OPDC
OLD OAK AND
PARK ROYAL
DEVELOPMENT
CORPORATION

Air Quality Study

LOCAL PLAN SUPPORTING STUDY

2017

MAYOR OF LONDON

4. Air Quality Study

Document Title	Air Quality Study
Lead Author	AMEC Foster Wheeler
Purpose of the Study	• Review existing and anticipated air quality issues across the construction, build-out and occupation phases of development. • Set out recommendations for mitigation and measures to ensure the highest possible air quality is achieved for future residents and workers.
Key outputs	• Review of relevant international, national, regional and local policy context and legislation. • Air quality mapping and identification of air quality hotspots within the OPDC area and its surrounds • Identification of policy implications from inside and outside the area • Advise on measures and policies to be included within OPDC's Local Plan and Construction and Logistics Strategy to mitigate threats to air quality • Advise on the need for OPDC to declare a separate management area for air quality
Key recommendations	• Adopt a wide range of measures and policies to mitigate against threats to air quality and ensure air quality is comprehensively monitored and assessed when individual developments are proposed. • Manage new development so that it does not add extra emissions to the area. • The area is suitable for declaration as a TfL Low Emissions Neighbourhood. • Adopt policies to minimise travel by private vehicle and encourage transport by low emission modes (walking, cycling and public transport). • Adopt innovative solutions to avoid emissions including consolidation of freight and use of clean freight vehicles. • Support extension of Ultra Low Emissions Zone (ULEZ). • Require development to meet the tightest emissions for on-site plant. • Adopt full enclosure of waste sites in line with Environment Agency guidance. • Plan construction activity in detail to minimise dust emissions and adopt highest standards for emissions from all plant and vehicles during construction.
Relations to other studies	Outputs cross-relate to the Utility Study, Park Royal Transport Strategy, Old Oak Strategic Transport Study, Environmental Standards Study and Public Realm, Walking and Cycling Strategy
Relevant Local Plan Policies and Chapters	• Policy SP2 (Good Growth), Policy SP8 (Green Infrastructure); • All place policies • Environment and Utility Policies EU4 (air quality), EU6 (waste), EU9 (Minimising carbon emissions and overheating) and EU10 (Energy systems)

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OLD OAK AND PARK ROYAL DEVELOPMENT CORPORATION

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Old Oak and Park Royal Development Corporation

Old Oak and Park Royal

Air Quality Study

March 2017

Amec Foster Wheeler Environment
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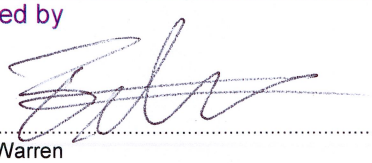

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Executive summary

Background

Amec Foster Wheeler Environment and Infrastructure UK Ltd (Amec Foster Wheeler) has been commissioned by the Old Oak and Park Royal Development Corporation (OPDC) to produce this Old Oak and Park Royal Air Quality Study (OPAQS) to identify the key air quality issues facing Old Oak and Park Royal at present, and those that will arise during the construction phase and when the Opportunity Area has been built out.

Old Oak and Park Royal will be a sustainable, highly accessible New Town focused around a world class transport 'super-hub', connecting High Speed 2 (HS2), Crossrail and the Underground and Overground networks. The area will become one of the most connected and largest railway interchanges in the country. The London Plan identifies that the Old Oak Common and Park Royal Opportunity Areas have the capacity to deliver a minimum of an additional 25,500 homes and 65,000 jobs. It is intended that the area will exemplify the highest standards of design, smart technology and environmental, social and economic sustainability during the all development stages.

As a local Planning Authority, the OPDC, will prepare its own Local Plan for the area. This OPAQS sits as a report in support of the Local Plan and forms an important component of the evidence base for the Local Plan policies. The OPAQS is central to the OPDC's objectives of improving the quality of life, enhancing health and well-being, and delivering social and economic benefits for local communities.

This study builds upon the extensive base of research into the impacts of air quality policy that has been developed in recent years and seeks to support delivery of an exemplary development that provides the best possible air quality. National policy and guidance on air quality is adopted as a starting point. Reference is also made to the ambitious policies that the Mayor of London is implementing to improve air quality in the city through the Greater London Authority (GLA) and Transport for London (TfL). The OPAQS provides guidance on how best practice should be implemented to achieve a high standard of air quality in a high density development on strategic industrial land. The emerging OPDC Local Plan will adopt the policies and guidance in this report and apply them to all development coming forward in the area.

Baseline Air Quality

The London boroughs of Brent (LBB), Ealing (LBE) and Hammersmith and Fulham (LBHF) have carried out the Local Air Quality Management (LAQM) Review and Assessment process. Areas within each borough were identified where concentrations of nitrogen dioxide (NO_2) and Particulate Matter (PM_{10}) exceed the relevant health-based Air Quality Objectives (AQOs). As a result, each council declared an Air Quality Management Area (AQMA). The Old Oak and Park Royal area straddles these AQMAs.

The latest monitoring data and the concentration mapping data from the London Atmospheric Emissions Inventory (LAEI) have been used to determine the current baseline air quality. High NO_2 concentrations have been linked with high numbers of Heavy Duty Vehicles (HDVs) in some areas (e.g. Old Oak Lane) and high levels of congestion in others (e.g. North Acton). Analysis detailed in the Old Oak Common Strategic Transport Study (OOC STS) confirms that a number of roads and junctions have volumes of traffic that exceed capacity resulting in slow moving traffic and high emissions. Strategic routes such as the A40 and A406 are under stress and junctions on the A40 such as Gypsy Corner, Savoy Circus and Hanger Lane are congested, particularly at peak periods.

Dispersion modelling was also carried out to create a baseline air quality model of the area and predict the future air quality. Pollutant concentrations were modelled using traffic data from the OOC STS. Modelling confirms that NO_2 concentrations currently exceed the AQOs, but indicates that they will reduce in the future as older vehicles are replaced by newer ones, with tighter emission standards, but there may still be exceedances of the annual mean NO_2 AQO around the busy roads and junctions in the area.

Exceedances of the 24-hour mean AQO for PM_{10} have also been recorded at monitoring stations in the vicinity of the Old Oak and Park Royal area. These exceedances are probably associated with a number of sources including industrial sites, traffic and dust resuspension.

Recommendations

The relevant international, national, regional and local policy context and legislation and guidance documents and case studies have been reviewed to ensure that OPDC policies complement existing policies. Measures and policies to be included within OPDC's Local Plan and Construction and Logistics Strategy have been recommended to mitigate against the identified threats to air quality and ensure that future pollutant concentrations are as low as possible. The monitoring and modelling results suggest a pressing need for mitigation measures to be implemented in order to meet the AQOs for NO_2. It is important that, where possible, developments should not add extra emissions to the area.

The area is suitable for declaration as a TfL Low Emission Neighbourhood (LEN) as it meets the relevant criteria. There are significant existing plans for development, the area will become the start and end point of a large number of journeys and there are opportunities for significant reductions in traffic, emissions and exposure to air pollution and a desire and need for improved air quality. As such, a package of measures has been recommended with the aim of reducing emissions, reducing exposure to pollution and ensuring that air quality is comprehensively monitored and assessed correctly when individual developments are proposed.

It has been identified that policies that minimise the demand for travel by private motor vehicles and encourage transport by low emission modes (walking, cycling and public transport) should be adopted. Innovative solutions that avoid the need for emitting activities, such as consolidation of freight and zero emission modes of freight delivery, are also recommended. Where activities cannot be carried out without emissions, it is recommended that these are minimised as far as possible by imposing emission standards. The OPDC will strongly support the proposed policy to extend the Ultra Low Emission Zone (ULEZ) to the north circular and make it operational by 2019. With implementation of this policy, the ULEZ will include the Old Oak and Park Royal area. This approach will encourage the use of the cleanest taxis, buses and goods vehicles. Proposed individual developments should meet the tightest emission standards for on-site plant detailed in the Mayor of London's SPG on Sustainable Design and Construction.

With regard to particulate emissions, studies conducted by the EA at waste sites have shown that full enclosure of waste sites can reduce particulate concentrations in neighbouring areas. Where possible, the policy of full enclosure of waste sites should be implemented in the Old Oak and Park Royal area. As there are existing particulate issues in the area and a huge amount of construction activity will be required, it is vital that construction activities are planned in detail and dust emissions are avoided as far as possible to avoid continued exceedance of the AQO. Recommendations for the construction phase include measures related to freight, delivery and servicing, the control of dust, Non-Road Mobile Machinery (NRMM) emission standards and the requirements for assessment and monitoring.

Abbreviations

Abbreviation	Definition
µgm^{-3}	Micrograms per cubic metre
AADT	Annual Average Daily Traffic
AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
AQO	Air Quality Objective
BPM	Best Practicable Means
CADS	Cleaning and Dust Suppressants
CAZ	Clean Air Zone
CHP	Combined Heat and Power
CMA	Calcium Magnesium Acetate
CoCP	Code of Construction Practice
Defra	Department for the Environment, Food and Rural Affairs
EA	Environment Agency
EC	European Commission
EU	European Union
FQP	Freight Quality Partnership
GLA	Greater London Authority
HDV	Heavy Duty Vehicle
HS2	High Speed 2
IAQM	Institute of Air Quality Management
LAEI	London Atmospheric Emissions Inventory
LAQM	Local Air Quality Management
LAQN	London Air Quality Network
LBB	London Borough of Brent
LBE	London Borough of Ealing
LBHF	London Borough of Hammersmith and Fulham
LDV	Light Duty Vehicle
LECV	Low Emission Commercial Vehicle
LEN	Low Emission Neighbourhood
LEV	Low Emission Vehicle

Abbreviation	Definition
LEZ	Low Emission Zone
LLAQM	London Local Air Quality Management
LV	Limit value
MAQS	Mayor's Air Quality Strategy
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
NRMM	Non-Road Mobile Machinery
OAPF	Opportunity Area Planning Framework
OJEU	Official Journal of the European Union
OLEV	Office for Low Emission Vehicles
OOC STS	Old Oak Common Strategic Transport Study
OPAQS	Old Oak and Park Royal Air Quality Study
OPDC	Old Oak and Park Royal Development Corporation
PM_{10}	Particulate Matter with an equivalent aerodynamic diameter of ten micrometers (10 µm) or less
$PM_{2.5}$	Particulate Matter with an equivalent aerodynamic diameter of two and a half micrometers (2.5 µm) or less
RHI	Renewable Heat Incentive
SPG	Supplementary Planning Guidance
TfL	Transport for London
ULED	Ultra Low Emission Discount
ULEV	Ultra Low Emission Vehicle
ULEZ	Ultra-low Emission Zone
ZEC	Zero Emission Capable
ZEN	Zero Emission Network

Contents

1. Introduction

Amec Foster Wheeler Environment and Infrastructure UK Ltd (Amec Foster Wheeler) has been commissioned by the Old Oak and Park Royal Development Corporation (OPDC) to produce this Old Oak and Park Royal Air Quality Study (OPAQS). The study seeks to identify the key air quality issues facing Old Oak and Park Royal at present, and those that will arise during the construction phase and when the Opportunity Area has been built out.

The OPAQS builds on the extensive base of research into the impacts of air quality policy that has been developed in recent years. Based on this research, recommendations are made to deliver an exemplary development that ensures the best possible air quality for future residents and workers.

National policy and guidance on air quality is adopted as a starting point. The ambitious policies that the Mayor of London is implementing to improve air quality in the city through the Greater London Authority (GLA) and Transport for London (TfL) are also referred to. The OPAQS provides guidance on how best practice should be implemented to achieve a high standard of air quality in a high density development on strategic industrial land. To ensure the best possible air quality, where policies and guidance have been developed with a range of options, the highest possible standards will be applied in Old Oak and Park Royal.

1.1 Old Oak and Park Royal Development Corporation (OPDC)

The Old Oak Common and Park Royal Opportunity Areas are conjoined and together they cover 650 hectares of land in West London. They are bordered by Harlesden and Stonebridge Park to the north, Kensal and North Kensington to the east, White City and Acton to the south and Alperton to the west. Park Royal forms one of the largest industrial estates in Europe. Old Oak is an area of industrial and railway land and is the planned location for a new railway station connecting High Speed 2 (HS2) to Crossrail and the Great Western Main Line.

The 2011 Localism Act provided the Mayor with powers to set up Mayoral Development Corporations (MDCs) and the OPDC is the second MDC in London. The OPDC was established by a statutory instrument (an order passed by Parliament) in January 2015, and was granted planning powers through a further statutory instrument in March 2015. The OPDC area straddles the London boroughs of Hammersmith & Fulham (LBHF), Brent (LBB) and Ealing (LBE). The OPDC's purpose is to "*use the once-in-a-lifetime opportunity of investment in HS2 and Crossrail, to develop an exemplar community and new centre in north-west London, creating opportunities for local people and driving innovation and growth in London and the UK*"[1].

As a Local Planning Authority, the OPDC has a duty to prepare a Local Plan that sets its strategy for development within its area and the policies that will be used to direct development and determine applications for planning permission across the entire OPDC area. The OPDC Planning Committee ensures decisions are made in an open, transparent and impartial manner.

1.2 Proposed development vision

The London Plan[2] identifies that the Old Oak Common Opportunity Area has the capacity to deliver a minimum of an additional 24,000 homes and 55,000 jobs. The Park Royal Opportunity Area could deliver a minimum of an additional 1,500 homes and 10,000 jobs. This level of development would make a major contribution to London's growth over the next few decades.

Old Oak and Park Royal will be a highly accessible location focused around a world class transport 'super-hub', connecting High Speed 2 (HS2), Crossrail and the Underground and Overground networks. As a result, the area will become one of the most connected and largest railway interchanges in the country. The area

[1] https://www.london.gov.uk/priorities/planning/old-oak-park-royal
[2] GLA (2015) Further Alterations to the London Plan (FALP)

will also benefit from significant London wide and local transport connections. This will help transform an area previously cut off from the rest of London and will also help bring economic benefits to surrounding local centres in Harlesden, Acton, Ealing and Kensal, including great local employment opportunities, both during and post construction.

The opportunity created by High Speed 2 and Crossrail will be used to secure investment that will deliver a thriving new centre at Old Oak with homes, a mix of employment space and associated infrastructure. Investment will be used to protect and regenerate the Park Royal industrial area as a cornerstone of the London economy. It is intended that development will showcase exemplar standards of design, smart technology and environmental, social and economic sustainability, during the planning, construction and operation stages.

1.3 Old Oak and Park Royal Air Quality study (OPAQS)

As a local Planning Authority, the OPDC, will prepare its own Local Plan for the area, with the aim of facilitating an exemplar development that will make a major contribution to strengthening London's role as a global city. In recognition of the importance of air quality as a key environmental issue facing London (as highlighted by the recent Kings College London study, 'Understanding the Health Impacts of Air Pollution in London'[3]), the Local Plan will include bespoke air quality policies. These will play a central role in improving the quality of life, enhancing health and well-being, delivering social and economic benefits for local communities and demonstrating viable approaches for other developments in London. The OPAQS sits as a report in support of the Local Plan and is a vital component of the evidence base for the Local Plan policies, which would be required to undergo an Examination in Public. This OPAQS is expected to be a key OPDC document, to help deliver an exemplar development and ensure the highest possible air quality for future residents and workers.

The structure of the OPAQS is provided in 1.1.

Table 1.1 Structure of the OPAQS

Section	Title	Contents
2	Review of Policy Context and Legislation and	The relevant international, national, regional and local policy context and legislation are reviewed to ensure that future OPDC policies comply with existing policies where appropriate.
3	Existing Air Quality	The latest monitoring data and concentration mapping data from the London Atmospheric Emissions Inventory (LAEI) for the OPDC area and surroundings are used to establish the current baseline pollutant concentrations. Dispersion modelling is used to create a baseline air quality model of the area.
4	Future Air Quality	Future air quality is modelled to provide design parameters that can be incorporated into the master plan and detailed plans throughout the development.
5	Policy Recommendations	Recommendations on measures and policies to be included within OPDC's Local Plan and Construction and Logistics Strategy are provided to improve local air quality and demonstrate how new development can be air quality positive by minimising emissions and using design solutions to reduce public exposure to pollution.

[3] KCL (2015) Understanding the Health Impacts of Air Pollution in London

2. Review of policy context and legislation

This section provides an overview of the current legislation and policy relevant to the quality of the air in this part of London. In order to ensure that the quality of air is as high as possible, and that the Old Oak and Park Royal area serves as an example for development in other areas of London it is proposed that development will meet the highest standards detailed in current policy. It is acknowledged that the policy framework will change over the lifetime of the OPDC development. As each phase or individual development passes through the planning process, it should meet the highest contemporary standards at the time of planning. The high volume of development in the area also affords the opportunity for the OPDC to lead the development of new ambitious and feasible standards that can be applied across London.

2.1 International

EU directive

The legislative framework for air quality consists of legally enforceable EU Limit Values that are transposed into UK legislation as Air Quality Standards (AQS) that must be at least as challenging as the EU Limit Values. Action in the UK is then driven by the UK's Air Quality Strategy[4].

The EU Limit Values are set by the European directive on air quality and cleaner air for Europe (2008/50/EC)[5] and the European directive relating to arsenic, cadmium, mercury, nickel, and polycyclic aromatic hydrocarbons in ambient air (2004/107/EC)[6] as the principal instruments governing outdoor ambient air quality policy in the EU. The Limit Values are legally binding levels for concentrations of pollutants for outdoor air quality.

Air quality in London currently meets the EU Limit Values for all the required pollutants except nitrogen dioxide (NO_2). In February of 2014 the European Commission (EC) announced that it was taking legal action against Britain, and other Member States, for non-compliance with the European air quality limit values for NO_2. A "letter of formal notice" of the EC's intention to take legal action was sent to the Government. In addition, in April 2015, a ruling by the UK's Supreme Court required the government to take immediate action to reduce NO_2 concentrations as soon as possible[7].

2.2 National

Air Quality regulations

The two European directives, as well as the European Council's decision on exchange of information were transposed into UK Law via the Air Quality Standards Regulations 2010[8], which came into force in the UK on 11 June 2010, replacing the Air Quality Standards Regulations 2007[9]. Air Quality Standards are concentrations recorded over a given time period, which are considered to be acceptable in terms of what is scientifically known about the effects of each pollutant on health and on the environment.

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[4] Defra in partnership with the Scottish Executive, Welsh Assembly Government and Department of the Environment Northern Ireland (2007) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland.
[5] Official Journal of the European Union, (2008) Directive 2008/50/EC of the European Parliament and of The Council of 21 May 2008 on ambient air quality and cleaner air in Europe.
[6] Official Journal of the European Union, (2004) Directive 2004/107/EC of the European Parliament and of The Council of 15 December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air.
[7] The Supreme Court (2015) Press Summary - R (on the application of ClientEarth) (Appellant) v Secretary of State for the Environment, Food and Rural Affairs (Respondent) [2015] UKSC 28 On appeal from [2012] EWCA Civ 897 - https://www.supremecourt.uk/cases/docs/uksc-2012-0179-press-summary.pdf
[8] The Stationery Office Limited (2010) Statutory Instrument 2010 No. 1001 Environmental Protection – The Air Quality Standards Regulation 2010.
[9] The Stationery Office Limited (2007) Statutory Instrument 2010 No. 64 Environmental Protection – The Air Quality Standards Regulation 2007.

UK Air Quality strategy

The UK Air Quality Strategy sets the Air Quality Objectives (AQOs), which give target dates and some interim target dates to help the UK move towards achievement of the EU Limit Values. The AQOs are a statement of policy intentions or policy targets and as such, there is no legal requirement to meet these objectives except in as far as they mirror any equivalent legally binding Limit Values in EU legislation. The most recent UK Air Quality Strategy for England, Scotland, Wales and Northern Ireland was published in July 2007.

NO_2, PM_{10} and $PM_{2.5}$ are the pollutants of greatest health concern associated with road traffic, the main source of pollution in London. National level measurements and modelling assessments carried out by Defra have shown that policy measures already in place ensure that concentrations of other pollutants comply with the relevant objectives even at busy roadside locations. The NO_X (NO and NO_2) emitted from vehicle exhausts and other combustion sources undergoes photochemical oxidation in the atmosphere, with NO_2 being formed by oxidation of NO to NO_2 and, conversely, NO_2 undergoing photolysis (in the presence of sunlight) to create NO and ozone (O_3). Table 2. sets out the AQOs that are relevant to this study, and the dates by which they are to be achieved. For NO_2, it is the annual mean objective that is the more stringent AQO; it is generally considered that the 1-hour mean NO_2 AQO will not be exceeded if the annual mean objective is not exceeded. For PM_{10}, the 24-hour mean objective is more stringent than the annual mean. Meeting these AQOs does not mean that the health impacts of pollution are avoided. Further reductions below these concentrations will also reduce health impacts.

Table 2.1 Summary of relevant air quality standards and objectives

Pollutant	Objective (UK)	Averaging Period	Date to be Achieved by and Maintained thereafter (UK)
Nitrogen dioxide - NO_2	200 μgm^{-3} not to be exceeded more than 18 times a year	1-hour mean	31 Dec 2005
	40 μgm^{-3}	Annual mean	31 Dec 2005
Particles - PM_{10}	50 μgm^{-3} not to be exceeded more than 35 times a year	24-hour mean	31 Dec 2004
	40 μgm^{-3}	Annual mean	31 Dec 2004
Particles - $PM_{2.5}$	25 μgm^{-3}	Annual mean	2020
	Target of 15% reduction in concentration at urban background locations	3 year mean	Between 2010 and 2020

LAQM

Since Part IV of the Environment Act 1995[10] came into force, local authorities have been required periodically to review concentrations of the UK Air Quality Strategy pollutants within their areas and to identify areas where the AQOs may not be achieved by their relevant target dates. This process of Local Air Quality Management (LAQM) is an integral part of delivering the Government's AQOs detailed in the Strategy. Local authorities investigate the levels of pollution in their area by a combination of ambient monitoring and dispersion modelling in the Review and Assessment process. Passive or automatic (continuous) monitoring equipment is used to measure ambient concentrations of the main pollutants at a limited number of locations. However, as monitors cannot give a complete picture of an entire borough, dispersion modelling is often used to predict pollutant concentrations across a wide area, to investigate future scenarios and to estimate the contribution of different sources to the total pollution, known as source apportionment. In this way, air quality models can be used to assess whether or not the national air AQOs are likely to be breached.

[10] HMSO (1995) Environment Act 1995.

Under LAQM, where AQOs are not (or are unlikely to be) met, Air Quality Management Areas (AQMAs) must be designated officially by means of an 'order'. The extent of the AQMA may be limited to the area of exceedance or encompass a larger area such as an entire town centre. Following the declaration of an AQMA, the local authority must undertake an assessment of air quality in the AQMA within 12 months and develop and implement an Air Quality Action Plan (AQAP) to improve air quality in that area. AQMAs are what drive various legal provisions in relation to air quality, specifically within the planning system. The local authority may update the action plan from time to time. The Latest guidance on the LAQM process is given in Defra's 2016 Local Air Quality Management Technical Guidance (LAQM TG(16))[11].

While district councils have a statutory duty to carry LAQM, it is important to note that councils are not obliged to achieve the AQOs as they do not have sufficient control over all of the sources that could potentially give rise to the breach. Large industrial sources are regulated by the Environment Agency (EA), major roads are controlled by Highways England and, in London, by Transport for London. Much pollution is regional in nature, arising from other areas in the UK or even outside the UK. When the Review and Assessment process was devised it was thought that national and European measures would achieve compliance with the EU LVs across the UK with the exception of limited number of hot spots which local authorities would identify and address. However, this is not what has happened and councils are now faced with widespread exceedances.

December 2015 Nitrogen Dioxide action plan

In December 2015, Defra published plans to improve air quality in the UK focused on "*Tackling nitrogen dioxide in our towns and cities*"[12]. The document sets out the UK's approach to meeting the NO_2 limit values set out in the Ambient Air Quality Directive in the shortest time possible. This plan was produced following the Supreme Court order of 2015 that the government must submit new air quality plans to the European Commission no later than 31 December 2015[13].

The UK is divided into 43 zones and agglomerations for air quality monitoring and reporting purposes. Compliance assessments are submitted to the Commission on an annual basis which demonstrate progress towards the limit values. The plans are in the form of an overarching national plan and individual local plans for each of the 38 zones currently exceeding the annual mean limit value for NO_2. The Old Oak and Park Royal Area is located in the *Greater London Urban Area* Agglomeration.

The Defra Pollution Climate Mapping (PCM) model has been used to project future NO_2 concentrations, which provide expected UK compliance dates for each of the UK zones. Compliance is predicted to be achieved by 2030 with no new measures, and by 2025 with the implementation of the measures detailed in the plans.

The overview document includes the following measures to reduce NO_2 concentrations:

- Clean Air Zones (CAZs);
- London Ultra-Low Emission Zone;
- An improved LAQM system;
- Incentivising ultra low emission vehicles through various Office of Low Emission Vehicle (OLEV) schemes such as the Plug-in Car Grant;
- Government Procurement including the Government Buying Standards (GBS) which set down minimum mandatory and best practice standards requirement for cars, vans, buses and trucks;
- Improvements to the road network;
  - Highways England road investment strategy;

[11] Defra (2016) Local Air Quality Management Technical Guidance LAQM.TG(16).
[12] Defra (2015). Improving air quality in the UK. Tackling nitrogen dioxide in our towns and cities UK Overview Document
[13] The Supreme Court (2015) Press Summary - R (on the application of ClientEarth) (Appellant) v Secretary of State for the Environment, Food and Rural Affairs (Respondent) [2015] UKSC 28 On appeal from [2012] EWCA Civ 897 - https://www.supremecourt.uk/cases/docs/uksc-2012-0179-press-summary.pdf

- Specific road improvements;
- Reducing emissions from buildings; and
- Reducing emissions from other sources;
  - Ports and shipping;
  - Aviation;
  - Rail;
  - Freight;
  - Industry;
  - Non-Road Mobile Machinery.

CAZs are areas where only the cleanest vehicles are encouraged (through the use of vehicle emission standards). Vehicle standards will be set based on emissions level for a vehicle type. This is to ensure that only the cleanest vehicles, including hybrid and vehicles using alternative fuels where appropriate, are encouraged to enter the area.

The government will legislate to require the implementation of CAZs in five cities (Birmingham, Leeds, Nottingham, Southampton and Derby) and CAZs will be implemented by other local authorities which decide emissions based access controls are the most effective solution for them to meet the limit values for NO_2. The proposed emission standards are the same as those proposed for the London Ultra Low Emission Zone (ULEZ)[14], and are as follows:

- Bus/ coach – 0.4 g/kWh (Equivalent to Euro VI for NO_X emissions);
- HGV – 0.4 g/kWh (Equivalent to Euro VI for NO_X emissions);
- Van (1305-3500kg) – 0.125 g/km (Equivalent to Euro VI for 1760-3500kg Diesel Light Commercial Vehicle); and
- Car/light commercial (up to 1305kg) – 0.08 g/km (Equivalent to Euro 4 petrol car and Euro VI diesel car.

The *Greater London Urban Area* plan[15] includes details on measures included in the Mayor's Air Quality Strategy, policies implemented since 2008, such as tighter LEZ standards, investment in cycling infrastructure and the introduction of the requirement for developments to be air quality neutral, and the following measures confirmed or implemented since 2012:

- London Ultra-Low Emission Zone;
- Cleaner Bus Plans;
- Taxi and minicab (PHV) Plans;
- Construction site policies;
- Building retrofit programme;
- Mayor's Air Quality Fund;
- Measures to support adaptation, public health and raise awareness;
- Encouraging smarter choices and sustainable travel
  - Mayor's Cycling Vision;

[14] https://tfl.gov.uk/modes/driving/ultra-low-emission-zone

[15] Defra (2015). Air Quality Plan for the achievement of EU air quality limit value for nitrogen dioxide (NO_2) in Greater London Urban Area (UK0001)

- School Sustainable Travel Active Responsible and Safe (STARS) accreditation scheme;
- Promoting technological change and cleaner vehicles;
  - TfL Transport Emissions Roadmap;
  - TfL Ultra Low Emission Vehicle Delivery Plan;
- NRMM LEZ;
- Energy efficient buildings;
  - RE:NEW (the Mayor's domestic energy retrofit programme);
  - RE:FIT (the Mayor's public buildings energy retrofit programme).

The plans recognise the central role of local authorities in achieving improvements in air quality. The individual zone plans detail measures that have been undertaken, are underway or are planned by local authorities. The *Greater London Urban Area* plan includes measures from the LBE and LBHF AQAPs. Details of these AQAPs are summarised in Section 2.4.

National Planning Policy Framework and National Planning Practice Guidance

The National Planning Policy Framework (NPPF)[16] sets out government's planning policies for England and how these are expected to be applied. With regards to air quality, the NPPF states:

> "*Planning policies should sustain compliance with and contribute towards EU limits values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan.*"

The government has also produced Planning Practice Guidance (PPG)[17] which provides guiding principles on how planning can take account of the impact of new development on air quality. With regards to the development of Local Plans, it is stated that:

> "*It is important to take into account air quality management areas and other areas where there could be specific requirements or limitations on new development because of air quality*" and
>
> "*the Local Plan may need to consider:*
>
> - *the potential cumulative impact of a number of smaller developments on air quality as well as the effect of more substantial developments;*
> - *the impact of point sources of air pollution (pollution that originates from one place); and,*
> - *ways in which new development would be appropriate in locations where air quality is or likely to be a concern and not give rise to unacceptable risks from pollution. This could be through, for example, identifying measures for offsetting the impact on air quality arising from new development including supporting measures in an air quality action plan or low emissions strategy where applicable.*"

It is stated that air quality is relevant to planning applications when the development would:

- "*Significantly affect traffic in the immediate vicinity of the proposed development site or further afield. This could be by generating or increasing traffic congestion; significantly changing traffic volumes, vehicle speed or both; or significantly altering the traffic composition on local roads. Other matters to consider include whether the proposal involves the development of a bus*

[16] Department for Communities and Local Government (2012) National Planning Policy Framework
[17] Department for Communities and Local Government (2014) National Planning Practice Guidance – Air Quality.

station, coach or lorry park; adds to turnover in a large car park; or result in construction sites that would generate large Heavy Goods Vehicle flows over a period of a year or more.

- *Introduce new point sources of air pollution. This could include furnaces which require prior notification to local authorities; or extraction systems (including chimneys) which require approval under pollution control legislation or biomass boilers or biomass-fuelled CHP plant; centralised boilers or CHP plant burning other fuels within or close to an air quality management area or introduce relevant combustion within a Smoke Control Area;*
- *Expose people to existing sources of air pollutants. This could be by building new homes, workplaces or other development in places with poor air quality.*
- *Give rise to potentially unacceptable impact (such as dust) during construction for nearby sensitive locations.*
- *Affect biodiversity. In particular, is it likely to result in deposition or concentration of pollutants that significantly affect a European-designated wildlife site, and is not directly connected with or necessary to the management of the site, or does it otherwise affect biodiversity, particularly designated wildlife sites.*"

Office of Low Emission Vehicles (OLEV) Investing in Ultra Low Emission Vehicles in the UK, 2015 to 2020

In April 2014, OLEV published the Government's proposed package of support for ULEVs in the period 2015-20[18]. This document included the government's plans on *Shaping the Required Infrastructure*. The key elements are detailed in Table 2.1.

Table 2.1 OLEV Plans for shaping ULEV infrastructure

Type of Infrastructure	Plan
Charging Infrastructure	There will be a rapid chargepoint at every motorway service station by the end of 2014 and we will have a network of over 500 rapid chargers across the country by March 2015 – the best network in Europe. We need to go further to ensure that worries about charging are never a barrier to ULEV adoption. We will provide a £32m fund for charging infrastructure in the period 2015-2020. Among other things, this will ensure that ULEV drivers can easily find a rapid chargepoint to help undertake any journey they choose.
Gas refuelling Infrastructure	We are allocating £4m to ensure the UK has an initial network of gas refuelling stations to support freight and logistics operators in their efforts to reduce the environmental impact of their businesses.
Hydrogen Infrastructure	We are positioning the UK to be a lead market for the introduction of hydrogen fuel cell vehicles and will announce soon, and no later than autumn, 2014 the actions that both Government and industry stakeholders will be taking to achieve this.

2.3 Regional

London Plan

The London Plan[19] is the overall Strategic Plan for London, setting out an integrated economic, environmental, transport and social framework for development over the 20-25 year period from its adoption. It sets the strategic, London-wide policy context within which boroughs should set their detailed local planning policies and provides the policy framework for the Mayor's decisions on the strategic planning

[18] OLEV (2014) Investing in ultra low emission vehicles in the UK, 2015 to 2020

[19] Mayor of London (2015) The London Plan – Spatial Development Strategy for Greater London, Consolidated with Alterations Since 2011

applications. The London Plan is currently under review and is likely to be changed as the Old Oak and Park Royal are is being developed.

Policy 7.14, Improving Air Quality states that the Mayor will work with strategic partners to ensure that the spatial, climate change, transport and design policies of this plan support implementation of his Air Quality and Transport strategies to achieve reductions in pollutant emissions and minimize public exposure to pollution. With regards to planning decisions, development proposals should:

- "*minimise increased exposure to existing poor air quality and make provision to address local problems of air quality (particularly within Air Quality Management Areas (AQMAs) and where development is likely to be used by large numbers of those particularly vulnerable to poor air quality, such as children or older people) such as by design solutions, buffer zones or steps to promote greater use of sustainable transport modes through travel plans (see Policy 6.3).*
- *promote sustainable design and construction to reduce emissions from the demolition and construction of buildings following the best practice guidance in the GLA and London Councils' 'The control of dust and emissions from construction and demolition'.*
- *be at least 'air quality neutral' and not lead to further deterioration of existing poor air quality (such as areas designated as Air Quality Management Areas (AQMAs)).*
- *ensure that where provision needs to be made to reduce emissions from a development, this is usually made on-site. Where it can be demonstrated that on-site provision is impractical or inappropriate, and that it is possible to put in place measures having clearly demonstrated equivalent air quality benefits, planning obligations or planning conditions should be used as appropriate to ensure this, whether on a scheme by scheme basis or through joint area-based approaches.*
- *where the development requires a detailed air quality assessment and biomass boilers are included, the assessment should forecast pollutant concentrations. Permission should only be granted if no adverse air quality impacts from the biomass boiler are identified.*"

Policy 3.2, Improving Health and Addressing Health Inequalities, states that "*New developments should be designed, constructed and managed in ways that improve health and promote healthy lifestyles to help to reduce health inequalities*".

Policy 5.3, Sustainable Design and Construction, states that "*The highest standards of sustainable design and construction should be achieved in London to improve the environmental performance of new developments and to adapt to the effects of climate change over their lifetime*". Development proposals should minimise pollution (including noise, air and urban runoff) and meet the minimum standards outlined in the Mayor's Supplementary Planning Guidance Documents (SPGs).

Policy 5.11, Green Roofs and Development Site Environs, states that "*Major development proposals should be designed to include roof, wall and site planting, especially green roofs and walls where feasible*".

Policy 6.9, Cycling, states that developments should provide secure, integrated, convenient and accessible cycle parking facilities and contribute positively to an integrated cycling network for London by providing infrastructure that is safe, comfortable, attractive, coherent, direct and adaptable. Development Plan Documents should identify, promote and facilitate the completion of relevant sections of cycle routes including Cycle Superhighways, Quietways and the Central London Grid and local borough routes and identify and implement safe and convenient direct cycle routes to town centres, transport nodes and other key uses such as schools.

Policy 6.10, Walking, states that Development proposals should ensure high quality pedestrian environments and emphasise the quality of the pedestrian and street space. Development Plan Documents should identify and implement accessible, safe and convenient direct routes to town centres, transport nodes and other key uses and encourage a higher quality pedestrian and street environment.

Policy 6.13, Parking, states that the Mayor wishes to see an appropriate balance being struck between promoting new development and preventing excessive car parking provision that can undermine cycling, walking and public transport use. It is stated that all developments in areas of good public transport accessibility should aim for significantly less than 1 space per unit. Developments must ensure that 1 in 5

spaces provide an electrical charging point to encourage the uptake of electric vehicles, with an additional 20 per cent passive provision for electric vehicles in the future. It is also stated that in locations with high public transport accessibility, car-free developments should be promoted (while still providing for disabled people).

Control of Dust and Emissions during Construction and Demolition SPG

This SPG[20] provides more detailed guidance on the implementation of all relevant policies in the London Plan and the Mayor's Air Quality Strategy. It is aimed at neighbourhoods, boroughs, developers, architects, consultants and any other parties involved in any aspect of the demolition and construction process. It sets out the methodology for assessing the air quality impacts of construction and demolition in London. Good practice for mitigating and managing air quality impacts is detailed, with the overarching aim of protecting public health and the environment.

It is stated that all demolition and construction sites should be monitored for the generation of air pollution. It is essential to monitor for dust generation, including PM_{10}. This can range from visual monitoring at low risk sites to automatic monitoring with alert trigger levels at high risk sites. The need for monitoring depends on existing air quality and the risk of air pollution from the development.

This document also includes a policy to reduce emissions from non-road mobile machinery (NRMM). To address this significant contribution of NRMM to London's poor air quality, the GLA is controlling emissions from this equipment with the application of emissions standards for London from September 2015. The policy seeks progressive reduction in emissions and includes higher standards for the Central Activity Zone (CAZ) and Canary Wharf, where there is likely to be concentrated construction activity. The policy thereby allows for more ambitious standards to be imposed. The policy is as follows:

From 1 September 2015 NRMM of net power between 37kW and 560kW used:

- in London will be required to meet the standards set out below. This will apply to both variable and constant speed engines for both NO_X and PM. These standards will be based upon engine emissions standards set in EU Directive 97/68/EC and its subsequent amendments.
- NRMM used on the site of any major development within Greater London will be required to meet Stage IIIA of the Directive as a minimum; and
- NRMM used on any site within the Central Activity Zone or Canary Wharf will be required to meet Stage IIIB of the Directive as a minimum.

From 1 September 2020 the following will apply:

- NRMM used on any site within Greater London will be required to meet Stage IIIB of the Directive as a minimum.
- NRMM used on any site within the Central Activity Zone or Canary Wharf will be required to meet Stage IV of the Directive as a minimum.

As detailed in the LLAQM Borough Air Quality Action Matrix[21], replacing an average size piece of NRMM equipment (37 ≤ kW < 75) meeting Stage II emission standards operating for the whole year by same size equipment meeting Stage IIIB emission standards would reduce NO_X and PM_{10} emissions by 53% and 94% respectively. The requirements set out above may be met using the following techniques;

- Reorganisation of NRMM fleet;
- Replacing equipment (with new or second hand equipment which meets the policy);
- Retrofit abatement technologies; and
- Engine replacement.

[20] GLA (2014) The Control of Dust and Emissions during Construction and Demolition: Supplementary Planning Guidance
[21] https://www.london.gov.uk/sites/default/files/air_quality_action_matrix.pdf

Sustainable Design and Construction SPG

This SPG[22] provides guidance on the implementation of London Plan policy 5.3 - Sustainable Design and Construction, as well as a range of policies, primarily in Chapters 5 and 7 that deal with matters relating to environmental sustainability.

The Mayor's priorities with regards to air quality are:

- "*Developers are to design their schemes so that they are at least 'air quality neutral';*
- *Developments should be designed to minimise the generation of air pollution;*
- *Developments should be designed to minimise and mitigate against increased exposure to poor air quality;*
- *Developers should select plant that meets the standards for emissions from combined heat and power and biomass plants set out in Appendix 7;*
- *Developers and contractors should follow the guidance set out in the dust and emissions from construction and demolition SPG when constructing their development*."

Minimum emission standards for combustion plant are detailed. These are applied in a tiered approach based upon differentiation according to the baseline air quality in the area of development. Band A emission standards apply when the baseline annual mean NO_2 or PM_{10} concentrations is over 5% below the national objective (<38 µg m^{-3}). Band B emission standards apply when NO_2 and PM_{10} concentrations are above this concentration. Emission standards are provided for:

- Individual gas boilers;
- Communal gas boilers;
- Solid biomass boilers; and
- Combined Heat and Power (CHP) plant.

As detailed in the LLAQM Borough Air Quality Action Matrix[21], use of equipment meeting GLA emission standards for APEC B band (0.3 g/kWh) for gas-fired (spark ignition) CHP plant rather than the Renewable Heat Incentive (RHI) emission standards, it would reduce NO_X emissions by 70%.

Air Quality Neutral Policy

The London Plan and the Mayor's Air quality Strategy set out that developments are to be at least 'air quality neutral'. To enable the implementation of this policy emission benchmarks have been produced for building operation and transport across London based on the average for existing land uses of different types. Developments that do not exceed these benchmarks are considered to be 'air quality neutral'. The benchmarks are to be considered minimum standards that will be kept under review and will be updated in line with technological and commercial advances. The application of this policy is detailed in the Air Quality Neutral Planning Support Update[23].

Developers of schemes which do not meet the 'air quality neutral' benchmark for buildings or transport (considered separately) after appropriate onsite mitigation measures have been incorporated are required to off-set any excess in emissions. The developer should investigate options for providing NO_x and PM abatement measures offsite in the vicinity of the development. This will involve working with the relevant planning authority or nearby property owners to identify suitable mitigation measures. Measures could include:

- Green planting/ walls and screens, with special consideration given to planting that absorbs or supresses pollutants;

[22] GLA (2014) Sustainable Design and Construction: Supplementary Planning Guidance
[23] Air Quality Consultants and Environ (2014) Air Quality Neutral Planning Support Update: GLA 80371

- Upgrade or abatement work to combustion plant;
- Retro-fitting abatement technology for vehicles and flues; and
- Exposure reduction.

Mayor's Air Quality Strategy

The Mayor's Air Quality Strategy (MAQS)[24] details how the Mayor aims to protect the health of people living in London and increase their quality of life by cleaning the air of the city. The strategy sets out a framework for improving London's air quality and measures aimed at reducing emissions from transport, homes, offices and new developments, as well as raising awareness of air quality issues. The MAQS contains the following policies:

- Policy 1 – Encouraging smarter choices and sustainable travel;
- Policy 2 – Promoting technological change and cleaner vehicles;
- Policy 3 – Identifying priority locations and improving air quality through a package of local measures;
- Policy 4 – Reducing emissions from public transport;
- Policy 5 – Schemes that control emissions to air;
- Policy 6 – Reducing emissions from construction and demolition sites;
- Policy 7 – Using the planning process to improve air quality;
- Policy 8 – Maximising the air quality benefits of low to zero carbon energy supply;
- Policy 9 – Energy efficient buildings;
- Policy 10 – Improved air quality in the public realm;
- Policy 11 – Encouraging innovation;
- Policy 12 – Raising public awareness of air quality issues;
- Policy 13 – Working with Government and other authorities; and
- Policy 14 – Working with boroughs.

It is stated that the planning system will be used to ensure no new development has a negative impact on air quality in London. The Mayor will ensure that new developments in London shall as a minimum be 'air quality neutral' through the adoption of best practice in the management and mitigation of emissions.

TfL Transport Emissions Roadmap (TERM)

The TfL Transport Emissions Roadmap (TERM), published on 10 September 2014[25], focuses on how to reduce ground-based emissions from transport in London. It is stated that the proposed measures will need to be developed to understand their feasibility, impact and funding requirements. The TERM is intended to be a platform document with which to engage stakeholders and the public to help build consensus and drive action. Many of the identified measures in TERM will need to be progressed and delivered by others and many of the ideas presented in the TERM require further development to understand their feasibility. It is stated that resources be sought from central Government, boroughs, other key stakeholders and the private sector. The TERM is intended as a continuous process, with stakeholder engagement beyond continuing

[24] Mayor of London (2010). Clearing the Air – The Mayor's Air Quality Strategy
[25] TfL (2014) Transport Emissions Roadmap: Cleaner transport for a cleaner London - http://content.tfl.gov.uk/transport-emissions-roadmap.pdf

after publication to generate further viable solutions, secure support for their implementation and begin the process of securing funding for them.

The TERM reports on both what has already been done (Table 2.2) and may be done in the future (Table 2.3), providing a range of new measures that should be considered to help reduce air pollutants and CO_2 emissions in London.

Table 2.2 Current strategies to reduce on-ground emissions in Greater London.

What is being doing already?	How is it being done?
Promoting a shift towards more sustainable travel choices	Land use planning New rail & underground infrastructure Bus stop and bus accessibility Walking improvements Cycle improvements Smarter Travel, Car Clubs and Travel Demand Management Smarter Freight Congestion Charging
Environmentally efficient use of existing vehicles and technology	Smarter Driving Traffic signal optimisation (SCOOT) Lane rental for roadworks Reduced engine idling Freight Operators Recognition Scheme Out of hours delivery
Development and uptake of low emission vehicles and technologies	Low Emission Zone Congestion Charging Ultra Low Emission Discount Zero emission vehicles and charge points Freight schemes Cleaner TfL Buses Cleaner Taxis and PHVs Powered Two Wheelers LU energy reduction Rail electrification River services
Tackling local air pollution focus areas	Clean Air Fund Clear Zones Mayors Air Quality Fund Airport Surface Access Strategies and Air Quality Strategies Access restrictions

The importance of land use planning in promoting a shift towards more sustainable travel choices is highlighted. It is stated that TfL permit greater density of development in areas which have better levels of public transport. In additional, it is stated that:

- TfL have included requirements for electric charging provision at parking spaces in the London Plan;
- Some London boroughs have applied differential rates for parking permits according to CO_2 emissions. This could be expanded to other boroughs, extended to include visitor parking and adjusted to capture air pollutants;
- The most recent update to the London Plan, consulted on in January 2014, increased the minimum cycle parking standards;
- The GLA has developed Supplementary Planning Guidance on sustainable design and construction, including the control of dust and emissions during construction;
- Opportunity Area Planning Frameworks (OAPFs) and work on developing specific Growth Areas secured investment in sustainable transport provision (eg Northern Line extension); and
- Car Lite and Car Free developments have been specified in planning agreements.

TERM contains a list of top 10 new and innovative ideas that could be implemented in London to strengthen existing actions and strategies. A list of these measures are set out in Table 2.3. They reflect a broad range of types of intervention covering; regulation, infrastructure, innovation, lobbying, fleet-specific changes and education and awareness campaigns to encourage behavioural change and more sustainable travel. This illustrates how a wide variety of approaches will be necessary to tackle transport emissions effectively, with action in a number of areas.

Table 2.3 Future focus areas to reduce on-ground emission in Greater London

Future measures	How are we doing this?
1) Ultra Low Emission Zone (ULEZ)	- The ULEZ has been proposed in Central London, coming into effect from 2020, which would set an emissions requirement for all types of vehicles entering central London. - Charges for noncompliance would discourage all but the cleanest vehicles. - This could reduce NO_X emissions in 2020 by as much as 51 per cent in central London, with wider benefits to surrounding areas.
2) The future of the Low Emission Zone	- Given vehicle availability and the cost of compliance over the whole of London, tightening LEZ significantly in the short term would be difficult. - Tightening LEZ after 2020 would be more feasible and effective, given the wider availability of suitable vehicles and additional compliance time for people and businesses - This could result in as much as a 19 per cent reduction in NO_X outside central London in addition to the saving achieved by ULEZ in central London.
3) Making traffic management and regulation smarter	- Changing our approach to traffic management, through such measures as improved channels of information and more sophisticated traffic lights, can help to mitigate congestion and related emissions - Reducing speed limits reduces the power demand on engines and can reduce vehicle emissions for NO_X, PM and CO_2. - By rethinking Vehicle Excise Duty (VED) and fuel tax, payment for use of the roads could be charged at point of use, and discounts could be made for ultra-low emission or zero emission vehicles. - Emissions of NOx in 2025 could be cut by 10 per cent in Central London (in addition to savings from ULEZ), 20 per cent across the rest of London and further reductions could be achieved at pollution hot spots.
4) Helping Londoners tackle air pollution and climate	- Behaviour change campaigns to promote sustainable travel and personalised travel plans, are just some of the measures used to substitute an existing vehicle for a lower emission equivalent. - There is potential to provide a more integrated approach to promoting travel options at key decision points in the system, helping people make a the most sustainable mode choice for longer distance journeys. - In the shorter term, central Government can help to reduce emissions by providing better information on existing vehicle emissions - In the longer term, a large media campaign with incentives for choosing sustainable travel could contribute further to the NO_X emission reductions.
5) Driving the uptake of low emission vehicles	- Increasing the use of low emission vehicles, including electric vehicles and a range of low emission vehicle technologies for heavier vehicles, would have a major impact on emissions of air pollutants and CO_2 if achieved on a significant scale. - Investment in future vehicle technology and creation of a nationwide alternative fuelling infrastructure will be needed at a national level to encourage uptake of alternatively fuelled vehicles. - Investment in upgrading the national electricity grid, as well as improving the reliability of public charge points, will be necessary to achieve a high uptake of electric vehicles. - Significant investment, market availability of LEVs and sufficient infrastructure will be required to achieve a high level of LEV uptake. - The introduction of a new compensation scheme at a national level for removing older, high polluting vehicles from the road, would also help to renew the vehicle fleet and stimulate the motor manufacturing industry. - In the longer term, central Government should continue to fund research for low emission vehicle technologies as it currently does through the Technology Strategy Board.
6) Cleaner electricity for London's transport	- In order to maximise the benefits of reducing air pollution and greenhouse gases, existing strategies must be complemented by the decarbonisation of electricity supply.

Future measures	How are we doing this?
	- The Mayor's low carbon energy supply policies and programmes for London aim to reduce carbon emissions and provide greater energy security - London is the first authority in the country to apply to the Office of Gas and Electricity Markets (OFGEM) for a new type of electricity supply licence, which will enable the capital's small electricity producers to sell power to the market at a better rate. - Alongside this, central Government is undertaking work to reduce the carbon intensity of the national grid by 2030.
7) Transforming London's bus fleet	- If sufficient additional funding is provided by central Government, there is potential for TfL's buses to get even cleaner. Roll out of a further 1,600 hybrid double-decker and 300 electric single-decker buses would help to support the ULEZ proposal. - Funding is not the only limiting factor. Catalysing an increase in manufacture capacity would go against the current approach for a steady turnover of vehicles over time, making use of new technology as it becomes available.
8) Delivering a zero emission taxi and PHV fleet	- As part of ULEZ it is proposed that from 2018 (subject to consultation) all new taxis and PHVs will be licensed if they are zero emissions capable. - In addition, supporting measures such as promotions, grants and other incentives could be used to encourage early uptake and support the taxi and private hire industry moving over to the new requirement. - Further action could be taken, for example from 2025, for all new taxis to be fully electric or hydrogen (effectively zero emissions at tailpipe).
9) Transforming London's public and commercial fleets	- Upgrading many of the public sector's support fleets and suppliers' fleets to meet ULEZ standards, would allow the public sector to lead by example in reducing NO_2 emissions. - Promoting the uptake of vehicles through on-vehicle advertising could help encourage a wider shift towards ultra-low emission vehicles. Schemes could include Metropolitan Police, London Fire Brigade and TfL's support fleets being ULEZ compliant in Greater London. - Emissions from tyre and brake wear are a significant source of particulates in London, and this has not been adequately addressed to date. Alongside upgrading the vehicle fleet, R&D in this area would require direct action and funding from national Government.
10) Low Emission Neighbourhoods	- Low Emission Neighbourhoods (LENs),could be targeted in local hotspot areas of poor air quality - In order to become a LEN, a number of measures would need to be adopted for an area, from a package supported by TFL, through to advice and incentives (Table 2.4)

In 2016, the Mayor of London announced proposals to extend the ULEZ to the North Circular Road and the South Circular Road and bring forward the introduction earlier than 2020. The ULEZ would therefore include the Old Oak and Park Royal area. Under earlier plans the ULEZ will only operate within the Congestion Charging Zone and it is due to come in from 2020. It is also proposed to introduce ULEZ standards for heavy vehicles London-wide from 2020[26].

The TERM proposes tackling local air pollution hotspots using a package of targeted measures or locations, which might not necessarily have high local pollution, but have high trip generation and therefore ability to influence transport emissions in the wider area. This concept is termed "Low Emission Neighbourhood" (LENs). The basic concept in the chosen area is surveyed in detail to understand how it functions: the numbers, types, reason for trips, destination and origin or trips, and how full or occupied vehicles are. Strong measures are then put in place to coordinate and consolidate servicing, reduce vehicle use and encourage or mandate the use of cleaner vehicles. This can be achieved by agreement, through servicing plans and travel plans, or regulated through traffic restriction and parking and loading controls.

In order to be designated as a LEN, the area needs to meet at least one of the following conditions[27]:

- The area includes or is part of an Opportunity Area, as identified in the London Plan;

[26] https://www.london.gov.uk/press-releases/mayoral/bold-plans-to-clean-up-londons-toxic-air
[27] TfL Low Emission Neighbourhoods Guidance note - https://www.london.gov.uk/sites/default/files/low-emission-neighbourhoods.pdf

- There are significant existing plans for major public realm and/or traffic reduction schemes, either borough or TfL led, that may be able to benefit from LEN complementary measures;
- There is an opportunity for
  - Significant reductions in traffic, emissions or exposure to air pollution
  - A desire and/or need for improved air quality, road casualties and urban realm
  - An active local community (commercial and/or residential), or a clear commitment from the local authority to foster an active local community through a potential LEN project
- The area is the start and/or end point of a large number of journeys (as the impact of that LEN would be felt far beyond its boundaries). This could include major destinations near the roads mentioned above, such as business districts and shopping centres. It would also include other sources of vehicles, such as industrial parks.

Since the publication of the TERM, TfL have been working with stakeholders, including boroughs, to develop this concept further. The impact of LENs will depend on their area, the main cause of pollution, and the extent of the measures selected for that neighbourhood. Most LENs are likely to need to be promoted and developed by boroughs. Potential LEN measures are listed in Table 2.4. Many of the suggested measures described in would not have a significant individual impact on emissions (although there are many other benefits associated with measures such as public realm improvements), but collectively they could have more significant local impacts.

Table 2.4 Potential measures for a typical low emission neighbourhood (LEN)

Category	Potential measures
Parking and charging infrastructure	- Workplace parking levies - Workplace charging facilities, including mobile charging units - Preferential parking for LEVs - Emissions based parking charges (parking permits, public on street, and/or public car parks) - Additional charging infrastructure (eg on street, at home) - Inductive charging networks
Low emission vehicles	- Geofencing 'hard' or 'soft' zone - LEV loans (similar to existing travelcard or bicycle loans) - LEV in car clubs (including vans for businesses) - 'Try before you buy' schemes for LEV - Neighbourhood ULEZ - Micro-ULEZ (eg key shopping roads at certain times) – potentially zero emission
Efficient operation	- Freight Management Plan (with survey) and use of microconsolidation through cycle freight or electric freight deliveries - Local implementation of Green Fleet scheme (eg amended FORS, ULEZ badging or ECOStars) - Anti-idling campaign - Optimising traffic signals to reduce emissions - Geofencing technology to switch on zero emissions mode of hybrid buses and taxis within hotspot areas
Engagement	- Schools engagement, eg Clean Air for Schools (CA4S) - School cycling training and events - Community engagement - Business engagement, eg CityAir - Workplace cycle challenge
Procurement	- Including emission standards and/or efficient operation in contracts let by the LA and a large proportion of local businesses
Smarter travel initiatives (with minimum numbers)	- Personalised travel plans - Corporate and Community travel plans - Installing cycling infrastructure - Smarter driving training - Encouraging cycling, through cycle training, Dr Bike, etc.

Category	Potential measures
	- Travel Campaign (where cars are a major source), eg Colchester and Kendal - Free car club membership - Car free days

Ultra low emission vehicle delivery plan for London

In July 2015, TfL published an Ultra Low Emission Vehicle (ULEV) Delivery Plan for London with the stated aim of making London the ULEV capital of Europe. It is recognised that travel by car is still needed for many journeys and encouraging ULEVs is a critical next step towards delivering a fully sustainable transport system for London[28]. ULEVs include battery electric vehicles (BEVs), plug-in hybrid vehicles (PHEVs), range-extended electric vehicles (RE-EVs) and hydrogen fuel cell electric vehicles (FCEVs). TfL has created a 15 point action plan to help stimulate uptake of ULEV's in the capital, shown in Table 2.5.

Table 2.5 TfL Ultra Low Emission Vehicle delivery plan for London

Action	Title	Summary
1	Support stakeholders' aspirations for expanding Source London	TfL will call on Bluepoint London (BPL), boroughs and charge point manufacturers to work together to deliver a reliable, open and accessible Source London network. BPL wants to increase the number of charge points to 6,000 by 2018.
2	Identify priority charging and refuelling infrastructure locations, based on research and stakeholder insight	TfL's research will be compiled into one strategic guidance document that will help public or private organisations which are installing charging/ refuelling infrastructure to ensure the right infrastructure is provided in the right locations, serving all ULEV users.
3	Work with car clubs to achieve a target of 50 per cent ULEVs in the London car club fleet by 2025	Through the Car Club Coalition, a working group has been set up to overcome the barriers to introducing ULEVs into car club fleets and share best practice and solutions. TfL will support and encourage the car club industry to achieve 50 per cent ULEVs in their fleets by 2025.
4	Deploy 1,000 vehicles in GLA Group fleets, including 120 ULEVs in TfL support fleet	TfL will develop an implementation plan to outline how we will achieve the target of 120 ULEVs in the TfL fleet.
5	Increase public awareness and acceptance of ULEVs	TfL will pilot a fleet audit programme in London boroughs, providing participating boroughs with a comprehensive report of the benefits of different fleet management options (such as leasing, rental and car clubs) which will include benefits of ULEVs, from winter 2015/spring 2016. In the medium term and subject to the success of upgrading fleets to include ULEVs, TfL will roll out the fleet audit programme to businesses in the private sector from early 2017.
6	Deploy a rapid charge point network	TfL will work with private hire and other commercial operators such as car clubs to understand their needs for rapid and other charging infrastructure (autumn 2015), issue an Official Journal of the European Union (OJEU) invitation in autumn 2015 and work with suppliers to deliver a network of 150 rapid charge points by 2018
7	Provide charging solutions for residents without off-street parking	TfL will encourage and support boroughs to sign up to the OLEV funding programme to provide on-street residential charging for ULEV owners and provide guidance and technical support on the charging options for on-street charge points (research report to be published by autumn 2015).
8	Offer attractive incentives to stimulate ULEV uptake	TfL will review the Ultra Low Emission Discount (ULED) requirements as emission standards improve so only the cleanest vehicles are incentivised, ensure the revised London Plan includes sufficient minimum requirements for charging infrastructure at new developments and place ULEVs at the centre of future Mayoral transport strategies for delivering a sustainable transport future for London.
9	Support the implementation of local air quality schemes	TfL will provide funding, data and guidance for boroughs to develop LENs.

[28] TfL (2015) An Ultra-low Emission Vehicle Delivery Plan for London: Cleaner vehicles for a cleaner city

Action	Title	Summary
10	Streamline the ULEV and charging infrastructure procurement processes	TfL will develop a new infrastructure procurement framework that is open to established and new entrants to the charge point market and provides best value for procurers in the GLA Group. The new framework will be in place by the second quarter of 2016. Develop a strategy for rolling out a cohesive charge point network across the TfL estate for the benefit of the whole organisation, by the end of 2015. Provide guidance and support to boroughs and other public sector organisations that are planning the procurement and distribution of ULEVs and supporting infrastructure. This assistance will be provided through workshops and stakeholder engagement during the second half of 2016.
11	Achieve zero emission capable taxis and PHVs on London's streets from 2018	TfL will continue to work closely with stakeholders to understand the needs of the trade and the plans of manufacturers to ensure suitable charging infrastructure is available, including rapid charging (Action 6) and residential charging options (Action 7).
12	Increase the uptake of ULEVs in freight and fleet organisations	TfL will implement the Low Emission Commercial Vehicle (LECV) Programme, starting with a scoping and feasibility exercise from summer 2015, use experience of setting FORS standards as a foundation for new voluntary environmental standards for commercial fleets and lead by example through procurement requirements, inform and support fleet operators, boroughs, vehicle manufacturers and cleaner fuel suppliers to increase the availability and uptake of LECVs and their fuel needs, and prepare the freight industry for the introduction of the ULEZ in 2020.
13	Demonstrate and test new technologies and approaches	TfL will trial innovative ULEV solutions, with a particular focus on solving the challenges of the demands on the electricity distribution network and reducing the space needed for infrastructure, from 2016 and continue to take part in new EU projects that focus on ULEV uptake and charging solutions.
14	Test and evaluate the application of geofencing for zero emission capable vehicles	TfL will continue to evaluate geofencing and engage with Zero Emission Capable (ZEC) taxi manufacturers to understand the technological feasibility and cost/benefits of geofencing for taxis.
15	Ensure London is ready for the commercialisation of hydrogen transport	TfL will use future funding opportunities to increase the deployment of hydrogen vehicles in the TfL fleet and encourage other public bodies to do the same, continue to lobby UK government for sector support and include hydrogen as a viable option for a zero emissions future for London policy, and support creation of policy and standards for forecourt integrated hydrogen refuelling stations.

London LAQM

The LAQM regime has been reviewed and updated to reinvigorate the process and drive efforts to tackle poor air quality. It has been estimated that in 2013, 43% of roads kilometres exceeding EU limit values for NO_2 in the UK were located in London[29]. Given the importance of improving air quality in London new London-specific arrangements for LAQM have been developed.

The Mayor of London and London boroughs (including the City) both have duties under EU law to take such measures as are appropriate and within their powers to comply with the Air Quality Directive, and to bring to an end any infraction of it. The Mayor has his own powers independently undertake to air quality reviews and assessments. He also has extremely broad powers of direction over the boroughs, following consultation with them and with regard to guidance issued by the Secretary of State. He may direct them as to the performance of their LAQM functions and may direct them to take such steps he considers appropriate to implement the Air Quality Directive or to bring the current infraction of that Directive as regards NO_2 limit values in their areas to an end, as compliance with the Directive is an obligation of the UK under the EU Treaties.

The Mayor also has powers to do anything which is calculated to facilitate, or is conducive or incidental to, the exercise of any of his air quality functions. This could include him giving guidance to the boroughs as to how they are expected to discharge their LAQM functions; the Mayor could use his powers of direction to require boroughs to have regard to that guidance.

[29] Defra (2015). Plans to improve air quality in the UK Tackling nitrogen dioxide in our towns and cities UK Overview Document

The new London LAQM (LLAQM) regime is intended to reduce unnecessary reporting burdens whilst facilitating regular monitoring and assessment of air quality. The new approach aims to encourage cooperation and knowledge transfer between boroughs and prioritise the implementation of the most effective actions to improve air quality.

The changes to the LLAQM process to be followed by local authorities in the new LLAQM regime can be divided into four overarching issues:

- USAs and Further Assessments have been removed. Boroughs are only required to submit Annual Status Reports. Reports include a new public facing 1-2 page Executive Summary – updating on headline concentrations and key actions, for boroughs to publish locally;
- AQMAs are retained. Instead of lengthy Updating and Screening Assessment (USA) reports, boroughs are required to review their AQMAs every four years only if monitoring data indicates a significant change over the past four years. Boroughs are provided with maps and information to assist with this basic desktop re-assessment. As AQMAs usually cover the whole borough, there is also a new emphasis on concentrating action in Air Quality Focus Areas where possible (as well as an opportunity for boroughs to nominate their own local hotspot areas as Focus Areas);
- Action Planning. The requirement for Action Plans is retained, but with clearer obligations on boroughs to deliver and regularly review action, and with more guidance, support, and information provided to assist; and
- New Guidance. London-specific policy and technical guidance has been provided to cover the above changes[30].

Production of action plans will be supported by the provision of a matrix of actions suitable for implementation by local authorities in London. This will reduce the reporting effort, and standardise the action plans across all authorities to make comparison, appraisal and dissemination of good practice easier. The impact of the measures themselves has been assessed and reported as part of the development of the Air Quality Action Matrix. The matrix of possible measures is included in Appendix A. These measures draw together other policies, such as enforcement of policies detailed in GLA SPGs, LENs, and ensuring engagement with Departments of Public Health. The plans for the LLAQM regime were consulted upon in 2015[31].

2.4 Local

OPDC opportunity area planning framework

The OPDC draft Opportunity Area Planning Framework (OAPF)[32] provides supplementary detail to the planning policies contained within Mayor of London's Further Alterations to the London Plan (2014) in the form of Supplementary Planning Guidance. It is proposed that the OAPF would be adopted as SPG to the London Plan.

The OAPF sets out an ambitious vision and planning guidance to capitalise on future transport improvements to deliver transformative change at Old Oak, regeneration of Park Royal and continue the protection of Wormwood Scrubs. Policy E3, Air Quality, states that proposals should:

- Minimise the generation of air pollution, both during and post construction, making new developments 'air quality neutral' or better; and

[30] Mayor of London (2016). London Local Air Quality Management (LLAQM) Policy Guidance 2016 (LLAQM.PG (16))
[31] GLA (2015) Consultation on proposals for a new London Local Air Quality Management system (LLAQM) - https://www.london.gov.uk/priorities/environment/consultations/consultation-on-proposals-for-a-new-london-local-air-quality-0
[32] OPDC (2015) Opportunity Area Planning Framework Adopted November 2015 - https://www.london.gov.uk/sites/default/files/oapf_for_web.pdf

- Achieve EU established health-based standards and objectives for a number of air pollutants (NO_X, PM_{10} and $PM_{2.5}$).

It is stated that longer-term improvements to air quality (and other benefits such as urban cooling) can also be delivered through a strategic approach to the provision of trees in the public realm which considers the form and structure of the canopy and how groups or avenues of trees interact with the open space network to create 'breeze pathways' that optimise air flow. The Green Infrastructure policy, E5, states that proposals should help reduce temperatures in hot weather and intensification of the urban heat island effect through providing shading and evaporative cooling and green and brown roofs and walls.

The energy strategy for the Old Oak and Park Royal area will have important implications for emissions from new developments. Policy E4, Energy, states that proposals should ensure that Old Oak and Park Royal area is an exemplar of low carbon development and commit to achieving the highest standards of energy efficiency and low/zero carbon technology.

Dust emissions

Existing uses at Old Oak include a number of industrial and waste recycling plants as well as other significant sources of emissions. The reconfiguration of the area is likely to see an improvement in current air quality issues.

It is stated that future dust emissions will be associated with activities including vehicular movements, site preparation, demolition, works and the use of haul routes within areas of construction. For example, dust concentrations are particularly acute near high density housing 20 meters to the east of the land required for construction on Stephenson Street. Two localities, Midland Terrace and Wells House Road are partially encircled by construction compounds at Old Oak Common Station, Old Oak Common Lane underbridge satellite compound and Victoria Road tunnel drive main compound. It is anticipated that the main dust-generating activities will occur at the construction compounds at Old Oak Common, Atlas Road, Victoria Road and Willesden Euroterminal. Mitigation measures will need, as a minimum, to be in accordance with the Control of Dust and Emissions from Construction and Demolition SPG.

Road traffic

It is recognised that road traffic is one of the main sources of existing air pollution in the area. As such, mechanisms for minimising air pollution are closely tied to the principles of the transport strategy. This aims to encourage use of public transport, walking and cycling and minimise the number of trips by private vehicle. Developers will be required to undertake strategies that assess baseline air quality levels, set targets for new air quality levels, monitor this during and post construction and take action if these targets are exceeded. It is also stated that new employment uses are required to demonstrate how they maximise the use of the Grand Union Canal and rail network for freight transport purposes.

Policies in the Transport Strategy chapter, which aims to maximise use of walking, cycling and public transport while minimising the number of additional vehicle trips, should help to mitigate some of the negative impacts on air pollution. Of particular importance is the parking policy which restricts the number of parking spaces as the modelling for the Old Oak Common Strategic Transport Study (OOC STS)[33] indicated that the road network would not be able to accommodate additional development related traffic unless parking was restricted to very low levels. The relevant policies are detailed in Table 2.6.

Table 2.6 OAPF traffic policies

Policy	Detail
T1: Rail and Underground	Proposals should: a. Deliver a state of the art rail station at Old Oak Common, providing interchange between HS2, Crossrail 1 and the Great Western Main Line; b. Provide new London Overground station(s) and supporting infrastructure;

[33] TfL (2015) Old Oak Common Strategic Transport Study

Policy	Detail
	c. Provide substantial capacity improvements to existing London Underground and Overground stations, particularly Willesden Junction and North Acton; d. Ensure that the impact on existing rail infrastructure is minimised during construction.
T2: Roads	Proposals should: a. Develop a network of new roads and streets to cater for the needs of all users, including measures to give priority to pedestrians, cyclists and buses, and to provide improved east-west and north-south connectivity; b. Ensure that roads in and around Old Oak and Park Royal can support development while maintaining capacity and reliability for strategic transport movements on an already heavily used network; c. Manage the cumulative impact of developments in west London on the A40 and A406 corridors, particularly on key junctions along these corridors including Hanger Lane, Gypsy Corner, Savoy Circus and Wood Lane; d. Provide appropriate links to, and improve junctions with the strategic road network; e. Provide sufficient capacity to enable the bus network to function effectively and for freight and site traffic to access and egress the site; f. Improve management of traffic on the existing network; g. Enhance existing highway infrastructure; h. Create new local links to the road network; and i. Create a legible, permeable and accessible network of streets for all users.
T3: Car Parking	Proposals should: a. Provide no car parking for new commercial development apart from parking for disabled people; and b. Provide no more than 1 car parking space per 5 residential units with priority given to disabled residents.
T4: Taxis, Private Hire and Coaches	Proposals should provide suitable facilities to cater for anticipated demand from taxis and coaches.
T5: Buses	Proposals should: a. Provide increases in bus frequencies on existing routes and introduce new and extended bus routes through the new development area; and b. Provide improvements to bus infrastructure.
T6: Walking and Cycling	Proposals should: a. Create a high quality pedestrian and cycle network of streets across the development area with a high level of segregated cycle infrastructure; b. Provide high quality cycling provision in line with the Mayor's Vision for Cycling and the adoption of best practice from the 'Mini Holland' projects; c. Connect to existing and planned pedestrian and cycle links in the wider area; d. Ensure that all key destinations including public transport interchanges, local centres, schools and community facilities are fully accessible on foot and by cycle; and e. Provide cycle parking in accordance with of in excess of emerging London Plan standards.
T7: Construction Freight, Deliveries and Servicing	Proposals should: a. Make maximum use of rail and water transport during the construction period, including removal of excavated material, and for servicing and deliveries; b. Co-ordinate and phase construction projects to enable the transport impacts to be effectively managed; c. Manage servicing and deliveries in line with best practice to minimise the impact on the surrounding road network; d. Support the provision and operation of measures to reduce freight trips and promote cleaner vehicles (e.g. consolidation centres).

Brent, Ealing and Hammersmith and Fulham Planning Policies

Brent

The Brent Core Strategy[34] sets out the spatial vision of how Brent should be in 2026 and how this will be achieved. This Core Strategy, a 15 year spatial planning strategy guided by sustainable development principles, adopted on 12th July 2010 by Brent Council, was the first of a suite of Development Plan Documents (DPD) forming the Local Development Framework (LDF). It is stated that Brent must develop an approach which can accommodate a population increase without exacerbating existing localised environmental problems, such as poor air quality. The importance of securing adequate green infrastructure and delivering high design quality buildings and spaces to build a sustainable and enduring environment (e.g. tree planting, Sustainable Urban Drainage systems and living roofs) is highlighted.

Two core policies within the Brent Core Strategy address air quality issues in the Borough of Brent:

CP 13: North Circular Road Regeneration Area

In order to respond to the poor, and worsening, living conditions along the North Circular Road and to enhance the image of the borough, the council will:

- Bring forward proposals that remove the houses most affected by noise and air pollution, with priority to those on the St Raphael's Estate facing the NCR while ensuring no net loss of homes;
- Use developments such as at Unisys/Bridge Park and Wembley Point to offer new focal points that also assist in providing alternative homes;
- Use small infill sites on the St Raphael's Estate to relocate some homes;
- Work with TfL to improve junctions, notably at Brentfield Road;
- Create cycle paths and environmental barriers/open space on the dwellings removed; and
- Bring forward more detailed area plans to identify areas of change.

CP 19: Brent Strategic Climate Change Mitigation and Adaptation Measures

- Major proposals (10 or more dwellings and 1,000m² or more floor space) and proposals for sensitive uses (education, health and housing) in Air Quality Management Areas, should submit a Sustainability Statement demonstrating, at the design stage, how sustainable design and construction measures are used to mitigate and adapt to climate change over the intended lifetime of a development. This includes the application of the London Plan energy hierarchy and meeting or exceeding the London Plan targets.

Strategic Objective 10, *Achieving Sustainable Development including mitigating and adapting to climate change* states that this will be achieved by promoting mixed use, mixed tenure development in growth areas integrating infrastructure and housing provision and reducing energy demand from current building regulation standards, particularly in growth areas and by achieving exemplar low carbon schemes and Combined Heat and Power plants.

Ealing

The Ealing Core Strategy[35] sets out the spatial vision of how the borough should be in 2026 and how this will be achieved. To support this growth, Ealing Council will develop and maintain a clear infrastructure delivery plan that will ensure the necessary physical, social and green infrastructure and services are provided and enhanced. The strategy lays out a range of policies related to air quality within the borough, in particular, Policy 1.1 *Spatial Vision for Ealing 2026*, the Council aims:

[34] London Borough of Brent (2010) Core Strategy - Adopted 12th July 2010

[35] London Borough of Ealing (2012) Development Strategy 2026 Development Plan Document Adopted 3rd April 2012

- To protect and enhance the pattern of green spaces and green corridors, identify and safeguard quiet areas and spaces of relative tranquillity and ensure that new development improves and adds to green space.
- To reduce the environmental impact of activities within the borough, protecting and improving air quality and ambient noise levels, achieving and maintaining a clean and healthy environment for all communities to enjoy.
- To promote sustainable design and construction in all development to play our part in addressing the global challenge of climate change.

In Policy 3.1, *Realising the potential of the A40 Corridor & Park Royal*, it is stated that the Council aims:

- To enhance greening opportunities along the A40 corridor, develop two cycle hubs in Greenford and Northolt and create new cycle/pedestrian routes parallel to the A40 but separated by trees and shrubs where opportunities exist (e.g. Pitshanger, Perivale, Acton);
- To further explore opportunities for creating a district energy network at Southern Gateway and Greenford town centre; and
- To further explore opportunities to reduce exposure to air and noise pollution for existing residents.

The Ealing Development Sites Development Plan Document (DPD)[36] supports the delivery of the Development Strategy through allocating land for a particular use or type of development. Site allocations seek to deliver specific objectives within the Development Strategy and support/promote proposals for the use of land. The document is organised into sections that reflect these proposed developments, prefaced by an explanatory section regarding the process for site selection and general considerations that apply to all of the allocations.

The Council will promote sustainable design and construction in all development to play their part in addressing the global challenge of climate change. The overarching principles across the development sites for sustainable design include provision of adequate levels of communal and private garden space for residents; any balconies fronting railway lines must achieve acceptable quality and usability standards particularly with regards to noise and air quality, and the provision of accessible roof space or terraces incorporating biodiversity features will be expected in flatted schemes.

Hammersmith and Fulham

The Draft Hammersmith & Fulham Local Plan[37] was published in January 2015. The Local Plan will be used, together with the London Plan, to help shape the future of the borough and to determine individual planning applications and deliver development. It highlights the strategic objectives for the borough, focusing on the key planning issues to be addressed, and include a delivery strategy for achieving these objectives.

Borough-wide Policy CC2 Sustainable Design and Construction

The council will require the implementation of sustainable design and construction measures in all major developments by:

- Implementing the London Plan sustainable design and construction policies to ensure developments incorporate sustainability measures, including, but not limited to, minimising energy use, making the most effective use of resources such as water and aggregates, sourcing building materials sustainably, reducing pollution and waste, promoting recycling and conserving the natural environment;
- Requiring Sustainability Statements (or equivalent assessments such as the Code for Sustainable Homes or BREEAM) for all major developments to ensure the full range of sustainability issues have been taken into account during the design stage; and

[36] London Borough of Ealing (2013) Development Sites Development Plan Document Adopted 10th December 2013
[37] Hammersmith & Fulham Council (2015) Draft Local Plan Regulation 18 Consultation January 2015

- Encouraging the integration of sustainable design and construction measures in all other (i.e. non-major) developments, where feasible.

Borough-wide Policy CC9 Air Quality

The council will seek to reduce the potential adverse air quality impacts of new developments by:

- Requiring all major developments to provide an air quality assessment that considers the potential impacts of pollution from the development on the site and on neighbouring areas and also considers the potential for exposure to pollution levels above the Government's air quality objective concentration targets;
- Requiring mitigation measures to be implemented to reduce emissions, particularly of nitrogen oxides and small particles, where assessments show that developments could cause a significant worsening of local air quality or contribute to the exceedances of the Government's air quality objectives; and
- Requiring mitigation measures that reduce exposure to acceptable levels where developments are proposed that could result in the occupants being particularly affected by poor air quality.

Some other key challenges and solutions related to air quality, noise and dust are outlined in the Council's vision for the future:

- The council will have reduced road traffic generated in the borough and will wherever possible have reduced the impact of other road traffic on the local environment, particularly in terms of noise and air quality impacts. Where the council does not control the roads, for example the busy A4 and A40, the council will have worked with its partners, particularly Transport for London to achieve these aims;
- The council will also have worked with partners to improve transport in the borough, particularly north-south links, as well as the opportunities for cycling and walking, including completion of the riverside walk. Where there is major development the council will have improved access for all, particularly for pedestrians and cyclists; and
- New buildings will be energy and resource efficient and much more of the borough's waste will be sustainably managed. All development in the borough, both buildings an infrastructure will have been designed to support the move to a low-carbon economy and take account of climate change impacts, particularly the risk of flooding. Work towards major developments in the regeneration areas being zero carbon exemplars.

Air Quality action plans

Brent Council considered air quality as part of their LAQM Review and Assessment and declared the majority of the borough as an AQMA, including the areas around Old Oak and Park Royal. In 2005 the Council published its AQAP outlining specific measures to be taken to reduce levels of these pollutants in hotspots throughout the borough[38]. By 2010 the Council had completed 72% of the actions, the remaining actions being either impractical or no longer relevant. The Council will maintain 9 fundamental elements of local air quality management in the new plan. These measures are considered essential for maintaining the reduction in pollution emissions achieved by the former plan and are summarised below in:

- Monitor key air pollutants throughout the borough;
- Reduce emissions to air from industrial installations and waste facilities;
- Implement all feasible options for reducing the impacts of idling engines from commercial and domestic vehicles;
- Implement measures to reduce carbon emissions in accordance with Council Carbon Strategies and promote the uptake of 'Green Deal' once it is introduced;

[38] London Borough of Brent Air Quality Action Plan 2012-2015

- Review all new planning applications for potential air quality impacts and implement controls to limit impacts;
- Implement measures to restrict the burning of waste;
- Work with West London Partners to reduce emissions regionally and work towards limiting pollutant emissions from major infra-structure projects such as HS2 and Crossrail;
- Raise awareness, engage and educate stakeholders and residents about air quality issues; and
- Support Mayoral, Government and EU initiatives to achieve emission reductions in the borough.

Ealing Council considered air quality as part of their LAQM review and assessment and declared its whole borough an AQMA on 14th December 2000. This was required after a review and assessment of air quality within the borough predicted that the levels of two pollutants, PM_{10} (fine particles) and nitrogen dioxide were predicted to fail to meet nationally set objectives. An AQAP was produced in response to this in order to improve air quality in Ealing with the aim of achieving the National Air Quality Objectives[39]. It is inextricably linked to Ealing's Interim Local Implementation Plan and Unitary Development Plan and takes into account the Mayor's Air Quality Strategy and statutory guidance. The policies and proposals within this Action Plan have been grouped into six sections:

- Traffic reduction;
- Reducing the need to travel;
- Promotion of cleaner technologies and alternative fuels;
- Improving environmentally friendly forms of transport;
- Non-traffic measures; and
- Awareness raising.

Hammersmith & Fulham Council declared its whole borough an AQMA in November 2000. An AQAP was produced in response to this in order to improve air quality with the aim of achieving the National Air Quality Objectives[40]. Themed actions to tackle local air pollution were developed. Whilst all of these areas are considered to be key sections of the AQAP, are ordered according to their estimated potential in effecting improvements to local air quality. They are:

- Reducing emissions at source through use of cleaner, more efficient vehicles and fuels and controlling emissions from building and construction site;
- Reducing the need to travel by using planning to enable better access to goods, services and activity centres;
- Encouraging a switch to less polluting forms of transport by working with public transport providers and utilising planning to provide for opportunities to access goods, services and activity centres other than by car;
- Making more efficient use of road transport by providing for and encouraging more resource effective road transport;
- Taking other measures to reduce road traffic through effective traffic management in consensus with local communities; and
- Raising awareness of the links between air quality, health and transport by continually and consistently explaining the interrelationships of transport use, air quality and health issues.

Hammersmith & Fulham Council has established a resident led Air Quality Commission that will recommend actions for inclusion in a new AQAP.

[39] London Borough of Ealing Air Quality Action Plan
[40] Hammersmith & Fulham Air Quality Action Plan

HS2 code of construction practice

The HS2 Code of Construction Practice (CoCP) contains control measures and the standards to be implemented throughout Phase One of the HS2 project including at the Old Oak Common station[41]. It is stated that site specific control measures will be included within Local Environmental Management Plans (LEMPs) to be developed following consultation with the relevant stakeholders. Across all HS2 construction sites contractors will be required to manage dust, air pollution, odour and exhaust emission during the construction works in accordance with Best Practicable Means (BPM). This will include the following as appropriate:

- Reference to the general site management and good housekeeping procedures (relevant to limiting dust and air pollution);
- Controls and measures to control or mitigate the effect of potential nuisance caused by the construction works;
- Dust and air pollution monitoring measures to be employed during construction of the project; and
- Measures relevant to control risks associated with asbestos dust.

The dust control measures detailed in the CoCP are similar to those in the Institute of Air Quality Management (IAQM) *Guidance on the assessment of dust from demolition and construction*[42] and GLA Supplementary Planning Guidance on *The Control of Dust and Emissions during Construction and Demolition*[20].

It is intended that excavated material from the HS2 project will be transported to railheads at Park Royal/Willesden. It is proposed that 86% of this material will be used on the HS2 project, but the material will need to be sorted for delivery, which may take place at Park Royal. There will be high volumes of excavated material in the early years of the project, from 2017. Sorting and transfer of excavated material has the potential to generate significant dust and particulate emissions. It is essential that this is fully considered in the LEMPs to ensure that current and future residents and businesses of the area are not adversely affected by the project.

[41] HS2: London-West Midland Environmental Statement, Volume 5 Technical Appendices. Draft Code of construction practice (CT-003-000). November 2013

[42] IAQM: Guidance on the assessment of dust from demolition and construction. February 2014.

3. Existing Air Quality

3.1 AQMAs

During the LAQM Review and Assessment process carried out by LBB, LBE and LBHF, areas within each borough were identified with relevant public exposure in which the AQOs for annual mean NO_2 (40 μgm^{-3}) and 24-hour mean Particulate Matter (PM_{10} – 50 μgm^{-3} not to be exceeded more than 35 days per year) were likely to be exceeded. As a result, the Councils designated AQMAs for these pollutants. The Old Oak and Park Royal area straddles these AQMAs. As traffic is the most important source in the area, followed by industrial sources, NO_2 and PM_{10} are the key pollutants to consider.

3.2 Monitoring

Continuous monitors

In 2014 there were six automatic air quality monitoring sites in the vicinity of the Old Oak and Park Royal area, located in the boroughs of Brent and Ealing.

Table 3.1 shows the location of the automatic monitors in the area and the classification type. Table 3.2 shows the monitored concentrations of NO_2 and PM_{10} for 2012 to 2014, available from the London Air Quality Network (LAQN). Figure 3.1 shows the location of the continuous monitors with relation to the Development Site. The Western Avenue monitor is the only one within the administrative area of the OPDC.

The results from 2012 to 2014 show that the NO_2 annual mean has remained above the AQO of 40 μgm^{-3} at the Western Avenue (annual mean concentration of 66 μgm^{-3} recorded in 2014) and Hangar Lane Gyratory (annual mean concentration of 68 μgm^{-3} recorded in 2014). This is a result of the location of these monitors on the side of busy roads in the area. These monitors did not record over eighteen exceedances of 200 μgm^{-3} in 2014, so the 1-hour AQO was not exceeded. The monitors at Horn Lane, and Neasden Lane recorded exceedances of the PM_{10} 24-hour mean AQO between 2012 and 2014. These exceedances are a result of industrial and waste management activities and associated and other traffic that generate particulate emissions in these areas.

Table 3.1 Automatic monitoring sites in development area

Local Authority	Site Name	Classification Type	X (m)	Y (m)	In AQMA?
Ealing	Ealing – Western Avenue	Roadside	520430	181950	Y
Ealing	Ealing – Hangar Lane Gyratory	Roadside	518537	182708	Y
Ealing	Ealing – Horn Lane	Industrial	520432	181428	Y
Brent	John Keble Primary School	Roadside	521619	183554	Y
Brent	Ikea	Roadside	520866	185169	Y
Brent	Neasden Lane	Industrial	521511	185204	Y

Table 3.2 Summary of automatic NO_2 and PM_{10} monitoring data

Site Name	Pollutant	2012 annual mean (µg m^{-3})	2013 annual mean (µg m^{-3})	2014 annual mean (µg m^{-3})
Ealing – Western Avenue	NO_2	N/A	N/A	**66** (17)
Ealing – Western Avenue	PM_{10}	N/A	N/A	29 (25)
Ealing – Hangar Lane Gyratory	NO_2	**95 (173)**	**74 (56)**	**68** (8)
Ealing – Hangar Lane Gyratory	PM_{10}	29 (18)	30 (19)	28 (16)
Ealing – Horn Lane	PM_{10}	34 **(49)**	38 **(76)**	34 **(55)**
Brent - John Keble Primary School	PM_{10}	24 (11)	25 (10)	N/A
Brent - Ikea	NO_2	**76 (32)**	N/A	N/A
Brent - Ikea	PM_{10}	33 (35)	34 **(38)**	29 (26)
Brent - Neasden Lane	NO_2	**44** (0)	N/A	N/A
Brent - Neasden Lane	PM_{10}	39 **(82)**	33 **(42)**	N/A

Brackets show the number of exceedances of the 1-hour mean AQO for NO_2 and the 24-hour mean AQO for PM_{10}
Exceedances shown in **bold**

Diffusion tube monitoring

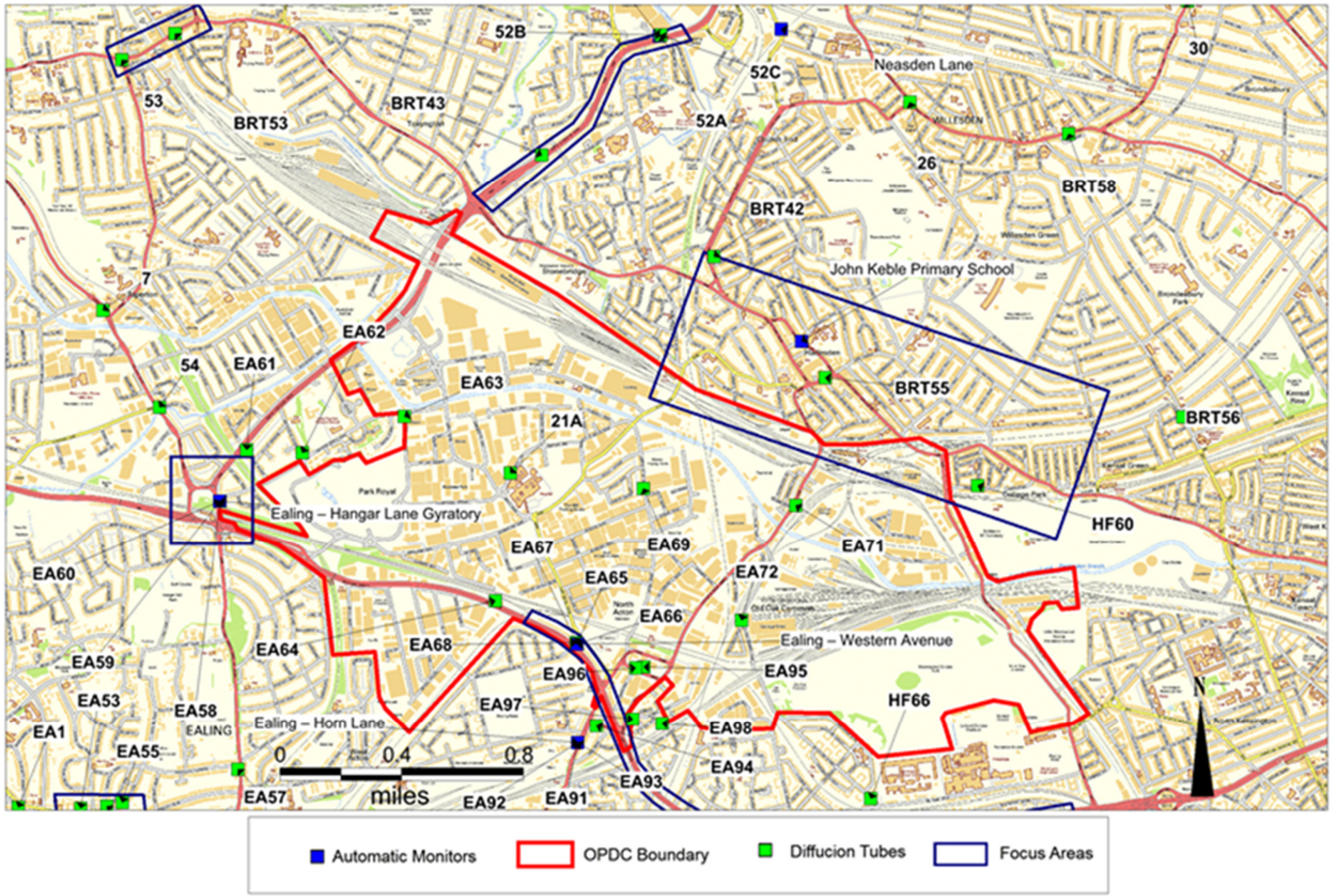
The local authorities also monitor NO_2 concentrations using the passive diffusion tube method. The locations of the monitoring sites nearest to the Old Oak and Park Royal area and their classification are given in Table 3.3. The bias-adjusted concentrations monitored for the years 2011-2014 are shown in Table 3.4 and bias adjustment factors are shown in Table 3.5. Figure 3.1 shows the nearest continuous and passive monitors. Eight of these sites are within the Old Oak and Park Royal area.

Table 3.3 Location details of passive monitoring sites near to the site

Local Authority	Site Name	Classification Type	X (m)	Y (m)	In AQMA?
Ealing	EA63	Near Road	519515	183155	Y
Ealing	EA64	Near Road	519997	182178	Y
Ealing	EA67	Roadside	520430	181950	Y
Ealing	EA69	Near Road	520780	182775	Y
Ealing	EA71	Roadside	521587	182684	Y
Ealing	EA72	Roadside	521301	182076	Y
Ealing	EA94	Near Road	520532	181517	Y
Ealing	EA95	Near Road	520783	181830	Y
Ealing	EA96	Roadside	520739	181824	Y
Ealing	EA97	Roadside	520724	181552	Y

Local Authority	Site Name	Classification Type	X (m)	Y (m)	In AQMA?
Ealing	EA98	Background	520880	181531	Y
Brent	7	Roadside	517921	183716	Y
Brent	21A	Roadside	520078	182857	Y
Brent	53	Roadside	518020	185043	Y
Brent	54	Roadside	518221	183206	Y
Brent	BRT42	Roadside	521155	184002	Y
Brent	BRT43	Roadside	520242	184541	Y
Brent	BRT53	Roadside	518303	185181	Y
Brent	BRT55	Roadside	521743	183361	Y
Brent	BRT56	Roadside	523635	183153	Y
Brent	52A	Roadside	520874	185173	Y
Hammersmith	HF44	Urban Background	522479	180656	Y
Hammersmith	HF63	Urban Background	522548	180960	Y
Hammersmith	HF66	Urban Background	521984	181132	Y
Hammersmith	HF60	Urban Background	522550	182790	Y

Figure 3.1 Diffusion tubes and automatic monitors in relation to the OPDC boundary and focus areas



Of the 23 diffusion tubes, only EA63, EA69, HF44 and HF66 demonstrate annual average NO_2 concentrations below the annual mean NO_2 AQO in all monitored data, showing that this AQO is regularly exceeded at the majority of locations in the area. Location EA69 was the only monitoring location within the Old Oak and Park Royal area where exceedances of the NO_2 annual mean AQO have not been recorded.

High NO_2 concentrations have been linked with high numbers of Heavy Duty Vehicles (HDVs) in some areas (e.g. Old Oak Lane, diffusion tube EA71, where the 2014 annual mean NO_2 concentration was 53.0 µg m^{-3}) and high levels of congestion in others (e.g. North Acton, diffusion tubes EA94-97 2014 annual mean concentrations were between 40.5 µg m^{-3} and 43.2 µg m^{-3}). Analysis detailed in the Old Oak Common OOC STS[33] confirms that a number of roads and junctions have volumes of traffic that are close to or exceeding their capacity. In particular, strategic routes such as the A40 and A406 are under stress. Junctions on the A40 such as Gypsy Corner, Savoy Circus and Hanger Lane are congested, particularly at peak periods. In addition to the exceedances described at roadside monitors, a significant proportion of monitors located in background locations, have recorded exceedance of the NO_2 annual mean AQO over the past 3 years (HF60, HF63 and EA98), showing that mitigation measures should seek to reduce overall emissions as well as focus on particular locations.

Table 3.4 Passive monitoring data of annual average NO_2 concentration (µgm^{-3}), 2012-2014

Local Authority	Site Name	2012	2013	2014
Ealing	EA63	N/A	N/A	34.4
Ealing	EA64	**56.0**	**59.3**	**56.0**
Ealing	EA67	**74.5**	**67.6**	**70.6**
Ealing	EA69	38.9	34.2	35.5
Ealing	EA71	**51.1**	**50.5**	**53.0**
Ealing	EA72	N/A	N/A	**41.3**
Ealing	EA94	**46.6**	**41.9**	**40.9**
Ealing	EA95	N/A	N/A	**40.5**
Ealing	EA96	N/A	N/A	**43.1**
Ealing	EA97	**44.8**	**44.7**	**43.2**
Ealing	EA98	**40.3**	33.7	36.5
Brent	7	**59.7**	**71.2**	**64.8**
Brent	21A	**47.1**	**49.5**	**45.1**
Brent	53	**66.9**	**64.4**	**58.6**
Brent	54	**49.7**	**47.0**	**42.8**
Brent	BRT42	**45.1**	**48.5**	**44.1**
Brent	BRT43	**64.2**	**66.9**	**60.9**
Brent	BRT53	**64.8**	**75.0**	**68.3**
Brent	BRT55	**76.2**	**70.4**	**64.1**
Brent	BRT56	**75.2**	**70.1**	**63.8**
Brent	52A	**102.8**	**104.1**	**94.7**

Local Authority	Site Name	2012	2013	2014
Hammersmith	HF44	35.0	37.9	29.6
Hammersmith	HF63	**56.0**	**65.2**	**56.1**
Hammersmith	HF66	33.0	38.1	33.2
Hammersmith	HF60	N/A	**42.8**	39.2

Exceedances shown in **bold**

Table 3.5 Bias adjustment factors of annual average NO_2 concentration (μgm^{-3}), 2012-2014

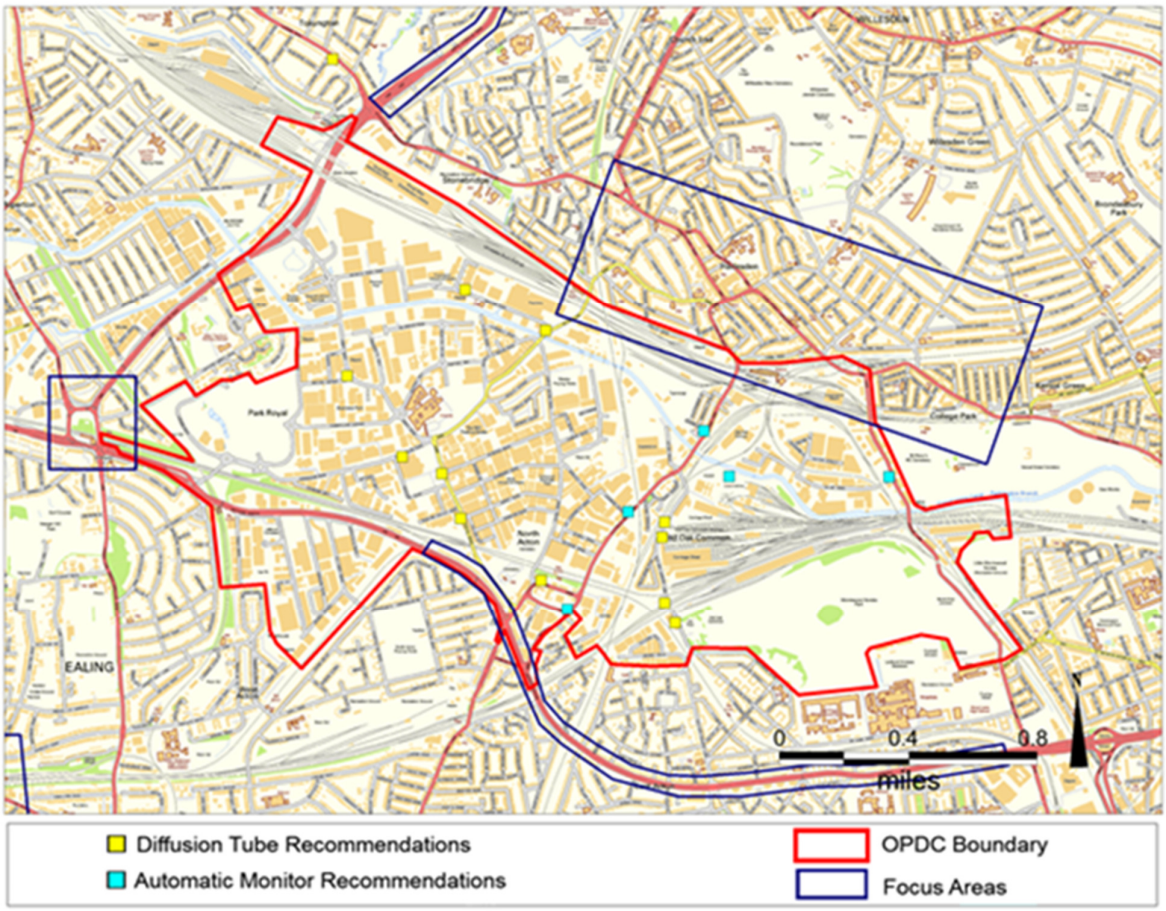
Borough	Bias Adjustment Factor 2012	Bias Adjustment Factor 2013	Bias Adjustment Factor 2014
LBHF	1.01	1.14	1.03
LBE	0.96	0.76	0.78
LBB	1.01	1.00	0.91

Monitoring recommendations

There is currently a good network of NO_2 diffusion tubes inside and surrounding the Old Oak and Park Royal area. However, there is a need for further monitoring in certain areas in order to increase knowledge of air quality across the area and to enable applicants to verify their dispersion modelling when they are preparing air quality assessments in support of planning applications. It is therefore recommended that:

- Installation of new automatic monitors with equipment to monitor NO_2 and PM_{10} on the main A-Roads in the area (Old Oak Lane, Victoria Road and Scrubs Lane) should be considered as these provide the highest quality data and there is only one automatic monitor in the area at present;
- Installation of a new automatic monitor in an urban background location (An urban location distanced from sources and therefore broadly representative of city-wide background conditions, e.g. urban residential areas) should be considered;
- Creation of new NO_2 diffusion tube sites on roads in the area (Old Oak Lane, Victoria Road, Scrubs Lane, Acton Lane, Park Royal Road, Coronation Road and Waxlow Road) should be considered to improve the spatial distribution of monitoring sites across the area;
- Increased monitoring of pollutant concentrations around Old Oak Common should be considered in view of the potential HS2 station development and concerns around NO_2 concentrations near to the railway lines;
- Increased monitoring of pollutant concentrations on A40 Westway and/or A404 Harrow Road should be considered depending on potential routes for construction related traffic (including HS2 links with Park Royal); and
- Developers should carry out monitoring around construction sites in accordance with the requirements of The Control of Dust and Emissions during Construction and Demolition SPG and emerging best practice. Where there are multiple sites under development at the same time collaborative approaches to local monitoring should be considered.

Figure 3.2 Recommended automatic monitor and diffusion tube locations in and around the OPDC boundary



3.3 Focus areas

It has been noted that general actions applied to whole local authority areas may have little impact on specific localised areas of poor air quality and may preclude certain measures that would be very effective in reducing local concentrations. In view of this, 187 Air Quality Focus Areas in London have been determined by the GLA[43]. These are locations where the EU annual mean Limit Value for NO_2 is exceeded and there is high human exposure. These were defined by the GLA using mapped pollutant concentration, consideration of exposure and local characteristics and local monitoring data. The Focus Areas in the vicinity of Old Oak and Park Royal are shown in Figure 3.3. The details of the Focus Areas within and immediately adjacent to the Old Oak and Park Royal area, at busy junctions and roads, are provided in Table 3.6. Recommendations are made in Section 5 regarding the extent of these Focus Areas in view of potential future land use and exposure to poor air quality.

[43] GLA (2014) http://data.london.gov.uk/dataset/air-quality-focus-areas - Accessed October 2015

Figure 3.3 Focus areas

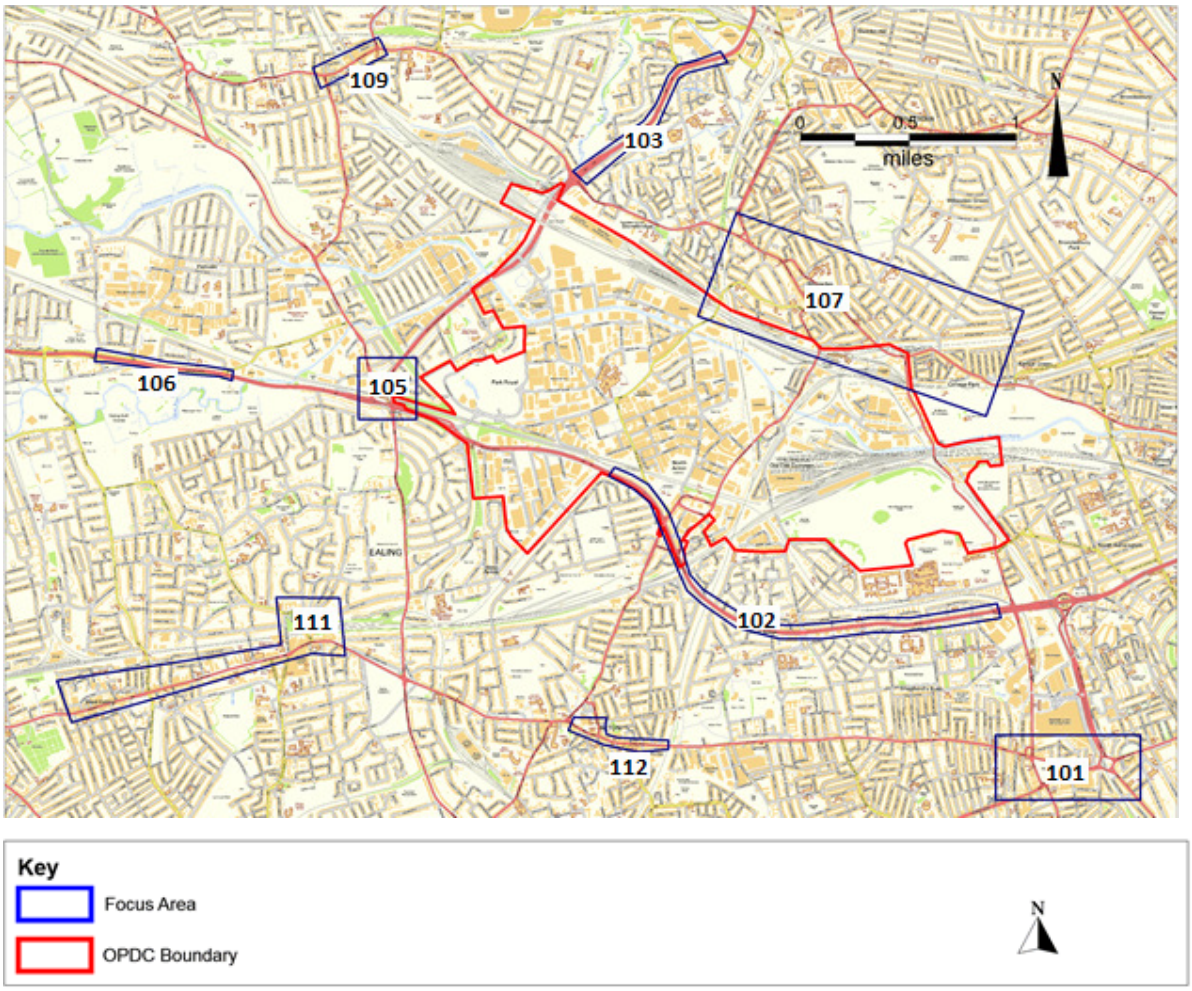


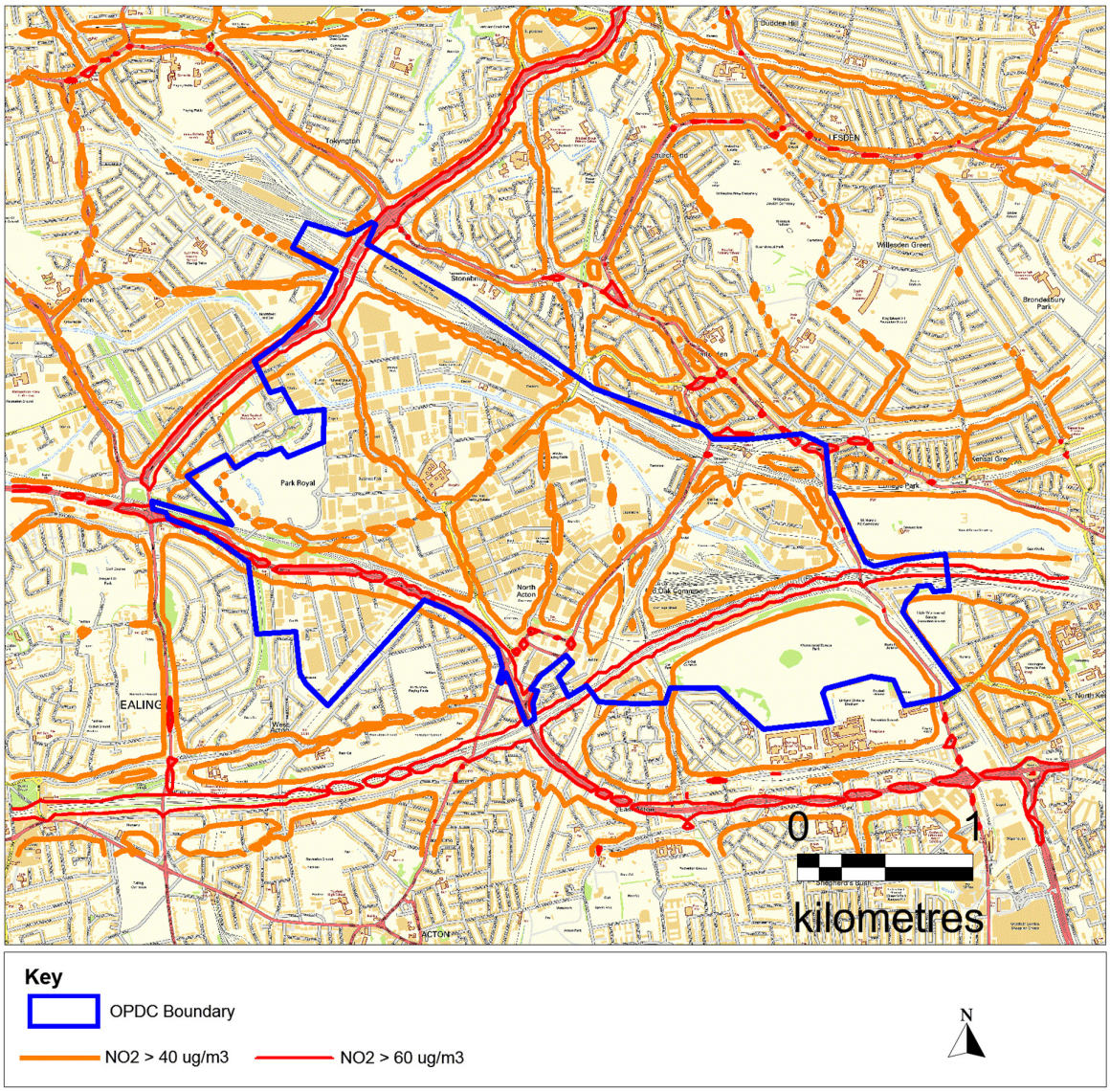
Table 3.6 Focus areas adjacent to the old oak and park royal area

I.D	Sub-region	Borough	Description	Area (km^2)
101	West	LBHF	Holland Park Uxbridge Rd/Shepherd's Bush Road/Bush Green/Holland Rd	0.52
102	West	Ealing	Acton A40 North Acton rail/Gypsy Corner/Sandy Circus/White City	0.35
103	West	Brent	A406 North Circular from Stonebridge	0.14
105	West	Ealing	Hanger Lane Twyford Abbey Road	2.00
106	West	Ealing	Perivale A40 Western Avenue Teignmouth Gardens to Aplerton Lane	0.77
107	West	Brent	Harlesden & Willesden Junction	1.88
109	West	Brent	Wembley High Road from Ealing Road to Park Lane	0.84
111	West	Ealing	Ealing Broadway and Haven Green	0.58
112	West	Ealing	Acton High Street from Steyne Road to rail	0.79

3.4 LAEI

The modelled annual average NO_2 concentrations have been taken from the London Atmospheric Emissions Inventory (LAEI)[44] to show the concentrations across the Old Oak and Park Royal area. This includes road, rail and industrial emission sources. Figure 3.4 shows the areas where the annual mean NO_2 concentration for the LAEI 2012 exceeded the AQO of 40 µg m^{-3}. The area where the annual mean concentration exceeds 60 µg m^{-3} is also shown as research[45] has shown that the 1-hour mean NO_2 objective is may be exceeded if the annual mean is greater than 60 µgm^{-3}.

Figure 3.4 Contour map displaying LAEI NO_2 mapped concentrations



NO_2 concentrations over 40µg m^{-3} are observable along major roads and junctions, both inside the Old Oak and Park Royal area and in the surrounding area. These exceedances are also observable along the train line running parallel to the northern boundary of the site, indicative of emissions from diesel trains on this line. Within the OPDC area, NO_2 exceedances of 40µg m^{-3} are present along the following roads and

[44] GLA (2014) http://www.cleanerairforlondon.org.uk/londons-air/air-quality-data/london-emissions-laei/laei-air-quality-data
[45] Defra (2016) Local Air Quality Management Technical Guidance LAQM.TG (16).

junctions: Park Royal Road, Abbey Road, Coronation Road, North Acton Road, Victoria Road, Chase Road, Scrubs Lane and Old Oak Lane.

NO_2 concentrations over 60µg m^{-3} can be observed along the length of West Way and Western Avenue (A40), which runs alongside the southern boundary of the OPDC area, as well as the North Circular, which runs alongside the western boundary of the OPDC area. Localised NO_2 exceedances of 60 µg m^{-3} are also present in and around the north eastern boundary of the development site, at major road junctions with the A404. Exceedances are also present at road junctions along the Victoria Road A4000 in the south of the OPDC area. Exceedances of 60µg m^{-3} are also observable along the length of the train line, which runs both inside and alongside the southern boundary of the OPDC area.

3.5 Industrial sites

Environment agency register

There are numerous industrial facilities located within the Old Oak and Park Royal area. Several of these are waste sites, which can give rise to dust and odour complaints. It is understood that some of the industrial sites may be relocated and some of which may be retained and developed. Figure 3.5 provides a map of the Part A industrial processes regulated by the EA[46] in the area. Details of these sites and their permits are provided in Table 3.7.

[46] Environment Agency (2015) What's In Your Backyard? - http://maps.environment-agency.gov.uk/wiyby

Figure 3.5 Map displaying industrial sites within the OPDC and the surrounding area

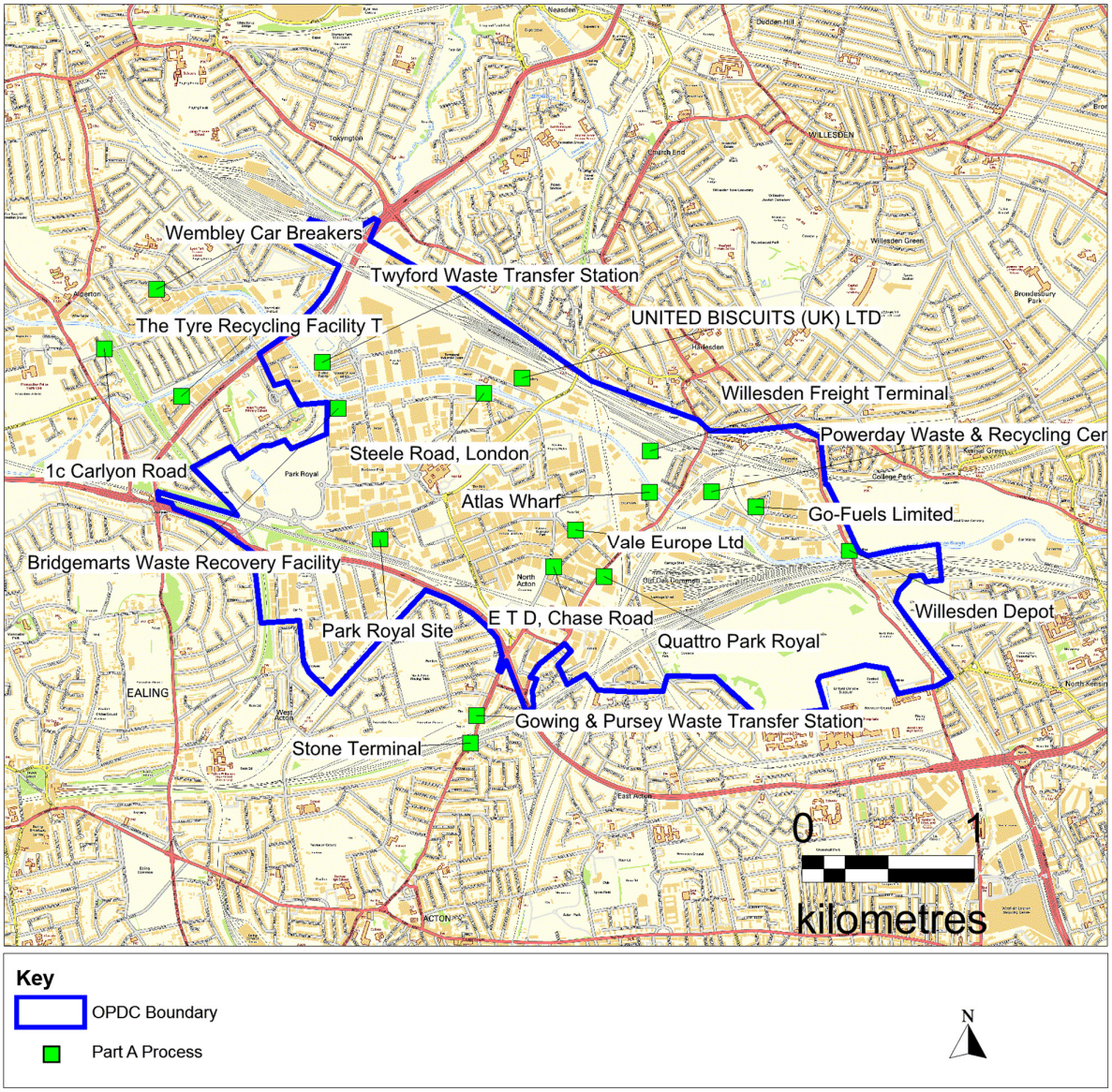


Table 3.7 Industrial site within the OPDC area and the immediate surrounding area

Site Name	Operator Name	Permit No.	Borough / Local Authority	Sector	X	Y
Harlesden Biscuit Factory	UNITED BISCUITS (UK) LTD	QP3032LE	Acton	Industrial	520442	183316
Harlesden Biscuit Factory	UNITED BISCUITS (UK) LTD	KP3938CX	Harlesden	Animal, vegetable and food	520650	183316
Acton Refinery	Vale Europe Ltd	FP3033FP	Acton	Industrial	520960	182435
Grange House Unit 39	Steele Road, London	104421	Acton	Waste transfer	520442	183143

Site Name	Operator Name	Permit No.	Borough / Local Authority	Sector	X	Y
Twyford Waste Transfer Station	Twyford Waste Transfer Station	80078	Acton	Waste transfer	519492	183407
Bridgemart 100 Twyford Abbey Rd	Bridgemarts Waste Recovery Facility	400803	Acton	Waste transfer	519826	182381
Unit 2 Sovereign Park Coronation Road	Park Royal Site	80083	Acton	Waste transfer	520834	182219
Unit 1 49 Chase Road	E T D, Chase Road	80528	Acton	Waste transfer	520863	182361
Regency Street Victoria Road Park	Quattro Park Royal	80595	Willesden	Waste transfer	521118	181946
Off Channel Gate Road Willesden	Willesden Freight Terminal	104421	Willesden	Waste transfer	521368	182828
Atlas Road Park	Atlas Wharf	80036	Willesden	Waste transfer	521750	182658
Old Oak Sidings Off Scrubs Lane	Powerday Waste Recycling & Recovery Centre	80723	Willesden	Waste transfer	521750	182658
Old Oak Sidings Off Scrubs Lane	Powerday Waste & Recycling Centre	WP3832NE	Willesden	Waste recovery	521820	182522
Unit 7 Enterprise Way	Go-Fuels Limited	XP3435CL	Willesden	Organic chemicals	522007	182569
106 Scrubs Lane	Willesden Depot	80371	Willesden	Waste treatment	522548	182314
108 Scrubs Lane	Scrubs Lane, Willesden	80019	Willesden	Waste transfer	522548	182314
186 Brent Crescent	The Tyre Recycling Facility T	400582	Ealing	Waste treatment	518674	183213
1c Carlyon Road Alperton	1c Carlyon Road	400500	Wembley	Waste treatment	518229	183485
Rear Of 122 Edwards Yard	Wembley Car Breakers	80677	Wembley	Waste treatment	518532	183832
307 Horn Lane	Gowing & Pursey Waste Transfer Station	80060	Acton	Waste transfer	520388	181358
Stone Terminal Horn Lane	Stone Terminal	80617	Acton	Waste treatment	520350	181202
Harlesden Biscuit Factory	UNITED BISCUITS (UK) LTD	QP3032LE	Acton	Industrial	520442	183316
Harlesden Biscuit Factory	UNITED BISCUITS (UK) LTD	KP3938CX	Harlesden	Animal, vegetable and food	520650	183316
Acton Refinery	Vale Europe Ltd	FP3033FP	Acton	Industrial	520960	182435

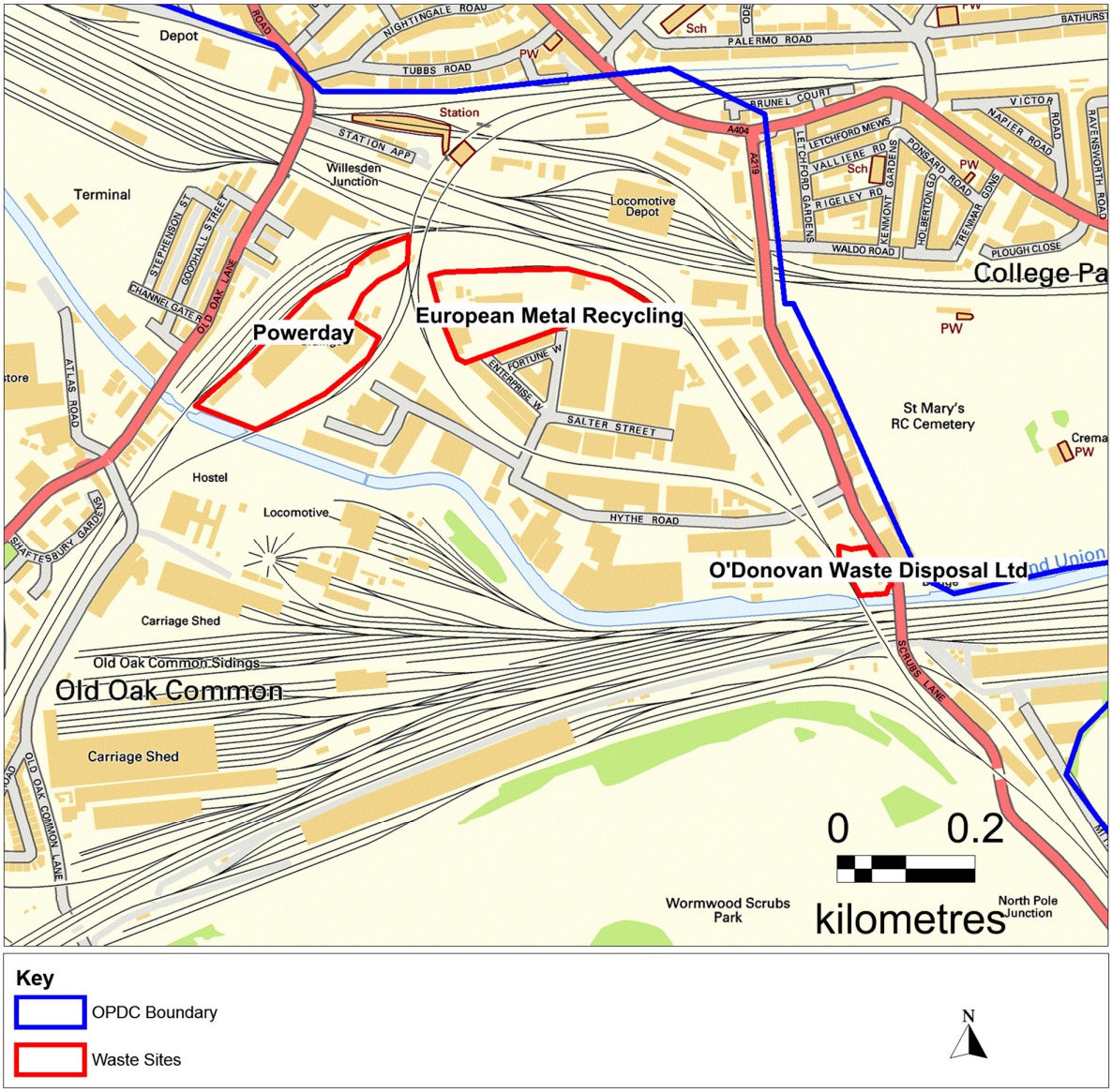
Waste sites

There are also a number of waste processing sites in the area which are not Part A processes. Figure 3.6 shows the key waste sites around Willesden Junction. Due to the number of waste sites in the area, the EA has had concerns regarding pollutant concentrations, particularly Particulate Matter and odorous emission. As a result of the concerns around particulate concentrations, the EA carried out a study of ambient air quality at Willesden between 20 January 2011 and 31 May 2011[47]. Pollutant concentrations were recorded at Willesden Traction Maintenance Depot to the north of the waste transfer and treatment sites.

The mean PM_{10} concentration over the monitoring period was 36.1 µg m^{-3}. If the assumption is made that the conditions during the monitoring periods were representative of a typical year, then the results would indicate that the AQS annual mean AQO would not be exceeded at the monitoring site. However, the 24-hour mean concentration was greater than 50µg m^{-3} on 22 occasions during the monitoring period, the maximum concentration being 86.5µg m^{-3}. If the assumption is made that the conditions during the monitoring period were representative of a typical year, then over a year, the 50µg m^{-3} level for 24-hour (midnight-midnight) mean concentrations would be exceeded on 63 occasions and thus the AQO for 24-Hours (midnight-midnight) mean concentrations would be exceeded at the monitoring site. Pollution events mainly occurred when the prevailing wind was from the direction of Powerday PLC/European Metal Recycling and the locomotive depot. The data do indicate that there is a risk of the PM_{10} 24-hour mean AQO being exceeded in the Old Oak and Park Royal Area. NO_2 concentrations at the monitoring site were marginal below the relevant AQOs (the mean was 39.1 µg m^{-3}, and 200 µg m^{-3} was not exceeded in any hour). It was concluded that if monitoring was undertaken at a different period, that the NO_2 concentrations at the monitoring site would exceed the annual AQO, due to the impact that varying meteorological conditions can have on concentrations.

[47] Environment Agency (2011) Study of Ambient Air Quality at Willesden 20 January 2011 – 31 May 2011. Report – IMAS/TR/2011/10

Figure 3.6 Waste sites around Willesden Junction



The EA has also commissioned monitoring to determine the impacts of mitigation measures at waste transfer sites. Monitoring was carried out upwind and downwind of Powerday (an enclosed Waste Transfer Site) and upwind and downwind of an unenclosed site close to Heathrow Airport[48]. The overall objective of the project was to determine whether Waste Transfer sites that carry out the majority of their activities in an enclosed shed have a lesser impact on airborne particulate concentrations than sites employing only very basic dust mitigation measures.

Powerday operates under Environmental Permit, EP (PP3093EE) and is licensed to accept waste 24 hours a day, seven days a week. The site processes municipal waste, business waste, construction and demolition waste. Powerday recycles as much waste as possible, with a small fraction recovered as Refuse Derived Fuel (RDF) and soils (for landfill capping). The facility consists of two buildings, both with automated Material Recycling Facilities (MRFs), for the reception, sorting and processing of waste. The report states that the Powerday site is an example of an existing operation which operates with a number of mitigation to control emissions of dust and Particulate Matter. Both of the buildings are fully enclosed and have water dust

[48] Environment Agency (2013) Waste and Air Quality Evidence Gathering Project Summary Report

suppression systems. The doors are rapid-close doors and they face away from residential areas. The comparison Waste Transfer Site is not enclosed and uses water as its main mitigation measure. The results at Powerday showed that PM_{10} concentrations were not significantly higher at the downwind station compared to the upwind station and were consistent with the fact that most of the waste handling processes are enclosed inside buildings. The results indicated that the Particulate Matter abatement at this site is effective. Downwind concentrations at the comparison site were higher than the upwind site, indicating that controls are less effective. These results have been used as justification for the following:

- Planning permission for all new sites to require full enclosure; and
- Varied Environmental Permits to require full enclosure.

As detailed in the OPDC Waste Strategy[49], the Powerday waste site meets LBHF's apportionment requirements and land requirements and is proposed to be safeguarded for the Local Plan period to 2037. The European Metal Recycling has been identified for early relocation to facilitate the regeneration of the area. The three waste sites on Scrubs Lane can make a valued contribution to the OPDC area's homes and jobs targets and it is not therefore proposed to safeguard these sites for waste. OPDC proposes to work with the other waste providers to determine the sites' waste throughout and find suitable alternative relocation sites.

Dust and particulate concentrations are also a concern on Horn Lane, immediately to the south of the Old Oak and Park Royal area (location of the Gowing & Pursey Waste Transfer Station and Stone Terminal in Figure 3.5). High particulate concentrations have been recorded at the Horn Lane automatic monitoring station, with exceedances of the PM_{10} 24-hour mean AQO recorded between 2012 and 2014 as a result of industrial and waste management activities (Table 3.2). In 2014 there were 55 daily exceedances of 50 µg m^{-3}, compared to the permitted 35 days. The potential for air quality issues related to haul routes in the vicinity has been identified. Trackout has been identified as a major problem from Acton Goods Yard Access Road and Horn Lane. Aggregate Industries and Hanson are believed to be the main sites with potential to contribute to trackout problems. To reduce emissions and improve local air quality. A Low Emission Strategy (LES) has been developed[50] to work towards compliance with the AQOs which is based on voluntary agreement with site operators and includes measures such as water dust suppression, remaking the access road surface, vehicle washing and provision of hardstanding.

The application of Calcium Magnesium Acetate (CMA) dust suppressant to reduce PM_{10} concentrations has been trialled as part of the TfL Cleaning and Dust Suppressants (CADS) programme[51]. CMA was sprayed manually from backpack sprayers within the yard by four industrial operators and onto the surrounding roads. At Horn Lane. A clear drop in local PM_{10} concentrations occurred in the hour following on-site CMA application of between 31% and 59% relative to the control. A lesser decrease was associated with the on-road applications (18%). The study provided evidence of a beneficial effect of CMA application on roads and industrial sites. It highlighted that CMA application is most effective in locations with unusually high local levels of PM_{10} most likely due to resuspension and that application had no identifiable effect in more typical roadside locations.

It is also understood that local authorities have received complaints regarding odour from sources in the area. Odorous releases will be restricted with the same measures that reduce particulate emissions. In particular, full enclosure of activities and material storage, and rapid-close doors that face away from residential areas. EA permits for waste transfer stations operating in the area typically require operators to prevent and minimise the release of offensive odours from the site so that all emissions to air from the specified waste management operations on the site shall be free from offensive odour in public areas outside the site boundary.

[49] OPDC (2016) Waste Strategy – Local Plan Supporting Study

[50] London Air (2015) Low Emissions Strategy Acton Goods Yard Horn Lane Acton – August 2015. Report - http://www.londonair.org.uk/london/reports/LB_Ealing_Low_Emissions_Strategy_Acton_Goods_Yard_Horn_Lane_Acton.pdf

[51] King's College London (2012) Evaluation of the impact of dust suppressant application on ambient PM_{10} concentrations in London

3.6 Dispersion modelling

In order to provide further information on pollutant concentrations across the Old Oak and Park Royal area, dispersion modelling has been used to predict pollutant concentrations at locations representative of exposure to traffic pollution. Discrete receptors were selected at the façades of buildings near the modelled road links. A high density of receptors was used for the Old Oak area, where residential development is expected. As a full inventory of emission sources in the area has not been established and only road traffic emissions are included. The modelling results are indicative only, but serve to highlight areas of peak pollutant concentrations. Traffic data from the OOC STS[33] has been used to quantify emissions which have been used to predict concentrations.

Methodology

Annual average concentrations in air of NO_X and PM_{10} and $PM_{2.5}$ have been determined using the ADMS-Roads version 3.2.4.0 atmospheric dispersion model[52] for the baseline year (2014).

Traffic data comprising Annual Average Daily Traffic (AADT) flows and numbers of different vehicle types for the roads in the area were derived from peak flows provided by TfL. The traffic data for 2014 were used to estimate pollutant concentrations at the site in the current baseline (2014).

Emissions were calculated using the latest emissions factors from Defra, the Emission Factor Toolkit v6.0.2[53], which is used to predict emissions which are imported into ADMS-Roads. Particulate generated due to brake and tyre wear are also included in the Toolkit. These two factors lead to improved forecasts of particulate concentrations due to traffic. $PM_{2.5}$ emissions were assumed to be the same as PM_{10} as a conservative approach.

Annual mean concentrations of NO_2 were derived from the model-predicted NO_x concentrations, through application of the NO_x to NO_2 conversion tool version 4.1 developed for LAQM purposes, which takes into account the interaction between nitrogen oxides and background ozone[54].

Model verification enables an estimation of uncertainty and systematic errors associated with the dispersion modelling components of the air quality assessment to be considered. There are many explanations for these errors, which may stem from uncertainty in the modelled number of vehicles, speeds and vehicle fleet composition. Defra has provided guidance in terms of preferred methods for undertaking dispersion model verification[11]. Model verification involves the comparison of modelled concentrations and local monitoring data.

Full details of the model verification procedure are provided in Appendix C. In summary, the verification process led to the conclusion that modelled Road-NO_X concentrations should be adjusted by a factor of 1.5 to result in a good agreement between modelled and monitored NO_2 concentrations.

Detailed dispersion modelling requires hourly sequential meteorological data from a representative synoptic observing station. Hourly sequential meteorological data was obtained for the Heathrow Airport synoptic observing station, which is situated approximately 15 km to the west of the Old Oak and Park Royal area. Meteorological data for 2014 has been used with monitoring data from 2014 in the baseline model.

Receptors locations were chosen to be adjacent to the road links and junctions modelled from which emissions were modelled. Locations were chosen to ensure that the highest pollutant concentrations along each road link were determined. Receptors were selected to quantify the air quality at existing residential locations and high concentrations of receptors were located in the area proposed residential development, and the Focus Areas both inside and outside of the area.

[52] www.cerc.co.uk/environmental-software/ADMS-Roads-model.html
[53] http://laqm.defra.gov.uk/review-and-assessment/tools/emissions.html#eft
[54] AEA Technology (2013). *NO_x to NO_2 Calculator version 4.1.* http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc

Nitrogen dioxide

Figure 3.6 presents the annual mean NO_2 concentrations for the baseline year of 2014. As expected, the highest concentrations are predicted alongside the main roads and inside the Focus Areas.

Overall, 16 receptors exceeded 60 μgm^{-3}, indicating that exceedances of the short term AQO for NO_2 are likely at these locations. There are five receptors with modelled concentrations over 60 μgm^{-3} around the busy junction in the Hanger Lane and Twyford Abbey Road Focus Area, to the south-west of the OPDC boundary. The highest recorded NO_2 concentrations of all 163 receptors was predicted at receptor E37, located at the Hanger Lane gyratory, with a concentration of 81.6 μgm^{-3} in the baseline year of 2014. Receptors in this Focus Area also recorded concentrations of 76.6 μgm^{-3} and 69.5 μgm^{-3}.

Exceedances of 60 μgm^{-3} are also recorded in the A406 North Circular from Stonebridge Focus Area and Acton A40 North Acton Rail Focus Area, north and south of the OPDC boundary respectively. There are five exceedances of 60 μgm^{-3} recorded on the junction between the A40 Western Avenue, Old Oak Common Lane and Old Oak Road. There are three exceedances of 60 μgm^{-3} recorded where the A40 Western Avenue meets Wales Farm Road and Victoria Road. The majority of the locations with concentrations above 60 μgm^{-3} are existing residential receptors, with the exception of two future receptors located where the A40 Western Avenue meets Wales Farm Road and Victoria Road, which are also the only two exceedances of 60 μgm^{-3} recorded inside the OPDC boundary.

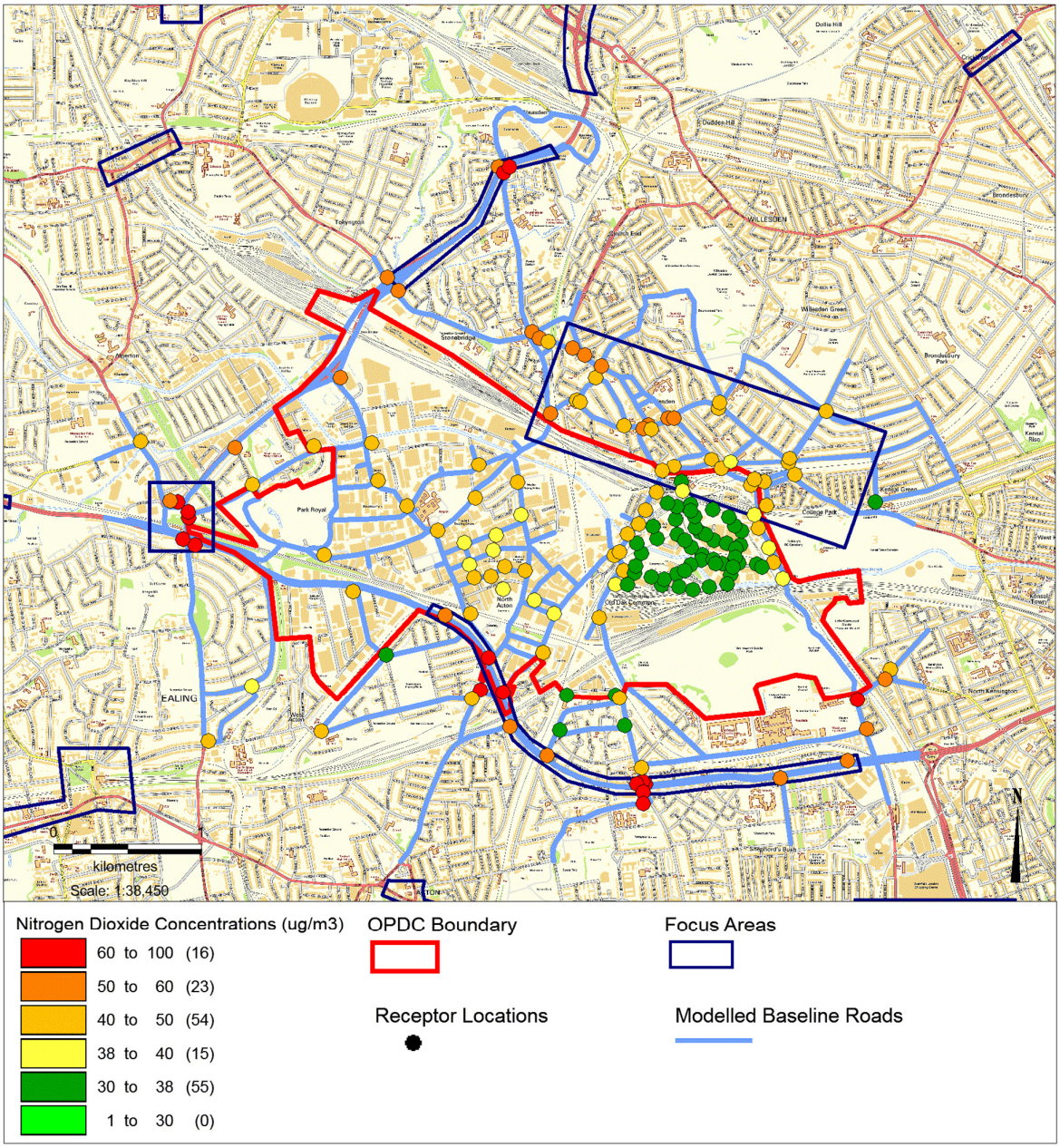
Concentrations between 50 and 60 μgm^{-3} were recorded at 23 of the modelled receptor locations. These receptors are primarily located within or adjacent to Focus Areas, in particular the Harlesden & Willesden Junction Focus Area, where there are 7 receptors with concentrations between 50 and 60 μgm^{-3}. There are also exceedances of 50 μgm^{-3} recorded outside of the Focus Areas identified, such as along Wood Lane and the B412 North Pole Road.

Overall, exceedances of the annual AQO of 40 μgm^{-3} were modelled at over half of the receptors in the 2014 baseline. Modelled concentrations were above 40 μgm^{-3} at 93 receptors, and between 40 and 50 μgm^{-3} at 54 receptors. The majority of receptors with concentrations between 40 and 50 μgm^{-3} are located along main roads within the OPDC site boundary, such as along Old Oak lane, Scrubs Lane and Acton Lane. Concentrations are similar to those predicted by the LAEI in Figure 3.4.

There are 15 receptor locations with predicted concentrations below but within 5% of the AQO. These receptors are mainly located in the residential areas inside the OPDC boundary.

There were many receptors where predicted concentrations were between 30 to 38 μgm^{-3}. These modelled receptors are primarily located around the proposed town centre uses and residential led development areas of the overall development plans, where there is little relevant exposure at present.

Figure 3.7 Thematic map of modelled NO_2 concentrations at receptor locations in the baseline year of 2014



Particulate matter

PM_{10}

Annual average PM_{10} concentrations were below the AQO of 40 μgm^{-3} at all modelled receptors. The highest modelled concentration was at existing receptor E37 where a concentration of 30 μgm^{-3} was predicted near the Hanger Lane gyratory. All other receptors recorded concentrations below 30 μgm^{-3}, which is well below the AQO. Modelling did not include emissions from industrial sites which may be significant sources of fugitive emissions as discussed in Section 3.5. Concentrations may therefore be underestimated.

$PM_{2.5}$

There were two exceedances of the annual average $PM_{2.5}$ AQO in the 2014 baseline. The highest modelled concentration was at existing receptor E37 where a concentration of 25.7 μgm^{-3} was predicted near the Hanger Lane gyratory. The other exceedance of the AQO was recorded at existing receptor E49, located in the A406 North Circular from Stonebridge Focus Area. All other receptors recorded concentrations below 25 μgm^{-3}. Modelling did not include emissions from industrial sites.

3.7 Summary of findings

NO_2 concentrations above the annual mean AQO of 40$\mu g\ m^{-3}$ have been recorded along major roads and junctions, both inside the Old Oak and Park Royal area and in the surrounding area. The AQO has also been exceeded at some background monitoring locations. Exceedances of the AQO have also been modelled in the LAEI along the train line running parallel to the northern boundary of the site, which is indicative of emissions from diesel trains on this line. Emissions from rail sources are expected to decrease with increased electrification. Exceedances of AQO have also been recorded in background locations, away from roads and railways, showing the influence of the high level of emissions in the area, and in London in general.

Dispersion modelling of concentrations at a wide variety of receptor locations within the OPDC area show a high number of exceedances of annual mean AQO for NO_2. Over half of the modelled receptors showing exceedances of 40 μgm^{-3}.

These results suggest a pressing need for mitigation measures to be implemented in order to meet the AQOs for NO_2. In view of the existing exceedances of the NO_2 AQOs and the high volume of development expected, it is important that, where possible, developments should not add extra emissions to the area. Policies that minimise the demand for travel by private motor vehicles and encourage transport by low emission modes (walking, cycling and public transport) should therefore be implemented. Innovative solutions to avoid the need for emitting activities, such as consolidation of freight and zero emission modes of freight delivery, should also be considered. Where activities cannot be carried out without emissions, consideration should be given to minimising these as far as possible by imposing emission standards. Proposed individual developments should meet the tightest emission standards detailed in the Mayor of London's SPG on Sustainable Design and Construction.

Over the last few years, exceedances of the 24-hour mean AQO for PM_{10} have been recorded at monitoring stations in the vicinity of the Old Oak and Park Royal area. These exceedances are associated with a number of sources such as the operation of waste sites, local HDV and bus traffic, inadequate street cleaning, tyre and brake wear, weight restrictions over bridges forcing traffic on to smaller unsuitable roads, as well as regional pollution episodes have all contributed to PM_{10} concentrations in the area. Studies conducted by the EA at waste sites have shown that full enclosure of waste sites can reduce particulate concentrations in neighbouring areas. As such, where possible, the policy of full enclosure of waste sites should be implemented in the Old Oak and Park Royal area. As there are existing particulate issues in the area and a huge amount of construction activity will be required it is vital that construction activities are planned in detail and dust emissions are avoided as far as possible to avoid continued exceedance of the AQO, particularly as development will introduce new receptors into the area.

4. Future Air Quality

4.1 Dispersion modelling

Predicted 2031 future traffic data from the OOC STS were used to predict pollutant concentrations in the Old Oak and Park Royal area. Traffic projections include general background growth, committed developments, the increase in travel demand resulting from the new HS2, National Rail and Crossrail station, and a medium development scenario of 24,000 homes and 55,000 jobs. Concentrations are therefore predicted for the situation when the majority of the OPDC area has been developed. The available emission factors and background pollutant concentrations are only available up to 2030, so these were used to predict 2031 concentrations.

The OOC STS identified that natural growth in traffic alone will compound stresses found on the highway network at present. With the development, the study found additional locations that were forecast to be approaching or overcapacity during peak periods of the day. A number of interventions concerning the road network have been proposed which are included in the modelling.

Following the introduction of European emission standards for road vehicles in 1992, emissions from the overall road vehicle fleet have been decreasing due to the penetration of new vehicles and trucks meeting the emission regulations. Future emissions (per vehicle) are therefore likely to continue to be lower than baseline concentrations as new vehicles, meeting the increasingly stringent emission regulations, replace older vehicles and form a greater part of the UK fleet. Market demand and future UK and European policies are likely to achieve further reductions in vehicle emissions.

However, predicted concentrations of NO_2 in urban areas have not declined as forecast on the basis of available emission factors, in part due to the increased prevalence of diesel cars and their higher real-world NO_X emissions than the emission standards. To account for this, pollutant exposure within the Old Oak and Park Royal area has also been predicted using the background concentrations from the baseline year of 2014 as a conservative approach. Actual pollutant concentrations in the future are likely to be between those in the two modelled scenarios.

Nitrogen dioxide

Figure 4.1 presents the annual mean NO_2 concentrations for the 2031 future scenario using 2014 background concentrations. Figure 4.2 presents the annual mean NO_2 concentrations for the 2031 future scenario using 2030 background concentrations.

Overall, there were no exceedances of 60 μgm^{-3}, indicating that exceedances of the short term AQO for NO_2 are unlikely in either of the future scenarios.

Concentrations between 50 and 60 μgm^{-3} were predicted at 2 of the modelled receptor locations in the 2031 future scenario using 2014 background concentrations. The highest recorded NO_2 concentrations of all 163 receptors was predicted at existing receptor E37, located at the Hanger Lane gyratory, with a concentration of 53.6 μgm^{-3}. The second highest recorded NO_2 concentrations was predicted at future receptor F32 where the A40 Western Avenue meets Wales Farm Road and Victoria Road. In comparison, there were no concentrations predicted above 50 μgm^{-3} in the 2031 future scenario using 2030 background concentrations. The highest recorded concentrations was at existing receptor E37 where a concentration of 44.1 μgm^{-3} was predicted.

Overall, exceedances of the annual AQO of 40 μgm^{-3} in 2031 future scenario were predicted at just over a quarter of the receptors modelled using 2014 background concentrations. Modelled concentrations were above 40 μgm^{-3} at 43 receptors, and between 40 and 50 μgm^{-3} at 41 receptors. The majority of receptors with concentrations between 40 and 50 μgm^{-3} are located in the Focus Areas outside the OPDC site boundary, such as the Hanger Lane gyratory and Acton A40 North Acton Rail Focus Area. In the 2031 future scenario using 2030 background concentrations, there were 4 exceedances of the AQO of 40 μgm^{-3}, which were located in the Hanger Lane, Acton A40 North Action Rail and A406 North Circular from Stonebridge Focus Areas.

There are 26 receptor locations with predicted concentrations below but within 5% of the AQO in the 2031 future scenario using 2014 background concentrations. These receptors are mainly located in the residential areas inside the OPDC boundary. In comparison, only one receptor was located below but within 5% of the AQO in the 2031 future scenario using 2030 background concentrations.

The majority of receptors have predicted concentrations of between 30 to 38 μgm^{-3} in the 2031 future scenario using 2014 background concentrations. These receptors are primarily located around the focus town centre uses and mainly residential led development areas of the overall development plans, where there is the highest density of receptors plotted. Figure 4.2 shows that there is unlikely to be exceedances of the AQO in 2031 with the development operational.

There are no receptors with predicted concentrations below 30 μgm^{-3} in the 2031 future scenario using 2014 background concentrations. However, in the 2031 future scenario using 2030 background concentrations there are 99 receptors with predicted NO_2 concentrations of less than 30 μgm^{-3}.

Overall, these results show that NO_2 concentrations in the Old Oak and Park Royal area are likely to be lower in the assessment year of 2031 than in the baseline year. Traffic flows indicate that NO_2 concentrations will be below the annual mean AQO of 40 $\mu g\ m^{-3}$ by this time in the residential/town centre areas of Old Oak Common, where public exposure would be greatest. There may still be exceedances of the annual mean AQO around the busy A roads and junctions in the area, particularly the A4000, Victoria Road.

Figure 4.1 Thematic map of modelled NO_2 concentrations at receptor locations in the 2031 future scenario with 2014 background concentrations

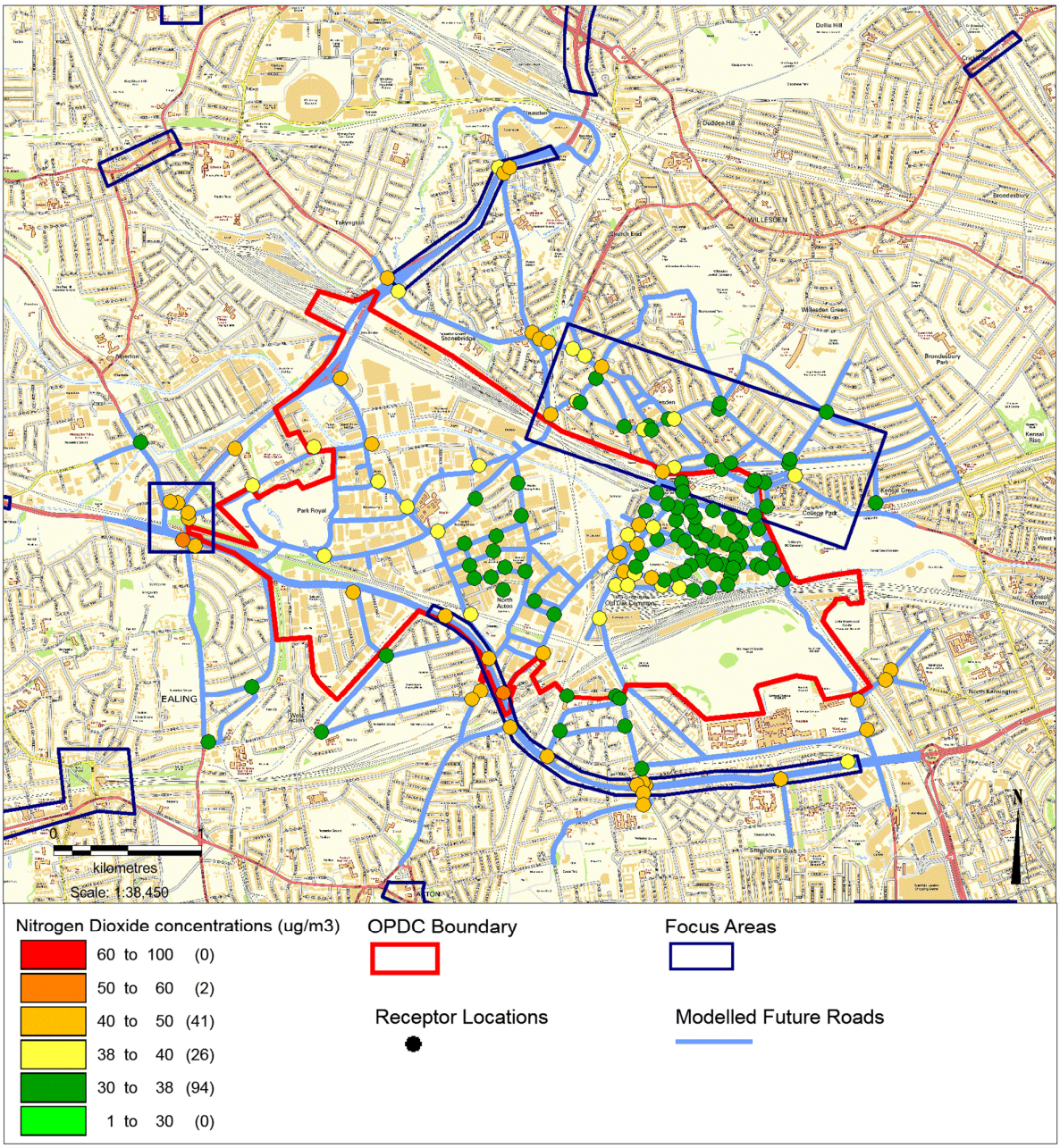
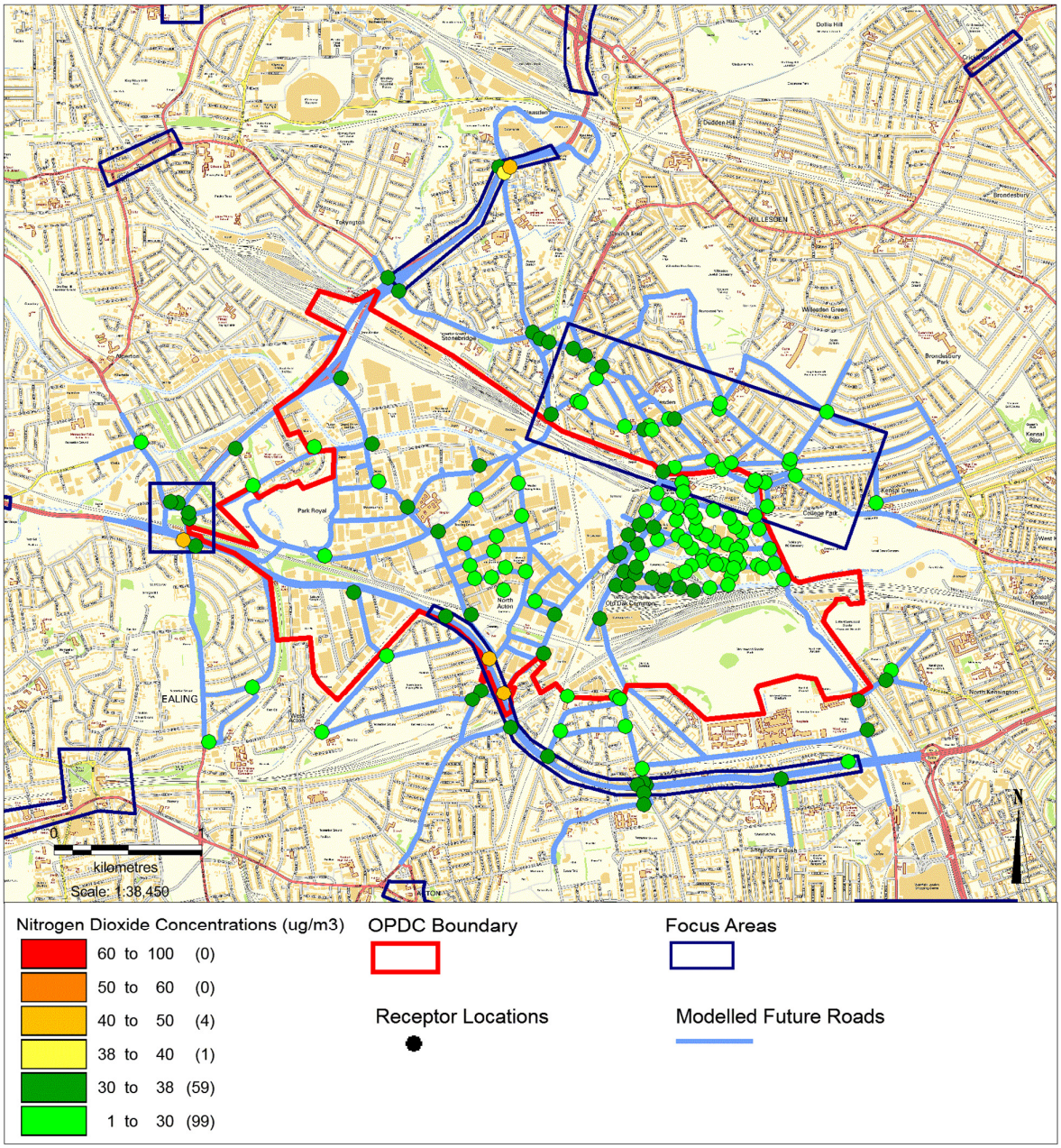


Figure 4.2 Thematic map of modelled NO_2 concentrations at receptor locations in the 2031 future scenario with 2030 background concentrations



Particulate matter

PM_{10}

Annual average PM_{10} concentrations were below the AQO of 40 μgm^{-3} at all modelled receptors in both 2031 future scenarios.

The highest modelled concentration in both scenarios was at existing receptor E37, where concentrations of 29.7 μgm^{-3} and 28.0 μgm^{-3}, were predicted near the Hanger Lane gyratory in the 2031 future scenarios including 2014 and 2030 background concentrations, respectively. All receptors recorded concentrations below 30 μgm^{-3}, which is well below the AQO.

The highest concentrations predicted at future receptors were 27.5 µgm^{-3} and 26.2 µgm^{-3} at receptor F32 in the Acton A40 North Acton Rail Focus Area, in the 2031 future scenarios including 2014 and 2030 background concentrations, respectively. Modelling did not include emissions from industrial sites.

$PM_{2.5}$

Annual average $PM_{2.5}$ concentrations were below the AQO of 25 µgm^{-3} at all modelled receptors in both 2031 future scenarios.

The highest modelled concentration in both scenarios was at existing receptor E37, where concentrations of 22.1 µgm^{-3} and 20.5 µgm^{-3}, were predicted near the Hanger Lane gyratory in the 2031 future scenarios including 2014 and 2030 background concentrations, respectively.

The highest concentrations predicted at future receptors were 20.2 µgm^{-3} and 18.6 µgm^{-3} at receptor F32 in the Acton A40 North Acton Rail Focus Area, in the 2031 future scenarios including 2014 and 2030 background concentrations, respectively. Modelling did not include emissions from industrial sites.

4.2 Summary of findings

Dispersion modelling undertaken to predict future pollutant concentrations in the Old Oak and Park Royal area shows that as a result of the churn in the vehicle fleet, which will see older vehicles replaced by newer vehicles which meet tighter European emission standards, emissions and pollutant concentrations will be lower in the future. This means that the area of exceedance of the NO_2 AQO will be reduced. Results are also presented assuming that background pollutant concentrations do not decline. This is in order to account for uncertainty around the rates of vehicle replacement and likely effectiveness of future emission standards. This scenario indicates that if reductions in emissions are not as great as predicted, it is likely that exceedances of the annual mean AQO will still occur, particularly around busy roads and junctions.

As continued exceedances of the AQOs are likely in future, policies that reduce overall emissions in the area of London are vital. These results support the prioritisation of low emission modes of transport, implementation of policies to avoid emissions where possible and imposition of emission standards for building plant and vehicles.

As exceedances of the NO_2 annual mean objective will remain longest around busy roads and junctions, local measures that reduce congestion, and therefore emissions, would be useful in helping the achieve compliance as soon as possible.

5. Policy recommendations

5.1 The role of planning in reducing emissions

Full consideration of the emissions generated by new developments is vital to ensure that the future air quality in the area is as good as possible. Local Plans therefore need to be developed with policies that minimise emissions as much as possible. Policies to reduce emissions should be developed in accordance with the Avoid-Shift-Improve (ASI) approach. Policies are considered hierarchically, with the first tier reducing emissions by avoiding, or reducing, the polluting activity, the second tier reducing emissions by shifting to lower emission modes, such as walking and cycling or public transport in the case of transport, and the third tier reducing emissions by improving technology.

Effective land-use planning plays a vital role in reducing the impact of new developments on air quality. At this design stage, demand for travel by road can be minimised through sustainable transport links between the home, workplace, educational, retail and leisure facilities[55], thereby reducing trip distances and avoiding emissions. Spatial planning should also be used to encourage the uptake of Low Emission Vehicles (LEVs) where journeys still need to be undertaken. Finally, enforcement of emission standards and development of new infrastructure can help to ensure that emissions from journeys that are not avoided, or shifted to different modes, emit as little pollution as possible.

The Department for Communities & Local Government Planning Practice Guidance[56] states that:

> "*Whether or not air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to generate air quality impact in an area where air quality is known to be poor. They could also arise where the development is likely to adversely impact upon the implementation of air quality strategies and action plans and/or, in particular, lead to a breach of EU legislation (including that applicable to wildlife)*".

As detailed in the 2015 IAQM guidance on "*Land-Use Planning & Development Control: Planning for Air Quality*"[55], in arriving at a decision about a specific proposed development, the local planning authority should pay particular attention to:

- COMPLIANCE with national air quality objectives and of EU Limit Values;
- whether the development will materially affect any air quality action plan or strategy;
- The overall degradation (or improvement) in local air quality; or
- Whether the development will introduce new public exposure into an area of existing poor air quality.

5.2 Development principles

The role of the planning system in minimising impacts, or even improving air quality has been recognised and over recent years several national, regional and local guidance documents have been produced which include recommendations on suitable design principles to minimise emissions. Examples have been produced by the Institute of Air Quality Management (IAQM) and Low Carbon Vehicle Partnership.

Institute of Air Quality management

In relation to land-use planning, the IAQM guidance strongly encourages the following actions:

[55] IAQM (2015) Land-Use Planning & Development Control: Planning For Air Quality

[56] Department for Communities & Local Government (2014) Planning Practice Guidance. When could air quality be relevant to a planning decision? Paragraph: 005 Reference ID: 32-005-20140306

- Full integration of the inputs of the planning, transport, housing, education and environment departments to ensure that environmental considerations, including those related to air quality, are considered at the earliest stages of the strategic planning processes;
- Ensuring public services are joined up and easier to access via public transport or other sustainable choices such as cycling and walking; and
- Giving careful consideration to the location of developments.

For the development design phase, the guidance recommends:

- New developments should not contravene the Council's Air Quality Action Plan, or render any of the measures unworkable;
- Wherever possible, new developments should not create a new "street canyon", or a building configuration that inhibits effective pollution dispersion;
- Delivering sustainable development should be the key theme of any application;
- New development should be designed to minimise public exposure to pollution sources, e.g. by locating habitable rooms away from busy roads, or directing combustion generated pollutants through well sited vents or chimney stacks.

For the operational phase, the guidance recommends:

- The provision of at least 1 Electric Vehicle (EV) "rapid charge" point per 10 residential dwellings and/or 1000m^2 of commercial floorspace. Where on-site parking is provided for residential dwellings, EV charging points for each parking space should be made;
- Where development generates significant additional traffic, provision of a detailed travel plan (with provision to measure its implementation and effect) which sets out measures to encourage sustainable means of transport (public, cycling and walking) via subsidised or free-ticketing, improved links to bus stops, improved infrastructure and layouts to improve accessibility and safety;
- All gas-fired boilers to meet a minimum standard of <40 mgNO_X/kWh;
- All gas-fired CHP Plant to meet a minimum standard of:
  - Spark ignition engine: 250 mgNO_x/Nm^3;
  - Compression ignition engine : 400 mgNO_x/Nm^3;
  - Gas turbine: 50 mgNO_x /Nm^3.
- A presumption should be to use natural gas-fired installations. Where biomass is proposed within an urban area it is to meet minimum emissions standards of:
  - Solid biomass boiler: 275 mgNO_x/Nm^3 and 25 mgPM/Nm^3.

Typical measures that may be considered to offset emissions include:

- Support for and promotion of car clubs;
- Contributions to low emission vehicle refuelling infrastructure;
- Provision of incentives for the uptake of low emission vehicles;
- Financial support to low emission public transport options; and
- Improvements to cycling and walking infrastructure.

Low carbon vehicle partnership

The Low Carbon Vehicle Partnership (LCVP) *Local measures to encourage the uptake of low emission vehicles Good Practice Guide*[57] includes a range of local authority measures to encourage the uptake of Low Emission Vehicles (LEVs) that relate directly to planning. These are detailed in Table 5.1.

Table 5.1 Planning measures to promote LEVs

Measure	Details
Planning conditions in development frameworks	Specify a minimum requirement for provision of LEV spaces (and associated infrastructure) in new developments
(U)LEV specifications in building codes	Specify the need for (U)LEV vehicle readiness in new and renovated buildings
Permitted development rights for charging infrastructure	Electric vehicle charge point installation designated as a permitted development right
Infrastructure installation in rental properties	Makes a term in a lease, contract, security instrument, or similar void to be unenforceable if it prohibits or unreasonably restricts the installation of electric vehicle charging in a lessee's designated parking space
Developer contributions	Planning obligations (section 106/section 75), community infrastructure levy, highway contributions
Local Development Orders securing land for infrastructure	Using Local Development Orders to secure land for infrastructure

This document also highlights the importance of parking in encouraging LEV uptake by influencing driver behaviour and choices. Dedicated parking can be used as an incentive by offering drivers the possibility of saving time and money. These measures are detailed in Table 5.2.

Table 5.2 Parking measures to promote LEVs

Measure	Details
Discounted on- and off-street parking for LEVs	LEVs permitted to use public parking facilities free or at a reduced cost
Dedicated LEV parking (not including recharging)	LEV-only car parking spaces that do not include charge points
Discounted residential parking permits for LEVs	Cost of parking permit reduced or waived for LEV owners
Reduced waiting time for parking permits for LEVs	Priority for parking permit applications given to LEV cars
Reduced parking spaces for high emission vehicles	Parking for conventional vehicles reduced
Workplace parking levy	Local authorities can charge businesses for every employee who parks in the area
Dedicated parking for LEV car club vehicles	Allocating parking for sole use by LEV car clubs

Reducing emissions from buildings

Guidance produced by CityAir, which is available on the Cleaner Air for London website, addresses how activities associated with existing building stock can reduce emissions[58]. Some of these include:

[57] LCVP (2015) Local measures to encourage the uptake of low emission vehicles Good Practice Guide
[58] CityAir (2015) Improving Air Quality in the City of London A practical guide for building engineers and facilities managers

- Building Management systems: Reviewing log books to establish temperature set points for each room/floor;
- Boilers: Ensure that boilers operate at maximum efficiency and produce minimum airborne contaminants, through routine inspection and maintenance;
- Generators: Ensure regular inspection, testing and reporting of emissions; and
- Air Conditioning and Filtering: Improve air quality by ensuring that air filters are regularly maintained and comply with EN 13779.

Green Infrastructure

The GLA has defined green infrastructure as[59]: "*A network of green spaces - and features such as street trees and green roofs - that is planned, designed and managed to provide a range of benefits, including: recreation and amenity, healthy living, reducing flooding, improving air quality, cooling the urban environment, encouraging walking and cycling, and enhancing biodiversity and ecological resilience*."

The importance of green infrastructure has been recognised in London policy documents. As detailed in the London Plan[19], development proposals should be designed to include roof, wall and site planting, especially green roofs and walls where feasible. Chapter 15 of the London Infrastructure Plan Consultation Document[60] highlights the need to create the equivalent of an additional 9,000 ha of accessible green space to keep pace with projected population growth and meet existing standards. It is recognised that there is a growing evidence base that green infrastructure can reduce costs for local authorities by minimising the management of negative externalities (such as storm water and air pollution). It is stated in the London Infrastructure Plan Consultation Document that the Mayor will ensure that:

- Development projects led by the GLA or TfL will embed the concept of green infrastructure at project inception; and
- New standards are developed that will ensure that, in those parts of the city that are subject to increased densification, there will be a minimum 10 per cent increase in the amount of green cover.

In December 2015, the Green Infrastructure Task Force established following the publication of the London Infrastructure Plan 2050 published the report *Natural Capital: Investing in a Green Infrastructure for a Future City*[61] this also recognises the benefits of green infrastructure with regards to air quality and includes a number of recommendations. Of particular relevance, it is recommended that the Mayor should work with TfL to ensure green infrastructure is integrated into its future cycling and walking strategies, and related design guides and that it should be ensured that the concept of green infrastructure is central to a placemaking agenda.

The policy framework for green infrastructure is provided by the All London Green Grid and the associated Supplementary Planning Guidance[62]. This recognises that creating new green spaces and linkages and the urban greening of streets and buildings will assist in further reducing air pollution and improving the health and enjoyment of those visiting, living in and working in London. The Grand Union Canal is identified as a strategic green infrastructure opportunity with potential to enhance links for walking and cycling and enhance the role of the Canal as a biodiverse corridor through the Park Royal industrial areas.

The Old Oak and Park Royal Opportunity Area Planning Framework[32] Principle E5: Green Infrastructure builds on the existing policy framework and states that proposals should:

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[59] GLA. Green Infrastructure - https://www.london.gov.uk/what-we-do/environment/parks-green-spaces-and-biodiversity/green-infrastructure

[60] Mayor of London (2014) London Infrastructure Plan 2050 A Consultation

[61] GLA on behalf of the Green Infrastructure Task Force (2015) Natural Capital Investing in a Green Infrastructure for a Future London

[62] Mayor of London (2012) Green Infrastructure and Open Environments: the All London Green Grid - Supplementary Planning Guidance

- Create a network of amenity spaces connected by soft landscaping and tree planting to encourage healthy, walkable neighbourhoods;
- Use green infrastructure to sustainably manage rainwater (see water section);
- Retain and enhance the value of existing ecological or nature conservation assets;
- Improve ecological connectivity by enhancing existing green corridors such as the canal and railway lines; and
- Help reduce temperatures in hot weather and intensification of the urban heat island effect through providing shading and evaporative cooling and green and brown roofs and walls.

Green infrastructure can reduce exposure to pollution in two main ways[63]:

- Trees and vegetation can reduce air pollution directly by trapping and removing fine particulate matter or by direct absorption of gaseous pollutants; and
- Green corridors across cities can reduce pedestrian exposure to pollution by providing attractive routes away from major roads.

When considering green infrastructure to include in development proposals, it is important that beneficial impacts are maximised through the choice of appropriate species. With regard to trees, species that don't emit the most Volatile Organic Compounds (VOCs) that lead to ozone production[64], but do have large leaf surface areas have the best effect on air quality. Studies have shown that Scots pine (*Pinus sylvestris*), common alder (*Alnus glutinosa*), larch (*Larix spp.*), Norway maple (*Acer platanoides*), field maple (*Acer campestre*), ash (*Fraxinus excelsior*) and silver birch (*Betula pendula*) remove the most pollutants without contributing to the formation of new pollutants, whilst oaks, poplars and willows can have a detrimental effect on air quality through VOC formation[65]. Evergreen species also have provide year-round benefits[66]. The London i-tree Eco Project[64] estimated that trees remove 698 tonnes of NO_2 and 299 tonnes of PM_{10} per year in Greater London. Studies into shrubs have shown that plants with high hair density (e.g. Silverbush, *Convolvulus cneorum*) are most efficient at trapping particulate matter, but other species with larger plants (e.g. Ivy, *Hedera helix*) may trap more pollution per plant[67]. One study predicted that the use of green walls in street canyons can achieve reductions in street level NO_2 and PM_{10} concentrations of as much as 40% and 60% respectively, and also highlighted the importance of not restricting dispersion of pollutants through poorly considered tree planting[68].

5.3 Other guidance and initiatives

Fleet Operator Recognition Scheme (FORS)

The TfL Fleet Operator Recognition Scheme (FORS) is an accreditation scheme that aims to improve fleet activity[69]. FORS applies to construction and other fleets. One of the aspects that fleet operators are audited upon is emissions. FORS is graduated into three levels enabling operators to demonstrate to customers and other companies the continuous improvement that they make to their fleets. Gold is the highest FORS award. To progress an operator must meet all the requirements of lower Bronze and Silver awards. To achieve the Gold Standard, operators must fulfil the following requirements related to their emissions:

[63] Houses of Parliament (2013). Urban Green Infrastructure. Post Note No. 448. - http://www.parliament.uk/business/publications/research/briefing-papers/POST-PN-448/urban-green-infrastructure
[64] Treeconomics London (2015) Valuing London's Urban Forest Results of the London i-Tree Eco Project
[65] Centre for Ecology and Hydrology. University of Lancaster. Trees and Sustainable Urban Air Quality
[66] Woodland Trust (2012). Urban Air Quality
[67] Imperial College London, Shackleton. K., Bell. N., Smith, H., & Davies, L. The role of shrubs and perennials in the capture and mitigation of particulate air
[68] Pugh, T., Mackenzie, A, Whyatt, J and Hewitt, C. (2012). Effectiveness of Green Infrastructure for Improvement of Air Quality in Urban Street Canyons. Environ. Sci. Technol., 2012, 46 (14), pp 7692–7699
[69] FORS (2015) http://www.fors-online.org.uk/cms/what-is-fors/

- Performance measurement - make meaningful improvements against the FORS Silver and Bronze baseline data in the following performance indicators:
  - Total fuel usage and by distances travelled;
  - Transport related CO_2 output and by distance travelled;
  - Total incident and collision data and costs involving personal injury, vehicle or property damage; and
  - Total transport related fines and charges.
- Fuels and emissions champions - appoint individuals who are responsible for both the economic and environmental sustainability of the business.

FORS estimate an 11% saving in fuel and emissions for scheme members and the City of London found between the financial years 2008/9 and 2009/10, there was a 16% reduction in emissions of CO_2, a 32% reduction in emissions of NO_X, and a 45% reduction in emissions of PM_{10} as a result of FORS[21].

Zero emission network

The Zero Emissions Network (ZEN) is a joint initiative between the London boroughs of Islington, Hackney and Tower Hamlets that helps businesses operate cheaper, cleaner and greener[70]. The scheme is designed to improve air quality and business efficiency within the 'ZEN' area. The ZEN project gives businesses exclusive access to offers to enable them to save money and reduce emissions. Offers include:

- Free business membership to city car clubs;
- Free trials of electric cars and vans;
- Free cycle workshops;
- Discounted 'Zero Emissions' taxi fares; and
- Free cycle training for all staff.

Freight consolidation

Tfl encourages the consolidation of freight[71] as it reduces the overall number of courier vehicles, which benefits the environment. The importance in ensuring that sufficient freight facilities are provided in new developments is highlighted, particularly where consolidation of deliveries could provide substantial congestion and environmental benefits. The potential of switching high delivery/collection concentrations to zero emissions modes of transport has also been identified.

High profile examples of Freight Consolidation Centres (FCCs) include the Meadowhall Centre in Sheffield, where over 50% of retailers use the scheme, and the Broadmead FCC in Bristol, with results indicating that participating retailers have benefitted from a 75% reduction in vehicle movements[72]. TfL also provides examples of freight consolidation coupled with low emission delivery including the Gnewt Cargo scheme for Regent Street[73], waste consolidation at the Olympic Park (which reduced off-site vehicle movements by over 80%)[74] the Heathrow Consolidation Centre (which has brought about a 66% reduction in the number of vehicle movements to airport terminals)[75], and the consolidation centre for the London boroughs of Camden,

[70] Cleaner Air for London (2015) http://www.cleanerairforlondon.org.uk/zen
[71] TfL (2007) London Freight Plan sustainable freight distribution: a plan for London
[72] WSP for BCSC (2015) Freight Consolidation and Remote Storage
[73] TfL Freight. Going the Extra Mile http://content.tfl.gov.uk/going-the-extra-mile.pdf
[74] TfL Freight. Waste Consolidation: An Olympic tale of victory http://content.tfl.gov.uk/veolia-waste-case-study.pdf
[75] TfL Freight. Expansion of Consolidation at Heathrow http://content.tfl.gov.uk/heathrow-case-study.pdf

Enfield, Islington and Waltham Forest (which has brought about a 45% reduction in the total distance travelled by delivery vehicles)[76].

With regard to construction, the London Construction Consolidation Centre (LCCC) in Silvertown has been operating since September 2005. The pilot scheme showed significant transport and construction efficiency benefits, such as increased delivery reliability (98 per cent), a reduction in vehicle trips to site and local emissions (of 75 per cent each) and the potential to reduce site waste[77]. The LCCC has more than doubled size in 2014 is currently servicing 15 major construction projects in London[78]. Similarly, the One Hyde Park construction consolidation centre reduced construction vehicle movements by 66%[79]. The Croydon Council Construction Logistics Handbook[80] identifies where Freight Consolidation Centres are appropriate and their benefits. Widespread adoption of such schemes can be promoted through:

- Consolidation being made compulsory through planning conditions;
- Construction clients requiring the consideration and/or use of consolidation through their contracts;
- Developers and contractors choosing to use consolidation for good practice and economic/productivity considerations;
- Encouraging construction consolidation through the planning process by using site construction plans, Construction Statements and transport assessments for construction and operational phases to minimise trips, contract deviation and waste; and
- Contract award criteria that encourage freight companies to actively demonstrate logistics best practice.

Zero emission last mile

Light Goods Vehicles (LGVs) are responsible for a significant proportion of emissions (13% of NO_X emissions[81]) in London. Delivery of goods and services by zero emission modes of transport has been identified as an important measure that can be used to reduce these emissions. This is the concept of zero emissions 'last mile' deliveries[82]. Such schemes have been used in other areas of the country. Diesel lorries are used to transport goods from suburban depots to microconsolidation centres and onward delivery is made by electric vans and Cargocycles. For example, Outspoken Delivery operate in Cambridge, Glasgow and Norwich[83]. Gnewt Cargo evaluated the existing Office Depot deliveries to the City of London using diesel vans against a system of Cargocycles and electric vans for the final stage of delivery. The trial showed zero local air pollutant emissions were generated and the amount of space taken up by delivery vehicles dropped by 50%. This is now considered best practice in the City of London. London Bike Hub currently operates a cycle delivery service on behalf of Better Bankside with the support of Transport for London, providing businesses within the Bankside a zero emission delivery service[84].

As detailed in the LLAQM Borough Air Quality Action Matrix[21], modelling for a main road showed that removing all LGV emissions, as an approximation of the impact of encouraging zero emissions last mile

[76] TfL Freight. The London Boroughs Consolidation Centre – a freight consolidation success story http://content.tfl.gov.uk/lbbc-case-study.pdf
[77] TfL Freight. Building on the benefits of consolidation centres http://content.tfl.gov.uk/building-on-the-benefits-of-consolidation-centres.pdf
[78] Freight in the City (2015) London Construction Consolidation Centre doubles in size as contractors realise benefits - http://freightinthecity.com/2015/04/london-construction-consolidation-centre-doubles-in-size-as-building-works-boom-in-the-capital/
[79] TfL Freight. Consolidating Luxury Construction http://content.tfl.gov.uk/one-hyde-park-case-study.pdf
[80] Croydon Council (2015) Construction Logistics Handbook https://www.croydon.gov.uk/sites/default/files/articles/downloads/Construction%20Logistics%20Handbook.pdf
[81] Cleaner Air for London (2015) GLA Emissions Summary http://www.cleanerairforlondon.org.uk/londons-air/air-quality-data/london-emissions-laei/gla-emissions-summary
[82] CityAir (2015) http://www.cleanerairforlondon.org.uk/sites/default/files/business/CA4B%20Appendix%20VIV%20-%20Zero%20Emission%20Last%20Mile.pdf
[83] Outspoken Delivery http://www.outspokendelivery.co.uk/
[84] London Bike Hub (2015) http://www.londonbikehub.com/betterbankside/

deliveries, would reduce NO_X and PM_{10} emissions by 18% and 30% respectively. Consequently, NO_2 and PM_{10} concentrations would decrease by 11% and 12% respectively.

Freight quality partnerships

Freight Quality Partnerships (FQPs) have been established across the country (e.g. Wiltshire and Swindon[85], Exeter[86] and Central London[87]) in order to develop an understanding of freight transport issues and problems, and then, to promote constructive solutions. FQPs are a partnership between the freight industry, local government, local businesses, the local community, environmental groups and others with an interest in freight.

Typical projects by FQPs include:

- Construction logistics plans;
- Delivery and servicing plans;
- Local mapping, signage and routing;
- Night-time deliveries; and
- Communications strategies.

FQPs offer the possibility of agreement of emission standards for construction and delivery/servicing vehicles to ensure that HDVs operating in an area emit less pollution. They also offer the possibility of implementing innovative solutions such as the automated advanced allocation of lorry parking spaces to help reduce traffic jams that has been used in Amsterdam[88].

Minimising emissions from supply chain

The impact of the supply chain on carbon emissions is well documented, but the resulting emissions of NO_X and PM_{10} are often not considered in procurement policy decisions[89]. Key areas for consideration to reduce the emission profile of business include:

- Implementing a Sustainable Supply Chain Policy: Embedding air quality and sustainability into the supply chain, as well as reducing carbon emissions;
- Reducing Journeys & Emissions: Through consolidation and centralisation of deliveries, as well as adopting sustainable transport methods; and
- Energy, Waste and Water: Broker energy from ‘green’ sources, avoid using combustion technologies, centralise recycling and explore Materials Recycling Facilities (MRF).

5.4 Recommended policies for Old Oak and Park Royal

The policies in the Local Plan should be used to ensure that the Old Oak and Park Royal area is an exemplar of low emission development. This will be done by committing to developers to achieving the highest standards for minimisation of air pollution. As an overarching measure, it is recommended that a

[85] Wiltshire and Swindon Freight Quality Partnership (FQP) http://www.wiltshire.gov.uk/parkingtransportandstreets/roadshighwaysstreetcare/transportfreight/freightqualityprtnershipwiltshire.htm

[86] Devon County Council Freight Quality Partnerships http://www.devon.gov.uk/index/transportroads/traffic/traffic_management/freight_quality_partnerships.htm

[87] Central London Freight Quality Partnership http://www.centrallondonfqp.org/

[88] Amsterdam Smart City. The Digital Road Authority - Air quality - http://amsterdamsmartcity.com/projects/detail/id/74/slug/the-digital-road-authority-air-quality

[89] CityAir (2015) http://www.cleanerairforlondon.org.uk/sites/default/files/business/CA4B%20Air%20Quality%20-%20Supply%20Chain.pdf

LEN should be established for the Old Oak and Park Royal area. The area meets all of the requirements of a LEN:

- The area is part of an Opportunity Area, as identified in the London Plan;
- There are significant existing plans for major public realm schemes that will benefit from LEN complementary measures;
- There is an opportunity for significant reductions in traffic, emissions and exposure to air pollution and a desire and need for improved air quality and urban realm; and/or
- The area will become the start and end point of a large number of journeys, with major destinations, such as transport hubs, business districts, shopping centres and industrial parks.

Based on the Old Oak and Park Royal Opportunity Area Planning Framework, the review of current legislation and guidance and the existing Local Plans for the area, the following policies are proposed for the Old Oak and Park Royal LEN:

Operational phase

Table 5.3 Recommended policies for the operational phase

No.	Policy Area	Recommended Policy	Rationale
	Measures to Reduce Emissions		
1	**Low Emission Neighbourhood**	In view of the sensitivity of the area to increased emissions and the opportunities available to reduce emissions, the OPDC will work with TfL to designate the entire Old Oak and Park Royal area as a Low Emission Neighbourhood (LEN). The recommendations that follow will be used to incorporate a package of measures into development design to reduce emissions and promote sustainable living and working. The measures to be implemented in the LEN are likely to differ between Old Oak and Park Royal in view of the varying land uses and emission sources in the two areas, with Old Oak being predominantly used for residential and transport purposes and Park Royal being predominantly industrial.	TfL encourages the establishment of a Low Emission Neighbourhood (LEN), an area-based scheme that includes a package of measures focused on reducing emissions (and promoting sustainable living more generally), when: - The area is part of an Opportunity Area; - There are significant plans for major public realm schemes that will benefit from LEN complementary measures; - There is an opportunity for significant reductions in traffic, emissions and exposure to air pollution; or - The area will become the start and end point of a large number of journeys. The Old Oak and Park Royal area meets all of these requirements, it is therefore recommended that, in collaboration with TfL, the entire area is designated as a LEN. The other recommended policies detailed below will form the package of measures for the LEN.
2	**Transport**	To minimise demand for travel by private motor vehicles and prioritise transport by low emission modes, proposals should: - Facilitate the development a network of new roads and streets with priority given to pedestrians, cyclists and buses; - Provide fully segregated cycle lanes on all trafficked roads and major pedestrian streets; - Support the delivery of a rail station at Old Oak Common; - Support the provision of a new London Overground station; - Support the provision of substantial capacity improvements to existing London Underground and London Overground stations; - Facilitate the provision of increased bus frequencies and new bus routes; and	The Old Oak and Park Royal Opportunity Area Planning Framework states that proposals should develop a network of new roads and streets and deliver significant improvements to public transport provision in the area. It is recommended that the importance of these policies to air quality are highlighted to make the area an exemplar of low emission development. 35% of car journeys by London residents are for 2 km or less. As detailed in the LLAQM Action Matrix, dispersion modelling for a main road showed that removing this proportion of car journeys, which would be reasonable to be replaced by walking or cycling, would reduce NO_X and PM_{10} emissions by 9% and 16% respectively. NO_2 and PM_{10} concentrations would be reduced by 6% and 8% respectively[21].

No.	Policy Area	Recommended Policy	Rationale
		- Ensure that destination sites, such as shops, train stations and schools, are safely and more easily accessible by foot and bike than by car.	
3	**Parking**	To encourage the uptake of electric vehicles and ensure that Old Oak and Park Royal area is an exemplar of low carbon development, proposed developments should be car free where possible and should provide no more than 1 car parking space per 5 residential units with one active electrical charging point per space. All spaces for retail and employment uses should provide an electrical charging point. Fast or rapid charging should be provided at strategic locations such, as retail uses, where electric vehicles may not be expected to park for long periods of time.	The Old Oak and Park Royal Opportunity Area Planning Framework states that proposals should provide no more than 1 car parking space per 5 residential units. It is stated in the London Plan that all developments in areas of good public transport accessibility should aim for significantly less than 1 space per unit and that developments must ensure that 1 in 5 spaces provide an electrical charging point to encourage the uptake of electric vehicles, with an additional 20 per cent passive provision for electric vehicles in the future. Combining these two policies would mean that there was only one charging point per 25 residential units, which would not provide significant encouragement to the uptake of electric vehicles. One charging point for every five residential units is not an onerous target for developers.
4	**Low Emission Vehicle Infrastructure**	To encourage the uptake of Low Emission Vehicles and ensure that Old Oak and Park Royal area is an exemplar of low carbon development, the OPDC will work with TfL and their preferred suppliers to deliver the local component of the Source London network. The OPDC will also work with private hire and other commercial operators such as car clubs to understand their needs for rapid and other charging infrastructure and ensure that their requirements are included in development proposals. All car club vehicles will be 100% electric.	The TfL Ultra Low Emission Vehicle Delivery Plan for London detailed how TfL will work with these organisations to deliver Low Emission Vehicle infrastructure in London. As the local planning authority, OPDC will play an active role is discussions to ensure that the area has the necessary Low Emission Vehicle infrastructure.
5	**Traffic**	Priority will be given to road and traffic management methods that prioritise sustainable transport modes such as: - Filtered access to prevent rat-running by cars but allowing cycle and pedestrian movement; - Positioning of through routes away from sensitive uses and amenity areas to minimise public exposure; and - Designing signalised junctions to prioritise pedestrian and cycle movements. In order to reduce emissions from motorised vehicle traffic and encourage walking and cycling by improving safety on trafficked roads and making them more pleasant and liveable, all local roads in the Old Oak and Park Royal area will have a speed limit of 20mph.	Reducing speed limits in built-up areas from 30mph to 20mph is recommended in the London LAQM Action Matrix. The potential for this measure to reduce emissions by reducing acceleration has been identified, as have numerous other benefits, such as improving safety, reducing noise, sharing road space more equitably between modes, and making streets more pleasant. Reducing the speed limit from 30mph to 20mph has been shown to have different effects on different types of car because of the way their engines operate. A study by Imperial College London[90] on behalf of the City of London determined that reducing the speed limit has been shown to increase NO_X emissions from petrol cars by around 11%, with a decrease in PM_{10} emissions of 6%. Reducing the speed limit has been shown to decrease NO_X and PM_{10} emissions from diesel cars by around 5%. Given the higher contribution of diesel vehicles to emissions of NO_X, it is possible that this measure could achieve significant reductions in concentrations.

[90] Imperial College London (2013) An evaluation of the estimated impacts on vehicle emissions of a 20mph speed restriction in central London - https://www.cityoflondon.gov.uk/business/environmental-health/environmental-protection/air-quality/Documents/speed-restriction-air-quality-report-2013-for-web.pdf

No.	Policy Area	Recommended Policy	Rationale
6	**Energy**	To make the Old Oak and Park Royal area an exemplar of low emission development preference should be given to zero or low emission sources of heat and electricity, such wind, solar and hydrogen. Where combustion based sources are used they should be designed and fitted with suitable after treatment to eliminate or minimise emissions. As a minimum, CHP and biomass proposed in individual development should meet the tightest emissions standards detailed in the Mayor of London's Supplementary Planning Guidance (SPG) on Sustainable Design and Construction. Any energy facilities should be designed and positioned with the development area to maximise the rapid dispersion of any residual pollutants and have as little impact as possible.	Monitoring and modelling of pollutant concentrations has shown that NO_2 concentrations in the area are between 5% below or above the annual mean Air Quality Objective (AQO) (above 38µg m^{-3}) across wide areas of the Old Oak and Park Royal Area. The Band B emission standards for CHP plant and solid biomass boilers in the Mayor of London's Supplementary Planning Guidance (SPG) on Sustainable Design and Construction will apply in these areas. As it is intended that proposals should ensure that Old Oak and Park Royal area is an exemplar of low carbon development and commit to achieving the highest standards of energy efficiency and low/zero carbon technology, and in view of the incremental increases in pollutant emissions that would occur as a result of such volume of development, the Band B emission standards should be applied across the area.
7	**Freight**	New employment uses should demonstrate how they maximise the use of the Grand Union Canal and rail network for freight transport purposes. To help in the development of servicing and delivery plans, the OPDC should consider creating a Freight Quality Partnership (FQP) that will be compulsory for any organisation operating HDVs in the area. To minimise the impact of emissions from vehicles delivering and collecting freight, the OPDC will support the establishment of local Freight Consolidation Centres that will facilitate delivery/collection by zero emission vehicles. HGVs serving any Freight Consolidation Centres should meet the best available emissions standards to minimise local and wider emissions on the road network. The OPDC should consider ensuring that the operators of all freight vehicles operating in the area have attained the Gold FORS accreditation so that they have made proven efforts to reduce emissions.	FQPs have been established across London to promote solutions to freight issues and problems. This will enable innovative solutions to pollution issues generated by freight movement to be considered, including those that make smart use of data. The Low Emission Neighbourhoods (LEN) scheme and London LAQM Action Matrix include freight consolidation, zero emissions last mile and FORS accreditation as measures that should be considered for implementation to reduce pollutant concentrations. These should be applied in the Old Oak and Park Royal area to ensure that it is an exemplar of low carbon development.
8	**Ultra Low Emission Zone (ULEZ)**	The OPDC will strongly support the proposed policy to extend the ULEZ to the north circular and make it operational by 2019. With implementation of this policy, the ULEZ will include the Old Oak and Park Royal area. Companies and organisations operating in the area will only be able receive deliveries and send freight using HGVs that are Euro VI or better, diesel light commercial vehicles that are Euro 6 or better and petrol vans or light commercial vehicles that are Euro 4 or better. Buses operating in the area would be Euro VI or better and taxis operating from the area would be Euro 6 or better (diesel) or Euro 4 or better (petrol). In the event that the amended London ULEZ proposals are not implemented, the OPDC should consider establishing a Class C CAZ to encourage the use of the cleanest buses, coaches, taxis, HGVs and LGVs. If the GLA or TfL bring forward proposals to 'geo-fence' buses and taxis to ensure they are operating in zero-emissions mode in certain areas,	The ULEZ is an area within which all cars, motorcycles, vans, minibuses, buses, coaches and heavy goods vehicles (HGVs) will need to meet exhaust emission standards (ULEZ standards) or pay a daily charge to travel. The emission standards are as follows: - Bus/coach – Euro VI for NO_X emissions; - HGV – Euro VI for NO_X emissions; - Van – Euro VI for NO_X emissions; and - Car/light commercial – Euro 4 petrol car and Euro VI diesel car for NO_X emissions. The original intention was for the ULEZ to apply in the Central London Congestion Charge Zone from 2020. In 2016, the Mayor announced proposals to extend the ULEZ to the North and South Circular roads and to begin the ULEZ from 2019. The December 2015 Defra action plan to improve air quality and meet the EU NO_2 limit values set out in the Ambient Air Quality Directive introduces the concept of CAZs to encourage the cleanest

No.	Policy Area	Recommended Policy	Rationale
		the OPDC should consider applying to become one of these zones.	vehicles, with emission standards the same as the ULEZ.
9	**Zero Emission Network**	The OPDC should consider establishing a Zero Emissions Network (ZEN) to help local businesses reduce the emissions associated with their activities. This will incentivise zero emission modes of transport and delivery and involve microconsolidation of freight.	The Zero Emission Network idea is already in operation in the London boroughs of Islington, Hackney and Tower Hamlets. It provides a means to encourage businesses to reduce their emissions.
10	**Waste Sites**	OPDC will work with European Recycled Metals, and the operators of the three waste sites on Scrubs Lane to find suitable alternative relocation sites where odour and dust impacts are minimised. In accordance with recognised best practice, planning permission for all new wastes sites will require waste sites to be fully enclosed and variation to Environmental Permits will introduce the requirement for full enclosure. The OPDC will work with existing businesses in the area and the Environment Agency to establish a programme of emission reduction that could include: - Full enclosure of existing sites; - Introduction of minimum standards for emissions from Non-Road Mobile Machinery on site and vehicles using the sites; and - CMA application to reduce PM_{10} concentrations, with a particular focus on locations where residential properties are introduced in close proximity to industrial areas.	OPDC proposes to work with waste providers to determine the sites' waste throughout and find suitable alternative relocation sites. An Environment Agency study has shown that full enclosure of waste sites can significantly reduce particulate concentrations in the surrounding areas. Full enclosure of waste sites is therefore recommended to ensure that the amenity and health of local residents is not affected by the activities of site operators. The beneficial effects of CMA application on PM_{10} concentrations near to industrial facilities have been demonstrated.
11	**Overall Emissions**	Proposals should minimise the generation of air pollution making new developments 'air quality neutral' or 'air quality positive' in accordance with the Mayor of London's Supplementary Planning Guidance (SPG) on Sustainable Design and Construction and any emerging guidance related to this policy.	The Old Oak and Park Royal Opportunity Area Planning Framework states that proposals should minimise the generation of air pollution, both during and post construction, making new developments 'air quality neutral' or better. Enforcement of the policies on transport and energy emissions should ensure that all developments are air quality neutral.
	Measures to Reduce Exposure to Pollution		
12	**Master-planning**	Developments should not create a new "street canyon", or a building configuration that inhibits effective pollution dispersion. In particular, bus and taxi facilities should be designed to avoid the build-up of pollution. The results of wind modelling for the masterplan development shall be used in the development of a Computational Fluid Dynamics (CFD) model of pollutant dispersion within the development area to ensure that the impact of emissions are properly understood and, if necessary, designs are amended to optimise dispersion.	IAQM/EPUK guidance[55] states that "*wherever possible, new developments should not create a new "street canyon", or a building configuration that inhibits effective pollution dispersion*". Previous Local Air Quality Management Technical Guidance (LAQM.TG(09)[91]) identifies wind tunnels and CFD modelling as useful tools with which to investigate the air quality impacts for certain meteorological Scenarios.

[91] Defra (2009) Local Air Quality Management Technical Guidance LAQM.TG (09).

No.	Policy Area	Recommended Policy	Rationale
13	**Green Infrastructure**	New developments should provide adequate, appropriate, and well located green space and infrastructure to help reduce pollutant concentrations and deliver public spaces that encourage walking and cycling. Where possible, evergreen tree species should be planted for the year-round benefits that they provide and species such as oaks, poplars and willows that produce VOCs should be avoided. Care should be taken to avoid reducing dispersion of pollutants through tree planting. Green walls should be used where possible to reduce pollution, and would be particularly beneficial in the most polluted areas.	The London Plan and Old Oak and Park Royal Opportunity Area Planning Framework refer to the benefits of green infrastructure. The London LAQM (LLAQM) Action Matrix includes the provision of green infrastructure as a measure for implementation that can reduce pollutant concentrations and improve public spaces. Research has been carried out into the species that provide the largest air quality benefits, and the use of these species should be prioritised.
14	**Exposure**	Proposals shall not increase the area of exceedance of EU established health-based standards and objectives for NO_2 and PM_{10}. Wherever possible buildings and public realm areas shall be designed to minimise public exposure to elevated levels of pollution. Positioning, layout and separation shall be preferred methods to minimise exposure in preference to active mitigation measures. It may be necessary to remove or relocate sources as well as receptors. In accordance with the Mayor of London's Supplementary Planning Guidance (SPG) on Sustainable Design and Construction, buildings should be air tight, with any air intakes located away from the main source of air pollution to minimise increased exposure to poor air quality.	The Old Oak and Park Royal Opportunity Area Planning Framework states that proposals should achieve EU established health-based standards and objectives for a number of air (NO_X, PM_{10} and $PM_{2.5}$). Developments should not increase the area of exceedance, but it is recognised that some development will occur in areas where the standards are exceeded. Developments should be designed to reduce exposure to pollutant concentrations above the objectives to protect the health of future residents and receptors.
	Assessment		
15	**Monitoring**	OPDC will: - Support the installation of new automatic monitors with equipment to monitor NO_2 and PM_{10} on the main A-Roads in the area (Old Oak Lane, Victoria Road and Scrubs Lane) and at an urban background location (broadly representative of city-wide background conditions, e.g. urban residential areas). Data from these monitors will be collected to AURN quality control standards and made publicly available on the internet through a service such as London Air; - Support the establishment of new NO_2 diffusion tube sites on roads in the area to improve the spatial distribution of monitoring sites across the area; - Support increased monitoring of pollutant concentrations around Old Oak Common in view of the planned HS2 station development; - Support increased monitoring of pollutant concentrations of A40 Westway and/or A404 Harrow Road depending on potential routes for	There is currently a good network of NO_2 diffusion tubes inside and surrounding the Old Oak and Park Royal area. However, there is a need for further monitoring in certain areas in order to increase knowledge of air quality across the area and to enable applicants to verify their dispersion modelling when they are preparing air quality assessments in support of planning applications. Consideration should be given to the new monitoring systems installed and how the data is used. The collection of real-time data offers the possibility using this data to make the area more sustainable and improve transport networks as part of the Smart Cities concept[92]. Trial projects to demonstrate the potential of using real-time air quality data to manage traffic flows for improved air quality are currently being undertaken[93].

[92] European Commission (2015) Smart Cities - https://ec.europa.eu/digital-agenda/en/smart-cities
[93] European Space Agency (2015) UTRAQ Urban Traffic Management and Air Quality - https://artes-apps.esa.int/projects/utraq-urban-traffic-management-and-air-quality

No.	Policy Area	Recommended Policy	Rationale
		construction related traffic (including HS2 links with Park Royal); and - Integrate pollution monitoring with public information systems and consider the options for integrating monitoring with traffic control as part of the Smart Cities initiative.	
16	**Assessment for planning purposes**	The inputs and results of the masterplan air quality modelling undertaken under recommendation 12 shall be made available to the developers of each site within the masterplan area. At each stage of the model, inputs shall be reviewed to ensure that they are up to date and include any additional information generated through the previous development steps. The outcomes of the modelling shall be used as design parameters to inform the detailed design of each phase to ensure that the development minimises exposure to poor air quality in all public and residential spaces. Wherever possible the design should also seek to aid the dispersion of pollutants from sources such as roads and energy centres. Preference will be given to design solutions that reduce exposure and enhance dispersion without resorting to mechanical ventilation or un-openable windows. In accordance with the Mayor of London's Supplementary Planning Guidance (SPG) on Sustainable Design and Construction, developers should produce an air quality assessment which should be submitted with the planning application. The scope and methodology of the air quality assessment should be agreed with the relevant local authority and should include the following: - a review of air quality around the development site using existing air quality monitoring and/or modelling data; - air quality dispersion modelling (including street canyon modelling where applicable) to predict the impact of the development and the pollutant concentrations to which introduced receptors would be exposed; - an assessment of the impact on air quality during the construction phase and detailed mitigation methods for controlling dust and pollution emissions in line with The Control of dust and emissions during construction and demolition SPG; - an outline and justification of mitigation measures associated with the design, location and operation of the development in order to reduce air pollution and exposure to poor air quality; - Details of the emissions from proposed plant demonstrating compliance with the relevant emission standards; and - Assessment against the air quality neutral guidance.	The Old Oak and Park Royal Opportunity Area Planning Framework states that developers will be required to undertake strategies that assess baseline air quality levels, set targets for new air quality levels, monitor this during and post construction and take action if these targets are exceeded. Assessment is required to demonstrate that the relevant policies have been incorporated into the development design and ensure that appropriate mitigation is included to reduce exposure where necessary.

Construction and Logistics Strategy

Table 5.4 Recommended policies for the construction phase

No.	Policy Area	Recommended Policy	Rationale
1	**Freight, Delivery and Servicing**	The OPDC will establish routing requirements for construction vehicles to keep HDVs on larger arterial routes, such as the A40 and A406, and avoid causing congestion and increasing pollution on local roads. To minimise emissions during the demolition and construction phase, proposals should: - Make maximum use of transport by rail and the Grand Union Canal during the construction period, including removal of excavated material and waste, and for servicing and deliveries; - Co-ordinate and phase construction projects to enable the transport impacts to be effectively managed; - Manage servicing and deliveries in line with best practice, including consolidation wherever possible, to minimise the impact on the surrounding road network; - Support the provision and operation of measures to reduce freight trips and promote cleaner vehicles (e.g. consolidation centres); and - Ensure that the operators of all freight vehicles operating in the area have attained the Gold FORS accreditation so that they have made proven efforts to reduce emissions. To minimise the impact of emissions from vehicles delivering and collecting freight, the OPDC should investigate the possibility of establishing one, or several, temporary construction Freight Consolidation Centres that will reduce the number of vehicle trips required. In order to provide the maximum benefits use should also be made of the existing TfL freight consolidation scheme[94]. Any new consolidation centres shall be integrated with the wider TfL freight consolidation scheme. Organisations operating HDVs in the area will be required to sign up to the OPDC FQP and abide by the requirements of the ULEZ.	These policies are included in the Old Oak and Park Royal Opportunity Area Planning Framework and should be enforced in order to reduce the pressure on the road network during the construction phase and minimise construction transport emissions as far as possible. The local rail network and the Grand union Canal offer significant non-road possibilities for the movement of construction freight and construction freight consolidation has been applied for many project across London. FORS accreditation has been achieved by operators across London. The highest standards should be applied in the Old Oak and Park Royal area.
2	**Control of Dust**	As a minimum, developers and contractors should follow the guidance set out in the Mayor's SPG on *The Control of Dust and Emissions during Construction and Demolition* when drafting their construction plans and measures to minimise air pollution during the demolition and construction process recommended in this SPG should be implemented. Wherever possible 'best in class' measures should be used based on the findings of the "London Low Emissions Construction	*The Control of Dust and Emissions during Construction and Demolition* SPG seeks to reduce emissions of dust, PM_{10} and $PM_{2.5}$ from construction and demolition activities in London. It sets out the methodology for assessing the air quality impacts of construction and demolition in London and identifies good practice for mitigating and managing air quality impacts that is relevant and achievable, with the over-arching aim of protecting public health and the environment. This SPG should be followed for developments in the Old Oak and Park Royal area.

[94] https://tfl.gov.uk/info-for/deliveries-in-london/delivering-efficiently/consolidating-deliveries#on-this-page-2

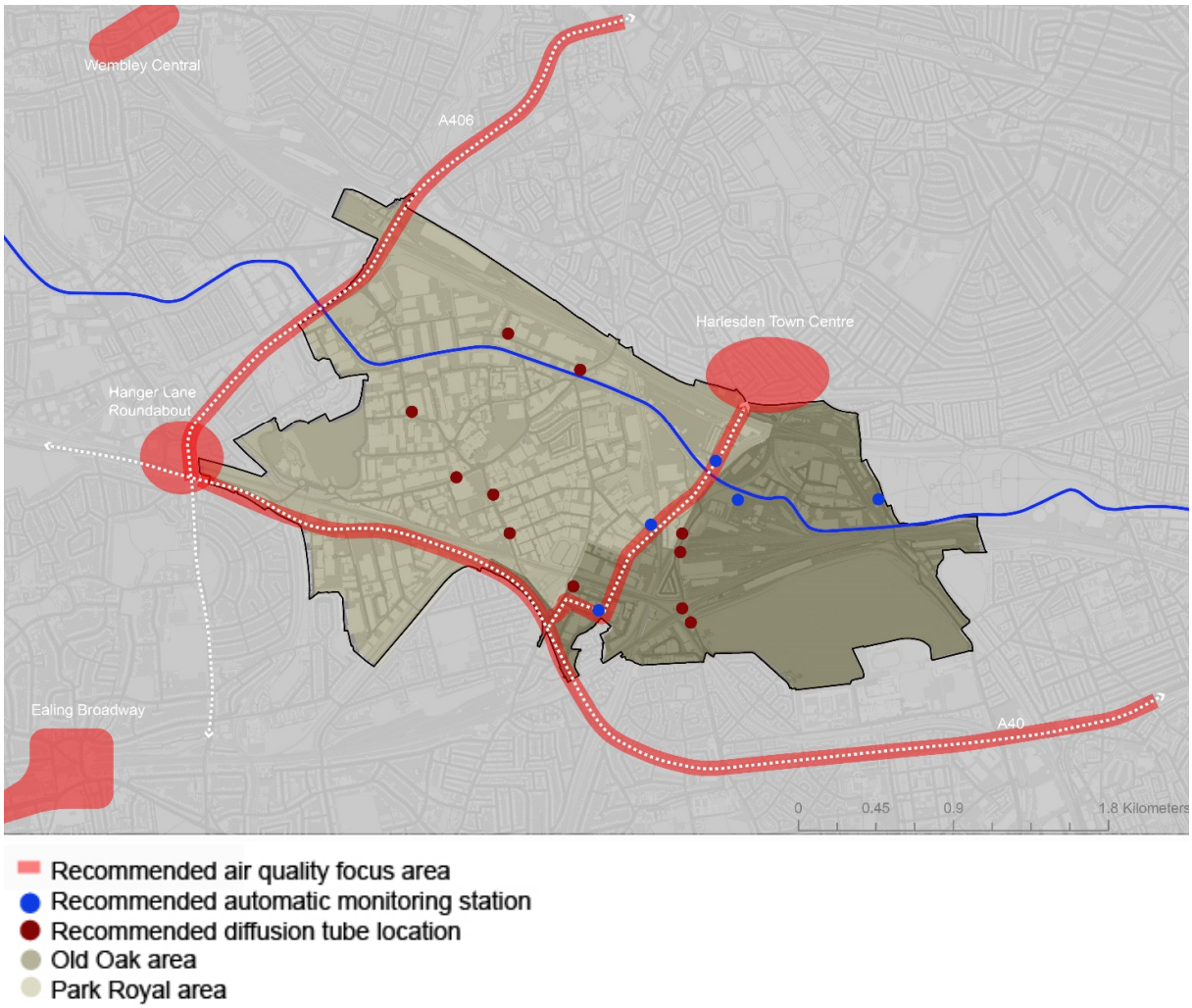
No.	Policy Area	Recommended Policy	Rationale
		Partnership"[95] and any subsequent developments of best practice. Where the opportunity arises, the OPDC will work with the GLA to secure funding to research and develop new mitigation techniques that have the potential to be applied across London. In areas where there is a high risk of trackout of material from construction sites, contractors should establish a regime of road cleaning and/or CMA application to reduce PM_{10} concentrations. These offsite measures should be undertaken collaboratively where there are multiple construction sites working at the same time.	The beneficial effects of CMA application on PM_{10} concentrations where resuspension is an important source have been demonstrated.
3	**Non-Road Mobile Machinery**	Wherever possible, renewable, mains or battery powered plant items should be used on construction sites in the area. The ODPC will ask for the area to be designated for tighter emissions controls, like the Central Activity Zone and Canary Wharf. This means that NRMM of net power between 37kW and 560kW used on any site will be required to meet Stage IIIB of the Directive as a minimum. This will apply to both variable and constant speed engines for both NO_X and PM. From 1 September 2020 NRMM used on any site will be required to meet Stage IV of the Directive as a minimum. Construction site managers should provide details of the NRMM used on the site to the GLA, through the NRMM database website (https://nrmm.london).	*The Control of Dust and Emissions during Construction and Demolition* SPG states that "*Even modern diesel or petrol powered plant items emit higher levels of PM and NO_X than electric equivalents. Therefore, wherever possible, renewable, mains or battery powered plant items should be used.*" *The Control of Dust and Emissions during Construction and Demolition* SPG includes details of a new NRMM Ultra Low Emissions Zone (ULEZ) which establishes emission standards for NRMM. In recognition of the expected concentration of construction activity, tighter standards are established for the Central Activity Zone (CAZ) and Canary Wharf. As there is likely to be highly concentrated construction activity in the Old Oak and Park Royal area, emission standards equivalent to those for the Central Activity Zone (CAZ) and Canary Wharf should be applied.
4	**Assessment**	A cumulative assessment of the impact on air quality of the development during each construction phase should be carried out in order to inform detailed mitigation methods for controlling dust and pollution emissions. As a minimum, these should be in line with *The Control of dust and emissions during construction and demolition* SPG. Where possible individual site developers should work together to develop collaborative measures for dust control. Opportunities to deliver this should be considered during the assessment phase.	*The Control of Dust and Emissions during Construction and Demolition* SPG sets out the methodology for assessing the air quality impacts of construction and demolition in London and identifies good practice for mitigating and managing air quality impact. Assessment is required to demonstrate that potential impacts have been considered and suitable measures have been incorporated into the Construction Environmental Management Plan (CEMP).
5	**Monitoring**	All demolition and construction sites should be monitored for the generation of air pollution. PM_{10} monitoring should be carried out at medium and high risk sites. The OPDC should consider establishing a construction monitoring website, in which real-time monitoring data from all active sites will be provided and tracked and investigate how the data can be shared and used across all the active sites to improve dust control. This will enable construction companies to demonstrate that they are controlling particulate emissions and enable a coordinated response when high particulate levels are recorded across a wide area.	*The Control of Dust and Emissions during Construction and Demolition* SPG sets out the monitoring requirements for construction sites in London. Monitoring best practice should be applied. This means that PM_{10} monitoring should be carried out at medium and high risk sites.

[95] http://www.llecp.org.uk/

Localised measures

Whilst the measures detailed above will help to reduce emissions across the Old Oak and Park Royal area and ensure that impacts of new developments are as minimal as possible, as there are four designated TfL Focus Areas adjacent to the area it is necessary to support measures that will help to reduce pollution in these hotspots and avoid the development of new areas of high pollution. It is recommended that OPDC discuss amendment of the boundaries of the Focus Areas with TfL to better reflect the current and future potential exposure high NO_2 concentrations around the A406 and A40. The proposed amended Focus Areas and locations for key localised measures are shown in Figure 5.1.

Figure 5.1 Localised air quality recommendations map



The policies for particular locations are recommended in Table 5.5.

Table 5.5 Recommended policies for particular locations

No.	Area	Recommended Policy	Rationale
1	**Focus Area 102** – Acton A40 North Acton rail/Gypsy Corner/Sandy	OPDC will work with TfL to seek improvements to the A40 focus area and neighbouring areas of Park Royal where there is expected to be increased exposure as a result of the development. OPDC will also support TfL schemes and improvement works that will	Very high NO_2 concentrations have been recorded on Western Avenue, which forms part of the southern border of the Old Oak and Park Royal area and provides an important connection to Central London. This is a result of high emissions resulting from high levels of traffic and congestion. OPDC will therefore

No.	Area	Recommended Policy	Rationale
	Circus/White City	improve the flow of traffic on the A40 and will therefore improve air quality. OPDC will actively support the proposals for the East-West Cycle Superhighway continuing as far as Acton. This will provide a direct cycle route from the Old Oak and Park Royal area to Central London, raise the profile of cycling options in the area and encourage the use of zero emission modes of transport. If the cycle superhighway is extended to Acton, the OPDC will ensure that it is easily accessible from, and integrated with, local cycle routes provided throughout the development area.	need to support TfL in implementing measures that will reduce emissions. It is proposed that the East-West Cycle Superhighway will run along the A40[96].
2	**Focus Area 103** – A406 North Circular from Stonebridge	In view of the potential additional future air pollution exposure, OPDC will work with TfL to seek improvements to the A406 focus area and the A406 between the focus area and Hangar Lane. OPDC will support TfL schemes and improvement works that will improve the flow of traffic on the North Circular Road and will therefore improve air quality.	Very high NO_2 concentrations have been recorded on the A406 North Circular Road, to the north of the Old Oak and Park Royal area. This is a result of high emissions resulting from high levels of traffic and congestion. OPDC will therefore need to support TfL in implementing measures that will reduce emissions. Improvement works are currently being carried out on the A406 North Circular Road at Neasden[97]. A new bus lane is being constructed which will remove the need for 8 buses per hour to travel along the A406, and a new slip road is being constructed which will improve traffic flows and journey times for all vehicles travelling on the main carriageway.
3	**Focus Area 105** – Hanger Lane Twyford Abbey Road	OPDC will support TfL schemes and improvement works that will improve the flow of traffic on the Hanger Lane Gyratory and will therefore improve air quality. OPDC will liaise with TfL to ensure that traffic light phasing is reviewed regularly to ensure the optimum movement of traffic through the gyratory system.	Very high NO_2 concentrations have been recorded on the Hanger Lane Gyratory system and neighbouring roads, to the west of the Old Oak and Park Royal area. This is a result of high emissions resulting from congested traffic flow. OPDC will therefore need to support TfL in implementing measures that will reduce emissions. The Hanger Lane traffic signals operate under the Split Cycle Offset Optimisation Technique (SCOOT) control system which allows the green time given to each approach to vary in response to demand measured by detectors located in the road. The timings of signals are reviewed on an annual basis to ensure that traffic movements are optimised[98].
4	**Focus Area 107** – Harlesden & Willesden Junction	OPDC will support the regeneration of Harlesden Town Centre to provide a better shopping environment in the town centre and encourage pedestrian visitors. This will help to reduce the volume of car traffic in the area and therefore overall emissions. This should include ensuring that provision of pedestrian and cycle infrastructure in OPDC is co-ordinated with new infrastructure in the Harlesden area. OPDC shall also ensure that the new and improved train stations are easily accessible	High NO_2 concentrations have been recorded on Harlesden High Street, to the north of the Old Oak and Park Royal area. This is a result of high emissions resulting from congestion. OPDC will therefore need to support the implementation of measures that will reduce emissions. Changes have recently been made to the road layout and parking system to encourage shoppers and improve the environment for pedestrian visitors[99].

[96] TfL (2015) Have your say on a new segregated East-West Cycle Superhighway through central London - https://consultations.tfl.gov.uk/cycling/eastwest

[97] TfL (2015) A406 Neasden Improvements - https://tfl.gov.uk/travel-information/improvements-and-projects/a406-neasden

[98] Change in light phasing on Hanger Lane Gyratory Freedom of Information request - https://www.whatdotheyknow.com/request/chnage_in_light_phasing_on_hange

[99] Brent Council (2014) Harlesden Town Centre Transformation - https://www.brent.gov.uk/council-news/press-releases/pr5883/

No.	Area	Recommended Policy	Rationale
		from Harlesden by accessible modes of transport.	
5	**Victoria Road/Old Oak Lane**	In view of potential future exposure to air pollution, OPDC will seek to ensure that Victoria Road and Old Oak Lane are not adversely affected by any new traffic caused by the development and are, if possible, improved. OPDC will investigate options to reduce congestion and queuing on Victoria Road as construction is carried out and new developments become operational in the Old Oak and Park Royal area. This will include options such as: - Prohibition of deliveries and collections during peak hours (implemented through the FQP); - The use of traffic light control systems, such as SCOOT, to optimise the flow of traffic; and - Working with TfL to identify and provide junction improvements to optimise the flow of traffic.	The data provided from the OOC STS indicates that, as a result of development in Old Oak and Park Royal, traffic flows on Victoria Road are likely to increase significantly and queueing and traffic delays on this road will increase. SCOOT technology is used at around half of all signalled junctions in London. Studies have shown that on average, installing SCOOT at a junction reduces traffic disruption by between 8% and 12%[100]. Trials into using traffic management systems to provide management responses to air quality monitoring data are currently being undertaken. The smart use of air quality and traffic data to improve air quality is an option that could provide benefits on congested roads in the Old Oak and Park Royal area.
6	**Roads around Old Oak Common railway station**	OPDC will support policies to reduce congestion and emissions on the roads around the Old Oak Common railway station. This will include options such as: - Prioritising access by sustainable modes of transport, including provision of sufficient numbers of secure cycle parking spaces and pedestrianised 'desire lines' to work places, residential areas and the other stations; - Restricting the number of waiting spaces and time available for collection and drop-off; - Reducing the number, or removing, longer term parking spaces; - Working with TfL to ensure adequate provision of onward bus connections to reduce the need to drive to the station; - Enforcing no-idling policies for cars, taxis and buses to ensure that unnecessary emissions do not take place; and - Provision of infrastructure to enable charging of electric taxis and buses with zero emissions.	The data provided from the OOC STS indicates that, as a result of development in Old Oak and Park Royal, traffic flows on the roads serving the Old Oak Common railway station are likely to be high and there may be a high level of congestion and queuing. To avoid creation of a new area of exceedance of the NO_2 annual mean AQO, policies will be required to reduce emissions in the area.

[100] TfL (2014) Delivering the Future of London's Traffic Signals - https://tfl.gov.uk/info-for/media/press-releases/2014/july/delivering-the-future-of-london-s-traffic-signals

Appendix A
LLAQM Borough air quality action matrix

Theme	Action #	Measure
Emissions from developments and buildings	1	Ensuring emissions from construction are minimised
	2	Ensuring enforcement of Non Road Mobile Machinery (NRMM) air quality policies
	3	Enforcing CHP and biomass air quality policies
	4	Enforcing Air Quality Neutral policies
	5	Ensuring adequate, appropriate, and well located green space and infrastructure is included in new developments
	6	Ensuring that Smoke Control Zones are appropriately identified and fully promoted and enforced
	7	Promoting and delivering energy efficiency retrofitting projects in workplaces and homes using the GLA RE:NEW and RE:FIT programmes to replace old boilers /top-up loft insulation in combination with other energy conservation measures.
Public health and awareness raising	8	Ensure that Directors of Public Health (DsPHs) have been fully briefed on the scale of the problem in your local authority area; what is being done, and what is needed. A briefing should be provided.
	9	Public Health Teams should be supporting engagement with local stakeholders (businesses, schools, community groups and healthcare providers). They should be asked for their support via the DsPH when projects are being developed.
	10	Director of Public Health to have responsibility for ensuring their Joint Strategic Needs Assessment (JSNA) has up to date information on air quality impacts on the population
	11	Strengthening co-ordination with Public Health by ensuring that at least one Consultant-grade public health specialist within the borough has air quality responsibilities outlined in their job profile
	12	Director of Public Health to sign off Statutory Annual Status Reports and all new Air Quality Action Plans
	13	Ensure that the Head of Transport has been fully briefed on the Public Health duties and the fact that all directors (not just Director of Public Health) are responsible for delivering them, as well as on air quality opportunities and risks related to transport in the borough. Provide a briefing which can be disseminated amongst the Transport team.
	14	Engagement with businesses
	15	Promotion of availability of airTEXT
	16	Encourage schools to join the TfL STARS accredited travel planning programme by providing information on the benefits to schools and supporting the implementation of such a programme
	17	Air quality at schools
Delivery servicing and freight	18	Update local authority Procurement policies to include a requirement for suppliers with large fleets to have attained silver Fleet Operator Recognition Scheme (FORS) accreditation
	19	Update Procurement policies to ensure sustainable logistical measures are implemented (and include requirements for preferentially scoring bidders based on their sustainability criteria)
	20	Re-organisation of freight to support consolidation (or micro-consolidation) of deliveries, by setting up or participating in new logistics facilities, and/or requiring that council suppliers participate in these
	21	Virtual Loading Bays and priority loading for ultra-low emission delivery vehicles
Borough fleet actions	22	Join the Fleet Operator Recognition Scheme (FORS) for the borough's own fleet and obtain Gold accreditation
	23	Increasing the number of hydrogen, electric, hybrid, bio-methane and cleaner vehicles in the boroughs' fleet
	24	Accelerate uptake of new Euro VI vehicles in borough fleet

	25	Smarter Driver Training for drivers of vehicles in borough Own Fleet i.e. through training of fuel efficient driving and providing regular re-training of staff
Localised solutions	26	Green Infrastructure
	27	Low Emission Neighbourhoods (LENs)
Cleaner transport	28	Discouraging unnecessary idling by taxis, coaches and other vehicles (e.g. through anti-idling campaigns or enforcement activity)
	29	Speed control measures e.g. lowering the legal speed limit to 20mph in built up residential areas
	30	Increasing the proportion of electric, hydrogen and ultra low emission vehicles in Car Clubs
	31	Very Important Pedestrian Days (e.g. no vehicles on certain roads on a Sunday) and similar initiatives
	32	Free or discounted parking charges at **existing** parking meters for zero emission cars
	33	Free or discounted residential parking permits for zero emission cars
	34	Surcharge on diesel vehicles below Euro 6 standards for Resident and Controlled Parking Zone permits
	35	Installation of residential electric charge points
	36	Installation of rapid chargers to help enable the take up of electric taxis, cabs and commercial vehicles (in partnership with TfL and/or OLEV)
	37	Reallocation of road space; reducing parking at accessible destinations and/or restricting parking on congested high streets and busy roads to improve bus journey times, cycling experience, and reduce emissions caused by congested traffic
	38	Provision of infrastructure to support walking and cycling
	39	Local Low Emission Zones (LEZ)

Appendix B
ADMS-roads model

Introduction

The ADMS-Roads dispersion model, developed by CERC[101], is a tool for investigating air pollution problems due to small networks of roads that may be in combination with industrial sites, for instance small towns or rural road networks. It calculates pollutant concentrations over specified domains at high spatial resolution (street scale) and in a format suitable for direct comparison with a wide variety of air quality standards for the UK and other countries. The latest version of the model, version 3.1.4, was used in this study.

ADMS-Roads is referred to as an advanced Gaussian or, new generation, dispersion model as it incorporates the latest understanding of the boundary layer structure. It differs from old generation models such as ISC, R91 and CALINE in two main respects:

- It characterises the boundary layer structure and stability using the boundary layer depth and Monin-Obukhov length to calculate height-dependent wind speed and turbulence, rather than using the simpler Pasquill-Gifford stability category approach; and
- It uses a skewed-Gaussian vertical concentration profile in convective meteorological conditions to represent the effect of thermally generated turbulence.

Model features

A description of the science used in ADMS-Roads and the supporting technical references can be found in the model's User Guide[101]. The main features of ADMS-Roads are:

- It is an advanced Gaussian, "new generation" dispersion model;
- Includes a meteorological pre-processor which calculates boundary layer parameters from a variety of input data e.g. wind speed, day, time, cloud cover and air temperature;
- Models the full range of source types encountered in urban areas including industrial sources (up to 3 point sources, up to 3 lines sources, up to 4 area sources, up to 25 volume sources) and road sources (up to 150 roads, each with 50 vertices);
- Generates output in terms of average concentrations for averaging times from 15minutes to 1 year, percentile values and exceedances of threshold values. Averages can be specified as rolling (running) averages or maximum daily values;
- The option to calculate emissions from traffic count data, speed and fleet split (light duty/ heavy duty vehicles) using UK emission factors. Alternatively, road emissions may be entered directly as user specified values;
- Models plume rise by solving the integral conservation equations for mass, momentum and heat;
- Models the effect of street canyons on concentrations within the canyon and vehicle–induced turbulence using a formulation based on the Danish OSPM model. It is usually only important to model street canyons when the aspect ratio (ratio of the height of buildings along the road to the width of the road) is greater than 0.5;
- Models the effects of noise barriers on concentrations outside the road;
- Models NO_X chemistry using the 8 reaction Generic Reaction Set plus transformation of SO_2 to sulphate particles, which are added to the PM_{10} concentration;
- Models the effect of a small number of buildings on dispersion from point sources;

[101] CERC (2011) ADMS-Roads, an Air Quality Management System, Version 3.1 User Guide, http://www.cerc.co.uk/environmental-software/assets/data/doc_userguides/CERC_ADMS-Roads3.1_User_Guide.pdf Date of access: 19th October 2012.

- Models the effect of complex terrain (hills) and spatially varying surface roughness. Terrain effects only become noticeable for gradients greater than 1:10, but for ground level sources in a built up area, such as urban roads, low gradients will have a negligible effect;
- Models concentrations in units of $ou_E m^{-3}$ for odour studies;
- Link to MapInfo and ArcGIS for input of source geometry, display of sources, aggregation of emissions and plotting of contours; and
- Link to an emissions inventory in Microsoft Access for input and export of source and emissions data.

In this study, street canyons, noise barriers, buildings and complex terrain were not modelled. The link to MapInfo was used to enter source geometry.

Validation

ADMS-Roads has been validated using UK and US data and has been compared with the DMRB spreadsheet model and the US model, CALINE. Validation of the ADMS and ADMS-Urban models are also applicable to the performance of ADMS-Roads as they test common features: basic dispersion, modelling of roads and street canyons, the effect of buildings and the effect of complex terrain. These validation studies are all reported on the CERC web site[102]. In addition, ADMS-Urban has been validated during its use in modelling many urban areas in the UK for local authorities as part of LAQM, Heathrow Airport for the Department for Transport[103] and all of Greater London for a Defra model inter-comparison exercise[104].

[102] http://www.cerc.co.uk/environmental-software/model-documentation.html#validation Date of access: 19th October 2012

[103] CERC (2007) Air Quality Studies for Heathrow: Base Case, Segregated Mode, Mixed Mode and Third Runway Scenarios Modelled Using ADMS-Airport, prepared for the Department for Transport, *HMSO* Product code 78APD02904CERC

[104] Carslaw, D. (2011), Defra urban model evaluation analysis – Phase 1, a report to Defra and the Devolved Authorities. http://uk-air.defra.gov.uk/library/reports?report_id=654 Date of access: 19th October 2012

Appendix C
ADMS-roads model verification

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The ADMS-Roads dispersion model has been widely validated for this type of assessment and is discussed in Defra's LAQM.TG (16)[105] guidance as an accepted dispersion model.

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

The predicted results from a dispersion model may differ from measured concentrations for a large number of reasons, including uncertainties associated with:

- Background concentration estimates;
- Meteorological data;
- Source activity data such as traffic flows and emissions factors;
- Model input parameters such as surface roughness length, minimum Monin-Obukhov length;
- Monitoring data, including locations; and
- Overall model limitations.

Model verification is the process by which these and other uncertainties are investigated and where possible minimised. In reality, the differences between modelled and monitored results are likely to be a combination of all of these aspects.

Model setup parameters and input data were checked prior to running the models in order to reduce these uncertainties. The following were checked to the extent possible to ensure accuracy:

- Traffic data;
- Road widths;
- Distance between sources and monitoring as represented in the model;
- Speed estimates on roads;
- Source types, such as elevated roads and street canyons;
- Selection of representative meteorological data;
- Background monitoring and background estimates; and
- Monitoring data.

Suitable local monitoring data for the purpose of verification is available for annual mean NO_x/NO_2 concentrations as shown in Table C1 below. All diffusion tubes along modelled roads were considered for verification. Background diffusion tubes were removed from the verification process. In total, 32 diffusion tubes were used for verification purposes.

[105] Defra (2016) Local Air Quality Management Technical Guidance TG(16)

Table C1 Local monitoring data suitable for ADMS-roads model verification

Location	2014 Annual Mean NO_2 (μgm^{-3})	X (m)	Y (m)
BRT21A	**45.1**	520078	182857
BRT54	**42.8**	518221	183206
BRT42	**44.1**	521155	184002
BRT43	**60.9**	520242	184541
BRT55	**64.1**	521743	183361
BRT56	**63.8**	523635	183153
BRT52A	**94.7**	520874	185173
Ealing Western Avenue	**66.0**	520430	181950
Ealing Hangar Lane Gyratory	**68.0**	518537	182708
EA57	39.4	518635	181288
EA58	**79.6**	518541	182707
EA59	**81.6**	518541	182707
EA60	**79.6**	518541	182707
EA61	**50.0**	518680	182979
EA63	34.4	519515	183155
EA64	**56.0**	519997	182178
EA65	**70.5**	520430	181950
EA66	**70.0**	520430	181950
EA67	**70.6**	520430	181950
EA69	**55.6**	520780	182775
EA71	35.5	521587	182684

Location	2014 Annual Mean NO_2 (μgm^{-3})	X (m)	Y (m)
EA72	36.5	521301	182076
EA74	**50.8**	521173	180981
EA75	**77.4**	521549	180923
EA76	**47.8**	521557	180996
EA80	31.9	521093	180613
EA90	**42.3**	520180	180896
EA91	**48.2**	520432	181428
EA92	**50.7**	520432	181428
EA93	**46.4**	520432	181428
EA94	**40.9**	520532	181517
EA96	**43.1**	520739	181824

Exceedances of the AQO are shown in **bold.**

Verification calculations

The verification of the modelling output was performed in accordance with the methodology provided in Annex 3 of LAQM.TG (09)[105]. Table C2 shows that there was systematic under prediction of monitored concentrations at the diffusion tubes. Due to the modelled concentrations under predicting at most of the tubes, it was considered necessary to adjust modelled concentrations.

Table C2 Verification, modelled versus monitored

Site	2014 Modelled Annual Mean NO_2 (μgm^{-3})	2014 Monitored Annual Mean NO_2 (μgm^{-3})	% (Modelled-Monitored)/ Monitored
BRT21A	39.6	45.1	-12.22%
BRT54	45.9	42.8	7.17%
BRT42	36.1	44.1	-18.21%
BRT43	61.1	60.9	0.36%
BRT55	51.8	64.1	-19.17%
BRT56	40.5	63.8	-36.49%
BRT52A	58.0	94.7	-38.71%
Ealing Western Avenue	60.4	66.0	-8.56%
Ealing Hangar Lane Gyratory	70.0	68.0	2.88%

Site	2014 Modelled Annual Mean NO_2 (μgm^{-3})	2014 Monitored Annual Mean NO_2 (μgm^{-3})	% (Modelled-Monitored)/ Monitored
EA57	45.0	39.4	14.09%
EA58	65.5	79.6	-17.71%
EA59	65.5	81.6	-19.73%
EA60	65.5	79.6	-17.71%
EA61	48.5	50.0	-3.04%
EA63	42.8	34.4	24.33%
EA64	51.1	56.0	-8.80%
EA65	60.4	70.5	-14.40%
EA66	60.4	70.0	-13.79%
EA67	60.4	70.6	-14.52%
EA69	38.0	35.5	7.04%
EA71	42.8	36.5	17.32%
EA72	38.3	53.0	-27.83%
EA74	47.6	50.8	-6.34%
EA75	48.4	77.4	-37.51%
EA76	41.9	47.8	-12.34%
EA80	37.7	31.9	18.28%
EA90	34.9	42.3	-17.52%
EA91	45.4	48.2	-5.85%
EA92	45.4	50.7	-10.49%
EA93	45.4	46.4	-2.20%
EA94	47.7	40.9	16.58%
EA96	51.0	43.1	18.40%

Table C3 shows the comparison of modelled road-NO_X, a direct output from the ADMS-Roads modelling, with the monitored road-NO_X, determined from the LAQM NO_X to NO_2 conversion tool. An adjustment factor, determined through regression, of 1.542 was used to adjust modelled results.

Table C3 Comparison of modelled and monitored road NO_x to determine verification factor

Site	2014 Modelled Annual Mean Road NO_x (μgm^{-3})	2014 Monitored Annual Mean Road NO_x (μgm^{-3})	Ratio
BRT21A	11.85	50.31	4.25
BRT54	28.23	43.50	1.54
BRT42	10.50	49.51	4.72
BRT43	69.26	97.29	1.40

Site	2014 Modelled Annual Mean Road NO_X (μgm^{-3})	2014 Monitored Annual Mean Road NO_X (μgm^{-3})	Ratio
BRT55	45.40	110.84	2.44
BRT56	23.18	113.91	4.91
BRT52A	67.87	231.33	3.41
Ealing Western Avenue	64.34	82.54	1.28
Ealing Hangar Lane Gyratory	96.98	90.21	0.93
EA57	32.94	132.12	4.01
EA58	81.80	139.75	1.71
EA59	81.80	132.12	1.62
EA60	81.80	35.19	0.43
EA61	31.14	12.27	0.39
EA63	11.91	50.40	4.23
EA64	36.51	97.92	2.68
EA65	64.34	96.18	1.49
EA66	64.34	98.27	1.53
EA67	64.34	50.04	0.78
EA69	8.17	7.23	0.89
EA71	22.11	49.14	2.22
EA72	11.21	44.01	3.93
EA74	35.28	131.85	3.74
EA75	37.39	35.86	0.96
EA76	20.85	63.22	3.03
EA80	10.98	29.16	2.66
EA90	11.52	29.61	2.57
EA91	22.39	36.27	1.62
EA92	22.39	24.93	1.11
EA93	22.39	11.51	0.51
EA94	28.26	10.58	0.37
EA96	37.16	17.01	0.46

Table C4 shows the comparison of the modelled NO_2 concentration calculated by multiplying the modelled road NO_X by the adjustment factor of 1.542 and using the LAQM's NO_X to NO_2 conversion tool to calculate the total adjusted modelled NO_2.

Table C4 Comparison of adjusted modelled NO_2 and modelled NO_2

Site	2014 Background NO_X Concentration	2014 Background NO_2 Concentration	2014 Adjusted Modelled Annual Mean NO_2 (μgm^{-3})	2014 Monitored Annual Mean NO_2 (μgm^{-3})	% (Modelled-Monitored)/ Monitored
BRT21A	58.7	34.3	42.3	45.1	-6.21%
BRT54	57.3	33.9	51.6	42.8	20.56%
BRT42	51.7	31.3	38.5	44.1	-12.61%
BRT43	59.1	34.9	72.3	60.9	18.64%
BRT55	56.4	33.4	60.1	64.1	-6.27%
BRT56	49.7	30.3	45.5	63.8	-28.68%
BRT52A	52.6	31.8	69.1	94.7	-26.99%
Ealing Western Avenue	61.4	35.8	70.9	66.0	7.38%
Ealing Hangar Lane Gyratory	60.0	35.5	84.1	68.0	23.74%
EA57	51.1	30.9	51.5	39.4	30.79%
EA58	60.0	35.5	78.0	79.6	-1.98%
EA59	60.0	35.5	78.0	81.6	-4.39%
EA60	60.0	35.5	78.0	79.6	-1.98%
EA61	60.0	35.5	54.6	50.0	9.22%
EA63	65.7	37.6	45.4	34.4	32.03%
EA64	62.6	36.1	58.0	56.0	3.55%
EA65	61.4	35.8	70.9	70.5	0.52%
EA66	61.4	35.8	70.9	70.0	1.24%
EA67	61.4	35.8	70.9	70.6	0.38%
EA69	58.7	34.3	39.9	35.5	12.42%
EA71	56.5	33.2	47.5	36.5	30.19%
EA72	56.5	33.2	40.8	53.0	-22.96%
EA74	54.2	32.8	54.5	50.8	7.19%
EA75	54.2	32.8	55.6	77.4	-28.23%
EA76	54.2	32.8	46.4	47.8	-2.95%
EA80	54.2	32.8	40.3	31.9	26.27%
EA90	48.0	29.6	37.6	42.3	-11.11%
EA91	61.4	35.8	50.1	48.2	3.86%
EA92	61.4	35.8	50.1	50.7	-1.26%

Site	2014 Background NO_x Concentration	2014 Background NO_2 Concentration	2014 Adjusted Modelled Annual Mean NO_2 (μgm^{-3})	2014 Monitored Annual Mean NO_2 (μgm^{-3})	% (Modelled-Monitored)/ Monitored
EA93	61.4	35.8	50.1	46.4	7.89%
EA94	61.4	35.8	53.4	40.9	30.44%
EA96	61.4	35.8	58.1	43.1	34.69%

Table C5 below shows the difference in agreement between the unadjusted and adjusted concentrations overall.

Table C5 Comparison of adjusted and unadjusted concentrations

Agreement	Unadjusted Concentrations	Adjusted Concentrations
Greater than 25% difference	4	9
10 to 25 % difference	18	7
Within 10% difference	10	16

Although, following adjustment, the number of monitoring sites where agreement was greater than ± 25% increased, it was decided to use this adjustment factor as a conservative measure, rather than not adjusting the modelled results upwards. Following adjustment, six of the nine sites where agreement was greater than ± 25% showed modelled concentrations higher than monitored concentrations and the number of modelled NO_2 concentrations within 10% of monitored concentrations increased from 10 to 16. Without adjustment, monitored concentrations are under-predicted at a greater number of sites (22 as opposed to 13). Modelled NO_2 and PM_{10} concentrations have therefore been adjusted using this adjustment factor.

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