Air Quality Assessment:
Bowes Primary Area Quieter Neighbourhood Scheme, Enfield

June 2021

Experts in air quality
management & assessment

Document Control

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1 Introduction

1.1 This report describes the potential air quality impacts associated with the Quieter Neighbourhood Scheme in Enfield. The assessment has been carried out by Air Quality Consultants Ltd on behalf of London Borough of Enfield (LB Enfield). This air quality assessment has been undertaken in conjunction with a noise assessment undertaken by AQC's sister company Noise Consultants Ltd.

1.2 The scheme was introduced in 2020 and, in alignment with the Mayor's Transport Strategy 2018 (GLA, 2018a), aims to reduce neighbourhood motor traffic, where *"through motor vehicle traffic is discouraged or removed"*[1].

1.3 The assessment has been conducted using traffic data provided by LB Enfield, consisting of raw measured traffic flows over two seven-day periods in July and November 2020 (pre- and post-scheme implementation). This has been used to calculate the changes in traffic attributable to the scheme, and to estimate associated impacts on local air quality. The traffic data were processed into the appropriate format for air quality modelling through adjustments to represent an annual mean. Uncertainties associated with this process, as well as with other parameters that would have influenced measured traffic data (i.e. school holidays, the COVID pandemic), have, to some extent, been taken into account within the assessment and conclusions, as further discussed in this report.

1.4 This report describes existing local air quality conditions (base year 2019), and the predicted changes in pollutant concentrations at sensitive receptors with the scheme in place (assessment year 2020). The assessment focuses on nitrogen dioxide, PM_{10} and $PM_{2.5}$ as the main pollutants of concern.

1.5 The predicted annual mean pollutant concentrations at selected receptors, with and without the scheme in place in 2020, and associated impacts, are also described in full in Appendix A5.

1.6 This report has been prepared taking into account all relevant local and national guidance and regulations.

1 Further information about the Quieter Neighbourhoods scheme can be found at: https://new.enfield.gov.uk/services/improving-enfield/quieter-neighbourhoods/

2 Policy Context and Assessment Criteria

2.1 All European legislation referred to in this report is written into UK law and will remains in place, although there is uncertainty at this point in time as to who will enforce the requirements of some of this legislation.

Air Quality Strategy

2.2 The Air Quality Strategy (Defra, 2007) published by the Department for Environment, Food, and Rural Affairs (Defra) and Devolved Administrations, provides the policy framework for air quality management and assessment in the UK. It provides air quality standards and objectives for key air pollutants, which are designed to protect human health and the environment. It also sets out how the different sectors: industry, transport and local government, can contribute to achieving the air quality objectives. Local authorities are seen to play a particularly important role. The strategy describes the Local Air Quality Management (LAQM) regime that has been established, whereby every authority has to carry out regular reviews and assessments of air quality in its area to identify whether the objectives have been, or will be, achieved at relevant locations, by the applicable date. If this is not the case, the authority must declare an Air Quality Management Area (AQMA), and prepare an action plan which identifies appropriate measures that will be introduced in pursuit of the objectives.

Clean Air Strategy 2019

2.3 The Clean Air Strategy (Defra, 2019) sets out a wide range of actions by which the UK Government will seek to reduce pollutant emissions and improve air quality. Actions are targeted at four main sources of emissions: Transport, Domestic, Farming and Industry. At this stage, there is no straightforward way to take account of the expected future benefits to air quality within this assessment.

Reducing Emissions from Road Transport: Road to Zero Strategy

2.4 The Office for Low Emission Vehicles (OLEV) and Department for Transport (DfT) published a Policy Paper (DfT, 2018) in July 2018 outlining how the government will support the transition to zero tailpipe emission road transport and reduce tailpipe emissions from conventional vehicles during the transition. This paper affirms the Government's pledge to end the sale of new conventional petrol and diesel cars and vans by 2040, and states that the Government expects the majority of new cars and vans sold to be 100% zero tailpipe emission and all new cars and vans to have significant zero tailpipe emission capability by this year, and that by 2050 almost every car and van should have zero tailpipe emissions. It states that the Government wants to see at least 50%, and as many as 70%, of new car sales, and up to 40% of new van sales, being ultra-low emission by 2030.

2.5 The paper sets out a number of measures by which Government will support this transition, but is clear that Government expects this transition to be industry and consumer led. The Government has since announced that the phase-out date for the sale of new petrol and diesel cars and vans will be brought forward to 2030 and that all new cars and vans must be fully zero emission at the tailpipe from 2035. If these ambitions are realised then road traffic-related NOx emissions can be expected to reduce significantly over the coming decades, likely beyond the scale of reductions forecast in the tools utilised in carrying out this air quality assessment.

Planning Policy

National Policies

2.6 The National Planning Policy Framework (NPPF) (2019a) sets out planning policy for England. It states that the purpose of the planning system is to contribute to the achievement of sustainable development, and that the planning system has three overarching objectives, one of which (Paragraph 8c) is an environmental objective:

"to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy".

2.7 To prevent unacceptable risks from air pollution, Paragraph 170 of the NPPF states that:

"Planning policies and decisions should contribute to and enhance the natural and local environment by…preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air quality".

2.8 Paragraph 180 states:

"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development".

2.9 More specifically on air quality, Paragraph 180 makes clear that:

"Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as

possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan".

2.10 The NPPF is supported by Planning Practice Guidance (PPG) (Ministry of Housing, Communities & Local Government, 2019b), which includes guiding principles on how planning can take account of the impacts of new development on air quality. The PPG states that:

"Defra carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with Limit Values. It is important that the potential impact of new development on air quality is taken into account where the national assessment indicates that relevant limits have been exceeded or are near the limit, or where the need for emissions reductions has been identified".

2.11 Regarding plan-making, the PPG states:

"It is important to take into account air quality management areas, Clean Air Zones and other areas including sensitive habitats or designated sites of importance for biodiversity where there could be specific requirements or limitations on new development because of air quality".

2.12 The role of the local authorities through the LAQM regime is covered, with the PPG stating that a local authority Air Quality Action Plan "*identifies measures that will be introduced in pursuit of the objectives and can have implications for planning*".

London-Specific Policies

2.13 The key London-specific policies are summarised below, with more detail provided, where required, in Appendix A1.

The London Plan

2.14 The London Plan (GLA, 2021) sets out an integrated economic, environmental, transport and social framework for the development of London over the next 20-25 years. The key policy relating to air quality is Policy SI1 on *Improving air quality*, Part B1 of which sets out key requirements for developments, including:

*An air quality positive approach is linked to other policies in the London Plan, such as **Healthy Streets**, energy masterplanning and green infrastructure.*

2.15 Policy D8 Public Realm recognises that:

The specific balance between the different functions of any one space, such as its place-based activities, its function to facilitate movement and its ability to accommodate different uses of the kerbside, should be at the heart of how the space is designed and managed. The Mayor's Healthy

Streets Approach explains how the design and management of streets can support a wide range of activities in the public realm as well as encourage and facilitate a shift to active travel.

2.16 Healthy Streets also has its own policy, T2, which states that:

A Development proposals and Development Plans should deliver patterns of land use that facilitate residents making shorter, regular trips by walking or cycling.

B Development Plans should: 1) promote and demonstrate the application of the Mayor's Healthy Streets Approach to: improve health and reduce health inequalities; reduce car dominance, ownership and use, road danger, severance, vehicle emissions and noise; increase walking, cycling and public transport use; improve street safety, comfort, convenience and amenity; and support these outcomes through sensitively designed freight facilities. 2) identify opportunities to improve the balance of space given to people to dwell, walk, cycle, and travel on public transport and in essential vehicles, so space is used more efficiently and streets are greener and more pleasant.

London Environment Strategy

2.17 The London Environment Strategy was published in May 2018 (GLA, 2018b). The strategy considers air quality in Chapter 4; the Mayor's main objective is to create a *"zero emission London by 2050".* Policy 4.2.1 aims to *"reduce emissions from London's road transport network by phasing out fossil fuelled vehicles, prioritising action on diesel, and enabling Londoners to switch to more sustainable forms of transport".* An implementation plan for the strategy has also been published which sets out what the Mayor will do between 2018 and 2023 to help achieve the ambitions in the strategy.

Mayor's Transport Strategy

2.18 The Mayor's Transport Strategy (GLA, 2018a) sets out the Mayor's policies and proposals to reshape transport in London over the next two decades. The Strategy focuses on reducing car dependency and increasing active sustainable travel, with the aim of improving air quality and creating healthier streets. It notes that development proposals should *"be designed so that walking and cycling are the most appealing choices for getting around locally".*

Air Quality Focus Areas

2.19 The GLA has identified 183 air quality Focus Areas in London as part of the 2016 update to the London Atmospheric Emissions Inventory (LAEI). These are locations that not only exceed the EU annual mean limit value for nitrogen dioxide, but also have high levels of human exposure. They do not represent an exhaustive list of London's air quality hotspot locations, but locations where the GLA believes the problem to be most acute. They are also areas where the GLA considers there to be the most potential for air quality improvements and are, therefore, where the GLA and Transport for London (TfL) will focus actions to improve air quality. The 'A406 North Circular between Bowes

Road and Great Cambridge' and 'Bound Green A109 junction with Durnsford/Brownlow Road B106' Air Quality Focus Areas are situated within the study area, as shown on Figure 5.

Local Transport Plan

2.20 LB Enfield has published their Transport Plan in 2019 (LB Enfield , 2019). It sets out how the Council will improve travel to, from and within the Borough, and forms the basis of the Council's third Local Implementation Plan. Objective O3 of the Plan is to *"monitor air quality and develop and deliver interventions which address local issues"*. Objective O7 is to "maintain and improve the transport network in Enfield including developing potential interventions." with a view to *"provide an enhanced transport network and significantly enhanced streetscape environments with associated environmental (air quality and emission) benefits as well as health benefits."*. A series of actions have been defined under each of these objectives, including:

- *"Work with TfL to develop plans for appropriate emergency measures to be undertaken to reduce or restrict vehicle use when forecast or actual periods of very high air pollution occur, for example, to tackle non-essential vehicle use or engine idling;*
- *Reliable and resilient charging infrastructure to support uptake of electric vehicles with a focus on rapid and fast charging points in strategic locations;*
- *Reducing traffic volumes by encouraging mode shift from travelling by car to walking, cycling and public transport;*
- *Continue to make the pedestrian environment more accessible to people with buggies, pushchairs and those using wheelchairs; and*
- *Provide a low speed environment".*

Local Policies

2.21 The Core Strategy (LB Enfield, 2010) was adopted in November 2010, and within this there is one policy which refer to air quality. Core policy 32 refers to pollution and states that LB Enfield:

"…will work with its partners to minimise air, water, noise and light […]. In particular, new development will be required to improve air quality by reducing pollutant emissions and public exposure to pollution, particularly in areas identified as having poor air quality in the Air Quality Action Plan. Criteria for assessing applications will be set out in the Development Management Document. The area action plans, particularly the North Circular Area Action Plan, will consider how pollution can be reduced or successfully mitigated against at a local level…"

2.22 LB Enfield is currently working on their new Local Plan. A consultation document (LB Enfield, 2018) was published in December 2018. The draft policy approach SI2 on health and wellbeing states that *"The Council will promote healthy lifestyles, reduce health inequalities and create healthier neighbourhoods. We will support efforts to promote healthy lifestyles and reduce health inequalities,* *by recognising the role of planning in doing so through the creation of healthy neighbourhoods and places. We will expect development proposals to respond to the following contributors to health and wellbeing: […]*

- *The need to improve Enfield's air quality, reduce exposure to airborne pollutants, having regard to national and international obligations[…]"*

2.23 Draft policy T2 on 'Reducing the impact of private vehicles on our street' states that *"The Council will secure a more sustainable local travel network that maximises opportunities for walking, cycling and using public transport, reduces congestion, improves public realm and improves health and well-being. We will achieve this by using the Healthy Streets approach to improve poor air quality and tackle climate change by reducing the reliance of private motor vehicles, easing levels of traffic and congestion and providing infrastructure to support alternative sustainable modes of transport to provide access to employment, schools and services[…]"*

2.24 The "Healthy Street" approach is described as *"an evidence-based approach to improve health and reduce health inequalities, which will help Londoners use cars less, and walk, cycle and use public transport more. It supports the delivery of the Mayor's aim that by 2041 all Londoners will be able to undertake at least the 20 minutes of active travel each day needed to stay healthy. It also requires better management of freight so the impact of moving goods, carrying out servicing and supporting construction on London's streets is lessened. To apply the Healthy Streets Approach, changes are required at strategic, network and street level."*

Air Quality Action Plans

National Air Quality Plan

2.25 Defra has produced an Air Quality Plan to tackle roadside nitrogen dioxide concentrations in the UK (Defra, 2017); a supplement to the 2017 Plan (Defra, 2018a) was published in October 2018 and sets out the steps Government is taking in relation to a further 33 local authorities where shorter-term exceedances of the limit value were identified. Alongside a package of national measures, the 2017 Plan and the 2018 Supplement require those identified English Local Authorities (or the GLA in the case of London Authorities) to produce local action plans and/or feasibility studies. These plans and feasibility studies must have regard to measures to achieve the statutory limit values within the shortest possible time, which may include the implementation of a CAZ. There is currently no straightforward way to take account of the effects of the 2017 Plan or 2018 Supplement in the modelling undertaken for this assessment; however, consideration has been given to whether there is currently, or is likely to be in the future, a limit value exceedance in the study area. This assessment has principally been carried out in relation to the air quality objectives, rather than the EU limit values that are the focus of the Air Quality Plan.

Local Air Quality Action Plan

2.26 The LB Enfield Air Quality Action Plan (LB Enfield, n/a) sets out a series of measures by which they will seek to achieve the air quality objectives in their AQMA. A series of measures concern transport, including Action 6 to *"Work with TfL to improve strategic roads, particularly the A406 North Circular"* and Action 15 which targets the development of *"a high-quality network of 'Greenway' cycle and walking routes using parks, open spaces, quiet traffic routes, and 20mph zones."* The Air Quality Action Plan is currently being reviewed and updated.

Assessment Criteria

2.27 The Government has established a set of air quality standards and objectives to protect human health. The 'standards' are set as concentrations below which effects are unlikely even in sensitive population groups, or below which risks to public health would be exceedingly small. They are based purely upon the scientific and medical evidence of the effects of an individual pollutant. The 'objectives' set out the extent to which the Government expects the standards to be achieved by a certain date. They take account of economic efficiency, practicability, technical feasibility and timescale. The objectives for use by local authorities are prescribed within the Air Quality (England) Regulations (2000) and the Air Quality (England) (Amendment) Regulations (2002).

2.28 The UK-wide objectives for nitrogen dioxide and PM_{10} were to have been achieved by 2005 and 2004 respectively, and continue to apply in all future years thereafter. The $PM_{2.5}$ objective was to be achieved by 2020. Measurements across the UK have shown that the 1-hour nitrogen dioxide objective is unlikely to be exceeded at roadside locations where the annual mean concentration is below 60 $\mu g/m^3$ (Defra, 2018b). Therefore, 1-hour nitrogen dioxide concentrations will only be considered if the annual mean concentration is above this level.

2.29 The objectives apply at locations where members of the public are likely to be regularly present and are likely to be exposed over the averaging period of the objective. Defra explains where these objectives will apply in its Local Air Quality Management Technical Guidance (Defra, 2018b). The annual mean objectives for nitrogen dioxide and PM_{10} are considered to apply at the façades of residential properties, schools, hospitals etc.; they do not apply at hotels. The 24-hour mean objective for PM_{10} is considered to apply at the same locations as the annual mean objective, as well as in gardens of residential properties and at hotels. The 1-hour mean objective for nitrogen dioxide applies wherever members of the public might regularly spend 1-hour or more, including outdoor eating locations and pavements of busy shopping streets.

2.30 EU Directive 2008/50/EC (The European Parliament and the Council of the European Union, 2008) sets limit values for nitrogen dioxide, PM_{10} and $PM_{2.5}$, and is implemented in UK law through the Air Quality Standards Regulations (2010). The limit values for nitrogen dioxide are the same numerical concentrations as the UK objectives, but achievement of these values is a national obligation rather than a local one. In the UK, only monitoring and modelling carried out by UK Central Government meets the specification required to assess compliance with the limit values. Central Government does not normally recognise local authority monitoring or local modelling studies when determining the likelihood of the limit values being exceeded, unless such studies have been audited and approved by Defra and DfT's Joint Air Quality Unit (JAQU).

2.31 The relevant air quality criteria for this assessment are provided in Table 1.

Table 1: Air Quality Criteria for Nitrogen Dioxide, PM_{10} and $PM_{2.5}$

Pollutant	Time Period	Objective
Nitrogen Dioxide	1-hour Mean	200 µg/m^3 not to be exceeded more than 18 times a year
	Annual Mean	40 µg/m^3
Fine Particles (PM_{10})	24-hour Mean	50 µg/m^3 not to be exceeded more than 35 times a year
	Annual Mean	40 µg/m^3 [a]
Fine Particles ($PM_{2.5}$) [b]	Annual Mean	25 µg/m^3

[a] A proxy value of 32 µg/m^3 as an annual mean is used in this assessment to assess the likelihood of the 24-hour mean PM_{10} objective being exceeded. Measurements have shown that, above this concentration, exceedances of the 24-hour mean PM_{10} objective are possible (Defra, 2018b).

[b] The $PM_{2.5}$ objective, which was to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

Descriptors for Air Quality Impacts and Assessment of Significance

2.32 There is no official guidance in the UK in relation to development control on how to describe air quality impacts, nor how to assess their significance. The approach developed jointly by Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM)[2] (Moorcroft and Barrowcliffe et al, 2017) has therefore been used. This includes defining descriptors of the impacts at individual receptors, which take account of the percentage change in concentrations relative to the relevant air quality objective, rounded to the nearest whole number, and the absolute concentration relative to the objective. The overall significance of the air quality impacts is determined using professional judgement, taking account of the impact descriptors. Full details of the EPUK/IAQM approach are provided in Appendix A2. The approach includes elements of professional judgement, and the experience of the consultants preparing the report is set out in Appendix A3.

[2] The IAQM is the professional body for air quality practitioners in the UK.

3 Assessment Approach

Proposed Scheme

3.1 Residents in the Bowes Primary & Surrounding Streets Quieter Neighbourhood Area have raised concerns with Enfield Council over traffic issues in the area for many years. In 2019 the Council engaged residents in the Bowes Primary & Surrounding Streets Quieter Neighbourhood Area through a Perception Survey to better understand the issues that they were experiencing. In response, LB Enfield has implemented a scheme which aims to moderate the speed and volume of traffic and remove through traffic on primary roads within the project area. To that effect, a series of measures have been proposed to divert through traffic from these minor roads onto 'key distributor roads'.

3.2 The scheme will be delivered in phases, as shown on Figure 1 below.

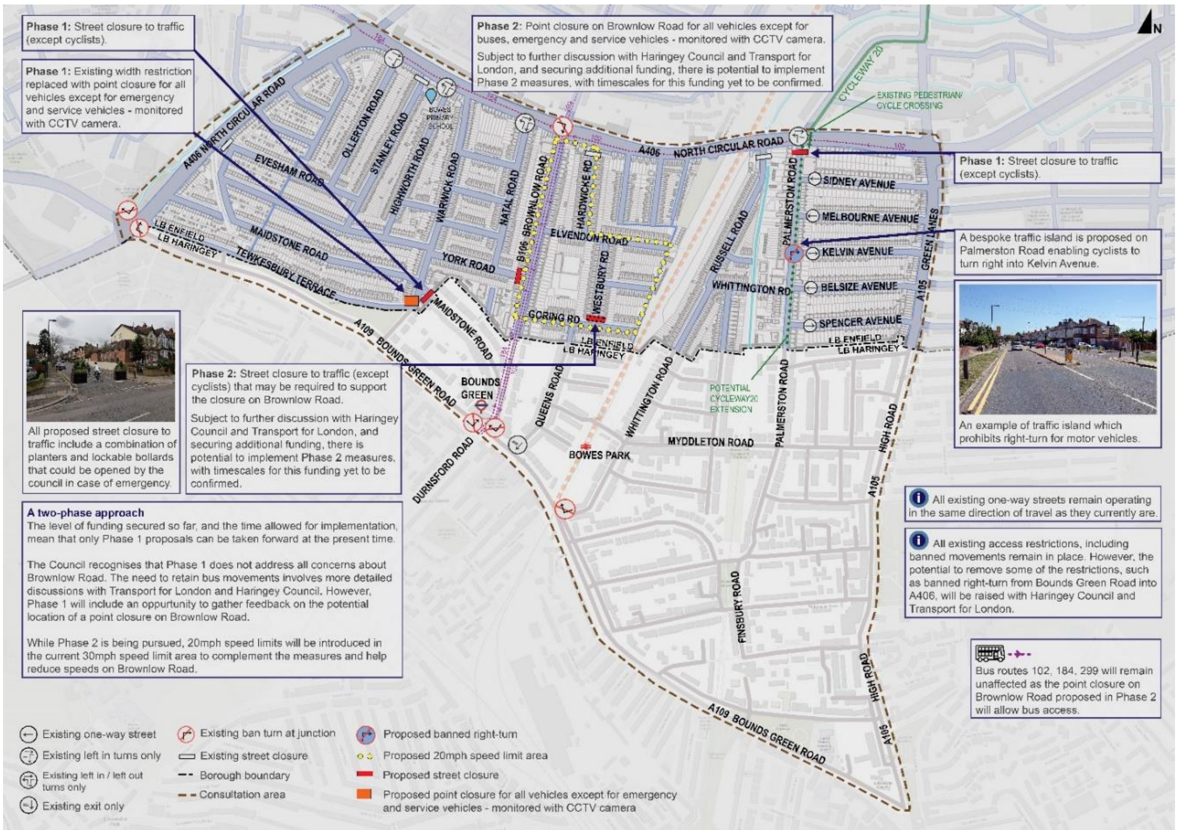

Figure 1: Enfield Quieter Neighbourhood Study Area

3.3 Phase 1 of the scheme started in 2020, with the road closures to motor vehicles at the following locations:

- Maidstone Road at its junction with Warwick Road
- York Road at its junction with Brownlow Road

- Palmerston Road northbound at its junction with the A406 North Circular Road
- Existing width restriction on Warwick Road, near its junction with Maidstone Road, replaced with point closure for all vehicles except for emergency vehicles and service vehicles

3.4 In order to monitor the scheme's impact on vehicle flows, traffic counts were commissioned by LB Enfield for one week prior to the scheme being implemented (in July 2020), and one week after implementation of the scheme (in November 2020). The monitored roads and consultation area are shown in Figure 2 below. In addition, Automatic Traffic Counts (ATCs) 34 and 39 located on the North Circular Road, and operated by Transport for London (TfL), were also used to supplement LB Enfield data (ATC34) and in processing the traffic data measured by the ATCs commissioned by LB Enfield (ATC39). The location of these two ATCs is displayed in Figure 3.

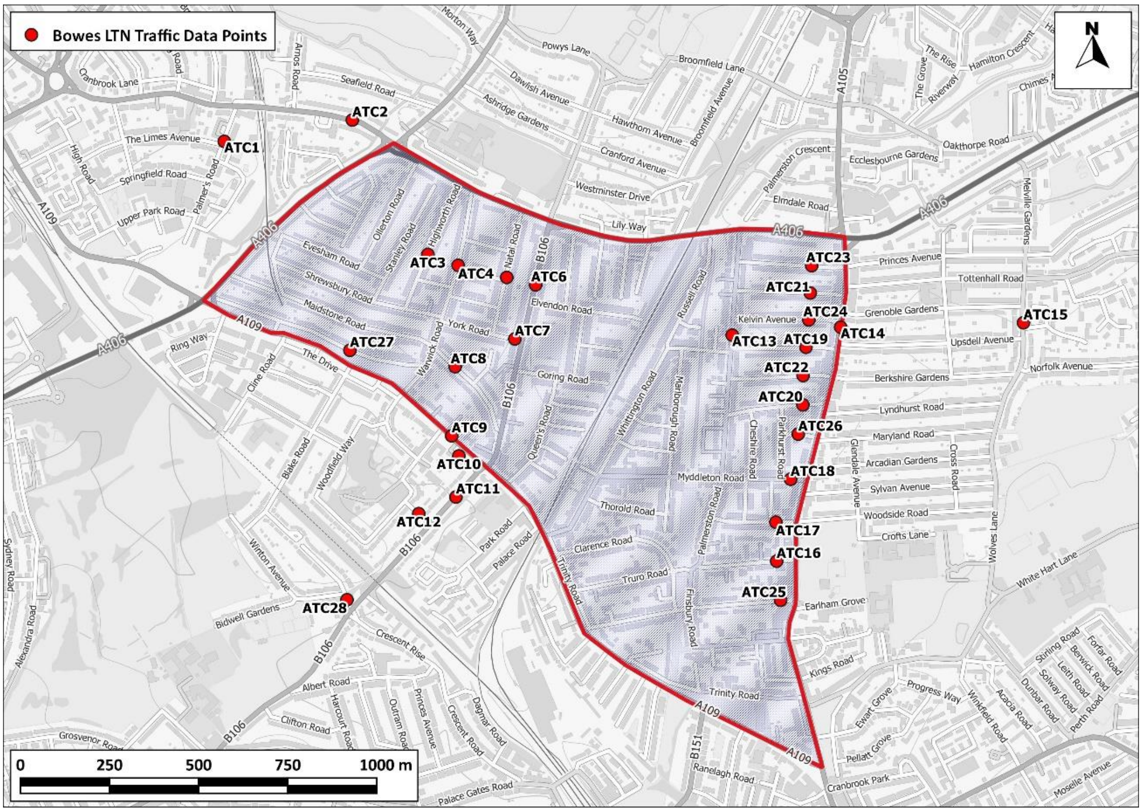

Figure 2: Monitored Roads and Extent of Study Area

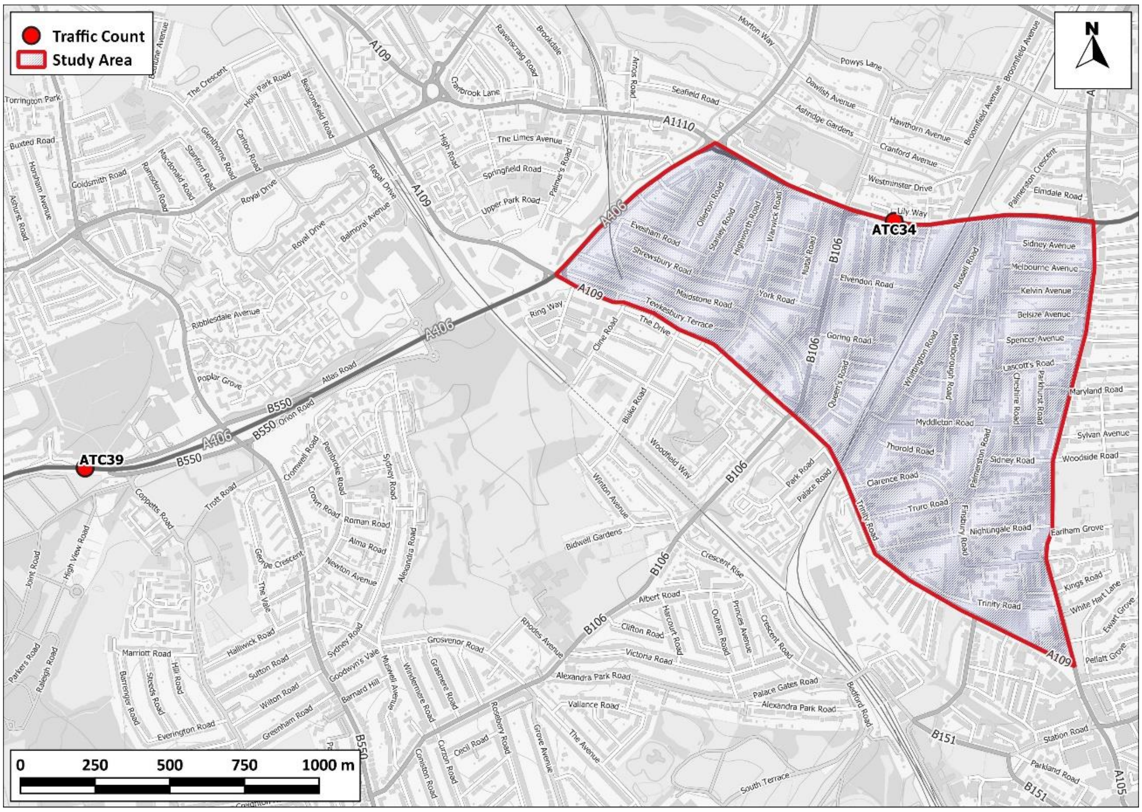

Figure 3: Locations of Automatic Traffic Counts 34 and 39

3.5 The re-distribution of traffic on local roads associated with the scheme may affect air pollutant concentrations that local residents and users are exposed to. The impacts of the proposed schemes on air quality have thus been assessed using detailed dispersion modelling and traffic data obtained by the commissioned survey prior to and after the implementation of the scheme.

Assessment Scenarios

3.6 Nitrogen dioxide, PM_{10} and $PM_{2.5}$ concentrations have been predicted for a base year (2019) and with and without the scheme operating in 2020.

Modelling Methodology

3.7 Concentrations have been predicted using the ADMS-Roads dispersion model. Details of the model inputs, assumptions and the verification are provided in Appendix A4. Where assumptions have been made, a realistic worst-case approach has been adopted.

Traffic Data and Emissions Calculation

3.8 Traffic data for the assessment have been informed by 26 traffic counts provided by LB Enfield[3], and supplemented by data collected by TfL at two traffic counts (ATC 34 and ATC39, both situated on the North Circular Road). The dispersion model used to predict annual mean pollutant concentrations throughout the study area uses traffic and meteorological data that are defined for a given calendar year, in order that the outputs can be compared to the air quality objectives, which in the case of this study are expressed as annual means. It has therefore been necessary to process the raw traffic data collected over 7 days into Annual Average Daily Traffic (AADT) flows; the format required for input into the dispersion model. The annualisation process addresses the seasonal variations in traffic, and how this could have impacted the recorded number of vehicles over the two seven-days traffic counts undertaken by LB Enfield. In this instance, the traffic flows in July would have been affected by Covid restrictions and school holidays (schools were only open to certain year groups in July and many would have already started school holidays), whilst the counts undertaken in November would have been impacted by Covid restrictions (the second lockdown), thus both sets of data have recorded lower levels of traffic compared to those normally experienced for these times of the year. If the daily traffic flows had been calculated simply by dividing the traffic recorded over seven days by seven, the numbers obtained would not have been representative of an average over 2020 and would have instead reflected the conditions during the seven days in July and November. Annualising the 7-days of data for July and November to the year 2020 has ‘evened out’ the data and thus addressed any seasonal variation or impact of lockdown between the two sets of data, allowing for the comparison between the predicted ‘without scheme’ and ‘with scheme’ pollutant concentrations.

3.9 AADT flows were calculated for each of the 26 traffic counts for the 2019 baseline, 2020 without scheme and 2020 with scheme scenarios by annualising measured data to the year of interest[4]. For the 2019 baseline and 2020 without scheme scenarios, the raw data collected in July 2020 was used, whilst data collected in November 2020 was used for the 2020 with scheme scenario. Three annualisation factors were calculated using data from ATC 39 operated by TfL; one for each scenario considered. ATC 39 was selected as it is not located within the study area and traffic flows measured at that location are not affected by the scheme. It is therefore a ‘reference’ traffic count, suitable for the annualisation process. To provide an example, in order to annualise the 7 days of data collected at LB Enfield’s ATC1 in July 2020 to the year 2019 (to obtain the 2019 baseline AADT data), the number of vehicles counted at ATC 39 over the same seven days in July were compared against the total number of vehicles counted at ATC39 in 2019, to obtain an adjustment factor (traffic over 7

[3] Two additional traffic counts were deployed for the traffic monitoring survey, but were omitted from the assessment due to low data capture (ATC 3 and ATC15).

[4] For 2020, flows were ‘annualised’ to the period 1st January 2020 to 24th November 2020, in the absence of traffic data covering the period 25th November to 31st December 2020.

days / traffic for the calendar year). This factor was then applied to the number of vehicles counted at ATC1 over the seven days in July 2020 to obtain an estimated total number of vehicles for the year 2019 on that road. The AADT is then obtained by dividing that number by 365 (i.e. the number of days in a year). This process is referred to as 'annualisation' of the traffic data and allows estimating an average daily number of vehicles over a calendar year, from a smaller set of data. This process was repeated for each of the 26 ATCs forming part of the study, and for the three scenarios considered (2019 baseline, 2020 without scheme and 2020 with scheme).

3.10 Because of the absence of any baseline traffic data representative of a 'typical' year for the minor roads within the study area, the traffic data were annualised using ATC39, as described above, which is situated on a road with higher traffic flows. For the 2019 baseline flows, this adjustment used 2019 flows at ATC39, hence, as far as possible, providing baseline traffic data for a 'typical' year. When comparing the impacts of the scheme, which was undertaken using 2020 emissions, in order not to overestimate the impacts of the scheme, a factor to adjust the 'before' and 'after' traffic data was derived based on 2020 flows. However, as can be seen in Table A2.1 in Appendix A2, the impact descriptors are determined based on the predicted change in pollutant concentration (columns) in the context of the total pollutant concentration at that location (rows). For example, a predicted change in concentration corresponding to 1% of the objective value would be described as a '*negligible*' impact if the total concentration was below 95% of the objective value, but would be described as '*slight*' or '*moderate*' with a total concentration corresponding to 95% or more of the objective value. In order to avoid underestimating the impacts associated with the scheme by using a baseline which is unusually low, a sensitivity test was undertaken whereby the predicted changes in concentrations as a result of the scheme were considered against 2019 total pollutant concentrations. These two approaches, ie the annualisation of traffic data, and the sensitivity test, have, as far as possible, addressed the impact of COVID restrictions within this study.

3.11 The ATCs provided data on totals at each hour of the week, with vehicle speeds and fleet composition. The measured distribution of traffic throughout the day ('profiles') were used within the dispersion model.

3.12 Vehicle emissions have been derived using Defra's Emission Factor Toolkit (EFT) (v10.1) (Defra, 2021). Further details about model input, traffic data and how AADT flows have been derived are presented in Appendix A4.

Sensitive Locations

3.13 Concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ have been predicted at a number of receptors (i.e. residential properties) within and in close proximity to the study area. Receptors have been identified to represent a range of exposure, including the worst-case locations (these being at the façades of the residential properties closest to affected road links). When selecting receptors, particular attention has been paid to assessing impacts close to junctions, where traffic may become congested and where there is a combined effect of several road links, and alongside those roads where changes in traffic volumes are most significant.

3.14 A number of existing residential properties have been identified as receptors for the assessment. These locations are shown in Figure 4. In addition, concentrations have been modelled at the ENF5 automatic monitoring site in order to verify the model outputs (see Appendix A4 for verification method).

3.15 It is important to note that receptors situated alongside the North Circular Road were selected to provide information on the baseline conditions in the study area. However, there were no traffic counts undertaken pre- and post-scheme alongside the various sections of this road, with the only available data provided by TfL's ATC 34. The scheme would have impacted each section of the North Circular differently, thus using data from ATC 34 and applying it to the whole road would not have been appropriate to assess the impacts of the scheme. It has therefore not been possible to calculate accurate changes in traffic flows, and associated air quality impacts, alongside the North Circular Road, other than for the section in which ATC34 is situated (i.e. between the B106 and Palmerston Road). Even for receptors located alongside that section, and as discussed in further details in paragraphs 5.6 and A4.9, the predicted impacts are a by-product of the use of emission profiles calculated based on ATC data rather than associated with traffic changes attributable to the scheme. Receptors situated alongside the North Circular have thus not been included in Figures 8 to 10 and were not considered in the assessment of the scheme's impacts on air quality. Results for receptors located on the same section of the North Circular Road as ATC34 are presented for information in Appendix A5, although as discussed above, the presented impacts are likely to be associated with the effect of profile change rather than traffic changes associated with the scheme.

Figure 4: Receptor Locations

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Uncertainty in Road Traffic Modelling Predictions

3.16 There are many components that contribute to the uncertainty of modelling predictions. The road traffic emissions dispersion model used in this assessment is dependent upon the traffic data that have been input, which will have inherent uncertainties associated with them, as discussed in paragraphs 3.8 to 3.10. The annualisation process to 2019 is based on traffic flows recorded prior to the COVID pandemic, and 2019 AADT flows can be expected to be representative of 'typical' flows on modelled roads. It is however recognised that the calculated 2020 AADT flows, both pre-scheme and post-scheme, are lower than that of a typical year, which is reflected by the reduction in traffic that has been observed in London due to the COVID pandemic (TfL, 2020). In addition, the annualisation process for the 2020 traffic data was not based on a full calendar year, with available data covering the period between the 1st January and the 24th November.

3.17 The assessment has however mainly focused on the predicted changes in pollutant concentrations associated with the scheme, which will not be significantly affected by total AADT. In addition, a sensitivity test has been undertaken combining the modelled impacts with 2019 concentrations (see paragraphs 3.10 and 5.5). The discussion on air quality conditions in the study area has also been based on the 2019 modelled concentrations, which are representative of a 'typical' year, rather than the 2020 concentrations. This approach has therefore addressed, as far as possible, the uncertainties relating to the irregular traffic flows associated with the COVID pandemic.

3.18 There are then additional uncertainties, as models, by their nature simulate real-world conditions through a series of algorithms.

3.19 An important stage in the process is model verification, which involves comparing the model output with measured concentrations. The level of confidence in the verification process is necessarily enhanced when data from an automatic analyser have been used, as has been the case for this assessment (see Appendix A4). Because the model has been verified and adjusted, there can be reasonable confidence in the prediction of base year (2019) concentrations.

3.20 Predicting pollutant concentrations in a future year[5] will always be subject to greater uncertainty. For obvious reasons, the model cannot be verified in the future, and it is necessary to rely on a series of projections provided by DfT and Defra as to what will happen to traffic volumes, background pollutant concentrations and vehicle emissions. Historic versions of Defra's EFT tended to over-state emissions reductions into the future. However, analyses of the most recent versions of Defra's EFT carried out by AQC (2020a) (2020b) suggest that, on balance, these versions are unlikely to over-state the rate at which NOx emissions decline in the future at an 'average' site in the UK. In practice,

[5] For the purposes of this assessment, the phrase 'future year' is used to describe a scenario in which air quality monitoring data is not yet available. There were no 2020 monitoring data at the time of publication, hence, 2020 is described as a 'future year'.

the balance of evidence suggests that NOx concentrations are most likely to decline more quickly in the future, on average, than predicted by the current EFT, especially against a base year of 2016 or later. Using EFT v10.1 for future-year forecasts in this report thus provides a robust assessment, given that the model has been verified against measurements made in 2019.

3.21 There are inherent uncertainties within the modelling, including the traffic data as primary input, and as such the results should not be considered exact, but represent the best possible estimates, using the best available data available at the time this report was undertaken.

4 Baseline Conditions

Existing Conditions

4.1 Information on existing air quality has been obtained by collating the results of air quality monitoring carried out by the local authority within the study area. Background concentrations have been defined using the national pollution maps published by Defra (Defra, 2021). These cover the whole country on a 1x1 km grid.

Air Quality Management Area and Focus Areas

4.2 LB Enfield declared a borough-wide Air Quality Management Area (AQMA) in 2001 for exceedances of the annual mean nitrogen dioxide and 24-hour PM_{10} objectives. Half of the Bowes Quieter Neighbourhood Scheme lies within this AQMA. LB Haringey also declared a borough wide AQMA in 2001 for exceedances of the annual mean nitrogen dioxide and 24-hour PM_{10} objectives. The remaining portion of the scheme is within this AQMA.

4.3 There are also two air quality Focus Areas situated within the study area (‘A406 North Circular between Bowes Road and Great Cambridge’ and ‘Bound Green A109 junction with Durnsford/Brownlow Road B106’). As explained in Paragraph 2.19, these were last defined in 2016, and correspond to areas where the EU annual mean limit value for nitrogen dioxide is exceeded, and where there are high levels of human exposure.

4.4 All receptors selected for the assessment are located within either the Enfield or Haringey AQMAs, whilst 35 receptors were selected within the two air quality Focus Areas.

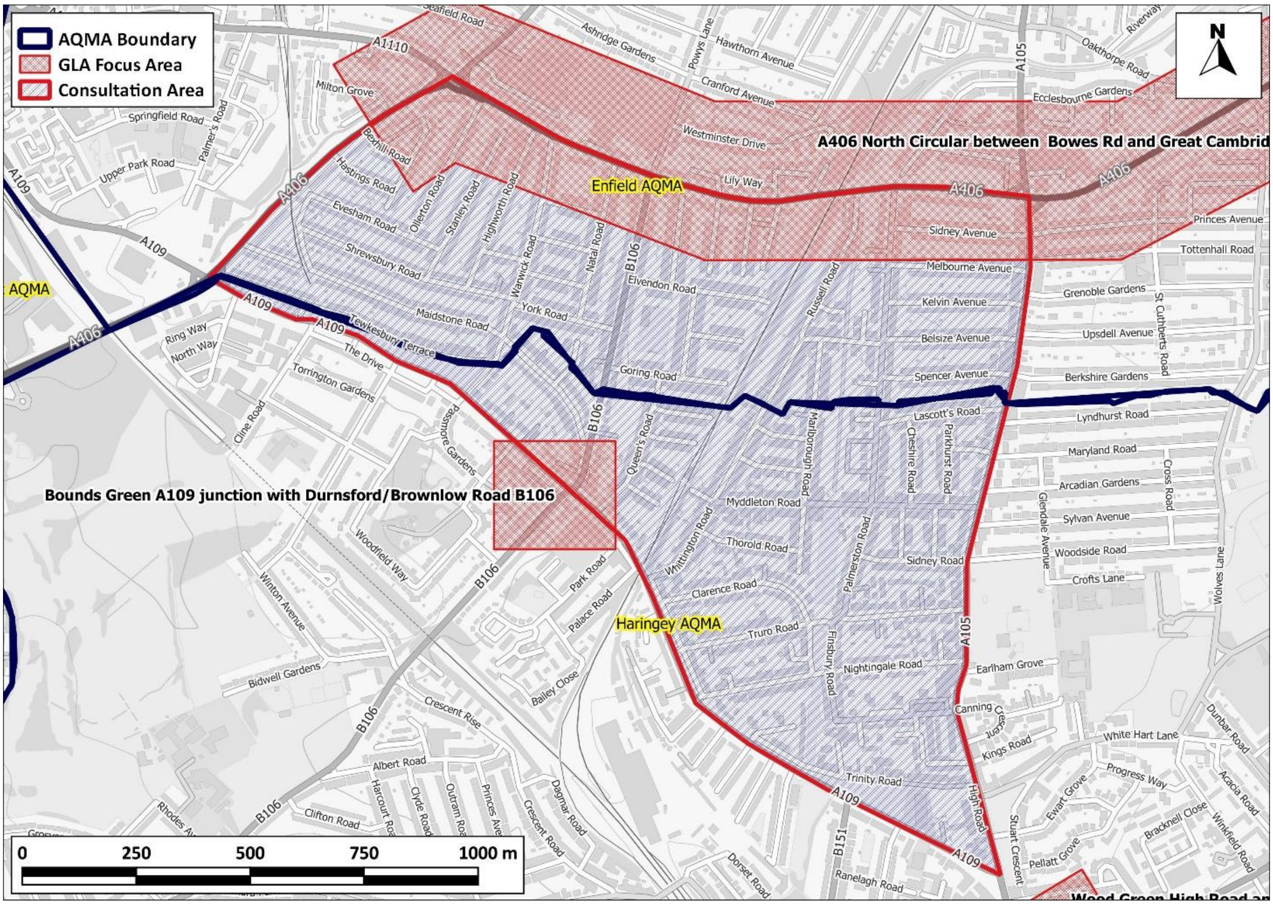

Figure 5: Consultation Area, AQMA and Air Quality Focus Areas

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Local Air Quality Monitoring

4.5 LB Enfield operates one roadside automatic monitoring station within the study area, situated adjacent to the North Circular on the north side of the consultation area. The council also operates two diffusion tubes within the consultation area; one situated on Warwick Road and one situated on Brownlow Road, which commenced monitoring in 2018. The Council's diffusion tubes are prepared and analysed by Socotec (using the 50% TEA in acetone method). LB Haringey also operates one nearby diffusion tube, which measures background pollutant concentrations at Bounds Green Primary School, 30 m from the Bounds Green Road kerbside, at the south of the consultation area.

4.6 Annual mean results for the years 2014 to 2019 are summarised in Table 2, while results relating to the 1-hour mean objective are summarised in Table 3. Exceedances of the objectives are shown in bold. The monitoring locations are shown in Figure 6. The monitoring data have been taken from the respective LB Enfield and LB Haringey Annual Status Reports (ASRs) (LB Enfield, 2020) (LB Haringey, 2020).

Table 2: Summary of Annual Mean NO_2 Monitoring (2014-2019) ($\mu g/m^3$)[a]

Site No.	Site Type	Location	2014	2015	2016	2017	2018	2019
ENF5	Automatic, Roadside	Bowes Road	**42**	**46**	**47**	**41**	**41**	39
Enfield 9	Diffusion Tube, Urban Background	Warwick Road	**55**	**43**	39	**51**	27	24
Enfield 10	Diffusion Tube, Urban Background	134 Brownlow Road	**-**	**-**	-	**-**	37	37
HR28	Diffusion Tube, Urban Background	Bounds Green Primary School	30	35	33	34	-	31
Objective			**40**					

[a] Exceedances of the objectives are shown in bold.

[b] Site types as listed within the monitoring sites' respective ASRs.

Table 3: Number of Hours With NO_2 Concentrations Above 200 $\mu g/m^3$

Site No.	Site Type	Location	2014	2015	2016	2017	2018	2019
ENF5	Automatic, Roadside	Bowes Road	0	1	6	3	0	0
Objective			**18**					

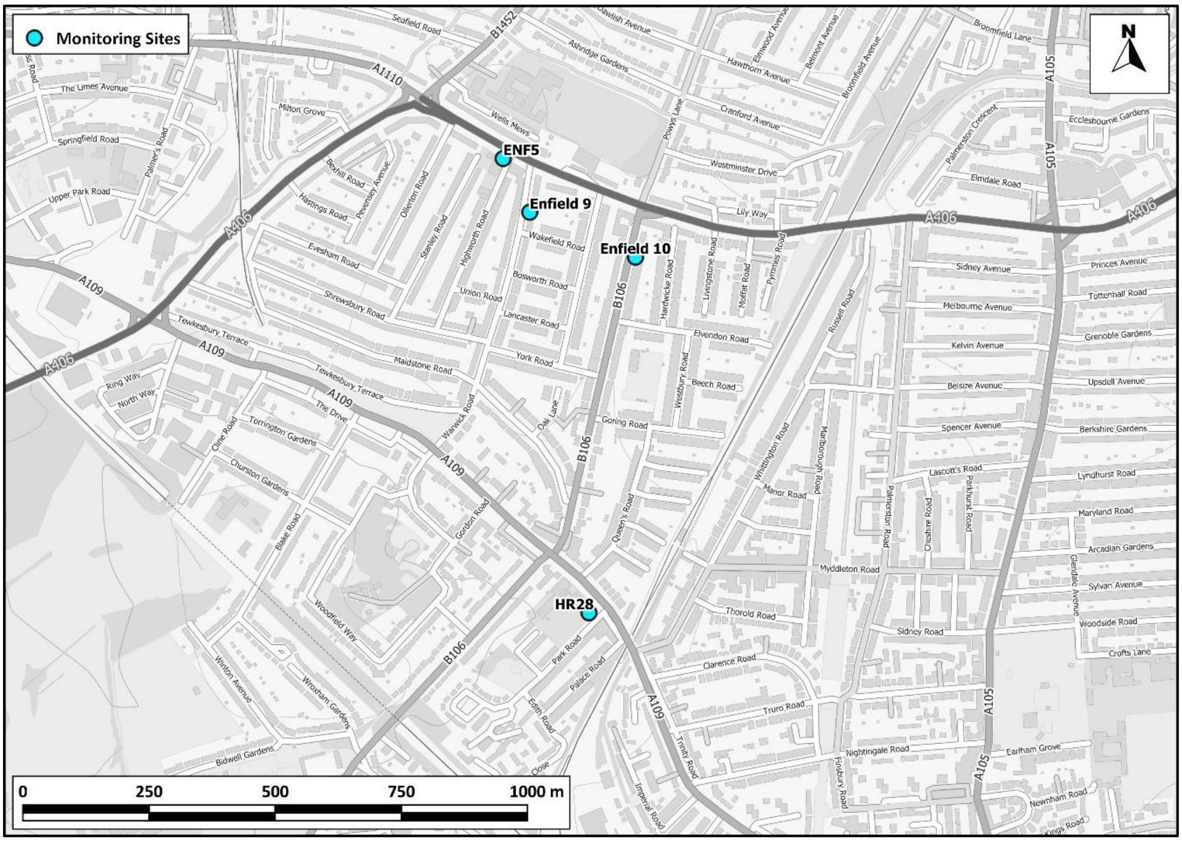

Figure 6: Monitoring Locations

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4.7 Monitoring indicates that annual mean NO_2 concentrations were below the objectives at all four monitors in 2019. Site ENF5 had been above the annual mean objective from 2014 to 2018, and Enfield 9 had exceeded the objective in 2014, 2015 and 2017. Both of the above are situated adjacent to roads, with the former 3 m from the North Circular kerbside, a road with high traffic volume and congestion. Enfield 10 commenced monitoring in 2018 and was below the objective in both 2018 and 2019. There is no clear trend in annual mean background or roadside concentrations over time, other than a decrease in annual mean concentrations in 2019, which was consistent between the three long term monitors. Hourly-mean concentrations of nitrogen dioxide monitored at ENF5 have remained below the objective since 2014.

4.8 Monitoring site ENF5 also measures PM_{10} concentrations. Annual mean results for the years 2014 to 2019 are presented in Table 4, while 24-hour mean concentrations are summarised in Table 5. $PM_{2.5}$ concentrations are not monitored within the study area.

4.9 Monitoring indicates that PM_{10} concentrations have been well below the annual mean and daily mean objectives since 2014. There is no clear trend in concentrations over time.

Table 4: Summary of Annual Mean PM_{10} Monitoring (2014-2019) (μg/m³)

Site No.	Site Type	Location	2014	2015	2016	2017	2018	2019
ENF5	Automatic, Roadside	Bowes Road	21	19	22	24	18	19
Objective			**40**					

Table 5: Number of Days With PM_{10} Concentrations Above 50 μg/m³

Site No.	Site Type	Location	2014	2015	2016	2017	2018	2019
ENF5	Automatic, Roadside	Bowes Road	11	1	10	9	2	No data [a]
Objective			**35**					

[a] Data unavailable in 2019 due to an error in the 2020 ASR.

Background Concentrations

4.10 Estimated background concentrations in the study area have been determined for 2019 and 2020 using Defra's background maps (Defra, 2021). The background concentrations are set out in Table 6 and have been derived as described in Appendix A4. The background concentrations are all well below the objectives.

Table 6: Estimated Annual Mean Background Pollutant Concentrations in 2019 and 2020 (μg/m³) [a]

Year	NO_2	PM_{10}	$PM_{2.5}$
2019	22.9 - 21.9	18.5 - 17.8	12.2 - 11.9
2020	21.5 - 20.6	18.1 - 17.4	12.0 - 11.6
Objectives	**40**	**40**	**25** [b]

[a] The range of values is for the different 1x1 km grid squares covering the study area.

[b] The $PM_{2.5}$ objective, which was to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

Baseline Dispersion Model Results

4.11 Baseline concentrations of nitrogen dioxide have been modelled at each of the selected receptor locations (see Figure 4 for receptor locations). The nitrogen dioxide results cover existing (2019) baseline conditions and are illustrated in Figure 7. The modelled road components of nitrogen oxides have been increased from those predicted by the model based on a comparison with local measurements (see Appendix A4 for the verification methodology).

4.12 The predicted annual mean concentrations of nitrogen dioxide are above the objective at a number of receptors in 2019. These exceedances are exclusively at receptors adjacent to the North Circular. Concentrations alongside the North Circular range between 41 and 59 µg/m^3, with concentrations at their highest adjacent to junctions and/or traffic lights, such as at the Powys Lane junction and the Green Lanes junction. Concentrations throughout the remainder of the study area are all below the objectives, ranging between 23 and 36 µg/m^3. Those at the high end are either situated adjacent to main roads, such as High Road, Green Lanes and Bounds Green Road, adjacent to junctions, where there would be increased pollutant emissions due to congestion, or both. Remaining receptors, along quieter residential roads, are all well below the annual mean air quality objective.

4.13 Concentrations are not predicted to exceed 60 µg/m^3 at any of the modelled receptors, meaning the 1-hour nitrogen dioxide objective is unlikely to be exceeded at any roadside location within the study area. This is consistent with monitoring data at automatic monitor ENF5 (Table 3).

4.14 Although not included within a figure, annual mean PM_{10} and $PM_{2.5}$ concentrations were also modelled for the year 2019 and shown to be well below the objectives throughout the study area.

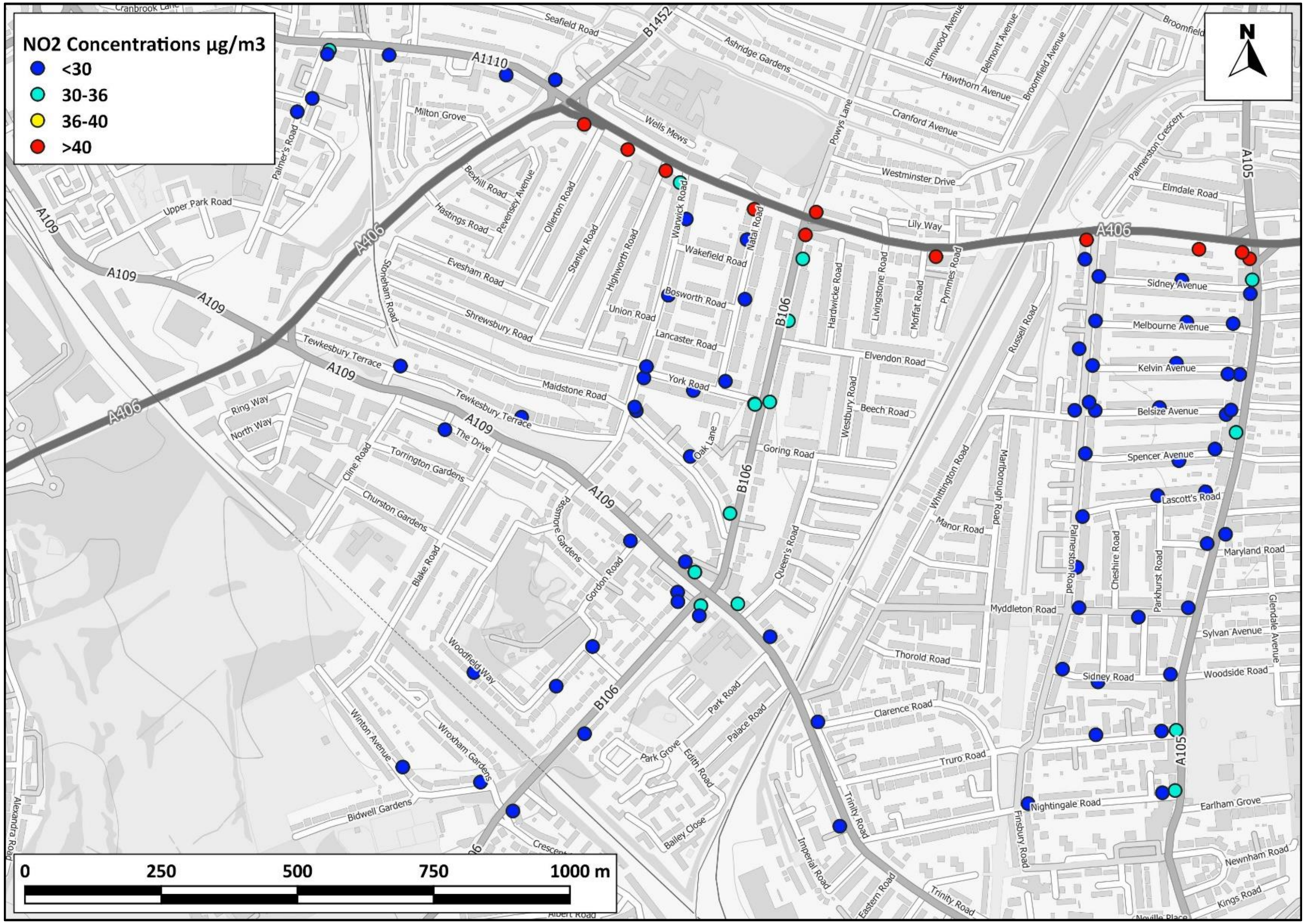

Figure 7: Predicted Annual Mean NO_2 Concentrations in the Study Area in the 2019 Baseline Scenario (µg/m^3)

5 Scheme Impact Assessment

5.1 This section presents the changes in annual mean pollutant concentrations predicted as a result of the scheme for the year 2020. The full set of results, including total concentrations, percentage changes and associated impact descriptors, are presented in Appendix A5.

5.2 The calculated percentage changes in traffic flow are shown in Figure 8, where decreases in traffic are illustrated by green shaded points, whilst increases are displayed in red shades. The decreases in traffic correlate with road closures, with increases occurring on alternative routes. The predicted changes in annual mean nitrogen dioxide, PM_{10} and $PM_{2.5}$ concentrations at receptors are presented in Figure 9, Figure 10 and Figure 11, with decreases in concentrations marked by blue shaded points, and increases displayed in yellow/red shades. White points indicate receptors where no changes are predicted.

5.3 The modelled data show that the implementation of the Quieter Neighbourhood Scheme led to slight decreases or increases in annual mean NO_2 concentrations, ranging between -0.1 and -1.3 µg/m^3 and between +0.1 and +0.9 µg/m^3, as shown on Figure 9. Such changes correspond to -3 % and +2% of the objective value, at most. The results correlate with the changes in traffic displayed on Figure 8.

5.4 While NO_2 concentrations are heavily influenced by vehicle emissions, PM concentrations are influenced by a wider range of sources, and thus are less influenced by vehicular emissions. Therefore, changes in PM_{10} and $PM_{2.5}$ concentrations follow a similar pattern to that of NO_2, but the changes are smaller, with either no predicted changes in concentrations, or increases and decreases in concentrations comprised between ±0.1 and 0.2 µg/m^3 for PM_{10}, and reaching ±0.1 µg/m^3 at most for $PM_{2.5}$. Such changes correspond to ±1% of the annual mean PM_{10} objective value at most, and 0% of the $PM_{2.5}$ objective value.

5.5 Using industry standard guidance (Moorcroft and Barrowcliffe et al, 2017), absolute changes in pollutant concentrations are considered, in conjunction with the associated predicted long-term concentrations, to determine the air quality impacts and effects at receptors (see paragraph 2.32). The full results are presented in Appendix A5, and show that in 2020, the predicted changes in annual mean PM_{10} and $PM_{2.5}$ pollutant concentrations are associated with 'negligible' impacts at all receptors within the study area. With regards to annual mean nitrogen dioxide concentrations, impacts are described as '*negligible*' at most receptors, with the exception of one receptor (33) where a *slight adverse* impact is predicted, and one receptor (106) where a *moderate adverse* impact is predicted. Receptor 33 represents a residential property above a shop at the junction between Truro Road and the High Road. Receptor 32, located 25 m to the west of that property, is predicted to experience a *negligible* impact as a result of the scheme. The predicted slight adverse impact thus concerns one property. Receptor 106 represents a residential property situated at the junction of High Road and the North Circular, where, as discussed in Paragraphs A4.8 and A4.9, there is significant uncertainty with regards to the modelled change in traffic and effect of profile on modelled concentrations. It is therefore not possible to ascertain whether or not this impact is a result of the model's uncertainties. However, if accurate, it would only concern a small number of properties, with a receptor (2) situated 40 m to the south predicted to see increases in annual mean nitrogen dioxide concentration of 0.4 µg/m^3, corresponding to a *negligible* impact. As such, overall, although the scheme leads to changes in pollutant concentrations, the scale of these changes in relation to total predicted concentrations are not great enough to lead to significant impacts, whether beneficial or adverse.

Impacts on the North Circular

5.6 Although, for reasons explained in paragraph 3.15, receptors directly adjacent to the North Circular are not included in the overall assessment of the scheme. Receptors located on the same section ATC34, for which there is more confidence in the traffic data relating to the impact of the scheme, have been included in the results table presented Appendix A5. These results show that annual mean nitrogen dioxide concentrations are predicted to decrease slightly at two locations, with a small increase predicted at the third location. Predicted changes range between zero and -1% and correspond to *negligible* impacts (with a *slight beneficial* impact predicted in the sensitivity test). Zero per cent changes and *negligible* impacts are predicted with regards to annual mean PM_{10} and $PM_{2.5}$ concentrations.

5.7 As noted, because counts were available by the hour for each ATC, hourly variations in traffic flow specific to each modelled road were input into the model. This allowed for the potential capture of the scheme's impact on daily flow variation to be taken account of, as profiles specific to the pre- and post- scheme conditions were used. However, as explained in paragraph A4.8, the road specific profiles used in the model show a lower proportion of trips occurring at night-time with the scheme in place, compared to pre-scheme conditions. It is unclear whether this, or other changes to the diurnal profiles, can be attributed to implementation of the scheme, to seasonal effects (for example longer days in the summer), or to the lockdown that was in place in November. On high traffic roads, with large associated rates of emission, relatively small shifts in hourly flows can have large impacts on annual mean concentrations. In this case, there is a shift towards lower traffic flow at night in the 'with Scheme' scenario. Due to changes in atmospheric composition at night, nocturnal emissions are less able to disperse, resulting in higher pollutant concentrations (Xuexi Tie et al., 2008), meaning night-time emissions result in higher pollutant concentrations than at other times of day. Therefore, this shift in hourly emission rates can significantly impact on annual mean values. As this shift in annual mean concentrations is judged to be the result of external factors, particularly in the case of the North Circular Road, it is judged that the presentation of modelled results along the North Circular do not represent the outcomes of the scheme, but rather the effect of the profile change.

Sensitivity Test

5.8 As stated in Paragraph 3.16, baseline pollutant concentrations were lower than usual in 2020, which may have affected impact descriptors at receptors. As can be seen in Table A2.1 in Appendix A2, and described in paragraph 3.10, the impact descriptors are determined based on the predicted change in pollutant concentration (columns) in the context of the total pollutant concentration at that location (rows). In order to avoid underestimating the impacts associated with the scheme, and as discussed in paragraph 3.10, a sensitivity test was undertaken whereby the predicted changes in concentrations as a result of the scheme were considered against 2019 total pollutant concentrations. Taken in that context, the predicted increases in pollutant concentrations would still correspond to negligible impacts at all receptors for PM_{10} and $PM_{2.5}$ concentrations. This would also be the case at most receptors for nitrogen dioxide concentrations, with the exception of receptor 106 located on High Road, near the junction with the North Circular, where a substantial adverse impact is predicted (instead of a moderate adverse impact in the context of 2020 concentrations), a receptor on York Road (43), where a slight beneficial impact is predicted, and receptor 33 on the Truro Road to High Road junction, where a slight adverse impact is predicted (as was also the case in the context of 2020 concentrations). Results from this sensitivity test are presented alongside 2020 results in Appendix A5.

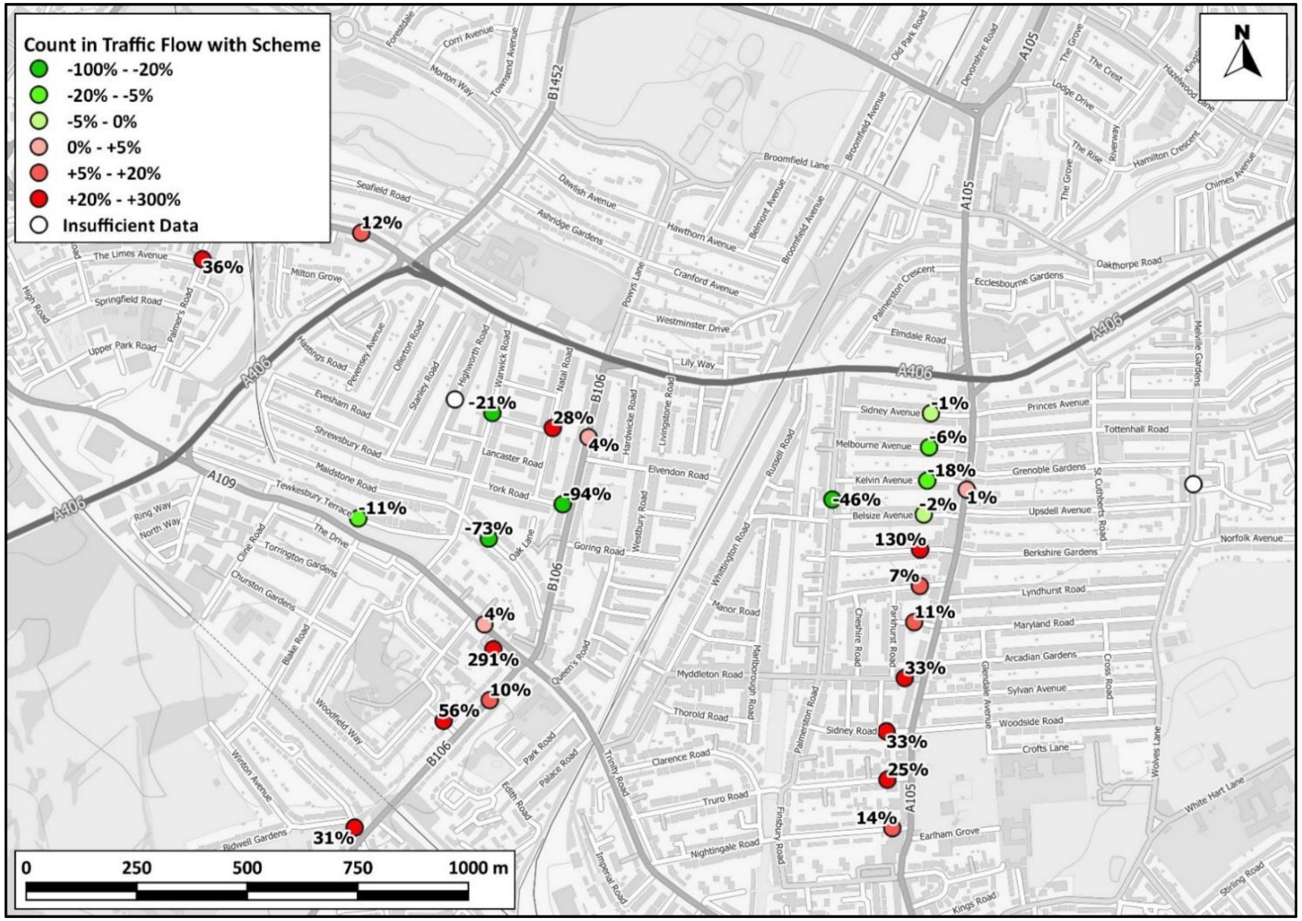

Figure 8: Percentage Change in Annualised Total Traffic Flows Resulting from the Scheme[6]

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[6] ATC 3 and ATC 15 are marked by a white dot due to gaps in the data which have prevented determining the %change in traffic associated with the scheme.

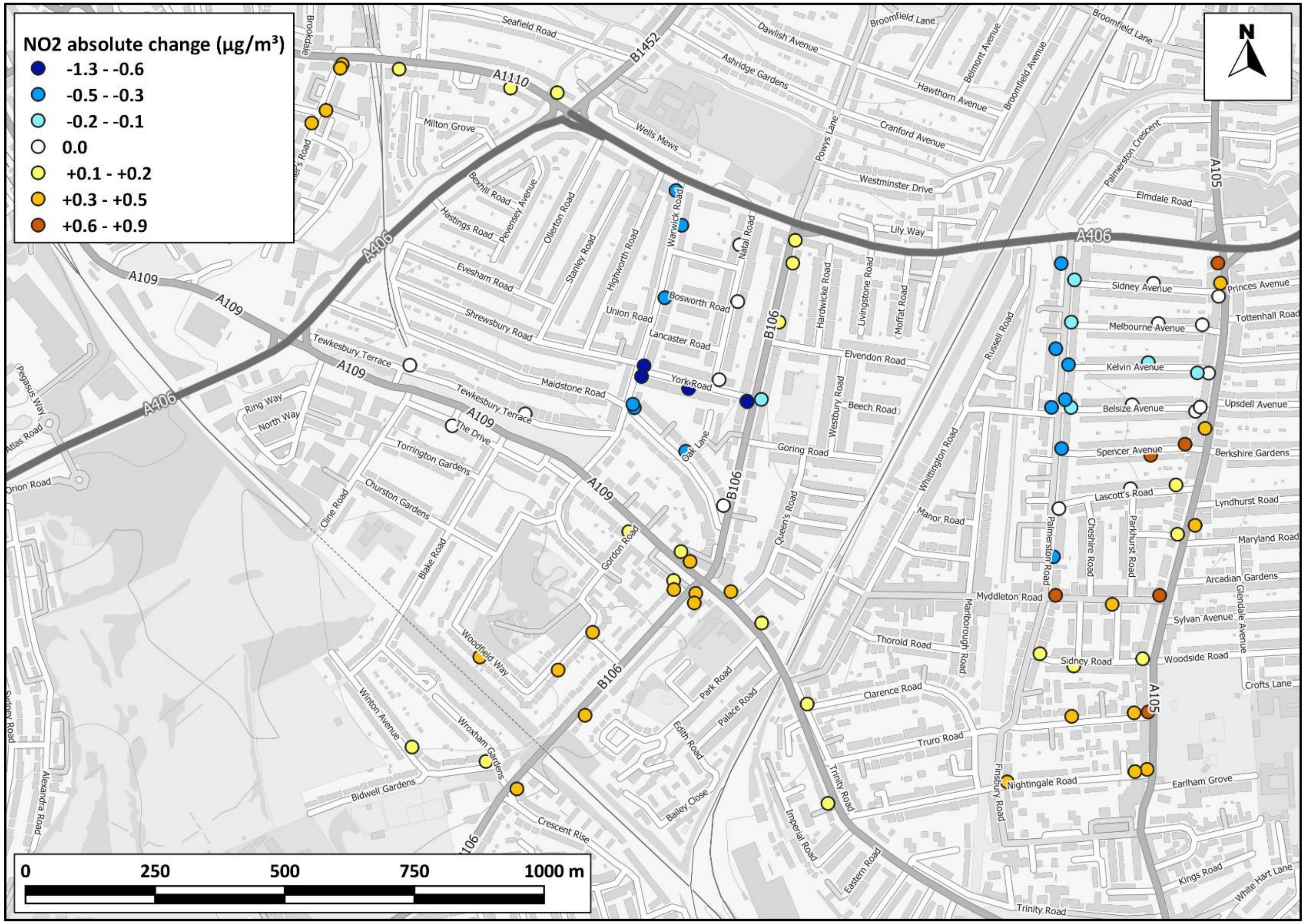

Figure 9: Predicted Changes in Annual Mean NO_2 Concentrations with Quieter Neighbourhood Scheme in 2020 (µg/m^3)

Figure 10: Predicted Changes in Annual Mean PM_{10} Concentrations with Quieter Neighbourhood Scheme in 2020(µg/m^3)

Figure 11: Predicted Changes in Annual Mean $PM_{2.5}$ Concentrations with Quieter Neighbourhood Scheme in 2020($\mu g/m^3$)

6 Summary and Conclusions

6.1 The assessment has considered the local air quality impacts of the Bowes Quieter Neighbourhood Scheme. Traffic flows were measured over two seven-day periods in July and November 2020 (pre- and post-scheme implementation). These have been used to estimate the changes in traffic attributable to the scheme. Dispersion modelling has then been used to predict the effect that these changes in traffic will have had on local air quality.

6.2 Annual mean concentrations of nitrogen dioxide in 2019 at several receptors adjacent to the North Circular are predicted to have been above the objective set by the UK Government. Concentrations at other receptors, which are along quieter residential roads, were all well below this objective. Annual mean PM_{10} and $PM_{2.5}$ concentrations were well below the current UK objectives throughout the study area.

6.3 Implementation of the Quieter Neighbourhood Scheme is predicted to have led to slight decreases and increases in nitrogen dioxide concentrations, in correlation with the changes in traffic observed with the scheme in operation. Changes to PM_{10} and $PM_{2.5}$ concentrations follow a similar pattern to those of NO_2, but the changes are smaller.

6.4 Although the scheme caused small changes to pollutant concentrations, the scales of these are described by industry standard guidance as *negligible* at all receptors for PM_{10} and $PM_{2.5}$ concentrations, and most receptors for nitrogen dioxide concentrations, with the exception of a location at the junction between Truro Road and the High Road where a *slight adverse* impact is predicted, and a location at the High Road to North Circular junction, where a *moderate adverse* impact is predicted. However, as discussed in Section 5, it is possible this *moderate adverse* impact is a result of uncertainties in the model's inputs.

6.5 There are many uncertainties around the predictions presented in this report. In particular, it is challenging to isolate those changes to traffic flows caused by the scheme from those caused by other factors, such as restrictions to control the COVID-19 pandemic. In order to account for this as best as possible, a sensitivity test has been undertaken which uses the impacts of the scheme in 2020 aligned with concentrations predicted for 2019 (which are higher than those in 2020). This showed that one receptor would be classed as experiencing a *substantial adverse* impact; however, as discussed in Section 5 and above, there is uncertainty with regards to this result. Elsewhere in the study area, one *slight adverse* and one *slight beneficial* impact are predicted at two further receptors, with *negligible* impacts predicted at all other receptors. Overall, taking into consideration the increases and decreases in concentrations, the results of this assessment are not considered to represent a significant effect on local air quality.

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8 Glossary

AADT	Annual Average Daily Traffic
ADMS-Roads	Atmospheric Dispersion Modelling System model for Roads
AQC	Air Quality Consultants
AQAL	Air Quality Assessment Level
AQMA	Air Quality Management Area
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
EFT	Emission Factor Toolkit
EPUK	Environmental Protection UK
Exceedance	A period of time when the concentration of a pollutant is greater than the appropriate air quality objective. This applies to specified locations with relevant exposure
HDV	Heavy Duty Vehicles (> 3.5 tonnes)
HMSO	Her Majesty's Stationery Office
IAQM	Institute of Air Quality Management
kph	Kilometres Per hour
LAQM	Local Air Quality Management
LDV	Light Duty Vehicles (<3.5 tonnes)
µg/m³	Microgrammes per cubic metre
NO	Nitric oxide
NO_2	Nitrogen dioxide
NOx	Nitrogen oxides (taken to be NO_2 + NO)
Objectives	A nationally defined set of health-based concentrations for nine pollutants, seven of which are incorporated in Regulations, setting out the extent to which the standards should be achieved by a defined date. There are also vegetation-based objectives for sulphur dioxide and nitrogen oxides
PM_{10}	Small airborne particles, more specifically particulate matter less than 10 micrometres in aerodynamic diameter
$PM_{2.5}$	Small airborne particles less than 2.5 micrometres in aerodynamic diameter

PPG	Planning Practice Guidance
Receptors	Receptors correspond to OS grid coordinates in the dispersion model, to allow for pollutant concentrations to be predicted at a specific point within the study area. They are representative of 'physical' locations of relevant exposure to the air quality objectives, such as residential properties, school, hospitals etc. in the study area.
Standards	A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal
TEA	Triethanolamine – used to absorb nitrogen dioxide

9 Appendices

A1 London-Specific Policies and Measures

London Environment Strategy

A1.1 The air quality chapter of the London Environment Strategy sets out three main objectives, each of which is supported by sub-policies and proposals. The Objectives and their sub-policies are set out below:

"Objective 4.1: Support and empower London and its communities, particularly the most disadvantaged and those in priority locations, to reduce their exposure to poor air quality.

- *Policy 4.1.1 Make sure that London and its communities, particularly the most disadvantaged and those in priority locations, are empowered to reduce their exposure to poor air quality*
- *Policy 4.1.2 Improve the understanding of air quality health impacts to better target policies and action*

Objective 4.2: Achieve legal compliance with UK and EU limits as soon as possible, including by mobilising action from London Boroughs, government and other partners

- *Policy 4.2.1 Reduce emissions from London's road transport network by phasing out fossil fuelled vehicles, prioritising action on diesel, and enabling Londoners to switch to more sustainable forms of transport […]*
- *Policy 4.2.4 The Mayor will work with the government, the London boroughs and other partners to accelerate the achievement of legal limits in Greater London and improve air quality*
- *Policy 4.2.5 The Mayor will work with other cities (here and internationally), global city and industry networks to share best practice, lead action and support evidence based steps to improve air quality*

Objective 4.3: Establish and achieve new, tighter air quality targets for a cleaner London by transitioning to a zero emission London by 2050, meeting world health organization health-based guidelines for air quality

- *Policy 4.3.1 The Mayor will establish new targets for $PM_{2.5}$ and other pollutants where needed. The Mayor will seek to meet these targets as soon as possible, working with government and other partners*
- *Policy 4.3.2 The Mayor will encourage the take up of ultra low and zero emission technologies to make sure London's entire transport system is zero emission by 2050 to further reduce levels of pollution and achieve WHO air quality guidelines*

- *Policy 4.3.3 Phase out the use of fossil fuels to heat, cool and maintain London's buildings, homes and urban spaces, and reduce the impact of building emissions on air quality*
- *Policy 4.3.4 Work to reduce exposure to indoor air pollutants in the home, schools, workplace and other enclosed spaces"*

A1.2 While the policies targeting transport sources are significant, there are less obvious ones that will also require significant change. In particular, the aim to phase out fossil-fuels from building heating and cooling and from NRMM will demand a dramatic transition.

Low Emission Zone (LEZ)

A1.3 The LEZ was implemented as a key measure to improve air quality in Greater London. It entails charges for vehicles entering Greater London not meeting certain emissions criteria, and affects diesel-engined lorries, buses, coaches, large vans, minibuses and other specialist vehicles derived from lorries and vans. Since 1 March 2021, a standard of Euro VI has applied for HGVs, buses and coaches, while a standard of Euro 3 has applied for large vans, minibuses and other specialist diesel vehicles since 2012.

Ultra Low Emission Zone (ULEZ)

A1.4 London's ULEZ was introduced on 8 April 2019. The ULEZ currently operates 24 hours a day, 7 days a week in the same area as the current Congestion Charging zone. All cars, motorcycles, vans, minibuses and Heavy Goods Vehicles will need to meet exhaust emission standards (ULEZ standards) or pay an additional daily charge to travel within the zone. The ULEZ standards are Euro 3 for motorcycles; Euro 4 for petrol cars, vans and minibuses; Euro 6 for diesel cars, vans and minibuses; and Euro VI for HGVs, buses and coaches.

A1.5 From 25 October 2021, the ULEZ will cover the entire area within the North and South Circular roads, applying the emissions standards set out in Paragraph A1.4 for light vehicles. The ULEZ will not include any requirements relating to heavy vehicle emissions beyond 1 March 2021, as these will be addressed by the amendments to the LEZ described in Paragraph A1.3.

Other Measures

A1.6 Since 2018, all taxis presented for licencing for the first time had to be zero emission capable (ZEC). This means they must be able to travel a certain distance in a mode which produces no air pollutants, and all private hire vehicles (PHVs) presented for licensing for the first time had to meet Euro 6 emissions standards. Since January 2020, all newly manufactured PHVs presented for licensing for the first time had to be ZEC (with a minimum zero emission range of 10 miles). The Mayor's aim is that the entire taxi and PHV fleet will be made up of ZEC vehicles by 2033.

A1.7 The Mayor has also proposed to make sure that TfL leads by example by cleaning up its bus fleet, implementing the following measures:

- TfL will procure only hybrid or zero emission double-decker buses from 2018;
- a commitment to providing 3,100 double decker hybrid buses by 2019 and 300 zero emission single-deck buses in central London by 2020;
- introducing 12 Low Emission Bus Zones by 2020;
- investing £50m in Bus Priority Schemes across London to reduce engine idling; and
- retrofitting older buses to reduce emissions (selective catalytic reduction (SCR) technology has already been fitted to 1,800 buses, cutting their NOx emissions by around 88%).

A2 EPUK & IAQM Planning for Air Quality Guidance

A2.1 The guidance issued by EPUK and IAQM (Moorcroft and Barrowcliffe et al, 2017) is comprehensive in its explanation of the place of air quality in the planning regime and contains impact descriptors for the assessment of significance.

A2.2 There is no official guidance in the UK in relation to development control on how to describe the nature of air quality impacts, nor how to assess their significance. The approach within the EPUK/IAQM guidance has, therefore, been used in this assessment. This approach involves a two stage process:

- a qualitative or quantitative description of the impacts on local air quality arising from the development; and
- a judgement on the overall significance of the effects of any impacts.

Impact Descriptors

A2.3 Impact description involves expressing the magnitude of incremental change as a proportion of a relevant assessment level and then examining this change in the context of the new total concentration and its relationship with the assessment criterion. Table A2.1sets out the method for determining the impact descriptor for annual mean concentrations at individual receptors, having been adapted from the table presented in the guidance document. For the assessment criterion the term Air Quality Assessment Level or AQAL has been adopted, as it covers all pollutants, i.e. those with and without formal standards. Typically, as is the case for this assessment, the AQAL will be the air quality objective value. Note that impacts may be adverse or beneficial, depending on whether the change in concentration is positive or negative.

Table A2.1: Air Quality Impact Descriptors for Individual Receptors for All Pollutants [a]

Long-Term Average Concentration At Receptor In Assessment Year [b]	Change in concentration relative to AQAL [c]				
	0%	1%	2-5%	6-10%	>10%
75% or less of AQAL	Negligible	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Negligible	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Negligible	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Negligible	Moderate	Substantial	Substantial	Substantial

a Values are rounded to the nearest whole number.

b This is the "Without Scheme" concentration where there is a decrease in pollutant concentration and the "With Scheme" concentration where there is an increase.

c AQAL = Air Quality Assessment Level, which may be an air quality objective, EU limit or target value, or an Environment Agency 'Environmental Assessment Level (EAL)'.

Assessment of Significance

A2.4 The guidance recommends that the assessment of significance should be based on professional judgement, with the overall air quality impact of the development described as either 'significant' or 'not significant'. In drawing this conclusion, the following factors should be taken into account:

- the existing and future air quality in the absence of the development;
- the extent of current and future population exposure to the impacts;
- the influence and validity of any assumptions adopted when undertaking the prediction of impacts;
- the potential for cumulative impacts and, in such circumstances, several impacts that are described as '*slight*' individually could, taken together, be regarded as having a significant effect for the purposes of air quality management in an area, especially where it is proving difficult to reduce concentrations of a pollutant. Conversely, a '*moderate*' or '*substantial*' impact may not have a significant effect if it is confined to a very small area and where it is not obviously the cause of harm to human health; and
- the judgement on significance relates to the consequences of the impacts; will they have an effect on human health that could be considered as significant? In the majority of cases, the impacts from an individual development will be insufficiently large to result in measurable changes in health outcomes that could be regarded as significant by health care professionals.

A2.5 The guidance is clear that other factors may be relevant in individual cases. It also states that the effect on the residents of any new development where the air quality is such that an air quality objective is not met will be judged as significant. For people working at new developments in this situation, the same will not be true as occupational exposure standards are different, although any assessment may wish to draw attention to the undesirability of the exposure.

A2.6 A judgement of the significance should be made by a competent professional who is suitably qualified. A summary of the professional experience of the staff contributing to this assessment is provided in Appendix A4.

A3 Professional Experience

Dr Clare Beattie, BSc (Hons) MSc PhD CSci MIEnvSc MIAQM

Dr Beattie is an Associate Director with AQC, with more than 20 years' relevant experience. She has been involved in air quality management and assessment, and policy formulation in both an academic and consultancy environment. She has prepared air quality review and assessment reports, strategies and action plans for local authorities and has developed guidance documents on air quality management on behalf of central government, local government and NGOs. She has led on the air quality inputs into Clean Air Zone feasibility studies and has provided support to local authorities on the integration of air quality considerations into Local Transport Plans and planning policy processes. Dr Beattie has appraised local authority air quality assessments on behalf of the UK governments, and provided support to the Review and Assessment helpdesk. She has carried out numerous assessments for new residential and commercial developments, including the negotiation of mitigation measures where relevant. She has also acted as an expert witness for both residential and commercial developments. She has carried out BREEAM assessments covering air quality for new developments. Dr Beattie has also managed contracts on behalf of Defra in relation to allocating funding for the implementation of air quality improvement measures. She is a Member of the Institute of Air Quality Management, Institution of Environmental Sciences and is a Chartered Scientist.

Pauline Jezequel, MSc MIEnvSc MIAQM

Miss Jezequel is a Principal Consultant with AQC with over ten years' relevant experience. Prior to joining AQC she worked as an air quality consultant at AECOM. She has also worked as an air quality controller at Bureau Veritas in France, undertaking a wide range of ambient and indoor air quality measurements for audit purposes. She now works in the field of air quality assessment, undertaking air quality impact assessments for a wide range of development projects in the UK and abroad, including for residential and commercial developments, transport schemes (rail, road and airport), waste facilities and industrial sites. Miss Jezequel has also undertaken a number of odour surveys and assessments in the context of planning applications. She has experience in monitoring construction dust, as well as indoor pollutant levels for BREEAM purposes. She is a Member of the Institute of Air Quality Management.

Jamie Dennis, MSci (Hons) AMIEnvSc AMIAQM

Mr Dennis is an Assistant Consultant with AQC, having joined the company in December 2019. Prior to joining, he completed an MSci degree in Chemistry at the University of Bristol, specialising in the regional modelling of trace gases. He has undertaken numerous air quality assessments, including road traffic and plant emissions modelling, as well as odour and construction dust risk assessments.

He is an Associate Member of both the Institute of Air Quality Management and Institution of Environmental Sciences.

A4 Modelling Methodology

Model Inputs

A4.1 Predictions have been carried out using the ADMS-Roads dispersion model (v5). The model requires the user to provide various input data, including emissions from each section of road and the road characteristics (including road width, street canyon width, street canyon height and porosity, where applicable). Vehicle emissions have been calculated based on vehicle flow, composition and speed data using the EFT (Version 10.1) published by Defra (2021). Model input parameters are summarised in Table A4.1 and, where considered necessary, discussed further below.

Table A4.1: Summary of Model Inputs

Model Parameter	Value Used
Terrain Effects Modelled?	No
Variable Surface Roughness File Used?	No
Urban Canopy Flow Used?	No
Advanced Street Canyons Modelled?	Yes
Noise Barriers Modelled?	No
Meteorological Monitoring Site	London City
Meteorological Data Years	2019
Dispersion Site Surface Roughness Length (m)	1.0
Dispersion Site Minimum MO Length (m)	75
Met Site Surface Roughness Length (m)	0.2
Met Site Minimum MO Length (m)	75
Gradients?	No

Traffic Data

A4.2 Traffic counts have been provided by LB Enfield, who have undertaken the transport survey for the scheme. The survey involved a two weeks' worth of traffic count data, taken in July, representing traffic flows without the scheme, and in November, representing traffic data with the scheme in place. Each individual vehicle count provided the vehicle type and the time of recording. In order to convert the traffic count data into a format appropriate for air quality roads modelling, a series of calculations and assumptions had to be made, which are set out in this section.

AADT Calculations

A4.3 The air quality model requires traffic data to be input in Average Annual Daily Traffic values (AADT). In order to calculate an annual average from the weekly average, a factor was applied. The factor was calculated using traffic count ATC39, operated by TfL, and situated along the North Circular, 1.7 km away from the consultation area boundary. The count is judged to be far enough away not to be impacted by the scheme to any major degree, but close enough to be representative of typical annual traffic flow variation in the study area. The factor was calculated by dividing the annual total[7], in either 2019 or 2020 (the former used for model verification purposes), by the period total, for each respective survey period. This factor was applied to the period total at each count to approximate annual totals at each of the LB Enfield ATCs. As discussed in Section 3, this method therefore provides values which, to some extent, take into account the annual variations in 2020 traffic, resulting from factors external to the scheme, such as COVID lockdown impacts and school holidays.

Traffic Speeds

A4.4 Dispersion modelling is based on average speeds on each section of road. The ATC data provided the speed of each individual vehicle, as well as an average measured speed for the week. This speed is, however, only applicable at a specific point on the road and will not necessarily be representative of speed alongside the whole road link. Moreover, average speeds pre- and post-scheme were reviewed, and it was not possible to correlate the variation in speeds with that in traffic data; it could have been expected to see average speeds decrease with increased traffic, and vice versa. Measured speeds were therefore not directly used as average speeds for modelling purposes. Instead, average traffic speeds were estimated based on road layout, proximity to junctions and traffic lights, speed limits and professional judgement. For example, where a section of road leads to a traffic light, vehicles will be stopped and thus idling for some time when the light is red, but under a green light, vehicles will travel at normal speed alongside that section of road. As such, for modelling purposes, such sections of roads are typically modelled at 20 kph, which correspond to a weighted average speed throughout the day. On sections of road situated away from junctions, average speeds were determined based on the applicable speed limits. Although the measured speeds were not used, as discussed above, they were reviewed against those determined following the procedure described above, to ensure there were no major discrepancies between measured and estimated average speeds alongside the road network considered in this study.

Fleet Composition

A4.5 The emissions calculated within the model are calculated by vehicle type, split by heavy duty vehicle (HDV) and light duty vehicle (LDV). These are split by being over/under 3.5 tonnes. Therefore, data are required on the proportions of each vehicle type from the traffic counts. The traffic count data provided a breakdown of vehicle counts by the following categories:

1. Short - car, light van.
2. Short towing – trailer, caravan, boat etc.
3. Two axle truck or bus

[7] For 2020, this covers the period 1st January to 24th November, in the absence of data for the rest of the year.

4. Three axle truck or bus
5. Four axle truck
6. Three axle articulated vehicle or rigid vehicle and trailer
7. Four axle articulated vehicle or rigid vehicle and trailer
8. Five axle articulated vehicle or rigid vehicle and trailer
9. Six (or more) axle articulated vehicle or rigid vehicle and trailer
10. B-double or heavy truck and trailer
11. Double road train or heavy tuck and two trailers
12. Triple road train or heavy truck and three (or more) trailers
14. Motorcycle
15. Cycle

A4.6 Categories 1, 2 and 14 are grouped into LDVs, while categories 4, 5, 6, 7, 8, 9, 10, 11 and 12 represent HDVs. Cycles do not have any associated emissions so were not included in the model. Category 3 does not fall into either category, as two axle trucks and buses may fall either side of the 3.5 tonnes boundary. In order to provide a worst-case assessment, it was assumed that all category 3 vehicles fell into the HDV category, and were modelled as such.

Time Varying Emissions

A4.7 As counts were available by the hour for each ATC, hourly variations in traffic flow specific to each modelled road were input into the model. This allowed for the potential capture of the scheme's impact on daily flow variation to be taken account of, as profiles specific to the pre- and post- scheme conditions were used. Examples of these time varying emission factors are provided in Figure A4.1.

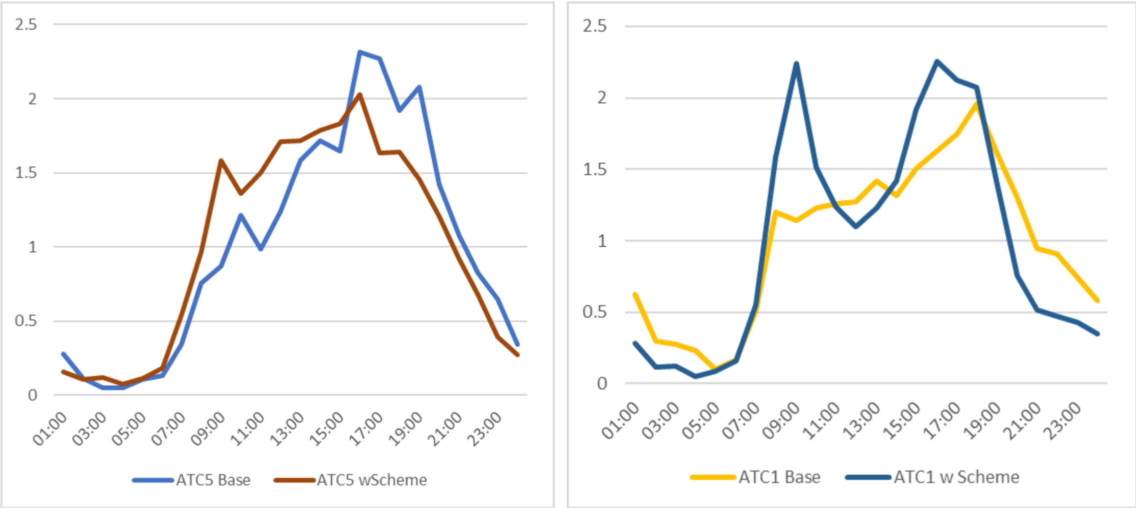

Figure A4.1: Average Time Varying Emission Factors[8] for ATC1 (Palmer's Road) and ATC5 (Natal Road), with and without the Quieter Neighbourhood Scheme.

A4.8 While the effect of the scheme on daily total traffic volumes has, as far as possible, been isolated from other concurrent drivers of change, it has not been possible to separate the effect of external factors from those of the scheme on the distribution of traffic flows throughout the day. For example, the profiles displayed in Figure A4.1 show a lower proportion of trips occurring at night time with the scheme in place, compared to pre-scheme conditions. It is unclear whether this, or other changes to the diurnal profiles, can be attributed to implementation of the scheme, to seasonal effects (for example longer days in the summer), or to the lockdown that was in place in November. On roads with larger baseline traffic flows, it is unlikely that the scheme would significantly impact on the total hourly flows. On the North Circular Road for example, the total daily change in traffic flow resultant from the scheme, according to the AADT flow calculations discussed in paragraph A4.3, is 1,300 additional vehicles, of a total of roughly 67,000. In Figure A4.2 however, there is a substantial shift in hourly flows between the 'base' and 'with scheme' scenarios, which cannot be attributable to such a small relative increase in traffic.

8 The y-axis represents the average traffic flow across the 7 days of traffic data capture, at each hour, standardised to 1.

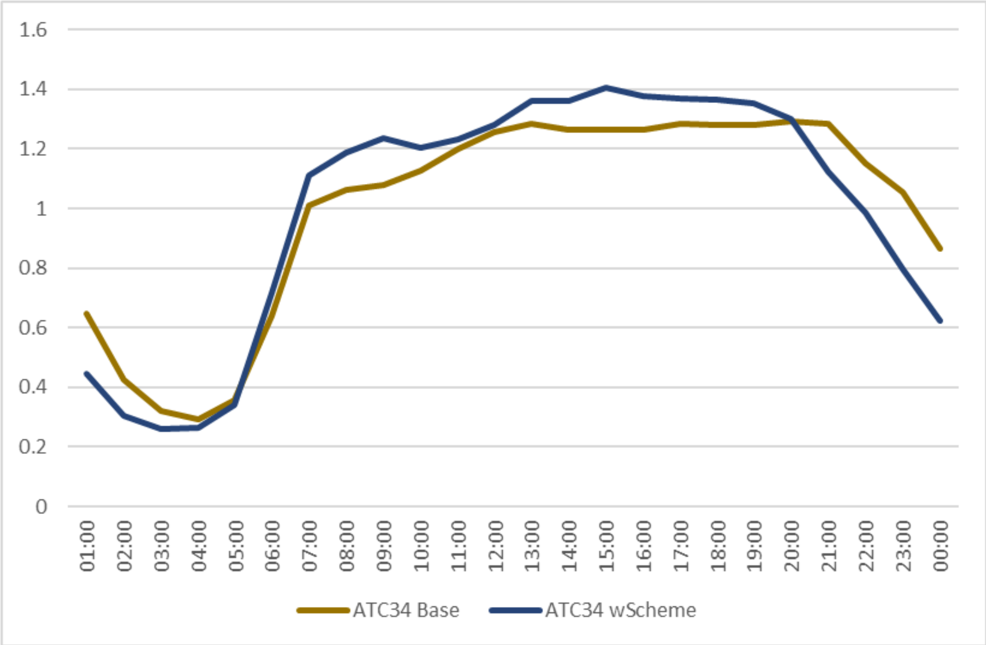

Figure A4.2: Average Time Varying Emission Factors[9] for ATC34 (North Circular), with and without the Quieter Neighbourhood Scheme

A4.9 On high traffic roads, with large associated rates of emission, relatively small shifts in hourly flows can have large impacts on annual mean concentrations. In this case, there is a shift towards lower traffic flow at night in the 'with Scheme' scenario. Due to changes in atmospheric composition at night, nocturnal emissions are less able to disperse, resulting in higher pollutant concentrations (Xuexi Tie et al., 2008), meaning nighttime emissions result in higher pollutant concentrations than at other times of day. Therefore, this shift in hourly emission rates can significantly impact on annual mean values. As this shift in annual mean concentrations is the result of external factors, particularly in the case of the North Circular Road, it is judged that the presentation of modelled results along the North Circular would not represent the outcomes of the scheme, but rather the effect of the profile change.

Missing Data

A4.10 There were a number of ATCs which had periods of data missing. This is not unusual and could be due to cars parked on the device's tube for long periods of time. Where possible, assumptions have been made in order to account for these missing data. Otherwise, these sections of the model have been omitted. A list of missing data and their respective omissions or assumptions made are shown in Table A4.2.

9 The y-axis represents the average traffic flow across the 7 days of traffic data capture, at each hour, standardised to 1.

Table A4.2: Summary of Missing Data in Traffic Counts

Count	Missing Data	Action Taken
ATC3	Missing data from Tuesday, Wednesday, Thursday and Friday of the July period.	Modelling data replaced with ATC5 for the 2019 base model, which is expected to experience similar levels of traffic. Baseline data could not be omitted due to proximity to verification site, but impacts alongside that road were not assessed due to gaps in the data.
ATC4	Sunday, Monday and Tuesday missing from week's data, and replaced with Friday from the previous week and Saturday and Sunday data from following week, for the July period.	Time varying emission factors replaced with ATC5 factors, which is situated on a nearby road and is anticipated to have similar weekly traffic flow variations. Change in daily flows accounted for in annualisation factor.
ATC14	Tuesday missing from week's data, and replaced with Sunday data from following week, for July period.	Time varying emission factors replaced with ATC2 factors, which is the most similar road in the study area in terms of daily flows and is anticipated to have similar weekly traffic flow variations. Change in daily flows accounted for in annualisation factor.
ATC15	Missing data from Wednesday, Friday and Saturday of November period.	Road omitted from model due to lack of data.
ATC17	Tuesday missing from week's data, and replaced with Saturday data from following week, for July period.	Time varying emission factors replaced with ATC16 factors, which is the most similar road in the study area in terms of location, daily flows and local changes due to the scheme. Change in daily flows accounted for in annualisation factor.
ATC18	Missing data from Monday morning and Saturday night to Sunday midday, for July period.	Time varying emission factors replaced with ATC13 factors, which is situated on a nearby road and is anticipated to have similar weekly traffic flow variations.
ATC23	Missing data from Wednesday afternoon, for July period.	Time varying emission factors replaced with ATC21 factors, which is situated on a nearby road and is anticipated to have similar weekly traffic flow variations.
ATC25	Tuesday missing from week's data, and replaced with Saturday data from following week, for July period.	Time varying emission factors replaced with ATC16 factors, which is the most similar road in the study area in terms of daily flows and is anticipated to have similar impacts from the scheme. Change in daily flows accounted for in annualisation factor.

Data Summary

A4.11 The traffic data used in this assessment are summarised in Table A4.3.

Table A4.3: Summary of Annualised Traffic Data used in the Assessment (AADT Flows) [a]

Road Name	Count	2019		2020 Base		2020 with Scheme	
		AADT	%HDV	AADT	%HDV	AADT	%HDV
Palmers Road	ATC1	2,437	12.7	2,134	12.7	2,900	11.9
Bowes Road	ATC2	12,895	14.9	11,291	14.9	12,602	12.8
Highworth Road [b]	ATC3	406	9.4	-	-	-	-
Warwick Road	ATC4	2,398	8.5	2,100	8.5	1,650	8.7
Natal Road	ATC5	406	9.4	355	9.4	455	10.1
Brownlow Road	ATC6	13,128	10.8	11,496	10.8	12,011	11.5
York Road	ATC7	1,888	8.2	1,653	8.2	103	5.0
Maidstone Road	ATC8	1,094	9.5	958	9.5	258	6.7
Bounds Green Road	ATC9	21,514	9.7	18,839	9.7	19,506	10.9
Rhys Avenue	ATC10	39	16.2	34	16.2	135	11.2
Durnsford Road	ATC11	12,398	11.8	10,857	11.8	11,981	11.4
Woodfield Way	ATC12	1,078	6.0	944	6.0	1,476	6.8
Palmerston Road	ATC13	2,809	7.6	2,460	7.6	1,317	7.3
High Road	ATC14	16,467	9.7	14,420	9.7	14,612	13.0
Wolves Lane	ATC15	8,775	9.0	7,683	9.0	8,299	7.8
Truro Road	ATC16	2,965	9.6	2,597	9.6	3,257	9.9
Sidney Road	ATC17	622	8.9	545	8.9	725	10.1
Myddleton Road	ATC18	1,857	8.1	1,626	8.1	2,169	10.1
Belsize Avenue	ATC19	1,292	9.3	1,132	9.3	1,105	8.5
Lascotts Road	ATC20	994	8.4	871	8.4	930	9.1
Melbourne Avenue	ATC21	569	10.0	498	10.0	466	11.3
Spencer Avenue	ATC22	653	10.0	572	10.0	1,319	11.2
Sidney Avenue	ATC23	543	7.9	475	7.9	469	9.7
Kelvin Avenue	ATC24	1,591	9.5	1,394	9.5	1,145	10.7
Nightingale Road	ATC25	2,999	9.3	2,626	9.3	2,981	11.2
Marquis Road	ATC26	422	8.5	369	8.5	411	9.8
Tewkesbury Terrace	ATC27	328	10.6	288	10.6	255	10.9
Wroxham Gardens	ATC28	1,405	7.0	1,230	7.0	1,613	11.2
North Circular (A406)	ATC34	74,295	8.2	66,229	8.2	67,560	8.2

[a] All these numbers correspond to annualised data, following the procedure described in Section 3. HGV proportions have been assumed to be identical in both 2019 and 2020.

b As the ENF5 verification site is situated adjacent to Highworth Road, due to gaps in baseline traffic data here, baseline flows along Natal Road (ATC5) have been used in its place for the purposes of verification. The verification site is also adjacent to the North Circular, which has a much greater traffic flow, meaning air quality will be more dependent on traffic flows along this road, so minor inaccuracies in Highworth Road baseline traffic flow will not make a significant difference to the verification factor.

A4.12 Figure A4.3 shows the road network included within the model, along with the average speed at which each link was modelled, and shows which sections of road have been modelled as canyons (marked with either a ‘Y’ or ‘No’).

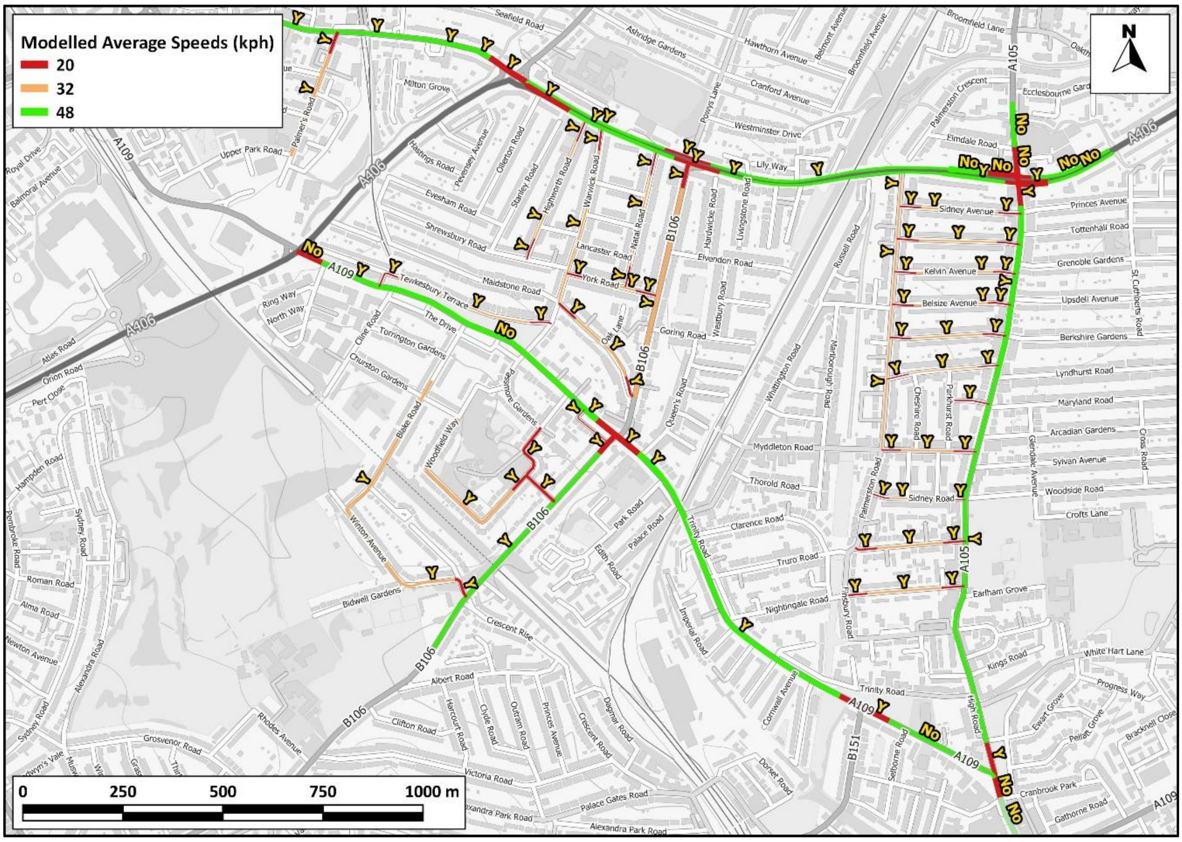

Figure A4.3: Modelled Road Network & Average Speed

Street Canyons

A4.13 For the purposes of modelling, it has been assumed that most of the roads within the study area are within street canyons formed by the building facades on each side of the roads. These have a number of canyon-like features, which reduce dispersion of traffic emissions, and can lead to concentrations of pollutants being higher here than they would be in areas with greater dispersion. These roads have, therefore, been modelled as street canyons using ADMS-Roads’ advanced canyon module, with appropriate input parameters determined from plans and local mapping. As shown in Figure A4.3, roads have been marked with either a 'Y' (indicating that a road has been modelled as a street canyon) or 'No'.

Model Verification

A4.14 In order to ensure that ADMS-Roads accurately predicts local concentrations, it is necessary to verify the model against local measurements. The model has been run to predict the annual mean concentrations during 2019 at the ENF5 automatic monitoring site, for nitrogen dioxide and PM_{10}, and the Enfield 10 diffusion tube for nitrogen dioxide. Monitoring sites Enfield 9 and HGY28 have been excluded from the nitrogen dioxide model verification due to being background sites.

A4.15 Most nitrogen dioxide (NO_2) is produced in the atmosphere by reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions of nitrogen oxides (NOx = NO + NO_2). The model output of road-NOx (i.e. the component of total NOx coming from road traffic) has been compared with the 'measured' road-NOx. Measured road-NOx has been calculated from the measured NO_2 concentration and the predicted background NO_2 concentration using the NOx from NO_2 calculator (Version 8.1) available on the Defra LAQM Support website (Defra, 2021).

A4.16 The unadjusted model has under predicted the road-NOx contribution; this is a common experience with this and most other road traffic emissions dispersion models. An adjustment factor has been determined as the slope of the best-fit line between the 'measured' road contribution and the model derived road contribution, forced through zero (Figure A4.4). The calculated adjustment factor of 1.4215 has been applied to the modelled road-NOx concentration for each receptor to provide adjusted modelled road-NOx concentrations.

A4.17 The total nitrogen dioxide concentrations have then been determined by combining the adjusted modelled road-NOx concentrations with the predicted background NO_2 concentration within the NOx to NO_2 calculator. Figure A4.5 compares final adjusted modelled total NO_2 at each of the monitoring sites to measured total NO_2, and shows a close agreement.

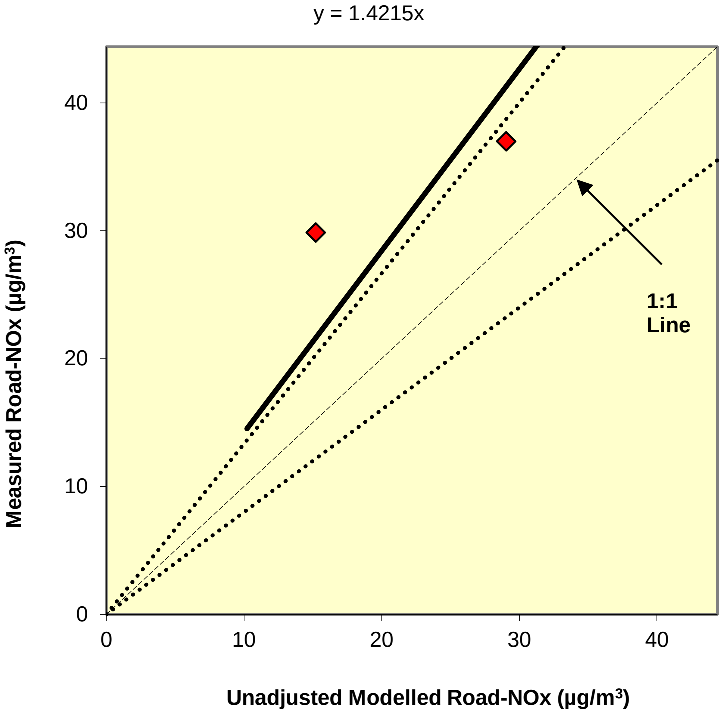

Figure A4.4: Comparison of Measured Road NOx to Unadjusted Modelled Road NOx Concentrations. The dashed lines show ± 25%.

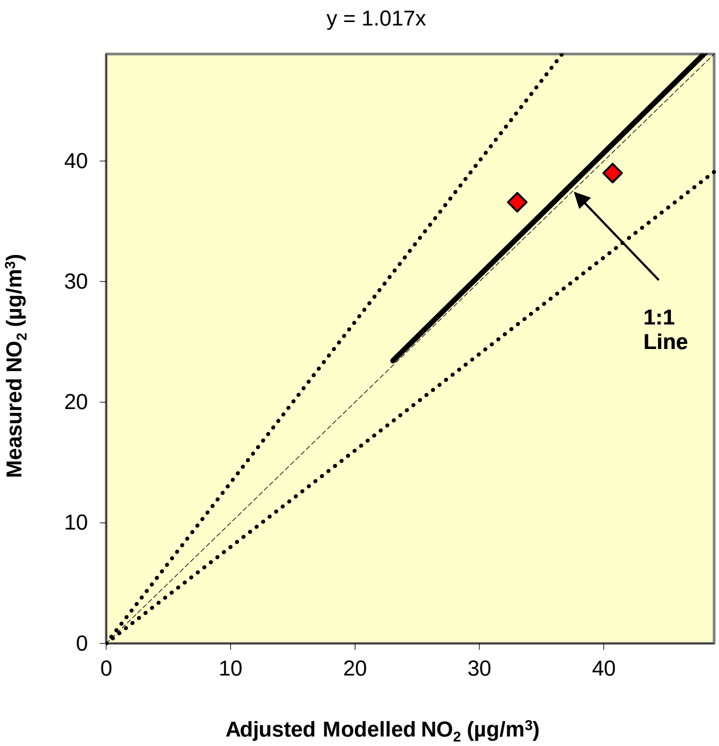

Figure A4.5: Comparison of Measured Total NO_2 to Final Adjusted Modelled Total NO_2 Concentrations. The dashed lines show ± 25%.

A4.18 The adjustment factor calculated for PM_{10} concentrations returned a number lower than one. As such, in order to be conservative, the model outputs of road-PM_{10} and road-$PM_{2.5}$ were adjusted by applying the adjustment factor calculated for road NOx. This would have led to an overestimation of PM concentrations and impacts, providing for a conservative assessment.

Post-processing

A4.19 The model predicts road-NOx concentrations at each receptor location. These concentrations have been adjusted using the adjustment factor set out above, which, along with the background NO_2, has been processed through the NOx to NO_2 calculator available on the Defra LAQM Support website (Defra, 2021). The traffic mix within the calculator has been set to “All London traffic”, which is considered suitable for the study area. The calculator predicts the component of NO_2 based on the adjusted road-NOx and the background NO_2.

A5 Modelling Results

A5.1 This section sets out the full 2020 results for nitrogen dioxide, PM_{10} and $PM_{2.5}$, using the impact descriptors set out in Table A2.1. Receptor locations and ID are set out in Figure A5.1 to Figure A5.3.

Table A5.1: Predicted Impacts on Annual Mean Nitrogen Dioxide Concentrations [a]

Receptor ID	2019	2020		Impact				
	2019 Baseline Concentration (µg/m³)	Without Scheme Concentration (µg/m³)	With Scheme Concentration (µg/m³)	Absolute Change in Concentration (µg/m³)	Change (% of AQAL)	Increase/ Decrease	Impact Descriptor	Sensitivity Test Impact Descriptor [c]
2	35.9	31.5	31.8	0.4	1	+	Negligible	Negligible
3	27.5	25.0	25.0	0.0	0	-	Negligible	Negligible
4	27.5	25.0	25.0	-0.1	0	-	Negligible	Negligible
5	26.5	24.0	24.0	0.0	0	+	Negligible	Negligible
6	29.6	26.7	26.3	-0.4	-1	-	Negligible	Negligible
7	25.0	22.9	22.8	-0.1	0	-	Negligible	Negligible
8	25.0	22.9	22.9	0.0	0		No Change	No Change
9	25.2	23.0	22.5	-0.5	-1	-	Negligible	Negligible
10	24.9	22.8	22.8	0.0	0	-	Negligible	Negligible
11	24.8	22.7	22.6	-0.1	0	-	Negligible	Negligible
12	25.4	23.2	22.9	-0.3	-1	-	Negligible	Negligible
13	25.4	23.1	23.1	0.0	0		No Change	No Change
14	25.4	23.2	23.2	0.0	0		No Change	No Change
15	24.3	22.4	22.3	0.0	0	-	Negligible	Negligible
16	24.9	22.7	22.6	-0.1	0	-	Negligible	Negligible
17	24.2	22.2	21.9	-0.4	-1	-	Negligible	Negligible
18	24.3	22.3	23.1	0.8	2	+	Negligible	Negligible
19	23.8	21.9	22.5	0.6	1	+	Negligible	Negligible
20	24.0	22.1	22.2	0.1	0	+	Negligible	Negligible
21	24.3	22.3	22.3	0.0	0	-	Negligible	Negligible
22	24.0	22.1	22.2	0.1	0	+	Negligible	Negligible
23	25.1	22.9	23.5	0.6	1	+	Negligible	Negligible
24	24.4	22.4	22.9	0.5	1	+	Negligible	Negligible
25	24.7	22.6	23.2	0.6	1	+	Negligible	Negligible

Receptor ID	2019	2020		Impact				
	2019 Baseline Concentration (µg/m³)	Without Scheme Concentration (µg/m³)	With Scheme Concentration (µg/m³)	Absolute Change in Concentration (µg/m³)	Change (% of AQAL)	Increase/ Decrease	Impact Descriptor	Sensitivity Test Impact Descriptor [c]
26	23.9	22.1	21.7	-0.4	-1	-	Negligible	Negligible
27	24.8	22.7	22.2	-0.5	-1	-	Negligible	Negligible
28	24.5	22.5	22.1	-0.4	-1	-	Negligible	Negligible
29	23.9	22.1	22.3	0.2	1	+	Negligible	Negligible
30	23.4	21.7	21.9	0.2	0	+	Negligible	Negligible
31	23.3	21.6	21.8	0.2	0	+	Negligible	Negligible
32	25.8	23.4	23.9	0.5	1	+	Negligible	Negligible
33	33.7	29.4	30.3	0.9	2	+	Slight Adverse	Slight Adverse
34	24.2	22.3	22.6	0.3	1	+	Negligible	Negligible
35	32.1	28.3	28.8	0.5	1	+	Negligible	Negligible
36	26.3	23.8	24.3	0.5	1	+	Negligible	Negligible
37	25.2	23.0	23.4	0.4	1	+	Negligible	Negligible
38	31.8	28.0	28.5	0.5	1	+	Negligible	Negligible
39	29.4	26.2	26.5	0.3	1	+	Negligible	Negligible
40	**42.2**	36.2	36.4	0.2	0	+	Negligible	Negligible
41	33.9	29.8	29.9	0.1	0	+	Negligible	Negligible
42	26.0	23.6	22.3	-1.3	-3	-	Negligible	Negligible
43	32.6	28.5	27.6	-0.9	-2	-	Negligible	Slight Beneficial
44	30.7	27.1	27.0	-0.1	0	-	Negligible	Negligible
45	25.4	23.2	22.2	-1.0	-3	-	Negligible	Negligible
47	27.8	25.3	25.3	0.0	0		No Change	No Change
48	24.1	22.2	22.1	0.0	0	-	Negligible	Negligible
49	32.7	29.0	28.7	-0.4	-1	-	Negligible	Negligible
50	27.3	24.8	24.5	-0.3	-1	-	Negligible	Negligible
51	26.4	24.0	22.9	-1.1	-3	-	Negligible	Negligible
55	24.5	22.6	22.2	-0.3	-1	-	Negligible	Negligible
56	25.2	23.1	22.8	-0.3	-1	-	Negligible	Negligible
57	31.0	27.3	27.2	0.0	0	-	Negligible	Negligible
59	25.1	23.0	23.0	0.0	0	+	Negligible	Negligible
60	29.7	26.5	26.7	0.2	0	+	Negligible	Negligible

Receptor ID	2019	2020		Impact				
	2019 Baseline Concentration (µg/m³)	Without Scheme Concentration (µg/m³)	With Scheme Concentration (µg/m³)	Absolute Change in Concentration (µg/m³)	Change (% of AQAL)	Increase/ Decrease	Impact Descriptor	Sensitivity Test Impact Descriptor [c]
61	30.8	27.2	27.5	0.3	1	+	Negligible	Negligible
62	27.0	24.4	24.6	0.2	1	+	Negligible	Negligible
63	30.7	27.1	27.4	0.3	1	+	Negligible	Negligible
64	28.7	25.6	25.8	0.3	1	+	Negligible	Negligible
65	33.5	29.1	29.6	0.5	1	+	Negligible	Negligible
66	28.4	25.4	25.8	0.3	1	+	Negligible	Negligible
67	23.8	22.1	22.3	0.2	1	+	Negligible	Negligible
68	24.7	22.7	23.2	0.5	1	+	Negligible	Negligible
72	25.8	23.5	23.9	0.4	1	+	Negligible	Negligible
73	24.7	22.8	23.1	0.3	1	+	Negligible	Negligible
74	29.2	26.0	26.0	0.1	0	+	Negligible	Negligible
75	31.1	27.4	27.9	0.5	1	+	Negligible	Negligible
76	29.3	26.1	26.3	0.2	1	+	Negligible	Negligible
86	25.6	23.4	23.1	-0.3	-1	-	Negligible	Negligible
87	24.6	22.6	22.6	0.0	0		No Change	No Change
88	30.2	26.7	26.8	0.1	0	+	Negligible	Negligible
89	25.2	23.1	22.2	-0.9	-2	-	Negligible	Negligible
90	24.5	22.5	22.3	-0.3	-1	-	Negligible	Negligible
91	26.3	23.9	24.0	0.1	0	+	Negligible	Negligible
92	24.8	22.8	22.8	0.0	0	+	Negligible	Negligible
93	25.2	23.1	23.1	0.0	0	+	Negligible	Negligible
94	23.9	22.1	22.4	0.3	1	+	Negligible	Negligible
95	23.5	21.9	22.1	0.3	1	+	Negligible	Negligible
96	28.6	25.6	25.9	0.3	1	+	Negligible	Negligible
97	23.4	21.7	21.9	0.2	0	+	Negligible	Negligible
98	28.4	25.4	25.6	0.2	0	+	Negligible	Negligible
99	29.3	26.0	26.3	0.3	1	+	Negligible	Negligible
100	29.4	26.2	26.4	0.2	1	+	Negligible	Negligible
101	25.0	23.0	23.4	0.4	1	+	Negligible	Negligible
102	29.3	26.1	26.3	0.2	1	+	Negligible	Negligible

Receptor ID	2019	2020		Impact				
	2019 Baseline Concentration (µg/m³)	Without Scheme Concentration (µg/m³)	With Scheme Concentration (µg/m³)	Absolute Change in Concentration (µg/m³)	Change (% of AQAL)	Increase/ Decrease	Impact Descriptor	Sensitivity Test Impact Descriptor [c]
103	23.7	21.9	21.9	0.0	0	+	Negligible	Negligible
104	24.7	22.7	22.5	-0.1	0	-	Negligible	Negligible
105	24.8	22.8	22.7	0.0	0	-	Negligible	Negligible
106	**46.0**	39.2	**40.1**	0.9	2	+	Moderate Adverse	Substantial Adverse
107	27.7	24.9	25.0	0.1	0	+	Negligible	Negligible
Receptors Adjacent to the North Circular								
80	42.3	36.8	36.6	-0.2	0	-	Negligible	Negligible
81	59.4	50.4	50.5	0.1	0	+	Negligible	Negligible
82	42.4	36.9	36.4	-0.5	-1	-	Negligible	Slight Beneficial
Objective	**40**			**-**	**-**	**-**	**-**	**-**

a Exceedances of the objective are shown in bold.

b % changes are relative to the objective and have been rounded to the nearest whole number.

c The sensitivity test has been conducted by applying the IAQM guidance impact descriptor criteria (see Table A2.1) to the modelled change in concentration, treating the 2019 baseline concentration as the "Long-term average concentration".

Table A5.2: Predicted Impacts on Annual Mean PM_{10} Concentrations

Receptor ID	2019	2020		Impact				
	2019 Baseline Concentration (µg/m³)	Without Scheme Concentration (µg/m³)	With Scheme Concentration (µg/m³)	Absolute Change in Concentration (µg/m³)	Change (% of AQAL)	Increase/ Decrease	Impact Descriptor	Sensitivity Test Impact Descriptor [b]
2	21.3	20.4	20.6	0.1	0	+	Negligible	Negligible
3	19.4	18.9	18.9	0.0	0	-	Negligible	Negligible
4	19.4	18.9	18.9	0.0	0	-	Negligible	Negligible
5	18.9	18.3	18.4	0.0	0	+	Negligible	Negligible
6	19.9	19.3	19.2	-0.1	0	-	Negligible	Negligible

Receptor ID	2019	2020		Impact				
	2019 Baseline Concentration (µg/m³)	Without Scheme Concentration (µg/m³)	With Scheme Concentration (µg/m³)	Absolute Change in Concentration (µg/m³)	Change (% of AQAL)	Increase/ Decrease	Impact Descriptor	Sensitivity Test Impact Descriptor [b]
7	18.6	18.1	18.1	0.0	0	-	Negligible	Negligible
8	18.6	18.1	18.1	0.0	0		Negligible	Negligible
9	18.7	18.1	18.0	-0.1	0	-	Negligible	Negligible
10	18.6	18.1	18.1	0.0	0	-	Negligible	Negligible
11	18.6	18.1	18.0	0.0	0	-	Negligible	Negligible
12	18.6	18.1	18.1	0.0	0	-	Negligible	Negligible
13	18.7	18.1	18.1	0.0	0		Negligible	Negligible
14	18.7	18.1	18.1	0.0	0		Negligible	Negligible
15	18.5	18.0	18.0	0.0	0	-	Negligible	Negligible
16	18.6	18.0	18.0	0.0	0	-	Negligible	Negligible
17	18.5	18.0	17.9	-0.1	0	-	Negligible	Negligible
18	18.5	18.0	18.1	0.1	0	+	Negligible	Negligible
19	18.4	17.9	18.0	0.1	0	+	Negligible	Negligible
20	18.5	17.9	18.0	0.0	0	+	Negligible	Negligible
21	18.5	17.9	17.9	0.0	0	-	Negligible	Negligible
22	18.5	18.0	18.0	0.0	0	+	Negligible	Negligible
23	18.6	18.1	18.2	0.1	0	+	Negligible	Negligible
24	18.5	18.0	18.1	0.1	0	+	Negligible	Negligible
25	18.5	18.0	18.1	0.1	0	+	Negligible	Negligible
26	18.4	17.9	17.9	-0.1	0	-	Negligible	Negligible
27	18.6	18.1	18.0	-0.1	0	-	Negligible	Negligible
28	18.6	18.0	17.9	-0.1	0	-	Negligible	Negligible
29	18.4	17.9	18.0	0.0	0	+	Negligible	Negligible
30	18.3	17.9	17.9	0.0	0	+	Negligible	Negligible
31	18.3	17.8	17.9	0.0	0	+	Negligible	Negligible
32	18.7	18.1	18.2	0.1	0	+	Negligible	Negligible
33	20.5	19.7	19.9	0.2	1	+	Negligible	Negligible
34	18.5	18.0	18.0	0.1	0	+	Negligible	Negligible
35	20.3	19.5	19.7	0.2	0	+	Negligible	Negligible
36	18.8	18.2	18.3	0.1	0	+	Negligible	Negligible
37	18.6	18.1	18.1	0.1	0	+	Negligible	Negligible

Receptor ID	2019	2020		Impact				
	2019 Baseline Concentration (µg/m³)	Without Scheme Concentration (µg/m³)	With Scheme Concentration (µg/m³)	Absolute Change in Concentration (µg/m³)	Change (% of AQAL)	Increase/ Decrease	Impact Descriptor	Sensitivity Test Impact Descriptor [b]
38	20.2	19.5	19.6	0.1	0	+	Negligible	Negligible
39	19.7	19.0	19.1	0.1	0	+	Negligible	Negligible
40	21.7	20.8	20.8	0.0	0	+	Negligible	Negligible
41	20.5	19.8	19.8	0.0	0	+	Negligible	Negligible
42	18.7	18.2	18.0	-0.2	-1	-	Negligible	Negligible
43	19.9	19.2	19.1	-0.2	0	-	Negligible	Negligible
44	19.6	18.9	18.9	0.0	0	-	Negligible	Negligible
45	18.3	17.8	17.7	-0.2	-1	-	Negligible	Negligible
47	19.4	18.9	18.9	0.0	0		Negligible	Negligible
48	18.5	17.9	17.9	0.0	0	-	Negligible	Negligible
49	20.3	19.6	19.5	-0.1	0	-	Negligible	Negligible
50	19.1	18.6	18.5	-0.1	0	-	Negligible	Negligible
51	18.5	18.0	17.8	-0.2	-1	-	Negligible	Negligible
55	18.2	17.7	17.7	-0.1	0	-	Negligible	Negligible
56	18.3	17.8	17.8	-0.1	0	-	Negligible	Negligible
57	19.7	19.0	19.0	0.0	0	-	Negligible	Negligible
59	18.4	17.9	17.9	0.0	0	+	Negligible	Negligible
60	19.2	18.6	18.6	0.0	0	+	Negligible	Negligible
61	19.1	18.5	18.5	0.0	0	+	Negligible	Negligible
62	18.6	18.0	18.1	0.0	0	+	Negligible	Negligible
63	19.4	18.7	18.8	0.0	0	+	Negligible	Negligible
64	18.8	18.2	18.3	0.0	0	+	Negligible	Negligible
65	19.5	18.8	18.9	0.1	0	+	Negligible	Negligible
66	19.1	18.5	18.6	0.1	0	+	Negligible	Negligible
67	18.1	17.6	17.7	0.0	0	+	Negligible	Negligible
68	18.2	17.7	17.8	0.1	0	+	Negligible	Negligible
72	18.7	18.2	18.3	0.1	0	+	Negligible	Negligible
73	18.6	18.1	18.2	0.1	0	+	Negligible	Negligible
74	19.2	18.6	18.6	0.0	0	+	Negligible	Negligible
75	19.9	19.2	19.3	0.1	0	+	Negligible	Negligible
76	19.6	19.0	19.0	0.0	0	+	Negligible	Negligible

Receptor ID	2019	2020		Impact				
	2019 Baseline Concentration (µg/m³)	Without Scheme Concentration (µg/m³)	With Scheme Concentration (µg/m³)	Absolute Change in Concentration (µg/m³)	Change (% of AQAL)	Increase/ Decrease	Impact Descriptor	Sensitivity Test Impact Descriptor [b]
86	18.4	17.9	17.8	-0.1	0	-	Negligible	Negligible
87	18.6	18.0	18.0	0.0	0		Negligible	Negligible
88	19.6	18.9	18.9	0.0	0	+	Negligible	Negligible
89	18.3	17.8	17.7	-0.2	-1	-	Negligible	Negligible
90	18.2	17.7	17.7	0.0	0	-	Negligible	Negligible
91	18.6	18.1	18.1	0.0	0	+	Negligible	Negligible
92	18.3	17.8	17.8	0.0	0	+	Negligible	Negligible
93	18.4	17.9	17.9	0.0	0	+	Negligible	Negligible
94	18.1	17.6	17.7	0.1	0	+	Negligible	Negligible
95	18.0	17.6	17.6	0.1	0	+	Negligible	Negligible
96	19.1	18.5	18.6	0.1	0	+	Negligible	Negligible
97	18.0	17.6	17.6	0.0	0	+	Negligible	Negligible
98	19.4	18.8	18.8	0.0	0	+	Negligible	Negligible
99	18.9	18.3	18.3	0.1	0	+	Negligible	Negligible
100	19.7	19.0	19.1	0.1	0	+	Negligible	Negligible
101	18.6	18.1	18.2	0.1	0	+	Negligible	Negligible
102	19.7	19.0	19.1	0.0	0	+	Negligible	Negligible
103	18.4	17.9	17.9	0.0	0	+	Negligible	Negligible
104	18.6	18.1	18.0	0.0	0	-	Negligible	Negligible
105	18.6	18.1	18.1	0.0	0	-	Negligible	Negligible
106	22.4	21.4	21.6	0.1	0	+	Negligible	Negligible
107	19.3	18.7	18.7	0.0	0	+	Negligible	Negligible
Receptors Adjacent to the North Circular								
80	23.0	22.0	22.0	0.0	0	-	Negligible	Negligible
81	25.1	23.8	23.8	0.0	0	+	Negligible	Negligible
82	23.1	22.0	21.9	-0.1	0	-	Negligible	Negligible
Objective	40			-	-	-	-	-

[a] % changes are relative to the objective and have been rounded to the nearest whole number.

[b] The sensitivity test has been conducted by applying the IAQM guidance impact descriptor criteria (see Table A2.1) to the modelled change in concentration, treating the 2019 baseline concentration as the "Long-term average concentration".

Table A5.3: Predicted Impacts on Annual Mean $PM_{2.5}$ Concentrations

Receptor ID	2019	2020		Impact				
	2019 Baseline Concentration (µg/m³)	Without Scheme Concentration (µg/m³)	With Scheme Concentration (µg/m³)	Absolute Change in Concentration (µg/m³)	Change (% of AQAL)	Increase/ Decrease	Impact Descriptor	Sensitivity Test Impact Descriptor [b]
2	13.8	13.3	13.4	0.1	0	+	Negligible	Negligible
3	12.7	12.4	12.4	0.0	0	-	Negligible	Negligible
4	12.8	12.4	12.4	0.0	0	-	Negligible	Negligible
5	12.5	12.2	12.2	0.0	0	+	Negligible	Negligible
6	13.0	12.7	12.6	0.0	0	-	Negligible	Negligible
7	12.3	12.0	12.0	0.0	0	-	Negligible	Negligible
8	12.3	12.0	12.0	0.0	0		Negligible	Negligible
9	12.4	12.0	12.0	-0.1	0	-	Negligible	Negligible
10	12.3	12.0	12.0	0.0	0	-	Negligible	Negligible
11	12.3	12.0	12.0	0.0	0	-	Negligible	Negligible
12	12.4	12.0	12.0	0.0	0	-	Negligible	Negligible
13	12.4	12.0	12.0	0.0	0		Negligible	Negligible
14	12.4	12.0	12.0	0.0	0		Negligible	Negligible
15	12.3	12.0	12.0	0.0	0	-	Negligible	Negligible
16	12.3	12.0	12.0	0.0	0	-	Negligible	Negligible
17	12.3	11.9	11.9	0.0	0	-	Negligible	Negligible
18	12.3	12.0	12.0	0.1	0	+	Negligible	Negligible
19	12.2	11.9	12.0	0.1	0	+	Negligible	Negligible
20	12.2	11.9	11.9	0.0	0	+	Negligible	Negligible
21	12.2	11.9	11.9	0.0	0	-	Negligible	Negligible
22	12.2	11.9	12.0	0.0	0	+	Negligible	Negligible
23	12.3	12.0	12.1	0.1	0	+	Negligible	Negligible
24	12.3	12.0	12.0	0.1	0	+	Negligible	Negligible
25	12.3	12.0	12.0	0.1	0	+	Negligible	Negligible
26	12.2	11.9	11.9	0.0	0	-	Negligible	Negligible
27	12.3	12.0	11.9	-0.1	0	-	Negligible	Negligible
28	12.3	12.0	11.9	-0.1	0	-	Negligible	Negligible
29	12.2	11.9	12.0	0.0	0	+	Negligible	Negligible
30	12.2	11.9	11.9	0.0	0	+	Negligible	Negligible

Receptor ID	2019	2020		Impact				
	2019 Baseline Concentration (µg/m³)	Without Scheme Concentration (µg/m³)	With Scheme Concentration (µg/m³)	Absolute Change in Concentration (µg/m³)	Change (% of AQAL)	Increase/ Decrease	Impact Descriptor	Sensitivity Test Impact Descriptor [b]
31	12.1	11.9	11.9	0.0	0	+	Negligible	Negligible
32	12.4	12.1	12.1	0.1	0	+	Negligible	Negligible
33	13.4	12.9	13.1	0.1	0	+	Negligible	Negligible
34	12.3	12.0	12.0	0.0	0	+	Negligible	Negligible
35	13.3	12.8	12.9	0.1	0	+	Negligible	Negligible
36	12.4	12.1	12.1	0.0	0	+	Negligible	Negligible
37	12.3	12.0	12.0	0.0	0	+	Negligible	Negligible
38	13.3	12.8	12.9	0.1	0	+	Negligible	Negligible
39	13.0	12.5	12.6	0.1	0	+	Negligible	Negligible
40	14.1	13.6	13.6	0.0	0	+	Negligible	Negligible
41	13.4	13.0	13.0	0.0	0	+	Negligible	Negligible
42	12.4	12.1	12.0	-0.1	0	-	Negligible	Negligible
43	13.1	12.7	12.6	-0.1	0	-	Negligible	Negligible
44	12.9	12.5	12.5	0.0	0	-	Negligible	Negligible
45	12.2	11.8	11.7	-0.1	0	-	Negligible	Negligible
47	12.8	12.4	12.4	0.0	0		Negligible	Negligible
48	12.2	11.9	11.9	0.0	0	-	Negligible	Negligible
49	13.3	12.9	12.8	0.0	0	-	Negligible	Negligible
50	12.6	12.3	12.3	0.0	0	-	Negligible	Negligible
51	12.3	11.9	11.8	-0.1	0	-	Negligible	Negligible
55	12.1	11.8	11.7	0.0	0	-	Negligible	Negligible
56	12.2	11.8	11.8	0.0	0	-	Negligible	Negligible
57	13.0	12.5	12.5	0.0	0	-	Negligible	Negligible
59	12.2	11.9	11.9	0.0	0	+	Negligible	Negligible
60	12.7	12.3	12.3	0.0	0	+	Negligible	Negligible
61	12.6	12.2	12.3	0.0	0	+	Negligible	Negligible
62	12.3	12.0	12.0	0.0	0	+	Negligible	Negligible
63	12.8	12.4	12.4	0.0	0	+	Negligible	Negligible
64	12.4	12.1	12.1	0.0	0	+	Negligible	Negligible
65	12.9	12.4	12.5	0.0	0	+	Negligible	Negligible

Receptor ID	2019	2020		Impact				
	2019 Baseline Concentration (µg/m³)	Without Scheme Concentration (µg/m³)	With Scheme Concentration (µg/m³)	Absolute Change in Concentration (µg/m³)	Change (% of AQAL)	Increase/ Decrease	Impact Descriptor	Sensitivity Test Impact Descriptor [b]
66	12.6	12.2	12.3	0.0	0	+	Negligible	Negligible
67	12.0	11.7	11.7	0.0	0	+	Negligible	Negligible
68	12.1	11.8	11.8	0.1	0	+	Negligible	Negligible
72	12.4	12.1	12.1	0.0	0	+	Negligible	Negligible
73	12.3	12.0	12.1	0.0	0	+	Negligible	Negligible
74	12.7	12.3	12.3	0.0	0	+	Negligible	Negligible
75	13.1	12.7	12.7	0.1	0	+	Negligible	Negligible
76	12.9	12.5	12.5	0.0	0	+	Negligible	Negligible
86	12.2	11.9	11.8	0.0	0	-	Negligible	Negligible
87	12.3	12.0	12.0	0.0	0		Negligible	Negligible
88	12.9	12.5	12.5	0.0	0	+	Negligible	Negligible
89	12.2	11.8	11.7	-0.1	0	-	Negligible	Negligible
90	12.1	11.8	11.8	0.0	0	-	Negligible	Negligible
91	12.3	12.0	12.0	0.0	0	+	Negligible	Negligible
92	12.2	11.8	11.8	0.0	0	+	Negligible	Negligible
93	12.2	11.9	11.9	0.0	0	+	Negligible	Negligible
94	12.0	11.7	11.8	0.0	0	+	Negligible	Negligible
95	12.0	11.7	11.7	0.0	0	+	Negligible	Negligible
96	12.6	12.2	12.3	0.0	0	+	Negligible	Negligible
97	12.0	11.7	11.7	0.0	0	+	Negligible	Negligible
98	12.8	12.4	12.4	0.0	0	+	Negligible	Negligible
99	12.5	12.1	12.1	0.0	0	+	Negligible	Negligible
100	13.0	12.5	12.6	0.0	0	+	Negligible	Negligible
101	12.4	12.0	12.1	0.1	0	+	Negligible	Negligible
102	12.9	12.5	12.6	0.0	0	+	Negligible	Negligible
103	12.2	11.9	11.9	0.0	0	+	Negligible	Negligible
104	12.3	12.0	12.0	0.0	0	-	Negligible	Negligible
105	12.3	12.0	12.0	0.0	0	-	Negligible	Negligible

Receptor ID	2019	2020		Impact					
	2019 Baseline Concentration (µg/m³)	Without Scheme Concentration (µg/m³)	With Scheme Concentration (µg/m³)	Absolute Change in Concentration (µg/m³)	Change (% of AQAL)	Increase/ Decrease	Impact Descriptor	Sensitivity Test Impact Descriptor [b]
106	14.6	13.9	14.0	0.1	0	+	Negligible	Negligible
107	12.7	12.3	12.4	0.0	0	+	Negligible	Negligible
Receptors Adjacent to the North Circular								
80	14.9	14.2	14.2	0.0	0	-	Negligible	Negligible
81	16.2	15.4	15.4	0.0	0	+	Negligible	Negligible
82	14.9	14.2	14.2	-0.1	0	-	Negligible	Negligible
Objective	**25**			**-**	**-**	**-**	**-**	**-**

[a] % changes are relative to the objective and have been rounded to the nearest whole number.

[b] The sensitivity test has been conducted by applying the IAQM guidance impact descriptor criteria (see Table A2.1) to the modelled change in concentration, treating the 2019 baseline concentration as the “Long-term average concentration”.

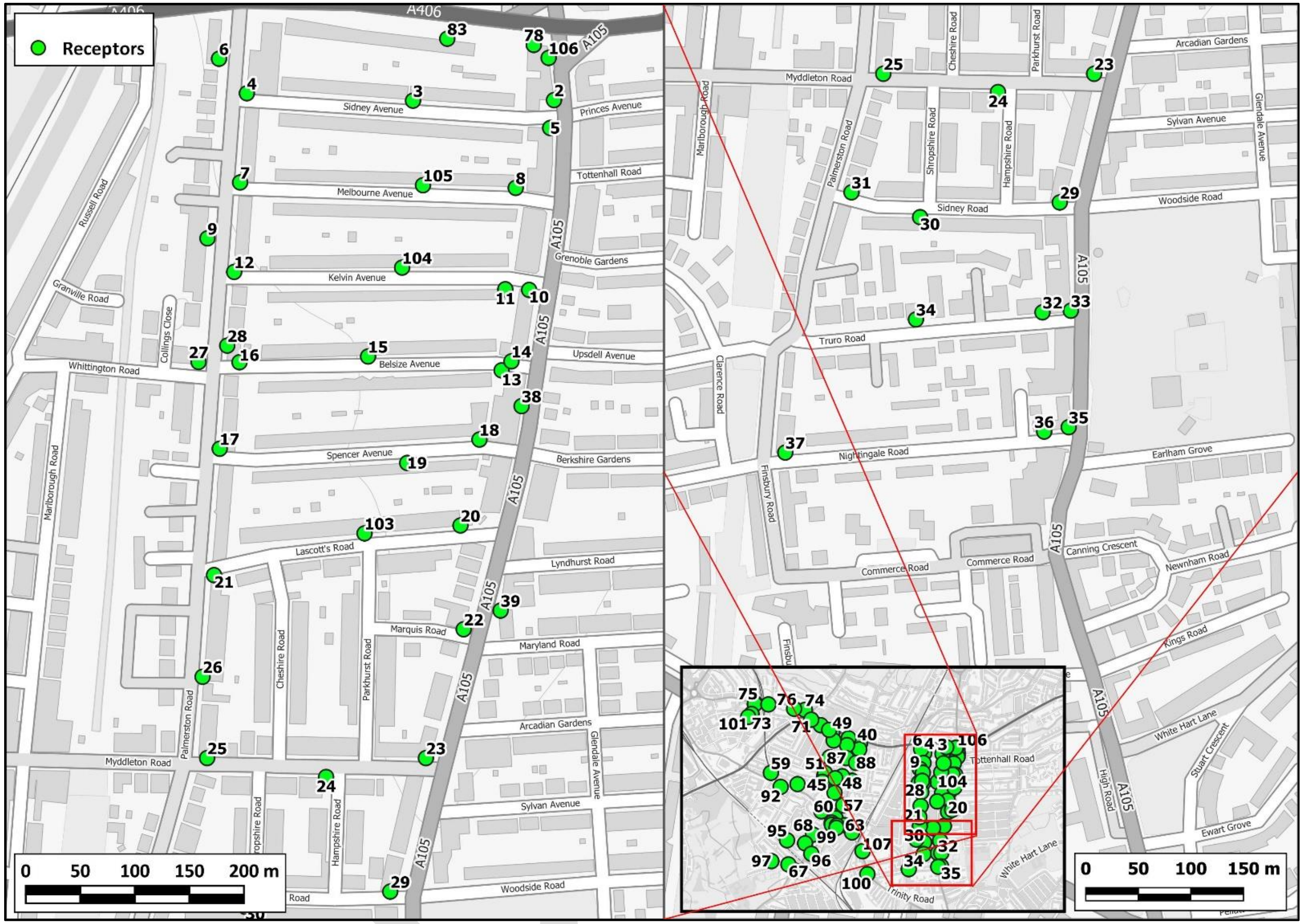

Figure A5.1: Modelled Receptors with Labels - East

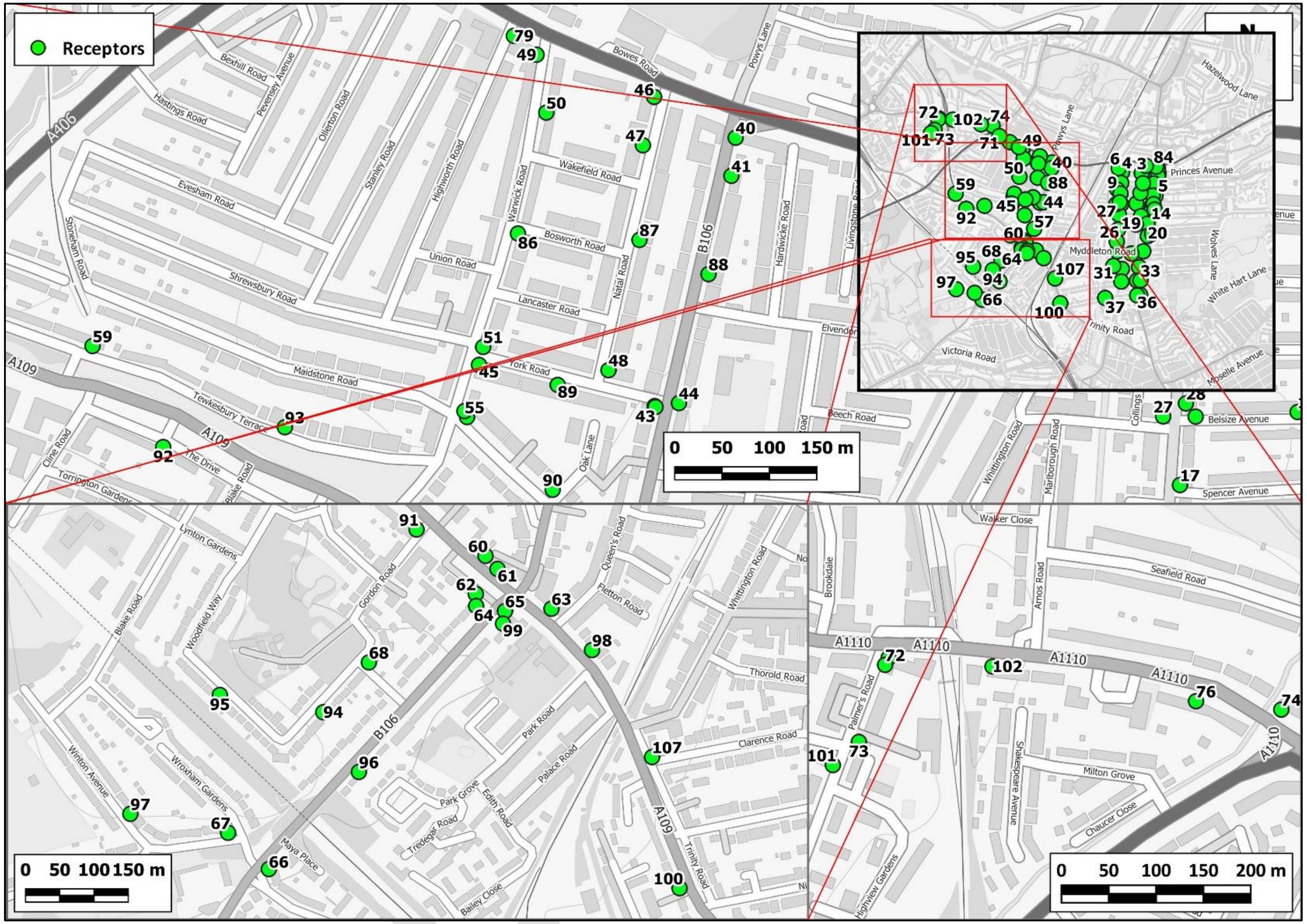

Figure A5.2: Modelled Receptors with Labels - West

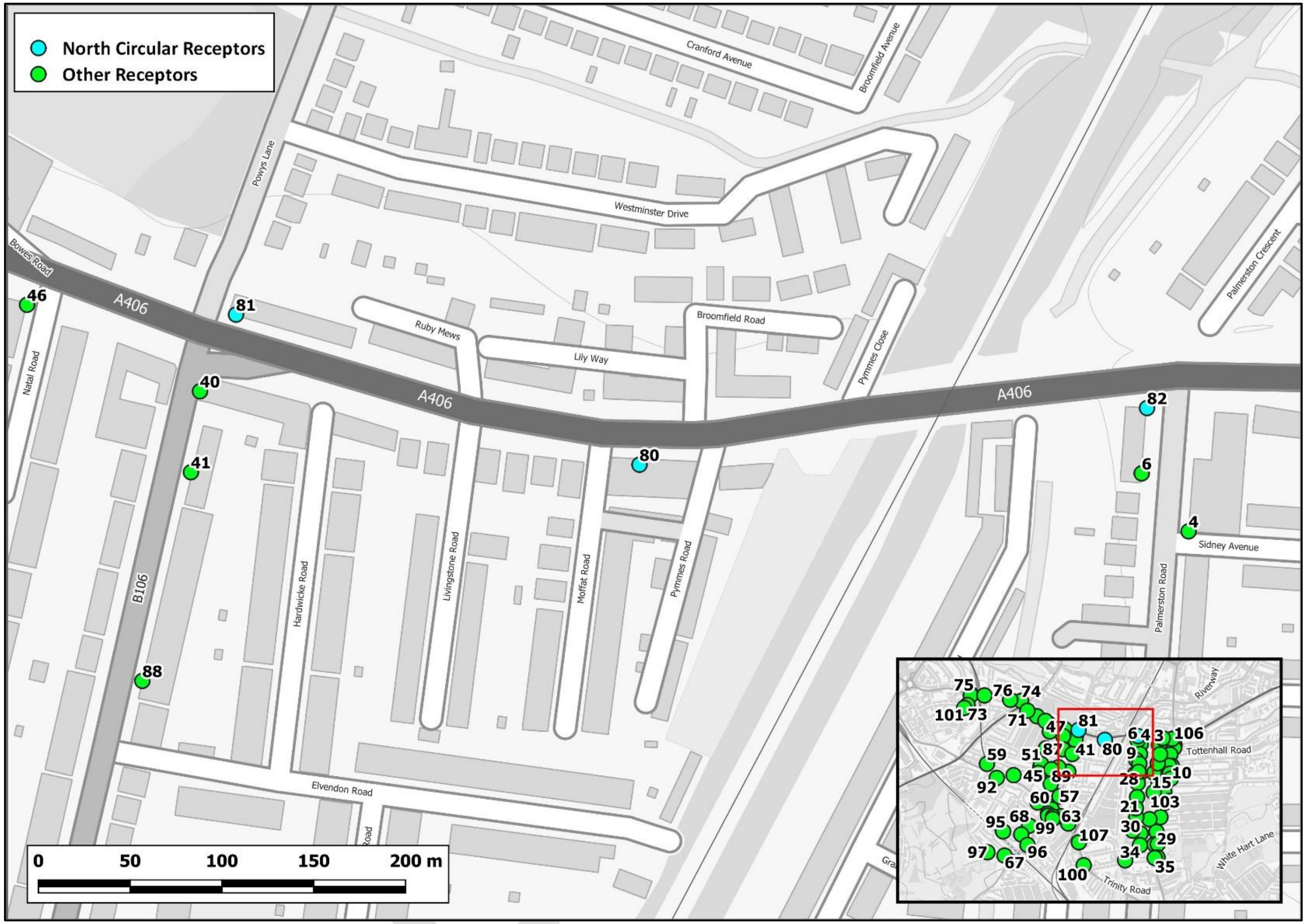

Figure A5.3: Modelled Receptors with Labels – North Circular