the modelled road network, all ecological receptors identified within Table 4.6 have been scoped out of this air quality assessment.

Additionally, a review of the predicted traffic flows (summarised in Table 6.1 and Table 6.2 of this report) has shown that receptor E6 (Liverpool Bay SPA) is predicted to experience a change in traffic flow of <1000 AADT between the future baseline and operational year. Therefore, in accordance with the guidance within, "A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites" receptor E6 has been screened out of this air quality assessment and the impacts can be determined to 'negligible'.

All ecological receptors have been included within the air quality assessment of impacts from the proposed boilers to be installed at the Stadium.

5. Assessment of Air Quality Impacts - Construction Phase

5.1 Methodology

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

Four construction processes are considered; these are demolition, earthworks, construction and trackout. Additionally, all construction processes and mitigation outlined within the Construction Management Plan (CMP) prepared by Laing O'Rourke have been considered.

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.

5.2 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, demolition or windblown stockpiles.

5.3 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.

5.4 Construction Vehicle Movements

Based upon the provided traffic data (Mott MacDonald), it is predicted that there will be ~192 vehicles 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.

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 is shown within Section 6.0 of this report. This updated report takes into account the changes to the construction methodology and subsequent changes to the distribution of the construction vehicle movements.

5.5 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) and the Environment Agency Technical Guidance Note (TGN) M17 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 proposed development and based on best practice guidance are discussed in the following sections.

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
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 stage 2B of the IAQM guidance. The assessment has determined the area sensitivities as shown in the Table 5.2.

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 proposed development site	Low	1-10 receptors within 20m of proposed development site	High	A designation (SPA) and a designated feature which may be affected by dust soiling
Earthworks	High		Low		High	
Construction	High		Low		High	
Trackout	High		Low		High	

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 significance of dust emissions associated with the road improvements phase, without mitigation, is presented below.

Table 5.3 Impact Significance of Construction Activities without Mitigation

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

Appropriate mitigation measures are detailed and presented in Section 7. Following the adoption of these measures, the subsequent impact significance 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 a potential risk of exposure of air pollutants at receptors.

6.1 Air Quality Energy Centre Assessment

Following a review of the Energy and Sustainability Assessment (published by Buro Happold Engineering), no CHP is proposed. However, a proposed boiler plant is to be installed, the air quality impacts of these boilers on surrounding sensitive receptors have been included within the assessment shown in Section 7.

6.2 Air Quality Traffic Assessment

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 proposed 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.

This updated Air Quality Assessment is considered to represent a worst-case as it still includes the air quality impacts associated with the vehicle movements associated with the MSCP. The level of parking and subsequent vehicle development trips is consequently expected to be considerably lower than reported in this assessment.

Following the inclusion of the Lightbody Street residential-led mixed use scheme (LPA ref. 20L/1948) the committed development traffic has been analysed by Mott Macdonald who have determined the change in traffic would not have a material impact on traffic on the existing network.

The below comments discuss the comments regarding electric vehicle charging points, shuttle buses and supporter coach parking.

1. Electric Vehicle Parking – This has been considered by Mott MacDonald within the updated Transport Assessment. The location of the parking bays are also summarised in the Design & Access Statement prepared by Pattern Architects and the updated planning/landscaping drawings associated with the revised scheme.
2. Shuttle Buses – Shuttle Buses are to be run on a commercial basis and are not within the club's control in terms of specification of vehicle.
3. Disabled supporter shuttle buses; pre-booked shuttle services for disabled supporters which will run between the stadium, a park & ride facility at Stanley Park (existing surface car park owned by LCC) and Sandhills train station.

4. Supporter Coach Parking - The appointed transport consultants (MottMacDonald) have confirmed that publicly available facilities are nearby to the proposed coach parking location(s) to encourage drivers to switch off engines to avoided idling where possible.

In accordance with the provided traffic data, the operational phase assessment has been undertaken with an assumed operational opening year of 2023. This assessment year considered the Liverpool Waters Committed Development (as detailed within Section 1.5 of this report). The assessment scenarios are, therefore:

- 2018 Baseline = Existing baseline conditions (Scenario 1 TEMPRO);
- 2023 "Do Minimum" = Baseline conditions + Liverpool Waters Permission + Cumulative Development flows (Scenario 6); and,
- 2023 "Do Something" = Baseline conditions + Liverpool Waters Permission + cumulative development + The Proposed Development with event (Scenario 5).

6.3 Existing and Predicted Traffic Flows

Projected 2023 '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 road 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 1.08 was applied to the supplied Project 2023 'Do Nothing' traffic data (Ref: Scenario 1).

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

Discussions with Mott Macdonald confirmed that there are no changes to the previously provided traffic following the design changes as part of this updated technical report.

6.3.1 Construction Phase

For the purpose of the Construction Phase assessment, a worst-case assessment of 2020 has been used. This year has been based upon a three-year construction period as set out in the Construction Management Plan (CMP) which informs the planning application submission.

To calculate the 2020 'do minimum' scenario, a TEMPro factor of 1.04 has been applied to all traffic links. To determine the 'do something' scenario traffic flows, the construction vehicle movements provided by the Transport Consultants have been added on to the 'do minimum' flows. For the traffic flows sourced from the DfT database, an equal distribution at each junction has been considered.

Where no traffic data has been provided, proposed construction traffic has been distributed based on the details stated in the Construction Management Plan (published by Laing O'Rourke). The Construction Management Plan states: *"The main logistics route will be via A5035 Dunnings Bridge Road and A565 Derby Road. Local access to the site can be via Boundary Street, Sandhills Lane or Bankfield Street."*

Following recent changes to the construction methodology, the construction phase traffic assessment has been updated based upon the updates to the distribution of HGV movements.

6.3.2 Operational Phase

To calculate the 2023 'do minimum' scenario traffic flows for the links not provided by the Transport Consultants, a TEMPro factor of 1.07 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 2023 'do minimum' scenario flows. As a worst-case, an equal distribution at each junction has been considered.

Following design changes, the MCSP has been removed and as a result there are expected to be further reductions in the net vehicle movements associated with the development. Therefore, this assessment is considered to represent a worst-case scenario as it considers the vehicle movements including the MSCP.

Emission factors for the 2018 baseline and 2023 projected 'do minimum' and 'do something' scenarios have been calculated using the Emission Factor Toolkit (EFT) Version 9.0 (May 2019).

It is assumed the average vehicle speeds on the local road network in an opening year of 2023 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		2020			
		AADT	HGV%	Do Minimum		Do Something	
				AADT	HGV%	AADT	HGV%
Regent Road adj Boundary Street	48	7437	2.3	7694	2.3	7822	3.9
Regent Road adj Blackstone Street	48	7474	1.9	7733	1.9	7925	4.3
Regent Road adj Walter Street	48	8817	1.6	9122	1.6	9314	3.6
Regent Road adj Saltney Street	48	5699	1.5	5896	1.5	5896	1.5
Boundary Street West	48	1533	0.8	1586	0.8	1650	4.6
Blackstone Street West	48	1770	1.6	1831	1.6	1831	1.6
Walter Street	48	1227	0.8	1269	0.8	1269	0.8
Derby Road N	48	22603	1.5	23385	1.5	23449	1.8
Derby Road S	48	22727	1.6	23513	1.6	23513	1.6
Great Howard Street N	48	24421	1.5	25266	1.5	25266	1.5
Great Howard Street S	48	24431	1.5	25276	1.5	25276	1.5
Boundary Street East	48	481	7.3	498	7.3	498	7.3
Blackstone Street East	48	3937	2.2	4073	2.2	4073	2.2

Link	Speed (km/h)	2018		2020			
		AADT	HGV%	Do Minimum		Do Something	
				AADT	HGV%	AADT	HGV%
Site Access	10	0	0.0	0	0.0	192	100.0
A5054 Boundary Street (West of A5038)	48	6942	7.0	7225	7.0	7225	7.0
A5055 Sandhills Lane (West of A565)	48	2419	7.4	2518	7.4	2518	7.4
A5055 Sandhills Lane (East A565)	48	6005	8.0	6250	8.0	6250	8.0
A5036 Regent Road (North of Sandhills Lane)	48	9736	8.0	10133	8.0	10261	9.1
A565 Derby Road (North of Sandhills Lane)	48	22400	3.3	23314	3.3	23378	3.5
A5038 Commercial Road (North of Sandhills Lane)	48	9311	2.2	9691	2.2	9691	2.2
A5038 Commercial Road (South of Sandhills Lane)	48	13058	2.0	13591	2.0	13591	2.0
A5038 Vauxhall Road (Btw A5054 & A5053)	48	10889	1.6	11333	1.6	11333	1.6
A5036 Regent Road (Btw A5054 & A5052)	48	11345	3.3	11808	3.3	11808	3.3
A565 Great Howard Street (South of Saltney Street)	48	15356	3.0	15983	3.0	15983	3.0
A5053 (East of A565)	48	21568	1.9	22448	1.9	22448	1.9
A5053 (East of A5038)	48	25725	2.4	26775	2.4	26775	2.4
A567 Stanley Road (North)	48	14797	4.4	15401	4.4	15401	4.4
A567 Stanley Road (South)	48	5365	2.9	5584	2.9	5584	2.9
A5054 Blackstone Street (West of A567)	48	9843	5.4	10245	5.4	10245	5.4
A5054 Blackstone Street (West of A59)	48	9843	5.4	10245	5.4	10245	5.4
Bankfield Street	48	1488	15.5	1549	15.5	1549	15.5
A5036 Regent Road (North of Bankfield Street)	48	9128	8.4	9500	8.4	9628	9.6
A565 Derby Road (North of Bankfield Street)	48	22785	4.5	23715	4.5	23779	4.7
A5058 Millers Bridge (West of Derby Road)	48	5463	22.5	5686	22.5	5814	24.2
A5058 Millers Bridge (East of Derby Road)	48	9225	14.8	9601	14.8	9665	15.4
A565 Derby Road (North of Millers Bridge)	48	36175	6.9	37651	6.9	37779	7.2

Table 6.2 Operational Phase Traffic Data

Link	Speed (km/h)	2018		2023			
				Do Minimum		Do Something	
		AADT	HGV%	AADT	HGV%	AADT	HGV%
Regent Road adj Boundary Street	48	7437	2.3	10760	2.3	11327	2.3
Regent Road adj Blackstone Street	48	7474	1.9	10810	1.9	11597	1.9
Regent Road adj Walter Street	48	8817	1.6	12917	1.6	13102	1.6
Regent Road adj Saltney Street	48	5699	1.5	9978	1.5	9978	1.5
Boundary Street West	48	1533	0.8	1651	0.8	1871	0.8
Blackstone Street West	48	1770	1.6	2555	1.6	3061	1.6
Walter Street	48	1227	0.8	2079	0.8	2266	0.8
Derby Road N	48	22603	1.5	26588	1.5	26924	1.5
Derby Road S	48	22727	1.6	26720	1.6	26836	1.6
Great Howard Street N	48	24421	1.5	28454	1.5	28640	1.5
Great Howard Street S	48	24431	1.5	28879	1.5	29195	1.5
Boundary Street East	48	481	7.3	518	7.3	518	7.3
Blackstone Street East	48	3937	2.2	4423	2.2	4626	2.2
Site Access	10	0	0.0	0	0.0	972	1.9
A5054 Boundary Street (West of A5038)	48	6942	7.0	7475	7.0	7678	6.8
A5055 Sandhills Lane (West of A565)	48	2419	7.4	2605	7.4	2605	7.4
A5055 Sandhills Lane (East A565)	48	6005	8.0	6466	8.0	6466	8.0
A5036 Regent Road (North of Sandhills Lane)	48	9736	8.0	10484	8.0	11051	7.7
A565 Derby Road (North of Sandhills Lane)	48	22400	3.3	24120	3.3	24456	3.3
A5038 Commercial Road (North of Sandhills Lane)	48	9311	2.2	10026	2.2	10094	2.2
A5038 Commercial Road (South of Sandhills Lane)	48	13058	2.0	14061	2.0	14129	2.0
A5038 Vauxhall Road (Btw A5054 & A5053)	48	10889	1.6	11725	1.6	11793	1.6
A5036 Regent Road (Btw A5054 & A5052)	48	11345	3.3	12216	3.3	12216	3.3
A565 Great Howard Street (South of Saltney Street)	48	15356	3.0	16535	3.0	16851	3.0
A5053 (East of A565)	48	21568	1.9	23224	1.9	23292	1.9
A5053 (East of A5038)	48	25725	2.4	27701	2.4	27769	2.4
A567 Stanley Road (North)	48	14797	4.4	15933	4.4	15933	4.4
A567 Stanley Road (South)	48	5365	2.9	5777	2.9	5811	2.8
A5054 Blackstone Street (West of A567)	48	9843	5.4	10599	5.4	10667	5.4
A5054 Blackstone Street (West of A59)	48	9843	5.4	10599	5.4	10633	5.4
Bankfield Street	48	1488	15.5	1602	15.5	1602	15.5
A5036 Regent Road (North of Bankfield Street)	48	9128	8.4	9829	8.4	10396	8.1
A565 Derby Road (North of Bankfield Street)	48	22785	4.5	24535	4.5	24871	4.4
A5058 Millers Bridge (West of Derby Road)	48	5463	22.5	5883	22.5	6450	20.7
A5058 Millers Bridge (East of Derby Road)	48	9225	14.8	9933	14.8	10269	14.4
A565 Derby Road (North of Millers Bridge)	48	36175	6.9	38953	6.9	39520	6.9

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:

> "*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

The background concentrations shown in Table 6.3 were referenced 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 application site. In May 2019, Defra issued revised 2017 based background maps for nitrogen oxide (NO_X), NO_2, PM_{10} and $PM_{2.5}$.

Table 6.3 Published Background Air Quality Levels (µg/m³)

Receptor Location	2018			
	NO_2	NO_x	PM_{10}	$PM_{2.5}$
Local Authority Monitoring –Sefton AQMA Zone				
CM3	29.91	52.62	10.89	7.67
BM	29.91	52.62	10.89	7.67
BO	29.91	52.62	10.89	7.67
BQ	29.91	52.62	10.89	7.67
BR	29.91	52.62	10.89	7.67
BS	29.91	52.62	10.89	7.67
EM	29.91	52.62	10.89	7.67
Local Authority Monitoring – LCC Zone				
T2	24.55	38.13	11.91	7.98
N18	22.25	34.38	11.35	7.97
N19	20.20	30.16	11.21	7.64

Receptor Location	2018			
	NO_2	NO_x	PM_{10}	$PM_{2.5}$
N20	18.93	28.18	10.47	7.10
N21	24.55	38.13	11.91	7.98
Existing Sensitive Receptors				
R1	29.91	52.62	10.89	7.67
R2	29.91	52.62	10.89	7.67
R3	18.93	28.18	10.47	7.10
R4	20.20	30.16	11.21	7.64
R5	22.25	34.38	11.35	7.97
R6	24.55	38.13	11.91	7.98
R7	24.55	38.13	11.91	7.98
R8	24.55	38.13	11.91	7.98
R9	24.55	38.13	11.91	7.98
R10	19.87	29.58	10.97	7.43
R11	18.93	28.18	10.47	7.10
R12	18.93	28.18	10.47	7.10
R13	18.93	28.18	10.47	7.10
R14	18.93	28.18	10.47	7.10
R15	29.91	52.62	10.89	7.67

All the Defra background concentrations detailed in Table 6.3 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 6.4.

Table 6.4 Pollutant Source Apportionment of NO_X (µg/m³)

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 – Sefton AQMA Zone							
CM3	52.62	15.34	3.59	3.25	0.02	0.25	77.55
BM	52.62	15.34	3.59	3.25	0.02	0.25	77.55
BO	52.62	15.34	3.59	3.25	0.02	0.25	77.55
BQ	52.62	15.34	3.59	3.25	0.02	0.25	77.55
BR	52.62	15.34	3.59	3.25	0.02	0.25	77.55
BS	52.62	15.34	3.59	3.25	0.02	0.25	77.55
EM	52.62	15.34	3.59	3.25	0.02	0.25	77.55
Local Authority Monitoring Locations – LCC Zone							
T2	38.13	52.80	4.80	9.41	0.03	0.30	32.66
N18	34.38	33.16	6.08	6.88	0.03	0.31	53.54
N19	30.16	38.01	5.30	7.11	0.03	0.29	36.98
N20	28.18	24.84	5.32	5.59	0.02	0.21	45.97
N21	38.13	58.55	5.32	10.44	0.03	0.34	36.22
Modelled Receptor Locations							
R1	52.62	15.34	3.59	3.25	0.02	0.25	77.55
R2	52.62	15.34	3.59	3.25	0.02	0.25	77.55

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	28.18	30.31	6.49	6.82	0.03	0.26	56.09
R4	30.16	43.33	6.05	8.10	0.03	0.33	42.16
R5	34.38	33.16	6.08	6.88	0.03	0.31	53.54
R6	38.13	52.80	4.80	9.41	0.03	0.30	32.66
R7	38.13	52.80	4.80	9.41	0.03	0.30	32.66
R8	38.13	52.80	4.80	9.41	0.03	0.30	32.66
R9	38.13	52.80	4.80	9.41	0.03	0.30	32.66
R10	29.58	42.17	6.17	7.96	0.03	0.25	43.42
R11	28.18	30.31	6.49	6.82	0.03	0.26	56.09
R12	28.18	30.31	6.49	6.82	0.03	0.26	56.09
R13	28.18	30.31	6.49	6.82	0.03	0.26	56.09
R14	29.79	28.07	6.75	7.77	0.04	0.30	57.07
R15	52.62	15.34	3.59	3.25	0.02	0.25	77.55

Table 6.4 shows that the major background source of NO_x at the monitoring and sensitive receptor locations, where sources have been identified is mainly comprised of road sources.

Model Traffic NO_2 Contribution Analysis

A review of the model contribution at each of the Local Authority monitoring locations has been undertaken.

Table 6.5 shows the methodology followed to determine the background NO_2 concentration. The background concentration at each monitoring location has been determined through NO_X to NO_2 calculator (Version 7.1, April 2019).

As the background used in the modelling has to account for everything not in the model (i.e. smaller roads for which there is no AADT data available, domestic boiler, trainlines, aviation etc), WYG have subtracted the raw output from the model from the monitoring to provide an appropriate background concentration to be used which results in a model which accurately represents conditions within the study area. This also allows the model to account for micro-siting effects which are not as a result of traffic.

Table 6.5 Roadside Modelled Contribution at Tubes

Monitoring Location	2018 Monitored Annual Mean µg/m³ (NO_2)	Raw Modelled Output µg/m³ (NO_X)	NO_X to NO_2 Calculated NO_2 Output µg/m³ (NO_2)	Background NO_2 (µg/m³)
Local Authority Monitoring Locations – Sefton AQMA Zone				
CM3	41.50	18.80	23.79	4.99
BM	45.00	18.75	26.74	7.99
BO	32.00	4.09	19.69	15.60
BQ	36.00	4.83	21.62	16.79
BR	57.00	15.17	32.91	17.74
BS	43.00	18.01	23.51	5.50
EM	47.00	14.90	24.91	10.01
Local Authority Monitoring Locations – LCC Zone				

Monitoring Location	2018 Monitored Annual Mean µg/m³ (NO_2)	Raw Modelled Output µg/m³ (NO_X)	NO_X to NO_2 Calculated NO_2 Output µg/m³ (NO_2)	Background NO_2 (µg/m³)
Local Authority Monitoring Locations – Sefton AQMA Zone				
Monitoring Location	**2018 Monitored Annual Mean µg/m³ (NO_2)**	**Raw Modelled Output µg/m³ (NO_X)**	**NO_X to NO_2 Calculated NO_2 Output µg/m³ (NO_2)**	**Background NO_2 (µg/m³)**
T2	32.00	5.50	21.15	15.65
N18	32.00	7.91	21.15	13.24
N19	32.00	9.19	21.15	11.96
N20	34.00	11.59	22.11	10.52
N21	27.00	5.21	18.71	13.50

Following a review of all available background concentration data, the most appropriate background concentration is the published Defra Background Concentrations. This is considered most appropriate as the Model Contribution (shown in Table 6.5) gives a lower background concentration in comparison producing an unrepresentatively low monitoring result at the monitoring locations.

For comparison, the following additional scenario has been undertaken:

- Scenario 2 – Theoretical Emissions Scenarios (Appendix B)

Table 6.6 Utilised Background Concentrations (µg/m³)

Receptor Location	Source	2018	
		NO_2	NO_x
Local Authority Monitoring – Sefton AQMA Zone			
CM3	Defra Published Background Concentrations	29.91	52.62
BM		29.91	52.62
BO		29.91	52.62
BQ		29.91	52.62
BR		29.91	52.62
BS		29.91	52.62
EM		29.91	52.62
Local Authority Monitoring – LCC Zone			
T2	Defra Published Background Concentrations	24.55	38.13
N18		22.25	34.38
N19		20.20	30.16
N20		18.93	28.18
N21		24.55	38.13
Existing Sensitive Receptors			
R1	Defra Published Background Concentrations	29.91	52.62
R2		29.91	52.62
R3		18.93	28.18
R4		20.20	30.16
R5		22.25	34.38
R6		24.55	38.13
R7		24.55	38.13
R8		24.55	38.13
R9		24.55	38.13
R10		19.87	29.58
R11		18.93	28.18
R12		18.93	28.18

Receptor Location	Source	2018	
		NO_2	NO_x
R13		18.93	28.18
R14		18.93	28.18
R2		29.91	52.62

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 6.7 summarises the final model/monitored data correlation following the application of the model correction factor.

A worst-case assessment has been undertaken using the latest available air quality data for both the LCC and SMBC. At the time of this assessment SMBC have not released their 2018 monitoring data WYG have undertaken a zoned verification for both the AQMA within SMBC, using 2017 monitoring data, and a verification for the area within LCC using 2018 monitoring data.

Table 6.7 Comparison of Roadside Modelling & Monitoring Results for NO_2

Tube Location	NO_2 µg/m^3		
	Monitored NO_2	Modelled NO_2	Difference (%)
Local Authority Monitoring – Sefton AQMA Zone			
CM3	41.50	47.62	14.74
BM	45.00	47.58	5.73
BO	32.00	34.01	6.28
BQ	36.00	34.73	-3.52
BR	57.00	44.41	-22.08
BS	43.00	46.93	9.14
EM	47.00	44.17	-6.01
Local Authority Monitoring – LCC Zone			
T2	32.00	31.47	-1.66
N18	32.00	32.06	0.18
N19	32.00	31.73	-0.83
N20	34.00	32.46	-4.53
N21	27.00	31.12	15.26

The final model produced data at the monitoring locations to within 25% of the monitoring results and to within 10% at the majority of the receptors, as the requirement by TG16 guidance.

Although the divergence of monitored and modelled is above the criteria outlines within TG16 within Sefton AQMA 3, a review of the monitored concentrations at diffusion tube NBR show that the 2017 monitored concentration is much greater than in previous years. Therefore, this is considered to be less representative compared to the surrounding diffusion tubes and automatic monitoring location within the AQMA.

The final verification model correlation coefficient for Sefton AQMA Zone (representing the model uncertainty) is 1.00[1]. With the final verification model correlation coefficient for the LCC Zone (representing the model uncertainty) is 0.99[2]. 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 6.8 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
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 other 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 national speed limits
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 **9.0 (2019)** dataset was used.

[1] This was achieved by applying a model correction factor of 2.56 to roadside predicted NO_X concentrations before converting to NO_2
[2] This was achieved by applying a model correction factor of 2.03 to roadside predicted NO_X concentrations before converting to NO_2

Parameter	Description	Input Value
Year	Predicted EFT emissions rates depend on the year of emission.	**2018** data for verification and baseline Operational Phase Assessment. **2020** data for the Construction Phase Traffic Assessment. **2023** data for the Operational Phase Assessment.
Site Plan	**Source:** Pattern Design	**Drawing Name:** PLANNING ADDENDUM STADIUM PROPOSED PLANS - PROPOSED FLOOR PLAN| **Drawing No:** BMD01-PAT-4A-00-DR-A-20101

6.7 ADMS Modelling Results

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 proposed 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 2020, assessment of the effects of emissions from the proposed traffic associated with the construction phase, has been undertaken using the Emissions Factor Toolkit (EFT) 2020 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 (Scenario 1 TEMPro'd);
- 2020 "Do Minimum" = Baseline conditions (TEMPro'd to 2020); and,
- 2020 "Do Something" = Baseline conditions (TEMPro'd to 2020) + Construction Phase Traffic Flows.

Nitrogen Dioxide

Table 6.9 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 6.9 Predicted Annual Average Concentrations of NO_2 at Receptor Locations

Receptor		NO_2 (µg/m^3)			
		Baseline 2018	Do Minimum 2020	Do Something 2020	Development Contribution
R1	223 Derby Road	45.76	43.59	43.72	0.13
R2	227a Derby Road	41.59	40.03	40.13	0.10
R3	62 Regent Road	24.65	24.14	24.46	0.32
R4	76 Boundary Street	22.96	22.65	22.66	0.01
R5	154 Commercial Road	30.29	29.49	29.49	<0.01
R6	12 St Stephens Place	28.72	28.33	28.33	<0.01
R7	5 Stockdale Close	29.82	29.34	29.34	<0.01

Receptor		NO_2 (µg/m³)			
		Baseline 2018	Do Minimum 2020	Do Something 2020	Development Contribution
R8	41 Westmorland Drive	28.21	27.89	27.89	<0.01
R9	Flat 1 Blackstock Street	31.12	30.52	30.53	0.01
R10	Flat above Riverside Diner, Waterloo Road	24.99	24.49	24.49	<0.01
R11	Liverpool Waters Committed Development	-	19.37	19.37	<0.01
R12	Liverpool Waters Committed Development	-	20.54	20.62	0.08
R13	Proposed Hotel – Regent Road (LPA ref. 20F/0217)	-	24.15	24.47	0.32
R14	Lightbody Street (LPA ref. 20L/1948)	-	29.56	30.07	0.51
R15	234 Millers Bridge	41.55	40.00	40.10	0.10
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 6.9, 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 0.51 µg/m³ at Lightbody Street (R14).

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 below.

Table 6.10 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	0.13	0.32	0%	103-109 of AQO	Negligible
R2	0.10	0.25	0%	95-102% of AQO	Negligible
R3	0.32	0.80	1%	≤75% of AQO	Negligible
R4	0.01	0.02	0%	≤75% of AQO	Negligible
R5	<0.01	<0.01	0%	≤75% of AQO	Negligible
R6	<0.01	<0.01	0%	≤75% of AQO	Negligible
R7	<0.01	<0.01	0%	≤75% of AQO	Negligible
R8	<0.01	<0.01	0%	≤75% of AQO	Negligible
R9	0.01	0.02	0%	76-94% of AQO	Negligible
R10	<0.01	<0.01	0%	≤75% of AQO	Negligible
R11	<0.01	<0.01	0%	≤75% of AQO	Negligible
R12	0.08	0.20	0%	≤75% of AQO	Negligible
R13	0.32	0.80	1%	≤75% of AQO	Negligible
R14	0.51	1.27	1%	≤75% of AQO	Negligible
R15	0.10	0.25	0%	95-102% 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 construction phase, 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'.

Particulate Matter (PM_{10})

Table 6.11 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 6.11 Predicted Annual Average Concentrations of PM_{10} at Receptor Locations

Receptor		PM_{10} (µg/m³)			
		Baseline 2018	Do Minimum 2020	Do Something 2020	Development Contribution
R1	223 Derby Road	13.23	13.21	13.25	0.03
R2	227a Derby Road	12.62	12.61	12.64	0.03
R3	62 Regent Road	11.54	11.54	11.61	0.07
R4	76 Boundary Street	11.71	11.71	11.71	<0.01
R5	154 Commercial Road	12.62	12.62	12.62	<0.01
R6	12 St Stephens Place	12.62	12.62	12.62	<0.01
R7	5 Stockdale Close	12.79	12.79	12.79	<0.01
R8	41 Westmorland Drive	12.58	12.59	12.59	<0.01
R9	Flat 1 Blackstock Street	12.94	12.94	12.94	<0.01
R10	Flat above Riverside Diner, Waterloo Road	11.93	11.94	11.94	<0.01
R11	Liverpool Waters Committed Development	-	10.56	10.56	0.01
R12	Liverpool Waters Committed Development	-	10.80	10.81	0.01
R13	Proposed Hotel – Regent Road (LPA ref. 20F/0217)	-	11.55	11.62	0.07
R14	Lightbody Street (LPA ref. 20L/1948)	-	12.70	12.80	0.11
R15	234 Millers Bridge	12.59	12.59	12.62	0.03
Annual Mean AQO		**40 µg/m³**			

As indicated in Table 6.11, 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 0.11 µg/m³ at Lightbody Street (R14).

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 6.12.

Table 6.12 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) (µg/m³)	Change Due to Development (% of AQO)	% Change in Concentration Relative to AQO	% Annual Mean Concentration in Assessment Year	Impact Description
R1	0.03	0.08	0%	≤75% of AQO	Negligible
R2	0.03	0.06	0%	≤75% of AQO	Negligible
R3	0.07	0.17	0%	≤75% of AQO	Negligible
R4	<0.01	0.00	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**
R5	<0.01	0.00	0%	≤75% of AQO	Negligible
R6	<0.01	0.00	0%	≤75% of AQO	Negligible
R7	<0.01	0.00	0%	≤75% of AQO	Negligible
R8	<0.01	0.00	0%	≤75% of AQO	Negligible
R9	<0.01	0.00	0%	≤75% of AQO	Negligible
R10	<0.01	0.00	0%	≤75% of AQO	Negligible
R11	0.01	0.03	0%	≤75% of AQO	Negligible
R12	0.01	0.04	0%	≤75% of AQO	Negligible
R13	0.07	0.17	0%	≤75% of AQO	Negligible
R14	0.11	0.27	0%	≤75% of AQO	Negligible
R15	0.03	0.06	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 6.13 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 6.13 Predicted Annual Average Concentrations of $PM_{2.5}$ at Receptor Locations

Receptor		$PM_{2.5}$ (µg/m³)			
		Baseline 2018	**Do Minimum 2020**	**Do Something 2020**	**Development Contribution**
R1	223 Derby Road	9.09	9.04	9.06	0.02
R2	227a Derby Road	8.72	8.68	8.70	0.01
R3	62 Regent Road	7.72	7.71	7.75	0.04
R4	76 Boundary Street	7.93	7.93	7.93	<0.01
R5	154 Commercial Road	8.73	8.71	8.71	<0.01
R6	12 St Stephens Place	8.40	8.39	8.39	<0.01
R7	5 Stockdale Close	8.50	8.49	8.49	<0.01
R8	41 Westmorland Drive	8.37	8.36	8.36	<0.01
R9	Flat 1 Blackstock Street	8.59	8.58	8.58	<0.01
R10	Flat above Riverside Diner, Waterloo Road	7.99	7.98	7.98	<0.01
R11	Liverpool Waters Committed Development	-	7.15	7.15	<0.01
R12	Liverpool Waters Committed Development	-	7.29	7.29	0.01
R13	Proposed Hotel – Regent Road (LPA ref. 20F/0217)	-	7.72	7.76	0.04
R14	Lightbody Street (LPA ref. 20L/1948)	-	8.37	8.44	0.06
R15	234 Millers Bridge	8.72	8.68	8.70	0.01
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 6.13, 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 0.06 µg/m^3 at Lightbody Street (R14).

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 6.14.

Table 6.14 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/m^3)	Change Due to Development (% of AQO)	% Change in Concentration Relative to AQO	% Annual Mean Concentration in Assessment Year	Impact Description
R1	0.02	0.08	0%	≤75% of AQO	Negligible
R2	0.01	0.06	0%	≤75% of AQO	Negligible
R3	0.04	0.16	0%	≤75% of AQO	Negligible
R4	<0.01	0.00	0%	≤75% of AQO	Negligible
R5	<0.01	0.00	0%	≤75% of AQO	Negligible
R6	<0.01	0.00	0%	≤75% of AQO	Negligible
R7	<0.01	0.00	0%	≤75% of AQO	Negligible
R8	<0.01	0.00	0%	≤75% of AQO	Negligible
R9	<0.01	0.00	0%	≤75% of AQO	Negligible
R10	<0.01	0.00	0%	≤75% of AQO	Negligible
R11	<0.01	0.00	0%	≤75% of AQO	Negligible
R12	0.01	0.03	0%	≤75% of AQO	Negligible
R13	0.04	0.16	0%	≤75% of AQO	Negligible
R14	0.06	0.25	0%	≤75% of AQO	Negligible
R15	0.01	0.06	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 (Long-Term)

For the operational year of 2023, assessment of the effects of emissions from the proposed traffic associated with the scheme, has been undertaken using the EFT 2023 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 (Scenario 1 TEMPro'd);
- 2023 "Do Minimum" = Baseline conditions + Liverpool Waters Permission + Cumulative Development

flows (Scenario 6); and,

- 2023 "Do Something" = Baseline conditions + Liverpool Waters Permission + cumulative development + The Proposed Development with event (Scenario 5).

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

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

Nitrogen Dioxide

Table 6.15 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 6.15 Predicted Annual Average Concentrations of NO_2 at Receptor Locations

Receptor		NO_2 (µg/m³)			
		Baseline 2018	Do Minimum 2023	Do Something 2023	Development Contribution
R1	223 Derby Road	45.76	40.01	40.16	0.15
R2	227a Derby Road	41.59	37.39	37.52	0.13
R3	62 Regent Road	24.65	24.28	24.52	0.24
R4	76 Boundary Street	22.96	22.16	22.21	0.05
R5	154 Commercial Road	30.29	27.86	27.90	0.04
R6	12 St Stephens Place	28.72	27.49	27.50	0.01
R7	5 Stockdale Close	29.82	28.28	28.29	0.01
R8	41 Westmorland Drive	28.21	27.16	27.17	0.01
R9	Flat 1 Blackstock Street	31.12	29.24	29.27	0.03
R10	Flat above Riverside Diner, Waterloo Road	24.99	23.48	23.49	0.01
R11	Liverpool Waters Committed Development	-	19.30	19.44	0.14
R12	Liverpool Waters Committed Development	-	20.51	20.70	0.19
R13	Proposed Hotel – Regent Road (LPA ref. 20F/0217)	-	24.29	24.53	0.24
R14	Lightbody Street (LPA ref. 20L/1948)	-	28.10	28.56	0.46
R15	234 Millers Bridge	41.56	37.36	37.49	0.13
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. This is with the exception of R1 and R2 where there is predicted to be an exceedance of the AQO. It should be noted that R1 and R2 are located within the SMBC AQMA 3 and therefore predicted to experience high levels of concentrations prior to the introduction of the proposed scheme. Additionally, the change at these sensitive receptors are predicted to be 'negligible' and therefore, not predicted to be significant as a result of the Proposed Development.

As indicated in Table 6.15, 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 0.46 µg/m³ at Lightbody Street (R14).

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 the table below.

Table 6.16 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	0.15	0.37	0%	95-102% of AQO	Negligible
R2	0.13	0.32	0%	76-94% of AQO	Negligible
R3	0.24	0.60	1%	≤75% of AQO	Negligible
R4	0.05	0.12	0%	≤75% of AQO	Negligible
R5	0.04	0.10	0%	≤75% of AQO	Negligible
R6	0.01	0.02	0%	≤75% of AQO	Negligible
R7	0.01	0.02	0%	≤75% of AQO	Negligible
R8	0.01	0.02	0%	≤75% of AQO	Negligible
R9	0.03	0.07	0%	≤75% of AQO	Negligible
R10	0.01	0.02	0%	≤75% of AQO	Negligible
R11	0.14	0.35	0%	≤75% of AQO	Negligible
R12	0.19	0.47	0%	≤75% of AQO	Negligible
R13	0.24	0.60	1%	≤75% of AQO	Negligible
R14	0.46	1.15	1%	≤75% of AQO	Negligible
R15	0.13	0.32	0%	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 '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'.

Particulate Matter (PM_{10})

Table 6.17 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 development, based on modelled 'do minimum' and 'do something' scenarios.

Table 6.17 Predicted Annual Average Concentrations of PM_{10} at Receptor Locations

Receptor		PM_{10} (µg/m³)			
		Baseline 2018	Do Minimum 2023	Do Something 2023	Development Contribution
R1	223 Derby Road	13.23	13.19	13.23	0.04
R2	227a Derby Road	12.62	12.60	12.63	0.03
R3	62 Regent Road	11.54	11.88	11.93	0.05
R4	76 Boundary Street	11.71	11.73	11.74	0.01
R5	154 Commercial Road	12.62	12.62	12.63	0.01

Receptor		PM_{10} (µg/m³)			
		Baseline 2018	Do Minimum 2023	Do Something 2023	Development Contribution
R6	12 St Stephens Place	12.62	12.62	12.62	<0.01
R7	5 Stockdale Close	12.79	12.79	12.79	<0.01
R8	41 Westmorland Drive	12.58	12.59	12.59	<0.01
R9	Flat 1 Blackstock Street	12.94	12.94	12.95	0.01
R10	Flat above Riverside Diner, Waterloo Road	11.93	11.95	11.95	<0.01
R11	Liverpool Waters Committed Development	-	10.56	10.59	0.03
R12	Liverpool Waters Committed Development	-	10.88	10.91	0.03
R13	Proposed Hotel – Regent Road (LPA ref. 20F/0217)	-	11.89	11.94	0.05
R14	Lightbody Street (LPA ref. 20L/1948)	-	12.91	13.05	0.14
R15	234 Millers Bridge	12.60	12.58	12.61	0.03
Annual Mean AQO		**40 µg/m³**			

As indicated in Table 6.17, the maximum predicted increase in annual average exposure to PM_{10} at any existing receptor, due to changes in traffic movements associated with the development is 0.14 µg/m³ at Lightbody Street (R14).

The impact description 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 6.18.

Table 6.18 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) (µg/m³)	Change Due to Development (% of AQO)	% Change in Concentration Relative to AQO	% Annual Mean Concentration in Assessment Year	Impact Description
R1	0.04	0.10	0%	≤75% of AQO	Negligible
R2	0.03	0.08	0%	≤75% of AQO	Negligible
R3	0.05	0.13	0%	≤75% of AQO	Negligible
R4	0.01	0.03	0%	≤75% of AQO	Negligible
R5	0.01	0.02	0%	≤75% of AQO	Negligible
R6	<0.01	0.01	0%	≤75% of AQO	Negligible
R7	<0.01	0.01	0%	≤75% of AQO	Negligible
R8	<0.01	0.01	0%	≤75% of AQO	Negligible
R9	0.01	0.01	0%	≤75% of AQO	Negligible
R10	<0.01	0.01	0%	≤75% of AQO	Negligible
R11	0.03	0.08	0%	≤75% of AQO	Negligible
R12	0.03	0.08	0%	≤75% of AQO	Negligible
R13	0.05	0.13	0%	≤75% of AQO	Negligible
R14	0.14	0.35	0%	≤75% of AQO	Negligible
R15	0.03	0.08	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 proposed development, 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 6.19 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 development, based on modelled 'do minimum' and 'do something' scenarios.

Table 6.19 Predicted Annual Average Concentrations of $PM_{2.5}$ at Receptor Locations

Receptor		$PM_{2.5}$ (µg/m³)			
		Baseline 2018	Do Minimum 2023	Do Something 2023	Development Contribution
R1	223 Derby Road	9.09	8.98	9.00	0.02
R2	227a Derby Road	8.72	8.64	8.66	0.02
R3	62 Regent Road	7.72	7.89	7.92	0.03
R4	76 Boundary Street	7.93	7.93	7.94	0.01
R5	154 Commercial Road	8.73	8.69	8.70	0.01
R6	12 St Stephens Place	8.40	8.38	8.38	<0.01
R7	5 Stockdale Close	8.50	8.47	8.48	0.01
R8	41 Westmorland Drive	8.37	8.36	8.36	<0.01
R9	Flat 1 Blackstock Street	8.59	8.56	8.57	0.01
R10	Flat above Riverside Diner, Waterloo Road	7.99	7.98	7.98	<0.01
R11	Liverpool Waters Committed Development	-	7.15	7.16	0.01
R12	Liverpool Waters Committed Development	-	7.33	7.35	0.02
R13	Proposed Hotel – Regent Road (LPA ref. 20F/0217)	-	7.90	7.93	0.03
R14	Lightbody Street (LPA ref. 20L/1948)	-	8.47	8.54	0.07
R15	234 Millers Bridge	8.70	8.62	8.64	0.02
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 6.19, 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 development is 0.07 µg/m³ at Lightbody Street (R14).

The impact description 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 6.20.

Table 6.20 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	0.02	0.09	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
R2	0.02	0.07	0%	≤75% of AQO	Negligible
R3	0.03	0.12	0%	≤75% of AQO	Negligible
R4	0.01	0.03	0%	≤75% of AQO	Negligible
R5	0.01	0.02	0%	≤75% of AQO	Negligible
R6	<0.01	0.01	0%	≤75% of AQO	Negligible
R7	0.01	0.04	0%	≤75% of AQO	Negligible
R8	<0.01	0.01	0%	≤75% of AQO	Negligible
R9	0.01	0.04	0%	≤75% of AQO	Negligible
R10	<0.01	0.01	0%	≤75% of AQO	Negligible
R11	0.01	0.05	0%	≤75% of AQO	Negligible
R12	0.02	0.08	0%	≤75% of AQO	Negligible
R13	0.03	0.12	0%	≤75% of AQO	Negligible
R14	0.07	0.29	0%	≤75% of AQO	Negligible
R15	0.02	0.07	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 proposed development, 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'.

6.7.3 Assessment Scenarios – Operational Phase (Short-Term)

A short-term air quality assessment has been undertaken at existing identified receptor locations shown in Table 4.4. This short-term assessment is to determine the predicted exposure at the existing sensitive receptors, adjacent to the proposed taxi rank pre and post-match day events. The results of this assessment are considered to be extreme worst-case with the generation of 1,800 (two way) taxi vehicle trips. These traffic flows have been provided by the project Transport Consultant. To account for the idling and rolling of taxi's pre and post-match day event, a 5 km slow-down has been used along the entire road length of the A5054 Boundary Street (In accordance with section 7.249 of TG16). This is in accordance with drawing number: 385175-OPT1-TM4 (dated 14th October 2019).

To calculate the 'do minimum' traffic flows the AADT figure, (as shown in Table 6.2) for the A5054 Boundary Street, has been divided by 24 to produce an hourly flow. This is considered to be worst-case for the length of road.

A short-term air quality assessment of NO_2 has been undertaken in accordance with the short-term limits outlined in Table 2.1.

To calculate the maximum hourly annual NO_2 concentration, the primary adjustment factor has been applied to the modelled NO_x output. This figure has then been adjusted using the NO_x to NO_2 calculator using a

background concentration which is double those stated in Table 6.6. As referenced within the 'Air Emission Risk Assessment for Your Environmental Permit' Defra Guidance[3], a short-term background concentration can be assumed to be twice the long-term background concentration. The total NO_2 concentrations have been determined by adding the modelled NO_2 value on to the derived short-term NO_2 background concentration.

Nitrogen Dioxide

Table 6.21 shows the Maximum Annual Hourly NO_2 Concentration.

Table 6.21 Short-Term Modelled NO_2 Exposure

Receptor	Receptor Location	Maximum Hourly Annual NO_2 Concentration (µg/m³)		
		Do Minimum	Do Something	Development Contribution
ST1	76 Boundary Street	46.34	72.81	26.46
ST2	94 Boundary Street	47.58	79.90	32.32
ST3	1 Barmouth Way	46.91	75.38	28.47
ST4	98 Boundary Street	48.19	80.85	32.67
ST5	1 Steel Court	47.16	76.56	29.40
ST6	35 New Hedley Grove	46.36	73.19	26.82
Short-Term Mean AQO not to be exceeded			**200 µg/m³**	

The maximum predicted increase in hourly annual NO_2 concentrations, as a result of the proposed development, pre and post-match day event, is predicted to be 32.67 µg/m³ at 98 Boundary Street (ST4).

The results of the short-term modelling assessment showed that with the development, during pre and post-match day event, there are no predicted exceedances of the short-term NO_2 objective at any of the existing sensitive receptors. This shows that the amenity of the existing residential receptors, adjacent to the proposed taxi rank are not significantly affected during a one-hour period.

[3] https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit

7. Air Quality Assessment from the Boiler Operation

The stadium consists of a central boiler room located at level 3 in the East Stand. It is intended to provide 6 modular boilers. The boilers shall be gas fired pressure jet type with a fan dilution system to avoid extending conventional flues through the stadium roof. The diluted products of combustion will be discharged at the same level on the East elevation of the wrap around roof above any occupied floors through the fan dilution louvres but level with the back of the upper tier. A blank section of façade will be provided around the outlet point to mitigate against the discharged air passing back through the permeable façade.

The aim of the air quality assessment presented in this Appendix is to determine whether the impacts from the emissions from the operations of the boilers at the central boiler room meet the required air quality standards (AQSs), AQOs, or air quality environmental assessment limits (EALs) for the protection of human health and for the protection of vegetation and ecosystems.

The major assessment includes:

- Baseline evaluation;
- Identification of receptors, including ecological receptors;
- Using traffic air quality modelling results as a baseline concentration to produce a cumulative impact assessment;
- Assessment of potential air quality impacts from the operation of the boilers; and
- Assessment of impact on the ecological receptors using "IAQM's guide to the assessment of air quality impacts on designated nature conservation sites".

7.1 LCC Application Consultation Response - March 2020

As summarised in Section 1 of this assessment, Liverpool City Council's Environmental Protection Unit made comments on the potential Air Quality impacts associated with the Outdoor Broadcasting Compound in its statutory consultation response to the original submitted planning application (LPA ref. 20F/0001).

The proposed outdoor broadcasting system has been considered in term of air quality. It has been confirmed that the current proposals for the outdoor broadcasting system will involve zero emissions battery storage technology which will be powered through the mains electrical supply.

7.2 Baseline Condition for the Assessment of the Operations of the Boiler

Background Pollutant Mapping

Background pollutant concentration data on a 1km x 1km spatial resolution is provided by the UK National Air Quality Archive[4] and is routinely used to support LAQM and Air Quality Assessments where local pollutant monitoring has not been undertaken.

Background concentrations as used within the prediction calculations were referenced 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 site. Defra issued revised 2017 based background maps for NO_2. The updated mapped background concentrations adjacent to the site are summarised in Table 7.1 below.

Table 7.1 Predicted Background Concentrations

UK NGR (m)		2020 Predicted Background Concentration (µg/m3)
X	Y	NO2
333500	392500	17.65

Table 7.1 indicates that there were no background exceedances of the relevant AQOs within the vicinity of the facility during 2020.

7.3 Detailed Dispersion Modelling Methodology

In order to consider the air quality impacts of the biomass boilers on the local air quality, a quantitative assessment using the third generation Breeze AERMOD dispersion model has been undertaken. AERMOD is a development from the ISC3 dispersion model and incorporates improved dispersion algorithms and pre-processors to integrate the impact of meteorology and topography within the modelling output.

The model uses hourly meteorological data to define conditions for plume rise, transport, diffusion and deposition. It estimates the concentration for each source and receptor combination for each hour of input meteorology and calculates user-selected short-term averages.

7.3.1 Modelling Parameter and Averaging Period

The dispersion modelling has assessed cumulative impact of emissions from the boilers taking into consideration of the operation of the proposed installation.

The same averaging period should be used for comparison of emissions against environmental standards. For example, most long-term standards are expressed as an annual mean and many short-term standards

[4] www.airquality.co.uk.

as an hourly mean. Note that there are certain exceptions to this which are important when considering compliance with statutory EQS. The averaging period associated with the relevant modelled pollutants are detailed in Table 7.2.

Table 7.2 Modelling Parameter and Averaging Period

Parameter	Modelled As	
	Short Term	Long Term
NO_2	99.79th percentile (%ile) 1-hour mean	Annual Mean

NO_2 background concentrations are taken from ADMS Road modelling results, which includes the contribution from the traffic emissions.

For short term averaging periods, the following UK Defra methodology, for example, has been followed:

For 1-hour NO_2 concentrations:

- 99.79th percentile(%ile) 1-hour Process Contribution NO_2 + 2 x (annual mean background contribution NO_2).

7.3.2 Emission Sources from the Operation of Boilers

The central boiler room is located on the 3rd Floor of the stadium on the Eastern Section.

The emissions from the boilers have been calculated using the boiler technical data sheet. The fan dilution systems have designed by Jeremias UK Ltd in a report named as "Fan Dilution Flue System Calculation – UP10", dated on the 22/11/2019. The pollutant mass emission rates used within AERMOD and exhaust gas parameters are presented in Table 7.3.

The assessment is based on 6 boilers to be operating continuously to produce a worst-case assessment, although one boiler will be a spare.

The emission points are presented in Figure 6.

Table 7.3 Boiler Emissions and the Fan Dilution System Parameters

Parameter	Ultragas 575 Gas Boiler (Each Boiler)	Unit
Normal Load with Natural Gas	542	kW
Standard Emission rate of NOx - 1 Boiler	36	mg/kWh
Mass NO_x Emission Rate - 1 Boiler	19512	mg/hr
	5.42	mg/s
	0.00542	g/s

Parameter	Ultragas 575 Gas Boiler (Each Boiler)	Unit
Mass NO_x Emission Rate - 3 Boilers	0.01626	g/s
Fan Dilution System (Each System)		
Dilution Fan Volume (for a Group of 3 Boilers)	5.30	m^3/s
Dilution Fan Temperature per Group	27	°C
System Outlet Diameter per Group	0.95	m
Exhaust Duct Velocity per Group	7.50	m/s
System Outlet Height	26.2	m (above ground level)

7.4 Sensitive Receptors for Air Quality Assessment of the Boilers

7.4.1 Discrete (Individual) Receptors

The discrete sensitive receptors identified for the purposes of this air quality assessment are contained in Table 7.4 and shown further in Figure 4. The assessment has also been undertaken to determine the potential impacts at those selected receptors.

It should be noted that these do not represent an exhaustive list of all receptors within the vicinity of the Site, rather worst-case representative locations within and adjacent to the site.

Table 7.4 Modelled Sensitive Receptor Locations

Discrete Sensitive Receptors		UK NGR (m)	
AERMOD ID	Name	X	Y
D1	5 Billings Close	334493	392700
D2	76 Boundary Street	334111	392499
D3	32 Snowdon Lane	334090	392380
D4	84 Snowdon Lane	334071	392261
D5	3 Landor Close	334050	392165
D6	66 Colin Drive	334029	392013
D7	7 O'Reilly Court	334059	391942
D8	6 Fleming Court	334054	391846
D9	7 Jack McCabe Court	334041	391645
D10	Flat 247 Waterloo Quarry	333570	391365
D11	Liverpool Waters Committed Development	333286	292357
D12	Liverpool Waters Committed Development	333557	392369
D13	Proposed Hotel – Regent Road (LPA ref. 20F/0217)	333692	392549

Discrete Sensitive Receptors		UK NGR (m)	
AERMOD ID	Name	X	Y
D14	Lightbody Street (LPA ref. 20L/1948)	333885	392190

7.4.2 Ecological Receptors

Guidance of air emissions risk assessment for your environmental permit (Defra and Environment Agency, August 2016) states that assessments should consider whether conservation sites fall within set distances of the installation:

- Special Protection Area (SPAs), Special Areas of conservation (SACs) or Ramsar sites within 10 km of the installation (or within 15km for coal or oil-fired power stations); and
- Sites of Special Scientific Interest (SSSIs), National Nature Reserves (NNRs), Local Nature Reserves (LNRs), local wildlife sites and ancient woodland within 2 km of the location of the installation.

WYG Air Quality Consultants have liaised with the WYG Project Ecologist to determine any ecologically sensitive sites which are required to be assessed as part of this assessment.

Table below presents the identified ecological receptors, which are include in the assessment.

Table 7.5 Ecological Receptors

Site ID	Site	Designation	UK NGR (m)		Distance from Site (km)
			X	Y	
E1	Mersey Narrows	SSSI	331950	392746	1.2
E2	North Wirral Foreshore	SSSI	331159	394312	2.7
E3	Mersey Narrows & North Wirral Foreshore	SSSI, SPA & Ramsar	332017	392426	1.2
E4			331836	397101	4.7
E5	Mersey Estuary	SPA	331498	396707	4.4
E6	Liverpool Bay	SPA	333238	392476	Next to the site
E7	Ribble & Alt Estuaries	SPA & Ramsar	330955	397156	5.1
E8	Sefton Coast	SAC	330955	397456	5.3

7.5 Meteorological Data

The 3-year meteorological data (2016, 2017 and 2018) used in the assessment is derived from Liverpool Airport weather station, which is considered representative of conditions within the vicinity of the site, with all the complete parameters necessary for the AERMOD model. Reference should be made to Figure 5 for an illustration of the prevalent wind conditions at the Liverpool Airport (Speke) weather station.

7.6 Surface Characteristics

The land uses surrounding the Site are mostly described as industrial area and The River Mersey. A surface roughness value of 0.5m for the industrial area and A surface roughness value of 0.0001m for the water surface have been used in the modelling for a worst-case assessment.

7.7 Buildings in the Modelling Assessment

Buildings nearby or immediately adjacent to the stack/emission source could potentially cause building downwash effects on emission sources and have therefore been modelled for the proposed development.

The buildings used in the model to represent the stadium are given in Table below and illustrated in Figure 6.

The model building height has been determined using gantry levels shown in drawing number BMD01-PAT-ZZ-EX-DR-A-203000.

Table 7.6 Locations and Heights of Building Used in the Model

Name		UK NGR (m)		Modelled Building Height (m)
		X	Y	
1	Stadium North	333408	392557	43.80
2	Stadium West	333407	392555	43.80
3	Stadium East	333517	392558	43.80
4	Stadium South	333416	392406	43.80

7.8 Treatment of Terrain

The presence of steep terrain can influence the dispersion of emissions and the resulting pollutant concentrations. USEPA guidance indicates that terrain effects should be considered if the gradient exceeds 1:10. A digital terrain file in the UK Ordnance Survey (OS) Landranger format (.NTF) has been used in the assessment.

7.9 NO_X to NO_2 Conversion

Emissions of NO_x from combustion processes are predominantly in the form of NO. Excess oxygen in the combustion gases and further atmospheric reactions cause the oxidation of NO to NO_2. Given the short travel time to the areas of maximum concentration and the rate of reaction to convert NO to NO_2, it is unlikely that more than 30% of the NO_x is present at ground level as NO_2. This conversion factor is based on comparison of ambient NO and NO_2 continuous measurements evaluated over recent years.

Ground level NO_x concentrations have been predicted through dispersion modelling. NO_2 concentrations reported in the results section assume 70% conversion from NO_x to NO_2 for annual means and a 35% conversion for short term (hourly) concentrations, based upon EA methodology[5].

7.10 Modelling Uncertainty

Uncertainty in dispersion modelling predictions can be associated with a variety of factors, including:

- Model uncertainty - due to model limitations;
- Data uncertainty - including emissions estimates, background estimates and meteorology; and,
- Variability - randomness of measurements used.

However, potential uncertainties in model results have been minimised as far as practicable and worst-case inputs considered in order to provide a robust assessment. This included the following:

- Choice of model - AERMOD is a commonly used atmospheric dispersion model and results have been verified through a number of studies to ensure predictions are as accurate as possible.
- Facility operating parameters - Operational parameters were provided for the facility.
- Background concentrations - Background pollutant concentrations were obtained from a number of recognised sources in order to consider baseline levels in the vicinity of the site, as detailed within the main report text.
- Variability - All model inputs are as accurate as possible and worst-case conditions have been considered where necessary in order to ensure a robust assessment of potential pollutant concentrations.

7.11 Modelling Assessment Results: Protection of Human Health

7.11.1 Nitrogen Dioxide (NO_2)

Long-Term (Annual Mean) NO_2

The long-term emissions of NO_2 from the source considered were assessed for all 3 years of meteorological data. The maximum process contributions (PCs) within the modelled receptor locations and their associated predicted environmental concentrations (PECs) are compared against the relevant AQO, in Table 7.7

[5] Conversion Ratios for NO_x and NO_2, Environment Agency, updated.

From the meteorological dataset, the year resulting in maximum long-term NO_2 PC concentration was identified as 2017. The predicted maximum PC occurs at the receptor location 32 Snowdon Lane (D3).

The maximum NO_2 PC in Table 7.7 is 0.044 µg/m^3 and the associated NO_2 PEC is 21.33 µg/m^3, which is below the relevant long-term AQS of 40 µg/m^3 for the protection of human health.

Table 7.7 The Maximum Long-Term (Annual Mean) Concentrations of NO_2

Pollutant	Year	Process Contrib'tn (PC)	PC as %age of AQO	Background from the Traffic assessment	PEC[(a)] (PC +Background)	Easting (m)	Northing (m)	Receptor Name
NO_2	2016	0.039	0.10	21.29	21.329	334090	392380	32 Snowdon Lane
NO_2	2017	0.044	0.11	21.29	21.334	334090	392380	32 Snowdon Lane
NO_2	2018	0.037	0.09	21.29	21.327	334090	392380	32 Snowdon Lane
AQOs	40							

Note:

a. *Inclusive of Background concentration from the traffic assessment.*

Table 7.8 presents a summary of the predicted nitrogen dioxide concentrations, both PCs and PECs, at the modelled receptors locations.

The impact description of changes associated with the operations of the boiler with respect to annual mean NO_2 exposure has been assessed with reference to the criteria and the outcomes of the assessment are summarised in Table 7.8.

Table 7.8 The Long-Term (Annual Mean) Concentrations of NO_2 and Impact Description of Effects at Receptors

Receptor		Predicted Annual Mean Concentration (µg/m³) – 2017 Met Data, and NO_2 Impact Description at Receptors						
ID	Name	Process Contribution (PC)	PC as percentage of AQO (%)	Background from the Traffic assessment	PEC[(a)] (PC +Background)	PEC as percentage of AQO	PEC as percentage of AQO	Impact Descriptor
D1	5 Billings Close	0.016	0.04	22.35	22.37	55.9%	≤ 75 of AQO	Negligible
D2	76 Boundary Street	0.041	0.10	21.91	21.95	54.9%	≤ 75 of AQO	Negligible
D3	32 Snowdon Lane	0.044	0.11	21.29	21.33	53.3%	≤ 75 of AQO	Negligible
D4	84 Snowdon Lane	0.037	0.09	21.25	21.29	53.2%	≤ 75 of AQO	Negligible
D5	3 Landor Close	0.032	0.08	21.28	21.31	53.3%	≤ 75 of AQO	Negligible
D6	66 Colin Drive	0.021	0.05	21.30	21.32	53.3%	≤ 75 of AQO	Negligible
D7	7 Oreilly Court	0.018	0.04	25.50	25.52	63.8%	≤ 75 of AQO	Negligible
D8	6 Fleming Court	0.013	0.03	25.49	25.50	63.8%	≤ 75 of AQO	Negligible
D9	7 Jack Mcbae Court	0.008	0.02	25.55	25.56	63.9%	≤ 75 of AQO	Negligible
D10	Flat 247 Waterloo Quay	0.004	0.01	20.68	20.68	51.7%	≤ 75 of AQO	Negligible
D11	Liverpool Waters Committed Development	0.03	0.08	19.44	19.47	48.68	≤ 75 of AQO	Negligible
D12	Liverpool Waters Committed Development	0.24	0.60	20.70	20.94	52.35	≤ 75 of AQO	Negligible
D13	Proposed Hotel – Regent Road (LPA ref. 20F/0217)	0.21	0.53	24.53	24.74	61.85	≤ 75 of AQO	Negligible
D14	Lightbody Street (LPA ref. 20L/1948)	0.045	0.11	28.56	28.57	71.43	≤ 75 of AQO	Negligible
AQO		**40 µg/m³**						

The percentage changes in process contribution of NO_2 relative to the AQAL as a result of the boiler operations at all receptor locations, with respect to NO_2 exposure, are determined to be 0.11% or less. The impact is determined to be 'negligible'. The effect of the proposed boiler operations on the local area is considered to be insignificant.

The predicted long-term NO_2 concentrations from the proposed development are considered acceptable for the protection of human health.

Short-Term (1-Hour Mean) NO_2

The short-term emissions of NO_2 from the source considered were assessed for all 3 years of meteorological data. The maximum PCs within the modelled receptor locations and their associated PECs are compared against the relevant AQS, in Table 7.9.

From the meteorological dataset, the year resulting in maximum short-term NO_2 PC concentration was identified during 2017. The predicted maximum short-term PC occurs at the receptor location of 76 Boundary Street (D2).

The highest short-term NO_2 PC in Table 7.9 is 0.50 µg/m^3 and the associated short-term NO_2 PEC is 44.32µg/m^3, which is below the relevant short-term AQO of 200 µg/m^3 for the protection of human health.

Table 7.9 The Maximum Short-Term (1-Hour Mean, 99.79th Percentile) Concentrations of NO_2

Pollutant	Year	Process Contrib'tn (PC)	PC as %age of AQO	Background from the Traffic assessment	PEC[a] (PC +Background)	Easting (m)	Northing (m)	Receptor Name
NO_2	2016	0.44	0.22	42.580	43.02	334090	392380	32 Snowdon Lane
NO_2	2017	0.50	0.25	43.820	44.32	334111	392499	76 Boundary Street
NO_2	2018	0.49	0.25	42.580	43.07	334090	392380	32 Snowdon Lane
AQOs	200							

Note:

a. *Inclusive of Background concentration from the traffic assessment.*

The short-term NO_2 PEC concentrations have been calculated at each of the discrete receptors listed for the worst meteorological year of 2017 and these results are detailed in Table 7.10 (overleaf).

Table 7.10 Summary of the Predicted Short-Term NO_2 Concentrations at Discrete Receptors

Receptor		Predicted 1-hour Mean (99.79th Percentile) Concentration (µg/m^3) – 2017 Met Data				
ID	Name	Process Contribution (PC)	PC as %age of AQO	Background from the Traffic assessment	PEC[a] (PC +Background)	PEC as percentage of AQO
D1	5 Billings Close	0.37	0.19	44.70	45.07	22.54
D2	76 Boundary Street	0.50	0.25	43.82	44.32	22.16

Receptor		Predicted 1-hour Mean (99.79th Percentile) Concentration (µg/m³) – 2017 Met Data				
ID	Name	Process Contribution (PC)	PC as %age of AQO	Background from the Traffic assessment	PEC[(a)] (PC +Background)	PEC as percentage of AQO
D3	32 Snowdon Lane	0.44	0.22	42.58	43.02	21.51
D4	84 Snowdon Lane	0.43	0.22	42.50	42.93	21.47
D5	3 Landor Close	0.40	0.20	42.56	42.96	21.48
D6	66 Colin Drive	0.32	0.16	42.60	42.92	21.46
D7	7 Oreilly Court	0.26	0.13	51.00	51.26	25.63
D8	6 Fleming Court	0.24	0.12	50.98	51.22	25.61
D9	7 Jack Mcbae Court	0.20	0.10	51.10	51.30	25.65
D10	Flat 247 Waterloo Quay	0.19	0.09	41.36	41.55	20.77
D11	Liverpool Waters Committed Development	0.59	0.30	38.88	39.47	19.74
D12	Liverpool Waters Committed Development	1.86	0.93	41.40	43.26	21.63
D13	Proposed Hotel – Regent Road (LPA ref. 20F/0217)	2.42	1.21	49.06	51.48	25.74
D14	Lightbody Street (LPA ref. 20L/1948)	0.49	0.26	57.12	57.61	28.81
AQOs	200 µg/m³					

Note:

(a) Inclusive of Background concentrations from the traffic assessment.

As shown in Table 7.10, there are no exceedances of the short-term NO_2 AQO at any of the identified sensitive receptors. The predicted impacts are significantly below the AQO of 200 µg/m³.

Therefore, the predicted short-term NO_2 concentrations from the boiler operations are considered acceptable for the protection of human health.

The contour plots of the predicted long-term and short-term ground level PCs of NO_2 for all receptors are not presented due to the predicted PCs are well below of 1% of long-term AQO and 10% of short-term AQO respectively.

7.11.2 Cumulative Effect (in Combination Effect) of Air Quality Assessment for the Traffic Flows and the Operation of Boilers

It should be noted that the assessment results for the boiler presented in previous sections are the cumulative effects on the receptors because the results includes the pollution contributions from the air quality background, traffic movement, committed development traffic flows, proposed development traffic flows and the boilers.

Therefore, the predicted cumulative long-term and short-term pollutant concentrations at the selected receptor locations are all below the relevant AQOs for the protection of human health. The significance of cumulative effects on the emissions on the ground level receptors from the operations with respect to long-term pollutants is determined to be 'negligible'.

7.12 Habitat Assessment: Protection of Ecological Receptors

The habitat assessment has been undertaken for the following identified nature conservation sites.

- Mersey Narrows - SSSI
- North Wirral Foreshore - SSSI
- Mersey Narrows & North Wirral Foreshore - SSSI, SPA & Ramsar
- Mersey Estuary - SPA
- Liverpool Bay - SPA
- Ribble & Alt Estuaries – SPA & Ramsar
- Sefton Coast -SAC

The long-term traffic generated NO2 concentrations at those sites have been used for nitrogen deposition and habitat assessment, against relevant critical loads.

The long-term and short-term concentrations among those ecological sites have been calculated for habitat assessment against relevant critical loads, using 2017 met data (the year resulting in maximum long-term and short-term PC concentrations).

7.12.1 Predicted Nitrogen Oxide concentrations

The nitrogen depositions have been calculated using the predicted contribution in nitrogen oxide concentrations at the ecological receptor locations.

Table 7.11 presents a summary of the predicted nitrogen oxide concentrations using 2017 met data at the ecological receptor locations.

Table 7.11 Critical Level of Long-Term and Short-Term NO_x (as NO_2)

Ecological Receptor		Predicted Maximum Annual Mean Concentration (µg/m³)				Predicted 24-hour Mean Concentration (µg/m³)			
		Process Contribution (PC)	PC as %age of AQO	BC	PEC[a] (PC +Background)	Process Contribution (PC)	PC as %age of AQO	BC	PEC[b] (PC +Background)
E1	Mersey Narrows	0.006	0.02	23.61	23.62	0.09	0.13	27.86	27.95
E2	North Wirral Foreshore	0.003	0.01	24.00	24.00	0.06	0.08	28.32	28.38
E3	Mersey Narrows & North Wirral Foreshore 1	0.006	0.02	25.89	25.90	0.12	0.15	30.55	30.67
E4	Mersey Narrows & North Wirral Foreshore 2	0.002	0.01	19.03	19.03	0.04	0.05	22.46	22.49
E5	Mersey Estuary	0.003	0.01	33.15	33.15	0.05	0.06	39.12	39.16
E6	Liverpool Bay	0.099	0.33	29.99	30.09	1.16	1.54	35.39	36.55
E7	Ribble & Alt Estuaries	0.002	0.01	18.98	18.98	0.04	0.06	22.40	22.44
E8	Sefton Coast	0.002	0.01	18.98	18.98	0.05	0.06	22.40	22.44
	AQO/Critical Level (CL)	30[c]				75[d]			

Note:

[a] Inclusive of Background concentrations. The Background concentration was taken from http://www.apis.ac.uk/.

[b] The Inclusive of Background concentrations. The Background concentration was taken from http://www.apis.ac.uk/.

[c] The AQO of 30 µg/m³ is the annual standard for the protection of vegetation and ecosystems; and

[d] The AQO of 75 µg/m³ is the daily standard for the protection of vegetation and ecosystems.

The annual mean NO_x (as NO_2) PEC at the ecological receptor locations are below the annual mean critical level of 30 µg/m³ for the protection of vegetation and Ecosystems, with exception of the receptor of Mersey Estuary due to high background.

The NO_x daily (24 hour) predicted environmental concentration at all ecological receptor locations are well below the daily mean critical levels of 75 µg/m³ for the protection of vegetation and Ecosystems.

The significance of changes associated with the operations of the facility with respect to annual mean NO_x (as NO_2) exposure at the ecological receptors has been assessed and the outcomes of the assessment are summarised in Table 7.12.

Table 7.12 The Long-Term (Annual Mean) Concentrations of NO_x (as NO_2) and Significance of Effects at Ecological Receptors

Receptor		Predicted Annual Mean Concentration (µg/m³) – 2017 Met Data, and NO_2 Significance Impacts at Ecological Receptors						
		Process Contrib'tn (PC)	PC as %age of AQO	BC	PEC[a] (PC +Background)	PEC as %age of AQO	PEC as %age of AQO	Significance
E1	Mersey Narrows	0.006	0.02	23.61	23.62	78.72	76-94% of AQAL	Negligible
E2	North Wirral Foreshore	0.003	0.01	24.00	24.00	80.01	76-94% of AQAL	Negligible
E3	Mersey Narrows & North Wirral Foreshore 1	0.006	0.02	25.89	25.90	86.32	76-94% of AQAL	Negligible
E4	Mersey Narrows & North Wirral Foreshore 2	0.002	0.01	19.03	19.03	63.44	≤75% of AQAL	Negligible
E5	Mersey Estuary	0.003	0.01	33.15	33.15	110.51	≥110 % of AQAL	Negligible
E6	Liverpool Bay	0.099	0.33	29.99	30.09	100.30	95-102% of AQAL	Negligible
E7	Ribble & Alt Estuaries	0.002	0.01	18.98	18.98	63.27	≤75% of AQAL	Negligible
E8	Sefton Coast	0.002	0.01	18.98	18.98	63.27	75% of AQAL	Negligible

The percentage change in long-term process concentrations relative to the AQAL as a result of the proposed development at all ecological receptor locations, with respect to NO_x (as NO_2) exposure, are determined to be 0.33% or less. The significance is deemed to be 'negligible' for all ecological receptor locations.

As the percentage change in long-term process concentrations relative to the AQAL is below 1% of the relevant critical level for the protection of vegetation and Ecosystems, the long-term process contributions have been screened out against the relevant standard/critical level. The nitrogen deposition assessment has not been undertaken.

Furthermore, guidance outlined in 'A guide to the assessment of air quality impacts on designated nature conservation sites', June 2019 states that:

"5.5.2.3 In March 2015. AQTAG (Air quality Technical Advisory Group) clarified to the planning inspectorate that 'for installations other than intensive pig and poultry farms, AQTAG is confident that a process contribution (PC, as predicted by H1 or a detailed dispersion model) <1% of the relevant critical level or load (CL) can be considered inconsequential and does not need to be included in an in-combination assessment".

Therefore, in-combination habitat assessment (cumulative habitat assessment) does not need to be undertaken.

In summary, the NO_x impacts from the proposed development on the ecological receptors are insignificant.

7.13 Conclusions

The assessment has concluded the following.

Environmental Assessment for Protection of Human Health

The long-term and short-term predicted environmental concentrations of pollutant emissions of NO_2 are all below the relevant air quality objectives (AQO) at each of the modelled sensitive receptor locations.

The percentage changes in long-term process contribution of NO_2 are all less than 1.0% of the relative AQO as a result of the operations at all sensitive receptor locations. The impact on the sensitive receptors is determined to be 'negligible'.

Habitat Assessment

For the habitat assessment, both the annual mean and daily (24 hour) mean NO_x (as NO_2) predicted environmental concentrations at the ecological receptors are below the relevant critical level for the protection of vegetation and ecosystems.

The percentage change in long-term and short-term process contributions are less than 1.0% and 10% of the relevant critical levels respectively for the protection of vegetation and ecosystems, and the impact is determined to be 'negligible' at all the ecological receptors.

The air quality assessment determined that the effect of the emission impacts from the boiler operations on the local area is considered to be insignificant.

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

8. Mitigation

8.1 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.

The mitigation measures for the proposed development are detailed in Table 8.1 and 8.2 below and form part of the 'Construction Management (Delivery) Plan':

Table 8.1 "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.
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 logbook.
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.
Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.
Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.
Fully enclose site or specific operations where there is a high potential for dust production and the site is actives for an extensive period
Avoid site runoff of water or mud.
Keep site fencing, barriers and scaffolding clean using wet methods.

Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.
Cover, seed or fence stockpiles to prevent wind whipping.
Planning and controlling the orientation, shape and locations of stockpiles, to minimise the risk of dust rising through wind action.
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
Control measures and dust suppression techniques including reuse of site won water to minimise resource use on the project
Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
Ensure a dampening water bowser will be utilised to keep the dust on the site to a minimum. This can be towed behind various site vehicles to dampen down the site.
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.
Internally to the building, we will utilise vacs of different sizes to remove any dust that is generated by the construction works, brushes will not be used.
Skips will be emptied regularly and all skips that are removed from site will be sheeted over prior to leaving the site boundary.
Ensuring appropriate selection and maintenance of construction vehicles, plant and equipment (i.e. vehicle and plant which produce less emissions and are regularly serviced).
Ensuring plant and equipment is not left running for long periods when not directly in use.
Demolition
Ensure effective water suppression is used during demolition operations. Hand-held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition, high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground.
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.
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 logbook.
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).
A jet wash pull-along bowser will be used to clean the wheels of vehicles as they exit site, this will minimise and reduce the risk of dust emissions and deposition of material on the public highway.
Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.
Access gates to be located at least 10m from receptors where possible.

Table 8.2 "Desirable" Construction Phase Mitigation Measures

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

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

9. Conclusions

WYG have undertaken an updated Air Quality Assessment on behalf of Everton Stadium Development Limited in support of a full planning application for the development of a new stadium with associated facilities and infrastructure at Bramley-Moore Dock, Liverpool. This is in accordance with the methodology and parameters described within this report.

This Air Quality Assessment has been updated following design changes to the proposed scheme subsequent to the planning application (LPA ref. 20F/0001) having been submitted in December 2019. This assessment has also been updated following the consultation comments provided by Liverpool City Council Environmental Protection Unit March 2020.

9.1 LCC Consultation Response

On the 24th March 2020 Keith Dooley of Environmental Protection Unit at Liverpool City Council reviewed the Air Quality Assessment submitted with the planning application (LPA ref. 20F/0001) in December 2019.

Six main comments were raised in relation to the air quality assessment and these are summarised below:

1. Supporter Coaches Parking - Mott MacDonald (transport consultants) have confirmed that publicly available facilities are nearby to help encourage drivers to switch off engines to avoided idling where possible.
2. Outside Broadcasting Compound – Buro Happold have confirmed (within their Energy Statement) that the outdoor broadcasting compound (OBC) will be powered through battery storage technology and not diesel generators. As such there are no emissions associate with the OBC.
3. Fixed Plant within the stadium – This Air Quality Assessment covers the air quality impacts associated with the proposed boiler system to be installed within the stadium. Details of the boilers and locations have been provided by Buro Happold and are in line with their latest Energy Statement.
4. Electric vehicle Parking – This has been covered by Mott Macdonald within the updated Transport Assessment.
5. Shuttle Buses – Shuttle Buses are to be run on a commercial basis and are not within the club's control in terms of specification of vehicle.
6. Disabled Supporter Shuttle Buses; pre-booked shuttle services for disables supporters which will run between the stadium, a park & ride facility at Stanley Park (existing surface car park owned by LCC) and Sandhills train station.

On this basis, it is considered that all of the points raised in LCC initial planning application consultation response have been robustly addressed in this updated Air Quality Assessment and further updates can be found in the wider updated application submission.

9.2 Construction Phase

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 emissions from the construction phase will not be significant.

With respect to the detailed traffic modelling for the proposed construction flows, a 2020 assessment year based upon a three-year construction period, has been undertaken. The impact description of effects is determined to be 'negligible' at the all existing receptors for NO_2. This is expected to reduce to 'negligible' at all receptors, following mitigation in the form of a revised routing plan. For PM_{10} and $PM_{2.5}$ the exposure is determined to be 'negligible' at all sensitive receptor locations.

9.3 Operational Assessment

The 2023 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 0.32 µg/m^3 at 62 Regents 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 0.07 µg/m^3 at 62 Regent Road (R3). For $PM_{2.5}$, the maximum predicted increase in the annual average exposure is likely to be 0.04 µg/m^3 at 62 Regent Road (R3).

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, the impact description of effects is determined to be 'negligible' at all existing receptors.

A short-term (hourly) air quality assessment has been undertaken at sensitive receptors to determine the predicted exposure at the residential properties adjacent to the proposed taxi rank. The assessment has shown that there is not predicted to be any exceedances of the short-term AQO with respect to NO_2 during a pre and post-match event. The effect on the amenity of these existing receptors is not considered to be significant.

9.4 Boiler Assessment

The percentage changes in long-term process contribution of NO_2 are all less than 1.0% of the relative AQO as a result of the operations at all sensitive receptor locations. The impact on the sensitive receptors is determined to be 'negligible'.

The air quality assessment determined that the effect of the emission impacts from the boiler operations on the local area is considered to be insignificant.

9.5 Overall Conclusion

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 proposed development is not considered to be contrary to the statutory development plan or other relevant material considerations including the National Planning Policy Framework (NPPF) and the emerging Liverpool Local Plan (not full weight given it is pending formal examination).

Figures

Figure 1 Air Quality Assessment Area including Local Authority Monitoring Locations & Existing Sensitive Receptors

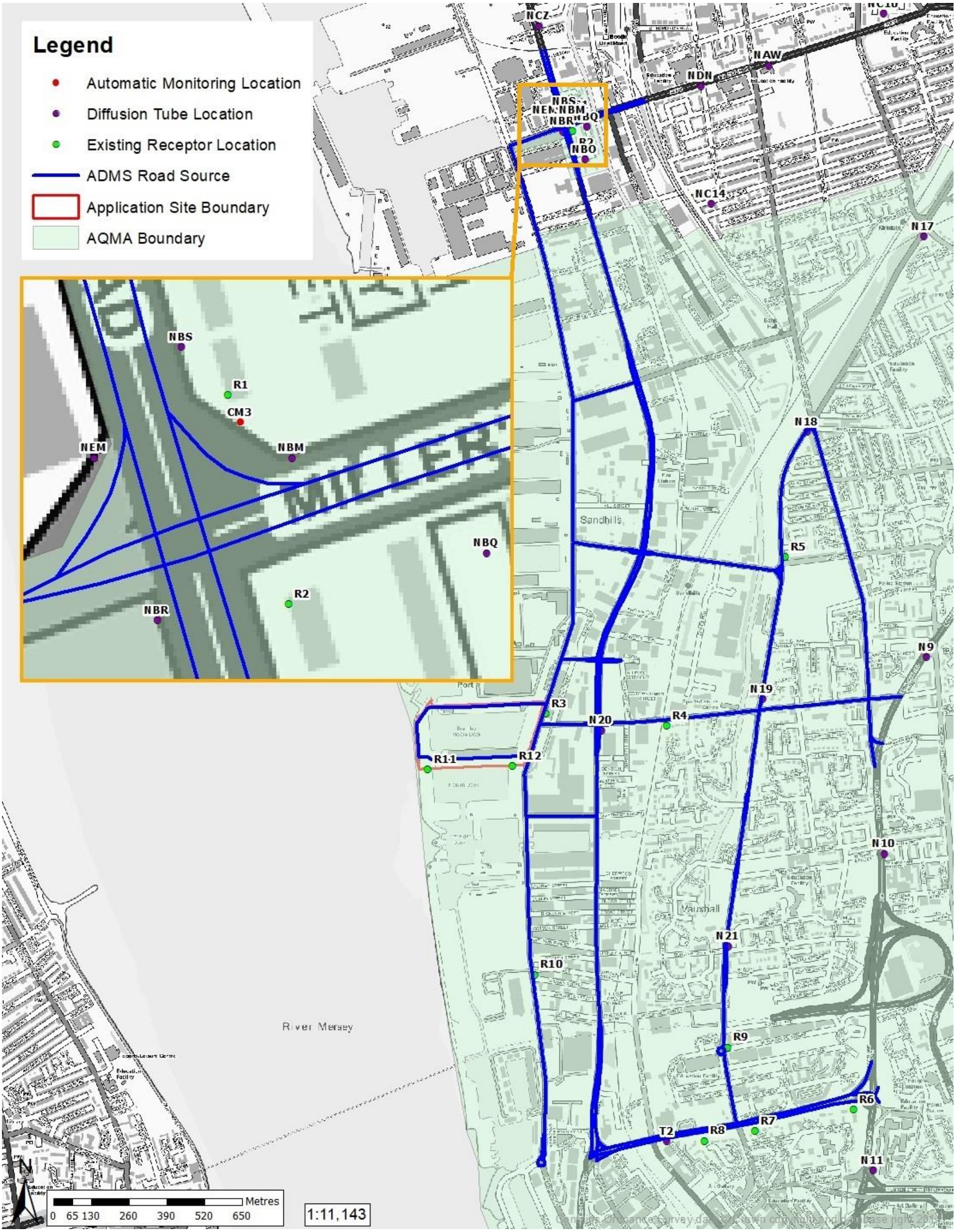


Figure 2: Air Quality Assessment Area including Ecological Sensitive Receptors

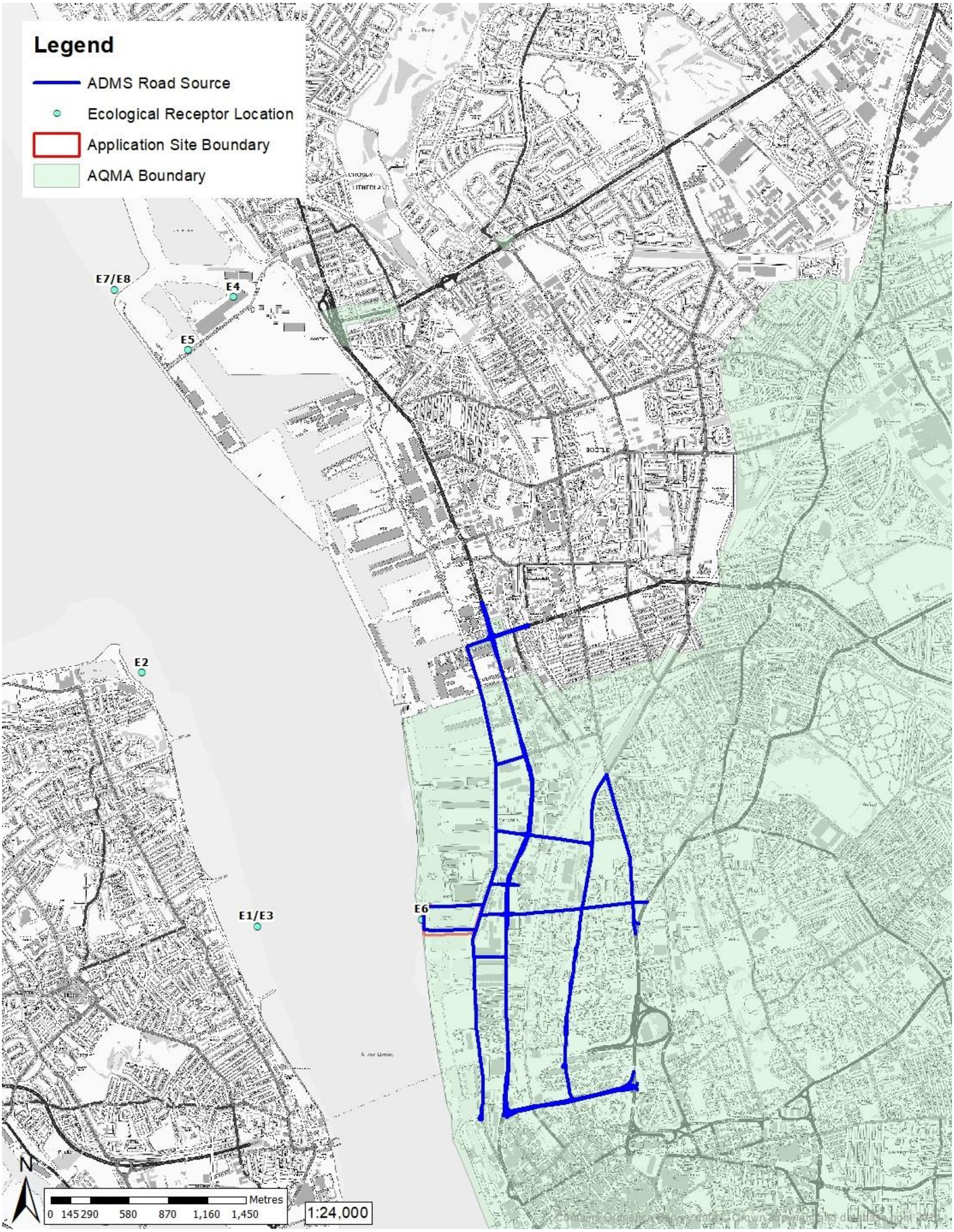


Figure 3: Short-Term Air Quality Assessment Area including Existing Sensitive Receptors

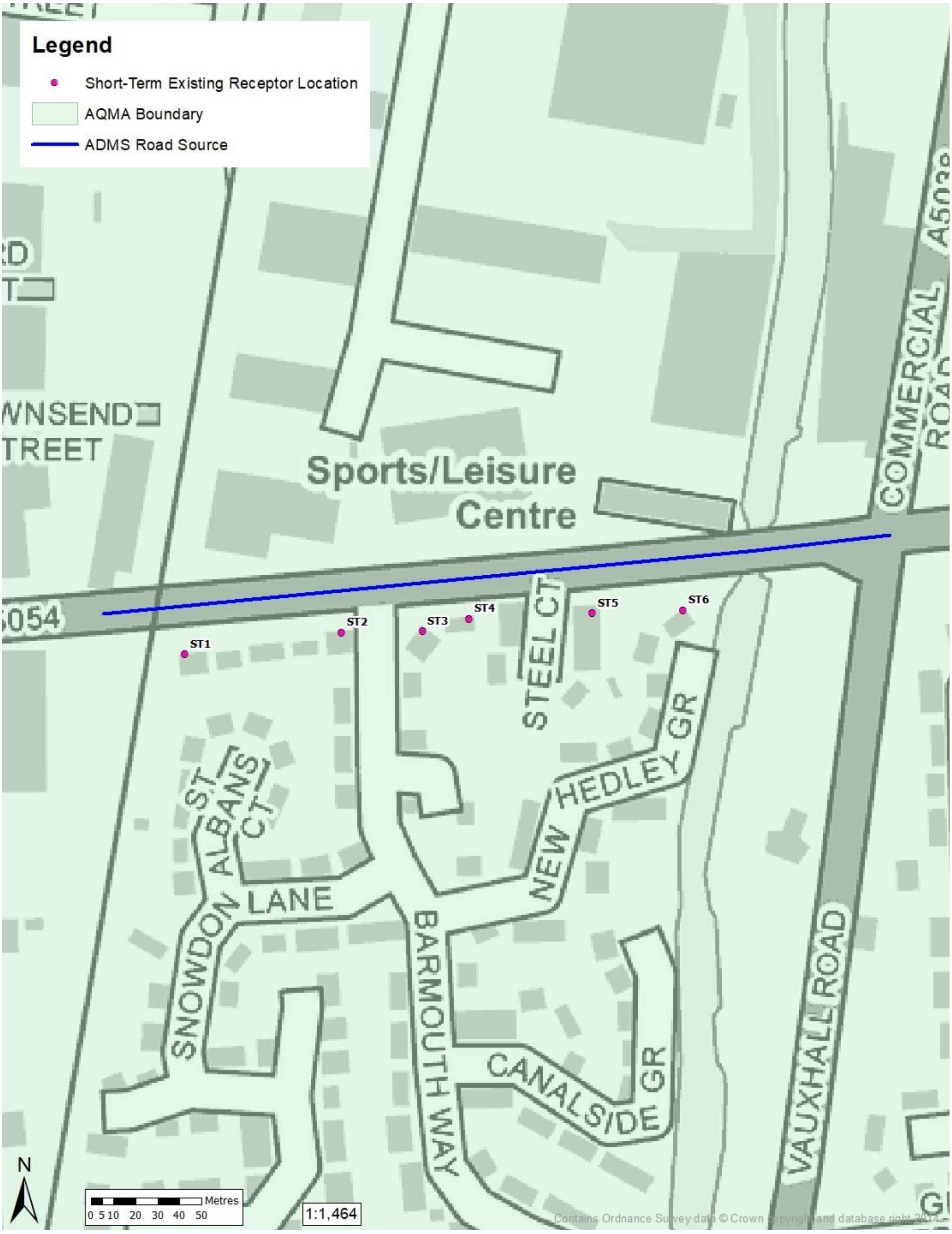


Figure 4 Proposed Boiler Assessment Receptor Locations

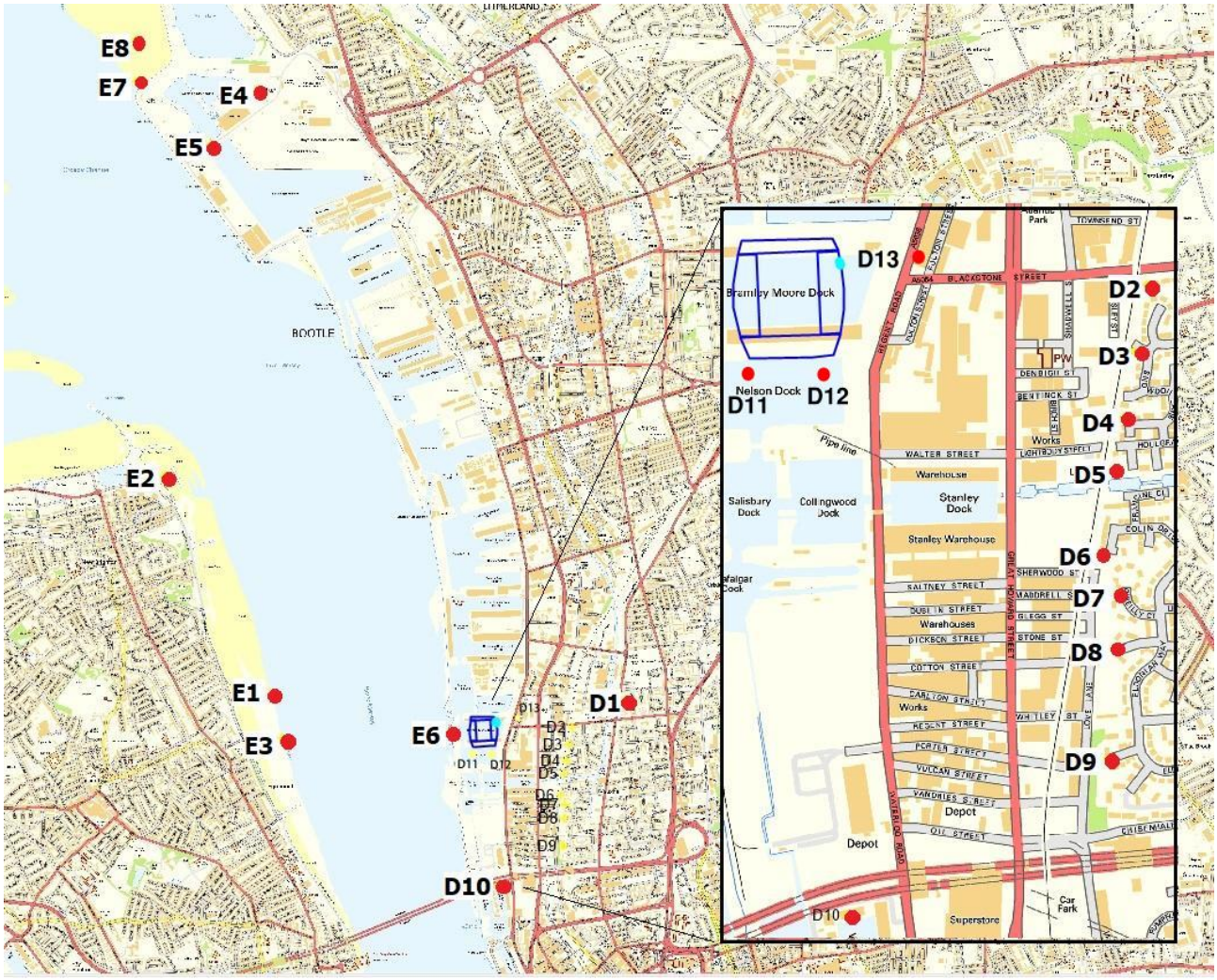
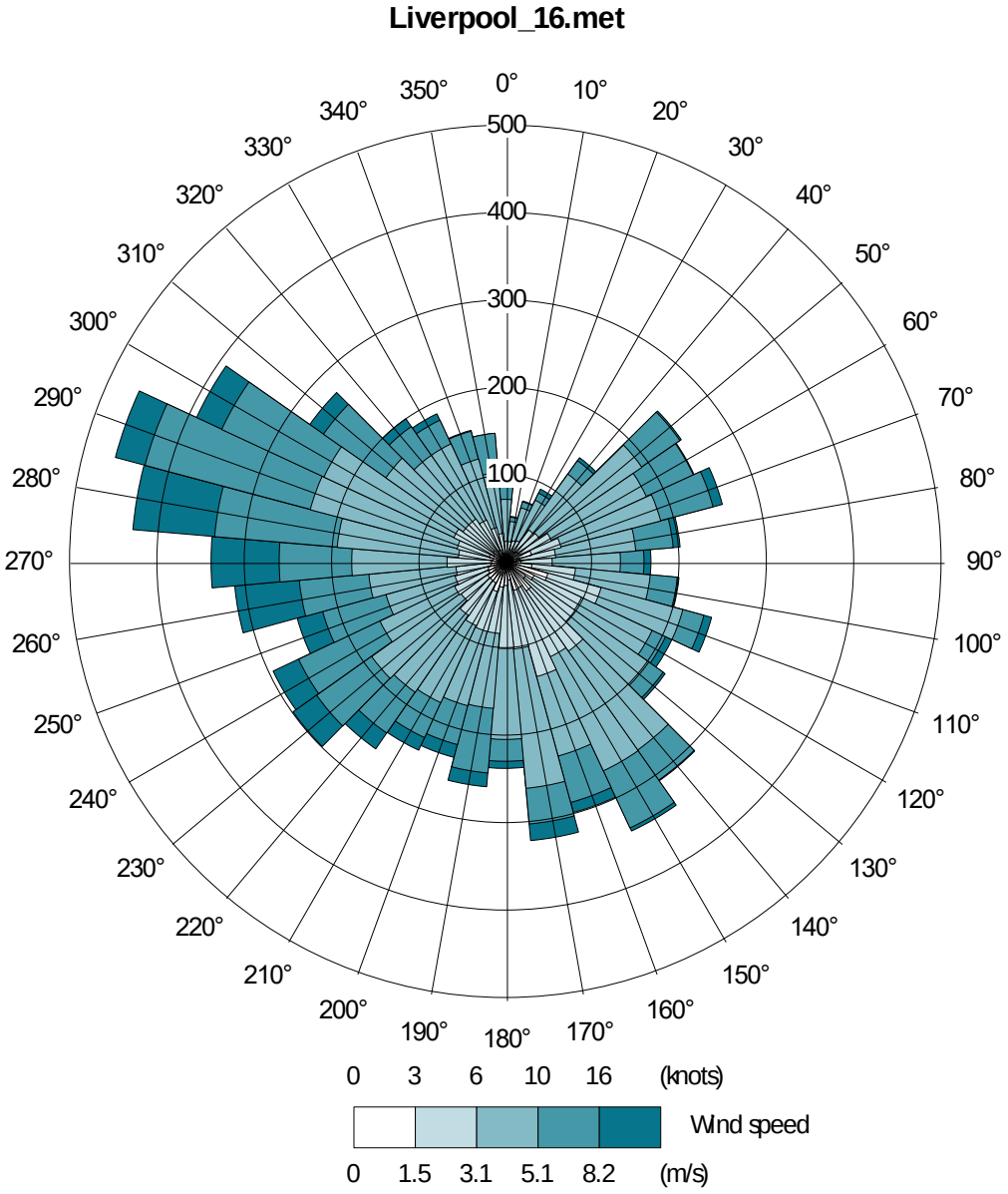
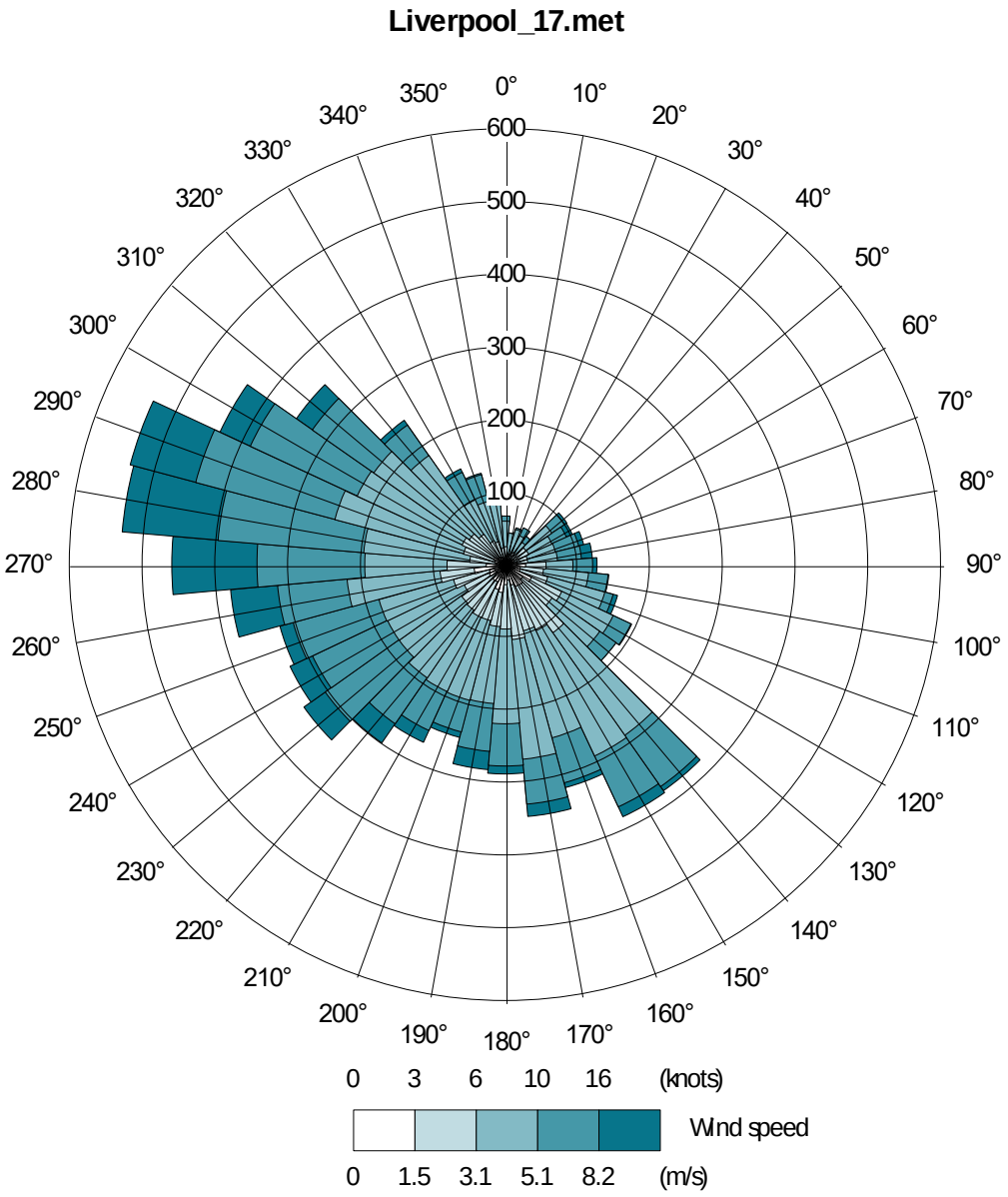


Figure 5 Liverpool Airport Meteorological Station Wind Rose

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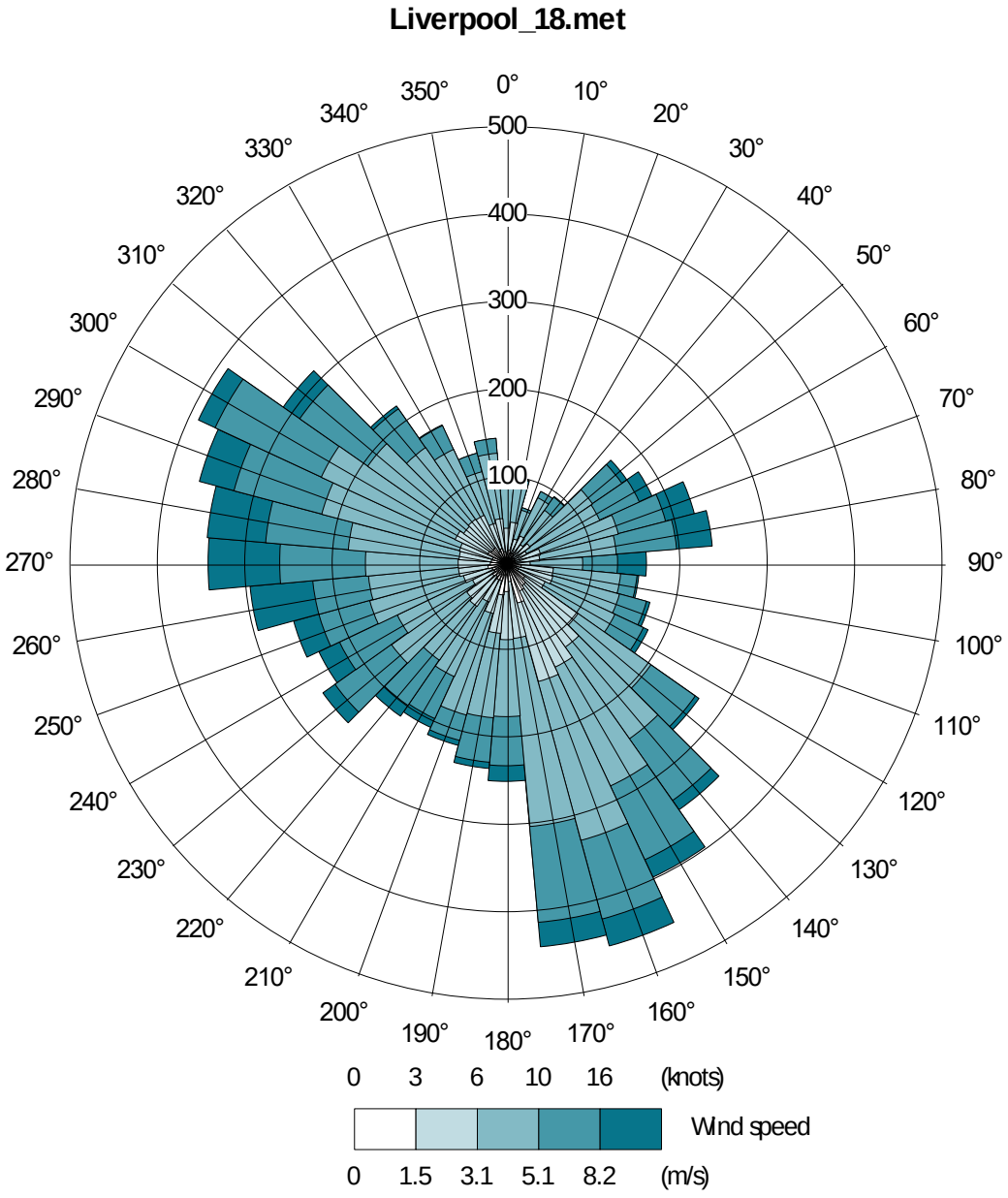
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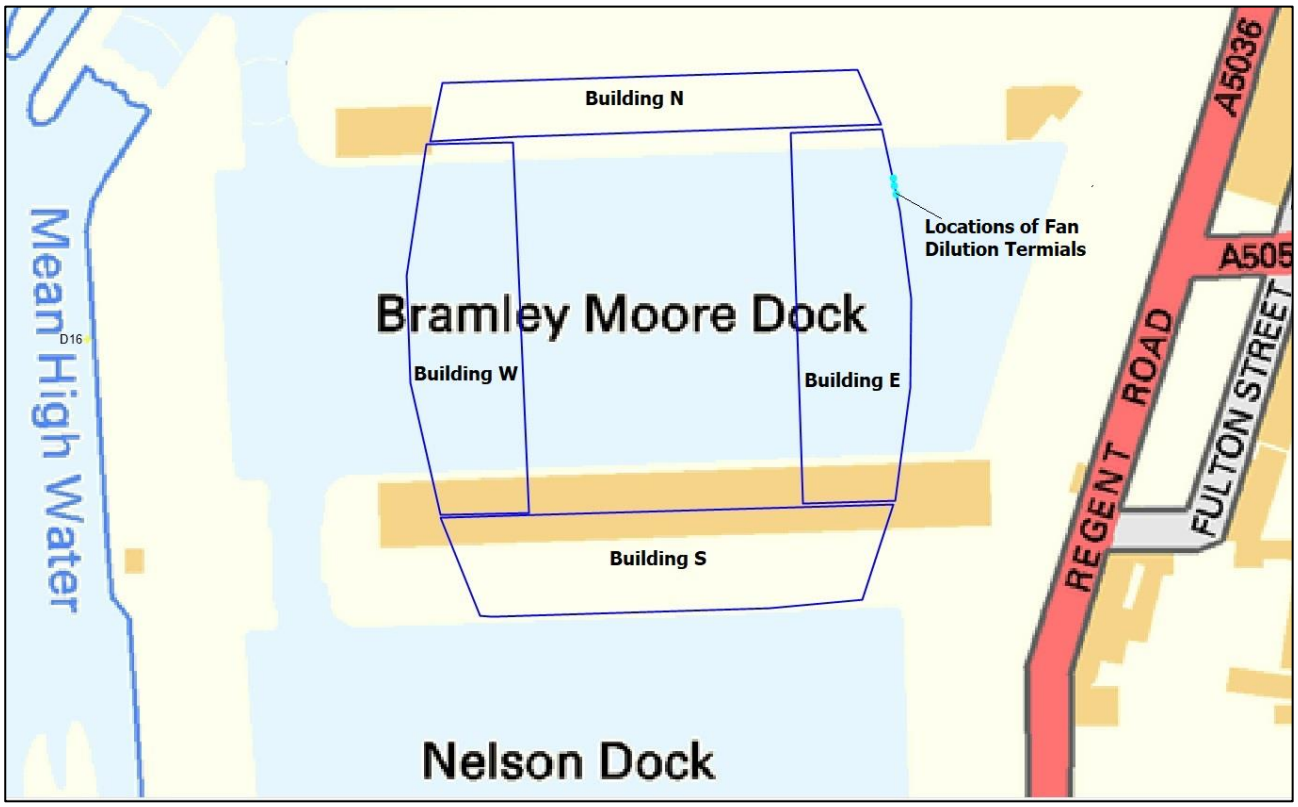
Wind speed
0 1.5 3.1 5.1 8.2 (m/s)

Figure 6 Stack Locations



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[6].

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.

[6] Institute of Air Quality Management 2014. *Guidance on the Assessment of dust from demolition and construction.*

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 A1– 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 A2 - 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 A3 - 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 A4 - 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 A5 - 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 A6 - 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 A7 - 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 (No Reduction in UK Fleet Emissions over Time) Results

Scenario Context

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:

- 2023 'Do Minimum' Theoretical Scenario = Baseline conditions + Liverpool Waters Permission + Cumulative Development flows (Scenario 6) (**using 2018 traffic emission factors**); and,
- 2023 '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)			
		Baseline 2018	Do Minimum 2023	Do Something 2023	Development Contribution
R1	223 Derby Road	45.76	46.84	47.05	0.21
R2	227a Derby Road	41.59	42.44	42.61	0.17
R3	62 Regent Road	24.65	26.85	27.21	0.36
R4	76 Boundary Street	22.96	23.28	23.35	0.07
R5	154 Commercial Road	30.29	30.90	30.96	0.06
R6	12 St Stephens Place	28.72	29.05	29.06	0.01
R7	5 Stockdale Close	29.82	30.23	30.25	0.02
R8	41 Westmorland Drive	28.21	28.50	28.52	0.02
R9	Flat 1 Blackstock Street	31.12	31.62	31.66	0.04
R10	Flat above Riverside Diner, Waterloo Road	24.99	25.40	25.41	0.01
R11	Liverpool Waters Committed Development	-	19.50	19.71	0.21
R12	Liverpool Waters Committed Development	-	21.30	21.59	0.29
R13	Proposed Hotel – Regent Road (LPA ref. 20F/0217)	-	26.86	27.22	0.36
R14	Lightbody Street	-	32.68	33.15	0.47
Annual Mean AQO		**40 µg/m³**			

Table B2 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	0.21	0.10	0%	≤75% of AQO	Negligible
R2	0.17	0.08	0%	≤75% of AQO	Negligible
R3	0.36	0.90	1%	≤75% of AQO	Negligible
R4	0.07	0.17	0%	≤75% of AQO	Negligible
R5	0.06	0.15	0%	76-94% of AQO	Negligible
R6	0.01	0.02	0%	≤75% of AQO	Negligible
R7	0.02	0.05	0%	76-94% of AQO	Negligible
R8	0.02	0.05	0%	≤75% of AQO	Negligible
R9	0.04	0.10	0%	76-94% of AQO	Negligible
R10	0.01	0.02	0%	≤75% of AQO	Negligible
R11	0.21	0.06	0%	≤75% of AQO	Negligible
R12	0.29	0.09	0%	≤75% of AQO	Negligible
R13	0.36	0.90	1%	≤75% of AQO	Negligible
R14	0.47	1.17	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.					

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

Receptor		PM_{10} (µg/m³)			
		Baseline 2018	Do Minimum 2023	Do Something 2023	Development Contribution
R1	223 Derby Road	13.23	13.41	13.45	0.04
R2	227a Derby Road	12.62	12.76	12.79	0.03
R3	62 Regent Road	11.54	11.97	12.02	0.05
R4	76 Boundary Street	11.71	11.76	11.78	0.02
R5	154 Commercial Road	12.62	12.72	12.73	0.01
R6	12 St Stephens Place	12.62	12.67	12.67	<0.01
R7	5 Stockdale Close	12.79	12.85	12.86	0.01
R8	41 Westmorland Drive	12.58	12.63	12.64	0.01
R9	Flat 1 Blackstock Street	12.94	13.02	13.02	0.00
R10	Flat above Riverside Diner, Waterloo Road	11.93	12.00	12.01	0.01
R11	Liverpool Waters Committed Development	-	10.57	10.59	0.02
R12	Liverpool Waters Committed Development	-	10.90	10.94	0.04
R13	Proposed Hotel – Regent Road (LPA ref. 20F/0217)	-	11.98	12.03	0.05
R14	Lightbody	-	13.13	13.22	0.09
Annual Mean AQO		**40 µg/m³**			

Table B4 Predicted Annual Average Concentrations of $PM_{2.5}$ at Receptor Locations

Receptor		$PM_{2.5}$ (µg/m³)			
		Baseline 2018	Do Minimum 2023	Do Something 2023	Development Contribution
R1	223 Derby Road	9.09	9.20	9.23	0.02
R2	227a Derby Road	8.72	8.80	8.82	0.02
R3	62 Regent Road	7.72	7.98	8.01	0.03
R4	76 Boundary Street	7.93	7.97	7.97	<0.01
R5	154 Commercial Road	8.73	8.79	8.80	0.01
R6	12 St Stephens Place	8.40	8.43	8.43	<0.01
R7	5 Stockdale Close	8.50	8.54	8.54	<0.01
R8	41 Westmorland Drive	8.37	8.40	8.40	<0.01
R9	Flat 1 Blackstock Street	8.59	8.64	8.65	0.01
R10	Flat above Riverside Diner, Waterloo Road	7.99	8.04	8.04	<0.01
R11	Liverpool Waters Committed Development	-	7.16	7.17	0.01
R12	Liverpool Waters Committed Development	-	7.35	7.38	0.03
R13	Proposed Hotel – Regent Road (LPA ref. 20F/0217)	-	7.98	8.01	0.03
R14	Lightbody Street	-	8.65	8.71	0.06
Annual Mean AQO		**25 µg/m³**			

For the theoretical scenario, 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 0.47 µg/m³ at Lightbody Street (R14).

Although there is predicted to be an exceedance of the AQO at two receptors (R1 and R2), these are located within the SMBC AQMA 3 and therefore experience high pollutant concentration prior to the introduction of the development. Additionally, the results of the theoretical scenario should not be considered 'more correct' in comparison to the 2023 assessment.

All modelled receptors predict NO_2 concentrations of below 60 µg/m³ 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 annual average exposure to PM_{10} at any existing receptor, due to changes in traffic movements associated with the development is 0.09 µg/m³ at Lightbody Street (R14).

For $PM_{2.5}$, 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 development is 0.06 µg/m³ at Lightbody Street (R14).

Appendix C Report Terms & Conditions

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