AIR QUALITY AND AIR QUALITY NEUTRAL ASSESSMENT
NORTHWOOD AND PINNER COTTAGE HOSPITAL
PINNER ROAD, HILLINGDON
NHS PROPERTY SERVICES AND NHS HILLINGDON CCG
AQA-22143-20-203 REVA
MARCH 2021

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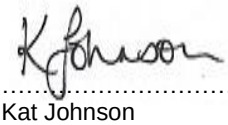

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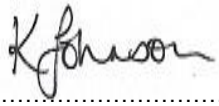

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SECTION 1 INTRODUCTION

1.1 NHS Property Services and NHS Hillingdon CCG proposes to redevelop the former Northwood and Pinner Cottage Hospital located to the north of Pinner Road in the London Borough of Hillingdon (LBH). The redevelopment comprises the partial demolition of the Cottage Hospital and redevelopment to provide a new fit for purpose healthcare facility and the comprehensive redevelopment of the reminder of the site for residential development across two, four-storey blocks.

1.2 IDOM Merebrook Limited (IDOM) has been commissioned by NHS Property Services and NHS Hillingdon CCG to undertake an Air Quality Assessment (AQA) for the proposed development.

1.3 The objectives of the assessment are to:

i. Set out the legislative and planning policy context;

ii. Establish baseline air quality from a desk-based review of published data sources;

iii. Identify sources of existing air pollution and sensitive receptors in the vicinity of the site;

iv. Undertake a site suitability assessment;

v. Identify potential air quality impacts associated with the construction phase;

vi. Identify potential air quality impacts associated with the operational phase;

vii. Undertake an Air Quality Neutral Assessment; and,

viii. Where any significant air quality issues associated with the proposed developments are identified, make recommendations for further assessment and/or mitigation.

1.4 The scope of the assessment was agreed by Dr Ana Grossinho (Director at Air Quality Experts Global Ltd), on behalf of LBH, on 3 March 2021.

1.5 This report has been prepared for NHS Property Services and NHS Hillingdon CCG for the sole purpose described above and no extended duty of care to any third party is implied or offered. Third parties making reference to the report should consult NHS Property Services and NHS Hillingdon CCG and IDOM as to the extent to which the findings may be appropriate for their use.

SECTION 2 POLICY CONTEXT & ASSESSMENT CRITERIA

2.1 NATIONAL POLICY

2.1.1 The National Planning Policy Framework (NPPF) published in March 2012 stated that air quality can be a material planning consideration and that local authority Air Quality Action Plans (AQAPs) for Air Quality Management Areas (AQMA) should be considered as part of the planning application process. It emphasised that the planning process should prevent both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of pollution and should consider cumulative impacts on air quality from individual sites in local areas.

2.1.2 The revised NPPF published in February 2019 reiterates these points stating that planning decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of AQMAs and Clean Air Zones (CAZs), 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. Planning decisions should ensure that any new development in AQMAs and CAZs is consistent with the local AQAP.

2.1.3 National Planning Practice Guidance (NPPG) was launched on 6 March 2014 to support the previous version of the NPPF. The guidance sets out guiding principles on how planning can take account of the impacts of new development on air quality. The guidance relating to air quality was updated in November 2019 and places greater emphasis on biodiversity effects (including cumulative effects) and includes the aspiration to deliver a net improvement in overall air quality.

2.1.4 The NPPG states that *'Whether air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to have an adverse effect on air quality in areas where it is already known to be poor, particularly if it could affect the implementation of air quality strategies and action plans and/or breach legal obligations (including those relating to the conservation of habitats and species). Air quality may also be a material consideration if the proposed development would be particularly sensitive to poor air quality in its vicinity'*.

2.1.5 The NPPG sets out the information that may be required in an air quality assessment, making clear that *'assessments need to be proportional to the nature and scale of development proposed and the potential impacts (taking into account existing air quality conditions)'*. It also provides guidance on options for mitigating air quality impacts, as well as examples of the types of measures to be considered. It makes clear that *'mitigation options will need to be locationally specific, will depend on the proposed development and need to be proportionate to the likely impact'*.

2.2 REGIONAL POLICY

2.2.1 Mayor's Air Quality Strategy (MAQS) [1]

2.2.1.1 For London, additional policy guidance is provided in the MAQS 2010 which aims to reduce pollutant concentrations and public exposure to pollution.

2.2.2 The London Plan 2021[2]

2.2.2.1 The new London Plan was formally adopted on 2 March 2021. Policy SI1 – 'Improving Air Quality', specifically addresses the subject of air quality as follows:

'A Development Plans, through relevant strategic, site-specific and area-based policies, should seek opportunities to identify and deliver further improvements to air quality and should not reduce air quality benefits that result from the Mayor's or boroughs' activities to improve air quality.

B To tackle poor air quality, protect health and meet legal obligations the following criteria should be addressed:

1) Development proposals should not:

a) lead to further deterioration of existing poor air quality;

b) create any new areas that exceed air quality limits, or delay the date at which compliance will be achieved in areas that are currently in exceedance of legal limits;

c) create unacceptable risk of high levels of exposure to poor air quality.

2) In order to meet the requirements in Part 1, as a minimum:

i. *a) development proposals must be at least Air Quality Neutral;*

ii. *b) development proposals should use design solutions to prevent or minimise increased exposure to existing air pollution and make provision to address local problems of air quality in preference to post-design or retro-fitted mitigation measures;*

iii. *c) major development proposals must be submitted with an Air Quality Assessment. Air quality assessments should show how the development will meet the requirements of B1;*

iv. *d) development proposals in Air Quality Focus Areas or that are likely to be used by large numbers of people particularly vulnerable to poor air quality, such as children or older people, should, demonstrate that design measures have been used to minimise exposure.*

[1] Mayor of London (2010), '*Clearing the air: The Mayor's Air Quality Strategy*'.
[2] Greater London Authority (2021) '*The London Plan'*

C Masterplans and development briefs for large-scale development proposals subject to an Environmental Impact Assessment should consider how local air quality can be improved across the area of the proposal as part of an air quality positive approach. To achieve this a statement should be submitted demonstrating:

i. a) how proposals have considered ways to maximise benefits to local air quality, and,

ii. b) what measures or design features will be put in place to reduce exposure to pollution, and how they will achieve this.

D In order to reduce the impact on air quality during the construction and demolition phase development proposals must demonstrate how they plan to comply with the Non-Road Mobile Machinery Low Emission Zone and reduce emissions from the demolition and construction of buildings following best practice guidance.

E Development proposals should ensure that where emissions need to be reduced to meet the requirements of Air Quality Neutral or to make the impact of development on local air quality acceptable, this is done on-site. Where it can be demonstrated that emissions cannot be further reduced by on-site measures, off-site measures to improve local air quality may be acceptable, provided that equivalent air quality benefits can be demonstrated within the area affected by the development.'

2.2.3 'Good Quality Homes for all Londoners' London Plan Guidance (LPG) (consultation draft)

2.2.3.1 The Greater London Authority's (GLAs) Sustainable Design and Construction Supplementary Planning Guidance (SDC SPG) which introduced the concept of 'air quality neutral' was revoked on 2 March 2021 when the new London Plan was formally adopted. It is to be replaced by the emerging 'Good Quality Homes for all Londoners' LPG. The consultation draft of this document was published in October 2020 and has undergone three months of consultation which ended in January 2021. It is formed of four documents (modules) which provide guidance on the implementation of the London Plan requirements.

2.2.3.2 Within Module C- 'Good Quality Housing For All Londoners', it states that the GLA intends to publish updated guidance on Air Quality Neutral and Air Quality Assessments in due course.

2.2.4 London Councils Air Quality and Planning Guidance

2.2.4.1 This technical guidance was produced by the Air Pollution Planning and the Local Environment (APPLE) working group in 2007.

2.2.4.2 It provides technical advice on how to deal with planning applications that could have an impact on air quality. The aim of the guidance is to help ensure consistency in the approach to dealing with air quality and planning in London.

2.3 LOCAL POLICY

2.3.1 Local Plan Part 1

2.3.1.1 The LBH's Local Plan Part 1 which was adopted in 2012 contains strategic policies and sets out the overall level and broad locations of growth up to 2026. Together with the Local Plan Part 2, Development Management Policies and, Site Allocations and Designation documents, it forms the Council's future development strategy for the borough.

2.3.1.2 Air quality is addressed throughout the Local Plan Part 1 however, specific mention of air quality issues relevant to the proposed development site are made in the following strategic objectives:

'SO10: Improve and protect air and water quality, reduce adverse impacts from noise including the safeguarding of quiet areas and reduce the impacts of contaminated land.

SO11: Address the impacts of climate change, and minimise emissions of carbon and local air quality pollutants from new development and transport.'

2.3.1.3 Reference to air quality is also made in following policies:

'Policy BE1: Built Environment:

10. Maximise the opportunities for all new homes to contribute to tackling and adapting to climate change and reducing emissions of local air quality pollutants. The Council will require all new development to achieve reductions in carbon dioxide emission in line with the London Plan targets through energy efficient design and effective use of low and zero carbon technologies. Where the required reduction from on-site renewable energy is not feasible within major developments, contributions off-site will be sought…'

'Policy EM1: Climate Change Adaption and Mitigation:

5. Promoting the use of decentralised energy within large scale development whilst improving local air quality levels.

6. Targeting areas with high carbon emissions for additional reductions through low carbon strategies. These strategies will also have an objective to minimise other pollutants that impact on local air quality. Targeting areas of poor air quality for additional emissions reductions.'

'Policy EM8: Land, Water, Air and Noise':

'All development should not cause deterioration in the local air quality levels and should ensure the protection of both existing and new sensitive receptors. All major development within the AQMA should demonstrate air quality neutrality (no worsening of impacts) where appropriate; actively contribute to the promotion of

sustainable transport measures such as vehicle charging points and the increased provision for vehicles with cleaner transport fuels; deliver increased planting through soft landscaping and living walls and roofs; and provide a management plan for ensuring air quality impacts can be kept to a minimum. The Council seeks to reduce the levels of pollutants referred to in the Government's National Air Quality Strategy and will have regard to the Mayor's Air Quality Strategy. London Boroughs should also take account of the findings of the Air Quality Review and Assessments and Actions plans, in particular where Air Quality Management Areas have been designated. The Council has a network of Air Quality Monitoring stations but recognises that this can be widened to improve understanding of air quality impacts. The Council may therefore require new major development in an AQMA to fund additional air quality monitoring stations to assist in managing air quality improvements.'

2.3.1.4 LBH proposes to implement Policy EM8 by:

i. '*Reviewing the Air Quality Action Plan to ensure new developments in areas of poor air quality are prioritised for low emission strategies aimed at working towards securing compliance with the national and EU air quality limits and standards.*

ii. Using planning conditions and Section 106 agreements to improve air quality and where appropriate, apply a Community Infrastructure Levy (CIL) on new developments.

iii. Implementing the Climate Change Strategy to secure reductions in local air pollutants and mitigate climate change.

iv. Implementing the borough Transport Strategy to ensure reductions in emissions from transport within the borough.'

2.3.2 Local Plan Part 2

2.3.2.1 The Local Plan Part 2 was adopted in January 2020 and provides the detail of the strategic policies set out in the Local Plan Part 1: Strategic Policies (2012).

2.3.2.2 The policies most relevant to air quality are as follows:

Policy DMEI 1: 'Living Walls and Roofs and on-site Vegetation' which states:

'i) All development proposals are required to comply with the following: i) All major developments should incorporate living roofs and/or walls into the development. Suitable justification should be provided where living walls and roofs cannot be provided; and ii) Major development in Air Quality Management Areas must provide onsite provision of living roofs and/or walls. A suitable offsite contribution may be required where onsite provision is not appropriate.'

Policy DMEI 14: 'Air Quality', which states:

'A) Development proposals should demonstrate appropriate reductions in emissions to sustain compliance with and contribute towards meeting EU limit values and national air quality objectives for pollutants. B) Development proposals should, as a minimum: i) be at least "air quality neutral"; ii) include sufficient mitigation to ensure there is no unacceptable risk from air pollution to sensitive receptors, both existing and new; and iii) actively contribute towards the improvement of air quality, especially within the Air Quality Management Area.'

Policy DMT 1: 'Managing Transport Impacts', which states:

'A) …v) have no significant adverse transport or associated air quality and noise impacts on the local and wider environment, particularly on the strategic road network.'

2.3.3 LBH AQAP

2.3.3.1 The AQAP was adopted in May 2019 and identifies measures and actions required to manage air quality within the AQMA and specifically hotspot areas, in order to reduce air pollution levels below Air Quality Objectives (AQO) within the AQMA and across the district. Actions include enforcement of Air Quality Neutral policy with a requirement for more stringent application of mitigation in the Hillingdon Focus Areas and ensuring emissions from construction are minimised.

2.3.3.2 Air Quality Focus Areas (AQFA) have been declared by the GLA where air pollutants are exceeding the environmental standards and where there are also high levels of human exposure. LBH has further defined the GLAs AQFAs into Hillingdon-specific AQFAs in order to fully encompass the GLA focus areas and to ensure that the sources contributing to the high levels of pollution are included. These Focus Areas are now embedded in LBH's planning process for the assessment of new developments and the requirements to achieve pollution emissions reductions. The site is partially located within the Hillingdon-specific 'Northwood East' Focus Area.

2.3.3.3 Action 5 of the AQAP states that *'in AQ focus areas, NOx damage calculation costs are requested to form the basis of planning obligation for costs where the developer mitigation is insufficient'*.

SECTION 3 ASSESSMENT CRITERIA

3.1 AIR POLLUTANTS OF CONCERN

3.1.1 Oxides of nitrogen (NO_x) are emitted by combustion processes, mostly in the form of the less harmful nitrogen oxide (NO). This is converted in the atmosphere to the Air Quality Strategy pollutant nitrogen dioxide (NO_2). The amount of NO_2 produced depends on a number of factors, including the presence of other pollutants (particularly ozone) and meteorological conditions. It therefore varies considerably over time and geographical area. However, the relative contribution of various

sources to the resulting ambient concentrations of NO_2 can generally be assumed to be in proportion to their emissions of NO_x.

3.1.2 PM_{10} comprises the proportion of airborne particulate matter that is less than 10 µm in diameter. This includes fine particles of less than 2.5 µm diameter ($PM_{2.5}$), which can penetrate deeper into the lungs than coarser particles and are becoming increasingly associated with the health effects of particulate pollution. Fine particles are emitted by combustion processes, non-exhaust traffic-related emissions (tyre and brake wear) and also include secondary particles, which are formed in the atmosphere by chemical reactions between other pollutants. The sources of secondary particles can be very distant and include areas outside the UK. The coarser fraction of PM_{10} originates primarily from non-combustion sources.

3.2 AIR QUALITY STANDARDS

3.2.1 The Environment Act 1995 requires Local Authorities to review and document air quality within their area with the aim of meeting specified AQO by target years, as defined in the Air Quality (England) Regulations 2000 and Air Quality (England) (Amendment) Regulations 2002 and set out in the UK National Air Quality Strategy 2007. The AQO are designed to be protective of human health and where they are unlikely to be achieved by the target year the Local Authority is required to designate an AQMA. The authority is then obliged to plan for future compliance with the objectives. Guidance is provided in the UK Air Quality Strategy 2007 and the London Local Air Quality Management Technical Guidance 2019 (LLAQM.TG(19)).

3.2.2 The relevant AQO for NO_2 are an annual mean concentration of 40 $\mu g.m^{-3}$ and an hourly concentration of 200 $\mu g.m^{-3}$ not to be exceeded more than 18 times per year. For PM_{10} the AQO are an annual mean concentration of 40 $\mu g.m^{-3}$ and a 24-hour mean of 50 $\mu g.m^{-3}$ not to be exceeded more than 35 times per year. The objectives for NO_2 and PM_{10} were to have been achieved by 2005 and 2004 respectively, and continue to apply in all future years thereafter.

3.2.3 The 2008 European Directive on ambient air quality and cleaner air for Europe (2008/50/EC) was published in May 2008. The Directive sets limit values for NO_2, PM_{10} and $PM_{2.5}$. Achievement of these values is a national obligation rather than a local one The EU limit values are transposed into UK legislation within the Air Quality Standards Regulations 2010. The limit values for NO_2 and PM_{10} are the same as the national AQO but applied from 2010 and 2005 respectively.

3.2.4 The focus of legislation for $PM_{2.5}$ is on limiting long-term exposure through the use of annual standards, coupled with a reduction in $PM_{2.5}$ background concentrations (15 %) in urban areas across the UK between 2010 and 2020. The annual mean limit value of 25 $\mu g.m^{-3}$ for $PM_{2.5}$ is to be achieved by 2015 whereas the national objective is to be achieved by 2020.

3.2.5 This assessment has been undertaken in accordance with current legislation and guidance including LLAQM.TG(19) issued by the Department for Environment Food and Rural Affairs (DEFRA) in 2019.

SECTION 4 SITE SETTING

4.1 The site is located north of Pinner Road (A404), in Northwood at approximate National Grid Reference (NGR) [5]10061, [1]90669. Drawing 22143-001-001 shows the site location and is provided in Appendix 1 of this report.

4.2 The existing site is divided over two adjacent parcels of land with the former Northwood and Pinner Cottage Hospital in the southwest and Northwood Health Centre in the northeast. It is understood that the Cottage Hospital site is currently used informally as rest place by the London Ambulance Service.

4.3 The site is located within a broadly residential area and is bound by residential properties on all sides with the exception of the southern boundary which is formed by Pinner Road (A404).

SECTION 5 BASELINE AIR QUALITY

5.1 INTRODUCTION

5.1.1 The site itself does not lie within a designated AQMA. The closest AQMA is the London Borough of Harrow whole-borough AQMA located approximately 0.6 km to the east of the site. This was declared in 2002 in respect of 24-hour mean concentrations of PM_{10} and annual mean concentrations of NO_2.

5.1.2 The site is not located within a GLA-designated AQFA however, the majority of the south western parcel is understood to be located within the Hillingdon-specific 'Northwood East' AQFA which also encompasses Pinner Road to the south.

5.1.3 The main source of air pollution in the vicinity of the site is anticipated to be transport emissions from the surrounding road network.

5.2 LOCAL AUTHORITY MONITORING DATA

5.2.1 Reference has been made to the following information sources:

i. LBH 2019 Air Quality Annual Status Report (ASR)

ii. LBH 2018 Air Quality ASR

iii. UK Air website[3]

iv. Air Quality England website[4]

[3] https://uk-air.defra.gov.uk/ (accessed on 25/02/2021)
[4] https://www.airqualityengland.co.uk/ (accessed on 25/02/2021)

5.2.2 The closest continuous monitoring station (CMS) is Hillingdon 1 – South Ruislip (HI1) which is a roadside monitor located 4.75 km to the south of the development site. There are no urban background CMS in close proximity to the redevelopment site.

5.2.3 Table 1 below summarises recent annual mean concentrations of NO_2 and PM_{10} at the HI1 CMS. However, due to the distance, it is not considered that this CMS is representative of baseline conditions at the proposed redevelopment site.

Table 1: Annual mean concentrations of NO_2 and PM_{10} at HI1 CMS

Site ID	Pollutant	Annual Mean Concentration (µg.m^{-3})						
		2015	2016	2017	2018	2019	2020	**AQO**
HI1	NO_2	**48.4**	**42.9**	**46**	36*	34*	25	**40**
	PM_{10}	24	22	17	17	17	17	**40**

Bold values exceed the AQO

* Relocation of station to provide room for a foot path meaning a slight shift away from the road and more representative of public exposure

5.2.4 Annual mean concentrations of NO_2 at the Hillingdon 1 – South Ruislip CMS consistently exceeded the AQO of 40 µg.m^{-3} until 2018 when concentrations fell below it. However, this is considered to be at least partly due to the relocation of the station away from the road. There have been no exceedances of the NO_2 hourly mean AQO since at least 2014.

5.2.5 Annual mean and 24-hour mean concentrations of PM_{10} have not exceeded long term or short term AQOs in all years reviewed.

5.2.6 Diffusion tubes are used to passively monitor concentrations of NO_2 throughout LBH. LBH reviewed its network of passive diffusion tube monitoring in 2018/2019, refining its monitoring programme to take into account the new AQAP and Hillingdon-specific AQFAs. The table below summarises the locations of the closest diffusion tubes (including the closest background monitoring location) and bias-adjusted monitoring data for recent years. Triplicate tubes were installed at the monitoring location adjacent to Pinner Road in 2018 (DT-NE3 A to C) however these were replaced by a single diffusion tube in 2019 (HILL34).

Table 2: Summary of diffusion tube monitoring data in the vicinity of the proposed development site (bias adjusted).

Site ID	Site type	Distance to development site	Annual Mean Concentration NO_2 (µg.m^{-3})					
			2015	2016	2017	2018	2019	**AQO**
HILL34	R	0.07km W	-	-	-	-	35.9*	
(DT-NE3A)	R	0.07 km W	-	-	-	36.9	-	**40**
(DT-NE3B)	R	0.07 km W	-	-	-	35.7	-	
(DT-NE3C)	R	0.07 km W	-	-	-	35.5	-	

Site ID	Site type	Distance to development site	Annual Mean Concentration NO_2 ($\mu g.m^{-3}$)					
			2015	2016	2017	2018	2019	**AQO**
HILL33 (DT-NE2)	R[A]	0.2 km SE	-	-	-	39.7	39.5*	
(DT-NE1)	R	0.36 km SE	-	-	-	29.9	-	
(DT-NE4)	R	0.47 km NW	-	-	-	32.5	-	
HILL14 (HD70)	B	4.8 km W	19.8	19.1	22.1	20.5	22.4	

Bold values represent exceedances of AQO
*Data capture is at or below 50%
(##) – Site ID in LBH 2018 Air Quality ASR
[A] – Designated a kerbside site in the LBH 2018 Air Quality ASR
R – Roadside
B – Background

5.2.7 Annual mean concentrations of NO_2 recorded at all of the roadside monitoring sites were below the AQO of 40 $\mu g.m^{-3}$ in all years reviewed.

5.2.8 Annual mean concentrations recorded at the background site[5] (HD70) have consistently been well below the AQO.

5.2.9 HILL34 (previously DT-NE3) is located adjacent to Pinner Road in close proximity to the southern portion of the site. However, as the proposed development façade is located 10 m north of Pinner Road at its closest point, concentrations are likely to be below those recorded at the HILL34 (previously DT-NE3) site which is located 2 m (previously 3.4 m) from the kerb.

5.3 DEFRA BACKGROUND MAPS

5.3.1 Reference has also been made to the DEFRA background air pollutant concentration maps available on the UK-AIR website. The background maps are presented in 1 km x 1 km grid squares across England, Wales, Scotland and Northern Ireland. The current version[6] of the background maps (reference year 2018) contains estimates for NO_x, NO_2, PM_{10} and $PM_{2.5}$ for the period 2018 through to 2030.

5.3.2 The 2018 reference year background maps are based on monitoring and meteorological data for 2018. The site lies across two grid squares. Predicted background concentrations for the reference year (2018) and the current year (2021) for both grid squares are summarised in the table below.

[5] Although described a s a background site, HD70 is located in close proximity (within 5 m) of the junction of Hall End Road and Rickmansworth Road.

[6] An updated version of the background maps (reference year 2018) was released in August 2020 after the modelling had been completed. Comparison of the 2017 and 2018 reference year maps indicates that the 2018 reference year predicted concentrations are lower than those used in the modelling exercise. The results are therefore considered robust and no reassessment is considered to be necessary.

Table 3: Predicted annual mean DEFRA background map concentrations

Pollutant	Annual Mean Concentration (µg.m^{-3})				
	[5]09500, [1]90500		[5]10500, [1]90500		AQO
	2018	2021	2018	2021	
NO_2	16.03	14.14	17.37	15.32	**40**
PM_{10}	15.06	14.24	15.54	14.69	**40**
$PM_{2.5}$	10.38	9.78	10.65	10.05	**25**

5.3.3 Predicted background concentrations for both grid squares which the proposed development site spans are well below (less than half) the respective annual mean AQOs for all key air pollutants.

5.4 INDUSTRIAL INSTALLATIONS

5.4.1 With reference to the Environment Agency (EA) online public register there are no Part A processes within 1 km of the proposed development site.

5.4.2 With reference to the 'Part B Installation List 2015' obtained from the LBH website, there are no registered processes within 500 m of the redevelopment site.

5.5 SUMMARY

5.5.1 The proposed development site is comprised of two adjacent parcels. The south western parcel is situated adjacent to Pinner Road and the north eastern parcel is situated approximately 70 m to the north of Pinner Road at its closest point. It is therefore expected pollutant concentrations within the northern parcel will be similar to urban background concentrations whereas those experienced on the southern parcel will be influenced by traffic emissions along Pinner Road.

5.5.2 Diffusion tube monitoring in close proximity to the site confirms that background and roadside concentrations of NO_2 in the local area are below the annual mean AQO.

SECTION 6 POTENTIAL IMPACT OF THE SCHEME ON LOCAL AIR QUALITY

6.1 INTRODUCTION

6.1.1 Developments can introduce new receptors into an area of poor air quality. They can also increase emissions of air pollutants during their construction and operational phases.

6.2 SITE SUITABILITY

6.2.1 The site is not situated within an AQMA however, it is understood to be partially situated within the Hillingdon-specific Northwood East AQFA which also encompasses Pinner Road immediately to the south.

6.2.2 The monitoring data indicates that, even in close proximity to major roads in the vicinity of the site, concentrations of air pollutants are below the relevant AQO. Therefore, it is expected that pollutant concentrations experienced at the proposed health centre (which is situated approximately 10 m from Pinner Road at the closest point) will be below the AQO.

6.2.3 With reference to the London Councils Air Quality and Planning Guidance (APPLE, 2007), as concentrations of NO_2 at the development site are likely to be greater than 5 % below the AQO, the Air Pollution Exposure Criteria (APEC) classification for the site is APEC-A - *'No air quality grounds for refusal; however mitigation of any emissions should be considered'.*

6.2.4 Notwithstanding this (and the site's partial location within an AQFA), detailed dispersion modelling has been undertaken to predict the concentrations experienced on site and to allow an assessment of the impacts of the proposed development on local air quality.

6.3 CONSTRUCTION PHASE

6.3.1 The development has the potential to result in emissions of dust and PM_{10} during the construction phase in the absence of appropriate mitigation. The risk of impacts is assessed in Section 7 with recommended mitigation measures outlined in Section 11.

6.4 OPERATIONAL PHASE

6.4.1 A Transport Assessment (TA) has been undertaken by RPS Group (RSP) who have supplied traffic data for use in the dispersion modelling exercise. The total trip generation of the proposed development is estimated to be 1130 (as Annual Average Daily Traffic (AADT)) which is a net increase of 513 relative to the existing use. The distribution of trips is estimated to be approximately 50:50 in either direction along the A404 which results in an increase of 257 trips as AADT in each direction.

6.4.2 Vehicle movements associated with the scheme do not therefore exceed the indicative criteria set out in the 'Planning for Air Quality' guidance document produced jointly by the Institute of Air Quality Management guidance (IAQM) and Environmental Protection UK (EPUK)[7] for schemes situated outside of AQMA's (>500 trips as AADT for light-duty vehicles (LDVs)) on any given road link. However, due to the site's location within a Hillingdon-specific AQFA, and the proximity of the London Borough of Harrow's AQMA (600 m east of the site), it is considered the operational traffic impacts of the scheme require further assessment.

6.4.3 Dispersion modelling has been undertaken using ADMS Roads to assess the potential impacts on existing sensitive receptors in the local area. The impact will be greatest at those receptors located closest to the road networks as concentrations

[7] Moorcroft and Barrowcliffe et al, (2017) 'Land-Use Planning & Development Control: Planning for Air Quality', IAQM

typically decrease with distance from the source. The impact on existing receptors as a result of increased traffic movements during the operational scheme is explored in Section 8.

6.4.4 The proposed heating strategy for the two residential blocks is for low temperature hot water (LTHW) to be generated via air source heat pumps (ASHPs) located on the roof of each building.

6.4.5 The healthcare centre will have external Variable Refrigerant Flow (VRF) units to provide heating/hot water. As a result, no new sources of NO_x / PM_{10} will be introduced on site as part of the proposed development. A number of existing boilers in the basement of the existing health centre will be removed and replaced with VRF units therefore, the overall effect of the proposed development in respect of building emissions will be beneficial.

6.4.6 An Air Quality Neutral assessment for transport emissions, as required by the London Plan, is presented in Section 9. As no sources of emissions will be incorporated on-site there is no requirement to include a building emissions assessment.

SECTION 7 CONSTRUCTION PHASE IMPACT ASSESSMENT

7.1 GENERAL

7.1.1 Potential emissions during the construction phase include dust and other forms of air pollution. Sources of emissions of air pollutants are exhaust from on-site plant and site traffic and dust-generating activities, including earthworks and vehicle movements on dry ground.

7.1.2 Guidance has been issued by the Institute of Air Quality Management (IAQM) *'Guidance on the Assessment of dust from demolition and construction'*, 2014. The construction phase impacts on local air quality associated with the redevelopment of the site have been assessed in accordance with this guidance.

7.1.3 In terms of vehicle movements within the site (plant exhaust), the impact of emissions would be very small, very localised and limited to vehicles in close proximity to potential receptors. With reference to the IAQM guidance, *'experience of assessing the exhaust emissions from on-site plant and site traffic suggest that they are unlikely to make a significant impact on local air quality and in the vast majority of cases they will not need to be quantitatively assessed'*. Exposure can be minimised by standard good practice.

7.1.4 The IAQM guidance indicates that construction impacts on local air quality can be divided into four key areas:

i. Demolition,

ii. Earthworks,

iii. Construction, and,

iv. Trackout.

7.1.5 Dust Emission Magnitude

7.1.6 Whilst no detailed information on the construction phase is currently available, the following assessment has been undertaken based on the scale of the proposals and broad assumptions.

7.1.7 Potential dust emission magnitude has been assessed for each of the four key areas above in relation to the development site. The dust emission magnitude is based on the scale of the anticipated works and is classified as small, medium, or large. The guidance provides examples of how the potential dust emission magnitude for different activities can be defined.

7.1.8 Demolition

7.1.9 The site is currently occupied by Northwood Health Centre in the northeast and the former Northwood & Pinner Cottage Hospital in the southwest. The proposals include the complete demolition of the Northwood Health Centre. The original construction from 1925 Cottage Hospital is proposed to be retained for the new healthcare centre, with local repair works where required. Later additions to the west and north of the building are to be demolished. All structures to be demolished are constructed of brick and cladding with an associated low dust-generation potential.

7.1.10 The total building volume requiring demolition is estimated to be less than 20,000 m^3. Demolition activities will not occur at greater than 10 m above ground.

7.1.11 The potential dust emission magnitude in the absence of mitigation is considered to be ‘small’.

7.1.12 Earthworks

7.1.13 As the site has been developed previously, it is not expected that significant levelling will be required. The main earthworks are anticipated to be associated with excavations for foundations and infrastructure. The site area is approximately 1 ha. Fewer than five heavy earth-moving vehicles are expected to be active at any one time with less than 20,000 tonnes of materials to be moved in total.

7.1.14 With reference to the British Geological Society (BGS) online geology viewer, the site is underlain by bedrock geology of London Clay Formation (clay and silt), there are no recorded superficial deposits. In its ‘as dug’ state, the inherent moisture content of the clay will limit the potential for dust generation. However, as the material dries it will be more prone to suspension due to the small particle size, especially where tracked over by vehicles/plant.

7.1.15 The potential dust emission magnitude in the absence of mitigation is considered to be ‘medium’.

7.1.16 Construction

7.1.17 The proposed development involves the refurbishment of the Northwood & Pinner Cottage Hospital including the construction of a new two-storey wing to the northeast to form a new healthcare centre. Two, four-storey residential blocks, providing a total of 70 units, will be constructed on land to the east and northeast of the refurbished health centre.

7.1.18 The proposed residential blocks will comprise a steel frame on piled pad foundations. The two-storey addition to the health centre is to be constructed from load-bearing masonry walls and partitions with steel frame, timber-joisted floor and piled foundations.

7.1.19 It is anticipated the total building volume will be less than 25,000 m^3. Concrete batching will not take place on site.

7.1.20 The potential dust emission magnitude in the absence of mitigation is considered to be 'small'.

7.1.21 Trackout

7.1.22 Trackout dust impacts are associated with heavy-duty vehicles (HDVs) leaving the site after moving over unpaved ground where they will accumulate mud and dirt that can then be tracked out onto the public highway. Trackout impacts are linked to the number of outward HDV movements over the course of a day.

7.1.23 It is assumed there will be less than ten outward HDV movements in any one day. The length of internal unpaved road is anticipated to be less than 50 m.

7.1.24 There are two vehicle access points to the site. The first from Pinner Road (A404) leads to the former Northwood Cottage Hospital site occupying the south western land parcel and the second from Neal Close leads to the north eastern land parcel (proposed residential development) which links to Pinner Road via Addison Way and Acre Way. The proposed HDV route is not known at this stage therefore trackout impacts have been assessed along Neal Close as well as in both directions along Pinner Road to produce a robust assessment.

7.1.25 The potential dust emission magnitude in the absence of mitigation is considered to be 'small'.

7.1.26 Summary

7.1.27 A summary of the assessed dust emission magnitude for each of the site activities is displayed in Table 4 below.

Table 4: Summary of the potential Dust Emission Magnitude

Activity	Dust Emission Magnitude
Demolition	Small
Earthworks	Medium
Construction	Small
Trackout	Small

7.2 SENSITIVITY OF THE AREA

7.2.1 Introduction

7.2.2 The following assessment of site sensitivity has been undertaken using IAQM methodology. The site is situated within a residential area and therefore is surrounded by high sensitivity receptors.

7.2.3 The overall sensitivity of the area (as determined by the number and sensitivity of receptors within a given distance) is summarised in the following sections.

7.2.4 Dust Soiling Effects

7.2.5 Nuisance dust is defined here as all particulate matter less than 75 µm but greater than 10 µm diameter, comprising both suspended and deposited dust.

7.2.6 The sensitivity of receptors to dust soiling effects is dependent upon the duration and frequency that people would expect to be exposed to the effects. Residential receptors can be expected to enjoy a high level of amenity and background levels of dust soiling are expected to be low. It can be expected that dust soiling would diminish the aesthetics of their property and such receptors are therefore assessed as being of high sensitivity. Residential properties, schools, nurseries and care homes are considered to be of high sensitivity for the purpose of this assessment.

7.2.7 Medium sensitivity receptors are those where users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home or people or property would not reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land. Places of work and community uses are considered to be of medium sensitivity for the purpose of this assessment.

7.2.8 Low sensitivity receptors are those where the enjoyment of amenity would not reasonably be expected or property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling. Exposure is of a transient nature and people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land.

7.2.9 With reference to satellite imagery, the site is predominantly surrounded by residential properties. It is estimated that approximately between 10 and 100 high-sensitivity receptors are present within 20 m of the site boundary and over a 100 are present within 20 m of the potential trackout routes (within 200 m of the site entrance).

7.2.10 The sensitivity of the surrounding area with regards to dust soiling effects is considered to be 'high'.

7.2.11 Human Health

7.2.12 For health effects of PM_{10}, sensitivities are based on whether or not the receptor is likely to be exposed to elevated concentrations over a 24-hour period.

7.2.13 High sensitivity receptors are those locations where members of the public are exposed over a time period relevant to the air quality objective for PM_{10} (eight hours or more in a 24-hour period). Indicative examples include residential properties, hospitals, schools, nurseries and residential care homes.

7.2.14 Workers are considered to be of medium sensitivity for the purpose of this assessment and low sensitivity receptors are those locations where human exposure is transient e.g. public footpaths, playing fields, parks and shopping streets.

7.2.15 With reference to DEFRA background maps annual mean concentrations of PM_{10} in the vicinity of the site are predicted to be below 24 $\mu g.m^{-3}$. In addition, annual mean concentrations of PM_{10} recorded at the roadside CMS HI1, have been below 24 $\mu g.m^{-3}$ since 2016. The modelling presented in Section 8 also demonstrates that concentrations remain below 24 $\mu g.m^{-3}$ even in roadside locations.

7.2.16 Taking into account the number and sensitivity of receptors identified in the dust-soiling section above and assumed baseline concentrations of PM_{10}, the sensitivity of the area with regards to human health impacts is considered to be 'low' surrounding the site and 'medium' along the potential trackout routes leading to the site.

7.2.17 Ecological Sensitivity

7.2.18 An 'ecological receptor' refers to any sensitive habitat affected by dust soiling. This includes the direct impacts on vegetation or aquatic ecosystems of dust deposition, and the indirect impacts on fauna (e.g. on foraging habitats).

7.2.19 Dust can have two types of effect on vegetation: physical and chemical. Direct physical effects include reduced photosynthesis, respiration and transpiration through smothering. Chemical changes to soils or watercourses may lead to a loss of plants or animals for example via changes in acidity. Indirect effects can include increased susceptibility to stresses such as pathogens and air pollution. These changes are likely to occur only as a result of long-term demolition and construction

works adjacent to a sensitive habitat. Often impacts will be reversible once the works are completed, and dust emissions cease.

7.2.20 With reference to the Multi-Agency Geographic Information for the Countryside (MAGIC) website there are no designated ecological sites or waterways within 50 m of the site boundary or proposed construction traffic routes.

7.2.21 Summary

7.2.22 The sensitivity of identified receptors within 350 m of the site boundary is summarised in the table below. For trackout impacts, receptors have been identified within 50 m of the edge of the anticipated HDV routes up to 200 m from the site entrance.

Table 5: Summary of the sensitivity of the surrounding area

Potential Impact	Sensitivity of the Surrounding Area			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	High	High	High	High
Human Health	Low	Low	Low	Medium
Ecological	n/a	n/a	n/a	n/a

7.3 RISK OF DUST IMPACTS

7.3.1 The potential dust emissions magnitude for each of the site activities has been combined with the sensitivity of the surrounding area to summarise the risk of dust impacts with no mitigation. This in turn determines the level of mitigation which must be applied. The dust risk is summarised in Table 6 below.

Table 6: Summary of Risk of Impacts

Potential Impact	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Medium	Medium	Low	Negligible
Human Health	Negligible	Negligible	Negligible	Negligible
Ecological	n/a	n/a	n/a	n/a

7.3.2 Due to the proximity and number of receptors there is considered to be a ‘medium’ risk of dust impacts during demolition and earthworks phases in the absence of mitigation.

7.3.3 Due to the low PM_{10} background concentration, there is a negligible risk to human health during all phases of construction in the absence of mitigation.

SECTION 8 OPERATIONAL PHASE IMPACT ASSESSMENT

8.1 METHODOLOGY

8.1.1 The main potential for air quality impacts during the operational phase of the development is as a result of increased traffic flows on the local road network. Dispersion modelling has been undertaken using ADMS Roads v.5.0.0.1. The model requires the user to provide various input data related to traffic flows and road characteristics.

8.1.2 The scenarios that have been considered are as follows:

i. 2018 base year (for the purpose of model verification);

ii. 2023 future base year (including general growth);

iii. 2023 future base year with proposed development.

8.1.3 A future year of 2023 was selected to correspond to the year the proposed development is expected to be completed.

8.1.4 Concentrations of NO_2, PM_{10} and $PM_{2.5}$ have been modelled explicitly at receptors that are considered to be representative of worst-case exposure (closest to the kerb, junctions etc.).

8.2 INPUT PARAMETERS

8.2.1 Background Concentration

8.2.1.1 The 2017 reference year DEFRA background map concentrations have been used to define background concentrations across the study area for NO_2, PM_{10} and $PM_{2.5}$. The background concentrations used in the modelling exercise are summarised in Table 7 below. As the study area spans two grid squares, the higher of the two values has been assumed in order to produce a conservative assessment.

Table 7: Background concentrations used in modelling exercise from grid square centred at [5]10500, [1]90500.

Pollutant	Annual Mean Concentration (µg.m^{-3})		
	2018	2023	AQO
NO_2	17.94	14.40	**40**
PM_{10}	15.22	14.30	**40**
$PM_{2.5}$	10.67	9.91	**25**

8.2.2 Traffic Data

8.2.2.1 Average road widths for the individual links have been estimated from aerial mapping. None of the modelled road links are considered to be street canyons.

8.2.2.2 Average speeds for the individual road links have been estimated based on speed limits, proximity to junctions and likely areas of congestion.

8.2.2.3 Development traffic flows have been provided by RPS who have undertaken a TA to accompany the application. The modelled road links are shown on Figure 1 in Appendix 2.

8.2.2.4 For the base year 2018 scenario, traffic flows for the A404 have been obtained from the Department for Transport (DfT) website (split across different vehicle classes). In the absence of a DfT count point along High Street (A4125), base year traffic data was obtained from the LAEI which forecasts flows in 2020 from 2013 base year data. For the future base year (2023), a growth factor has been applied to the base year flows to account for general growth in the area. The growth factor of 1.053 was provided by the transport consultant. Traffic flows for the 2023 'with scheme' scenario were derived by adding the estimated development traffic flows for each road link to the future base year flows.

8.2.2.5 Given the nature of the proposed development it is assumed that all development traffic comprises LDV's. Table A1 in Appendix 2 summarises the traffic inputs used in the dispersion modelling exercise[8].

8.2.2.6 A diurnal traffic profile was generated using Automatic Traffic Count (ATC) data supplied by RPS to represent the variation in flows throughout the course of the day for a typical weekday, Saturday and Sunday. The ATC survey was undertaken along Pinner Road for a week-long period at the start of February 2020. This profile was applied to all roads in all of the modelled scenarios. A graph illustrating the diurnal profile is provided as Figure 2 in Appendix 2.

8.2.3 Emission Factors

8.2.3.1 The modelling has been undertaken using version 9.0 of DEFRAs Emission Factor Toolkit (EFT) which was released in May 2019. An updated version of the EFT (v10) was released in August 2020 after the modelling had been completed. Detailed analysis of the difference between the two versions of the EFT was undertaken by Air Quality Consultants (AQC) in September 2020[9]. The study concluded that EFT v10 generally predicts lower NOx emissions than EFT v9. Independent comparison of NOx emission rates for each road link undertaken by IDOM Merebrook also confirms that this is the case. The modelling undertaken is therefore considered robust and no re-assessment is considered to be necessary.

8.2.3.2 Emission rates were calculated from traffic flows entered within ADMS Roads using the EFT v9.0. The EFT allows users to calculate road vehicle pollutant emission rates for NO_x, PM_{10} and $PM_{2.5}$ for a specified year, road type, vehicle speed and

[8] The proposed parking provision for the scheme has been reduced by one space since the modelling was undertaken reducing the net increase in daily trips to 513 rather than 515.
[9] AQC (2020). *'Comparison of EFT v10 with EFT v9'* available at https://www.aqconsultants.co.uk/resources

vehicle fleet composition. The road type was set as 'London (outer)' which is considered to be most representative of the study area.

8.2.3.3 In previous versions of the EFT there were concerns that the rate of decline assumed by DEFRA in future years was overly optimistic and sensitivity analysis was typically carried out (for example keeping future year emissions the same as base year emissions or using an uplift factor. Recent analysis of the latest version of the EFT undertaken by Air Quality Consultants (AQC) indicates that it is most likely to over-predict drive-cycle average NOx emissions from Euro 6 diesel cars in the future. It is therefore no longer considered necessary to undertake sensitivity testing in relation to DEFRAs predictions of NOx emissions from Euro 6 diesel vehicles in future years.

8.2.4 Meteorological data

8.2.4.1 ADMS Roads requires meteorological data, which it uses to simulate the behaviour of exhaust emission plumes in different weather conditions.

8.2.4.2 Data for 2018 was acquired from ADM Ltd for the weather station at Heathrow Airport situated approximately 15 km to the south which is considered to be suitably representative of the dispersion site. This data was used to simulate dispersion in both the base and future years.

8.2.4.3 A wind rose illustrating the meteorological data is presented in Figure 3 in Appendix 2. This indicates that the most frequent and strongest winds are from the west and southwest.

8.2.4.4 The file for 2018 contains 8551 usable lines of meteorological data (met lines) which equates to over 97 % usable data.

8.2.4.5 Based on a review of the surrounding land use, a surface roughness value of 0.5 m was used to represent the dispersion site, and 0.2 m for the meteorological site. Within ADMS-Roads these values correspond with 'Parkland, open suburbia' and 'Agricultural areas (min)' respectively.

8.3 MODELLED RECEPTORS

8.3.1 A total of 13 sensitive receptors have been selected along the modelled road links to represent 'worst-case' locations for exposure e.g. residential development located closest to kerbs/junctions.

8.3.2 The predicted impact at these individual receptor locations has been used to inform the assessment of the overall significance of the effect of the scheme on local air quality in Section 8.5.

8.3.3 The modelled receptor locations are indicated on Figure 4 in Appendix 2 and are summarised in the table below.

Table 8: Modelled receptor locations

Receptor ID	X	Y	Height (m agl)	Receptor type
ER1	509666.7	190771.3	1.5	Nursing home (James' Court)
ER2	510313.4	190514.2	1.5	School (Northwood)
ER3	509985.1	190639.6	1.5	Cottage hospital (Site)
ER4	510699.6	190349.2	1.5	Nursery School (Sundew Montessori)
ER5	509994.2	190603.3	1.5	Residential
ER6	510284.1	190529.9	1.5	Residential
ER7	509782.8	190712.9	1.5	Residential
ER8	509700.5	190745.5	1.5	Residential
ER9	509695.1	190840	1.5	Residential
ER10	509886.5	191278.5	1.5	Residential
ER11	509091.8	190899.2	1.5	Residential
ER12	508639.3	191339.9	1.5	Residential
ER13	510683.7	190317.3	1.5	Residential

8.4 MODEL VERIFICATION & ADJUSTMENT

8.4.1 In order to ensure that ADMS-Roads predicts road NO_x contributions with reasonable accuracy, the model has been verified against local measurements in accordance with the methodology outlined in LAQM TG16. Model verification has been undertaken using monitoring data from three diffusion tube sites, two located adjacent to the A404 (DT-NE3 and DT-NE1) and the third located adjacent to the A4125 (DT-NE4). As diffusion tube site DT-NE3 is a triplicate monitoring site, the average annual mean NO_2 concentration across the three tubes has been used for the purpose of model verification. The monitoring locations used in the verification exercise are shown on Figure 5 in Appendix 2.

8.4.2 The road NO_x contributions at each of the roadside diffusion tube sites have been calculated from total NO_2 concentrations using the 'NO_x to NO_2 calculator' (v 7.1)[10] (which is compatible with v9 of the EFT), using the assumed background concentration of 17.94 $\mu g.m^{-3}$. A comparison of calculated road NO_x contributions at the diffusion tube sites and corresponding modelled concentrations are summarised in the table below.

[10] https://laqm.defra.gov.uk/review-and-assessment/tools/tools.html

Table 9: Comparison of monitored and modelled road NO_x contributions

Monitoring site ref	Monitored total NO_2 ($\mu g.m^{-3}$)	Monitored road NO_x contribution ($\mu g.m^{-3}$)	Modelled road NO_x contribution ($\mu g.m^{-3}$)	Difference (%) +/-
DT-NE1	29.86	25.6	10.21	-53
DT-NE3	36.05	40.73	15.44	-62
DT-NE4	32.49	31.87	15.00	-53

8.4.3 Comparison of the monitored and modelled road-NOx contributions indicates that the model is underpredicting at all monitoring sites. This prompted a review of model inputs including road widths, traffic flows, speeds and distance of the verification sites relative to the roadside. Adjustments were made to the model parameters as appropriate, however, the resulting output remained greater than 25 % below measured concentrations at all verification sites as shown in Table 9. It was therefore considered appropriate to undertake adjustment of the model output.

8.4.4 Adjustment was performed on the modelled road NO_x contribution only. Model verification and adjustment was undertaken in accordance with Box 7.15 in LAQM TG16. The ratio of modelled road-NO_x to monitored road-NO_x was calculated to be 2.41, as shown on Figure 6 in Appendix 2. The model output was multiplied by this factor to calculate adjusted road NO_x contributions. Total annual mean NO_2 concentrations were then calculated using NO_x to NO_2 calculator. Within the calculator the traffic mix was specified as 'All London traffic' which is considered to be most representative of the site. After adjustment, the modelled annual mean NO_2 concentrations were within ±5 % of the measured concentrations as detailed in Table 10 below.

Table 10: Comparison of monitored and modelled total NO_2 concentrations after adjustment

Monitoring site ref	Monitored total NO_2 ($\mu g.m^{-3}$)	Modelled total NO_2 after adjustment ($\mu g.m^{-3}$)	Difference (%) +/-
DT-NE1	29.86	29.3	-1.88
DT-NE3	36.05	34.53	-4.22
DT-NE4	32.49	34.1	4.96

8.4.5 In the absence of any suitable monitoring data for verification of the model output for PM_{10} and $PM_{2.5}$, the NO_x adjustment factor has also been applied to the modelled road PM_{10} and $PM_{2.5}$ contributions prior to combining with assumed background concentrations.

8.5 RESULTS & IMPACT ASSESSMENT

8.5.1 Specific output has been generated for existing receptor locations. The predicted total NO_2 concentrations (after adjustment) with the scheme in place are presented in the table below.

8.5.2 The impact at individual receptors for future year scenarios has been assessed with reference to guidance produced jointly by the IAQM and EPUK[11]. An impact descriptor is determined for each receptor based on the change in annual mean pollutant concentration between the 'with-development' and 'without-development' scenarios and the total pollutant concentrations relative to the AQO with the scheme in place.

Table 11: Impact at individual receptors – NO_2

Receptor	Base year (2018) annual mean (µg.m^{-3})	Future year (2023) annual mean (µg.m^{-3})		Impact of the proposed scheme			
		Without scheme	With scheme	Annual mean as % of AQO	Change in NO_2 concentration (µg.m^{-3})	% increase relative to AQO	Significance
ER1	30.32	22.91	22.97	57	0.06	0.1	Negligible
ER2	27.61	21.04	21.09	53	0.05	0.1	Negligible
ER3	29.78	22.65	22.71	57	0.06	0.2	Negligible
ER4	23.89	18.58	18.63	47	0.05	0.1	Negligible
ER5	31.57	23.93	23.99	60	0.06	0.1	Negligible
ER6	31.70	23.89	23.95	60	0.06	0.1	Negligible
ER7	32.32	24.56	24.63	62	0.07	0.2	Negligible
ER8	35.00	26.35	26.43	66	0.08	0.2	Negligible
ER9	26.90	20.47	20.52	51	0.05	0.1	Negligible
ER10	25.79	19.67	19.71	49	0.04	0.1	Negligible
ER11	25.37	19.69	19.72	49	0.03	0.1	Negligible
ER12	26.14	20.45	20.48	51	0.03	0.1	Negligible
ER13	23.79	18.50	18.56	46	0.06	0.1	Negligible

Bold values indicate an exceedance of the AQO

8.5.3 The predicted future year (2023) concentrations are below the annual mean AQO of 40 µg.m^{-3} at all of the modelled receptors. As the predicted increase in concentrations is less than 0.5 %, the impact of the scheme is described as 'negligible' at all of the modelled receptors in accordance with the IAQM guidance. The maximum impact at a residential receptor is predicted to occur at ER8 (located adjacent to the Pinner Road and High Street junction) with an increase in NO_2 concentration of 0.08 µg.m^{-3}.

[11] Moorcroft and Barrowcliffe et al, (2017) 'Land-Use Planning & Development Control: Planning for Air Quality', IAQM

8.5.4 With reference to LAQM TG16, dispersion models cannot predict short-term concentrations as reliably as long-term concentrations. Previous research carried out on behalf of DEFRA concluded that exceedances of the 1-hour mean for NO_2 are unlikely to occur where the annual mean is below 60 $\mu g.m^{-3}$. The annual mean concentrations are predicted to be well below 60 $\mu g.m^{-3}$ at all of the modelled receptors and it can therefore be assumed that the short term (1-hour) mean AQO will not be exceeded.

8.5.5 The predicted total PM_{10} and $PM_{2.5}$ concentrations with and without the scheme in place are presented in Table A2 and A3 respectively in Appendix 3.

8.5.6 For PM_{10} and $PM_{2.5}$ the predicted future year concentrations are well below the annual mean AQOs of 40 $\mu g.m^{-3}$ and 25 $\mu g.m^{-3}$ respectively at all of the modelled receptor locations. The maximum annual mean PM_{10} concentration of 17.45 $\mu g.m^{-3}$ is predicted at receptor ER8 with the scheme in place. The predicted impact of the scheme is described as 'negligible' at all receptor locations. The maximum impact is predicted to occur at ER8 with increases of 0.024 $\mu g.m^{-3}$ and 0.014 $\mu g.m^{-3}$ for PM_{10} and $PM_{2.5}$ respectively.

8.5.7 The formula provided in LAQM TG16 has been used to estimate the number of 24-hour mean PM_{10} exceedances from annual mean concentrations. With the scheme in place, no exceedances of the 24-hour mean are predicted to occur.

8.6 ASSUMPTIONS, UNCERTAINTY AND LIMITATIONS

8.6.1 There are many components that contribute to the uncertainty of modelling predictions. Dispersion models such as ADMS Roads are dependent upon the traffic data that have been input, which will have inherent uncertainties associated with it. Additionally, the meteorological data required for the exercise has been obtained from a representative site but is not site-specific. There are also limitations, as the model is required to simplify real-world conditions into a series of algorithms.

SECTION 9 AIR QUALITY NEUTRAL ASSESSMENT

9.1 INTRODUCTION

9.1.1 London Plan Policy SI1 states that *'development proposals must be at least Air Quality Neutral'*. A study was undertaken by Air Quality Consultants Ltd in May 2013, and later updated in April 2014[12] which examined the potential options for implementing the policy as part of the (recently revoked) SDC SPG.

9.1.2 Benchmarks have been produced for building operation and transport across London based on the latest technology (including its effectiveness and viability). Building Emission Benchmarks (BEBs) and Transport Emission Benchmarks (TEBs) have been defined for NO_x and PM_{10}, for a series of land-use classes.

[12] Air Quality Consultants (April 2014) Air Quality Neutral Planning Support Update: GLA 80371

9.1.3 The assessment requires the calculation of NO_x and/or PM_{10} emissions from the buildings and transport elements of developments and subsequent comparison against the published benchmarks.

9.1.4 Developments that do not exceed these benchmarks will be considered to avoid any increase in NO_x and PM emissions across London as a whole and therefore be 'air quality neutral'. Where schemes do not meet benchmarks (after mitigation measures have been implemented onsite) the developer will be required to off-set emissions off-site.

9.2 SCHEME ASSESSMENT

Building-related emissions

9.2.2 IDOM has been advised by Sweco UK Limited that the residential blocks are to be served by ASHP and VRF units therefore no emissions sources will be introduced on site. The removal of existing boilers from the basement (and replacement with VRF) means that the proposed development will be air quality positive in respect of building emissions.

Transport-related emissions

9.2.3 The TS indicates that the anticipated trip generation of the proposed development is 1,130 as AADT. Although it is noted that the net increase compared to the existing use is considerably lower (513 trips) the total trips have been used in the calculation below.

Table 12: Calculation of transport emissions for proposed development

Pollutant	Daily trips	Emission factor (g/vehicle-km)	Trips per annum	Emissions (kg/annum)
NO_x	1,130	0.353	412,450	145.59
PM_{10}	1,130	0.0606	412,450	24.99

9.2.4 The proposed development is mixed-use comprising 70 residential flats (Use Class C3) and a new healthcare centre. The guidance only provides benchmark emissions for retail (A1), office (B1) and residential (C3)[13] land use classes in respect of transport. The land use class B1 has therefore been used for the healthcare centre as this enables a conservative assessment (by using the lowest benchmark figure). The site is located in Hillingdon (Outer London) and the TEB for the development has been calculated on this basis.

[13] Refer to land use classes used in the Air Quality Consultants (April 2014) Air Quality Neutral Planning Support Update: GLA 80371

Table 13: Calculation of TEB for NO_x and PM_{10}

Land Use Class	Units	GFA (m^2)	Benchmarked emissions (kg/NOx/annum)	Benchmarked emissions (kg/PM_{10}/annum)
B1	GFA m^2	1409	96.52	16.63
C3	No. of dwellings	70	108.71	18.69
Total			205.23	35.32

Table 14: Comparison of transport emissions against TEB

Transport emissions	NOx (kg/y)	PM_{10} (kg/y)
TEB	205.23	35.32
Proposed transport related emissions	145.59	24.99
Excess emissions	-59.63	-10.32

Summary

9.2.5 As the figures for excess emissions in Table 14 are negative, this indicates that the proposed development emissions are below the respective benchmarks. The proposed development can therefore be considered to be air quality neutral in terms of transport emissions. Due to the removal of existing gas-fired boilers, the scheme can be considered air quality positive in terms of building emissions.

SECTION 10 MITIGATION MEASURES

10.1 CONSTRUCTION PHASE

10.1.1 The IAQM guidance provides recommendations for mitigation measures commensurate with the risk of dust impacts. The following measures are highly recommended based on the risk assessment presented in Section 7:

10.1.2 Communications

i. Develop and implement a stakeholder communications plan that includes community engagement before work commences on site;

ii. Display the name and contact details of persons accountable for air quality and dust issues on the site boundary together with head or regional office contact information; and,

iii. Develop and implement a Dust Management Plan (DMP) which may include measures to control other emissions, approved by the LA. The DMP may include monitoring of dust deposition, dust flux, real-time PM_{10} continuous monitoring and/or visual inspections.

10.1.3 Site Management

i. Record all dust and air quality complaints, identify causes and take appropriate measures to reduce emissions in a timely manner. All records should be made available to the LA when asked; and,

ii. Record any exceptional incidents that occur, causing dust and/or air emissions, either on or off site, and the action taken to resolve the situation.

10.1.4 Monitoring

i. Carry out regular site inspections to monitor compliance with the DMP, increasing the frequency when activities with a high potential to produce dust are being carried out or during prolonged dry/windy conditions; and,

ii. Agree dust deposition, dust flux, or real-time PM_{10} continuous monitoring locations with the LA. Where possible commence baseline monitoring at least three months before work commences on site.

10.1.5 Preparing and maintaining the site

i. Plan site layout so that, where possible, machinery and dust causing activities are located away from receptors;

ii. Erect solid screens or barriers around the site boundary and implement intelligent screening, such as positioning site offices between potentially dusty activities and receptors;

iii. Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period;

iv. Avoid site runoff of water and mud;

v. Keep site fencing, barriers and scaffolding clean using wet methods;

vi. Remove materials that have a potential to produce dust from site as soon as possible unless being re-used on site. If being retained on site cover as described below; and,

vii. Cover, seed or fence stockpiles to prevent wind whipping.

10.1.6 Operating vehicle/machinery and sustainable travel

i. Ensure all on-road vehicles comply with the requirements of the London Low Emission Zone and the London NRMM standards;

ii. Implement a site policy that no vehicles are left idling and engines are switched off when not in use;

iii. Avoid the use of diesel or petrol-powered generators using mains electricity or battery powered equipment where practicable; and,

iv. Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.

10.1.7 Operations

i. Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques;

ii. Ensure adequate water supply for dust suppression, to avoid generation of wind-blown dust, using non-potable water where possible;

iii. Minimise drop-heights into skips and use enclosed chutes, conveyers and covered skips, where possible; and,

iv. Ensure equipment is readily available on site to clean any dry spillages as soon as reasonably practicable after the event using wet cleaning methods.

10.1.8 Waste Management

i. Ban the disposal of waste material by burning on site.

10.1.9 Demolition

i. Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective are more effective than hoses attached to equipment as the water can be directed where it is needed;

ii. Avoid explosive blasting using appropriate manual or mechanical alternatives; and,

iii. Bag and remove any biological debris or damp down such material before demolition.

10.1.10 Provided mitigation is employed for the duration of the construction works the overall effect on local air quality is judged to be 'not significant'.

10.2 OPERATIONAL PHASE

10.2.1 Recommended Measures

10.2.1.1 Guidance on mitigating against air quality impacts is provided in a document produced jointly by the IAQM and Environmental Protection UK (EPUK)[14]. The guidance emphasises that all developments should adopt good design principles to reduce emissions and minimise cumulative impacts regardless of the outcome of individual air quality assessments.

[14] Moorcroft and Barrowcliffe et al, (2015) 'Land-Use Planning & Development Control: Planning for Air Quality', IAQM

10.2.2 Proposed Measures

Minimising exposure to poor air quality

10.2.2.2 Monitored roadside concentrations of NO_2 in close proximity to the site and adjacent to Pinner Road are below the annual mean AQO. The proposed residential blocks are set back from Pinner Road by a significant distance (34 m at the southern façade of Block A which is situated closest the road). The Cottage Hospital is also in excess of 10 m from the road. Pollutant concentrations are known to drop off rapidly within the first 10 m from the kerb. The set-back distances proposed are therefore considered adequate to minimise exposure to air pollution.

Traffic

10.2.2.3 In accordance with IAQM/EPUK guidance the impact of the proposed development is assessed as 'negligible' at all of the modelled receptors and the overall effect on local air quality is judged to be 'not significant'.

10.2.2.4 Notwithstanding this, a Framework Travel Plan (FTP) has been produced by RPS to support the application. Separate residential and workplace Travel Plans (TPs) will be produced prior to occupation. These will identify the travel choice options open to residents and employees with the aim of reducing congestion and pollution caused by cars and the resulting impact on people's health and the local environment.

10.2.2.5 Proposed measures that are to be considered for individual TPs that could be used to work towards the aim of supporting more sustainable forms of travel and reducing the overall need to travel include:

i. Provision of Travel Information Packs for new residents and employees, (which would contain information regarding alternate travel options available, placing emphasis on the benefits of active travel);

ii. Offer of subsidised vouchers to each household to incentivise sustainable travel choices.

10.2.2.6 A total of 111 long-stay secure, covered, and accessible cycle parking spaces will be provided on-site for residential blocks A and B and 20 cycle parking spaces will be provided for the healthcare hub, comprised of both long and short-stay spaces. This is above the minimum required by planning policy which is understood to be 75 spaces and 11 spaces for the residential and healthcare uses respectively. A further increase to cycle parking provision will be considered if demand consistently exceeds 90%.

Heating scheme

10.2.3 It is understood the proposed development will be served by a combination of ASHP and VRF, therefore, no point sources of emissions will be introduced on site.

SECTION 11 CONCLUSIONS

11.1 The proposed redevelopment site is located to the north of Pinner Road (A404) in Northwood. The site comprises two adjacent land parcels. The south western site is currently occupied by the former Northwood & Pinner Cottage Hospital and the north eastern site is occupied by Northwood Health Centre. The proposed redevelopment comprises the refurbishment of the Cottage Hospital to form a new healthcare centre, the demolition of the existing Northwood Health Centre in the northeast and the construction of two, four-storey residential blocks.

11.2 The site is not situated within an AQMA, however the borough-wide AQMA for Harrow is located 0.6 km to the east of the site. The site is also partially situated the Hillingdon-specific Northwood East AQFA.

11.3 There is considered to be a 'medium' risk of dust impacts during the earthworks and demolition phases of construction in the absence of mitigation. Recommended mitigation measures are outlined in this report and should be incorporated into a future DMP / Construction Environmental Management Plan (CEMP). Provided mitigation is employed for the duration of the construction works the overall effect on local air quality is judged to be 'not significant'.

11.4 The anticipated net increase in traffic associated with the proposed development is approximately 513 vehicle trips per day, evenly split in each direction from the site entrances, resulting in a maximum increase of 257 trips on any one road link. Due to the site's location within an AQFA, it was considered appropriate to assess of the operational traffic impacts of the scheme on local air quality.

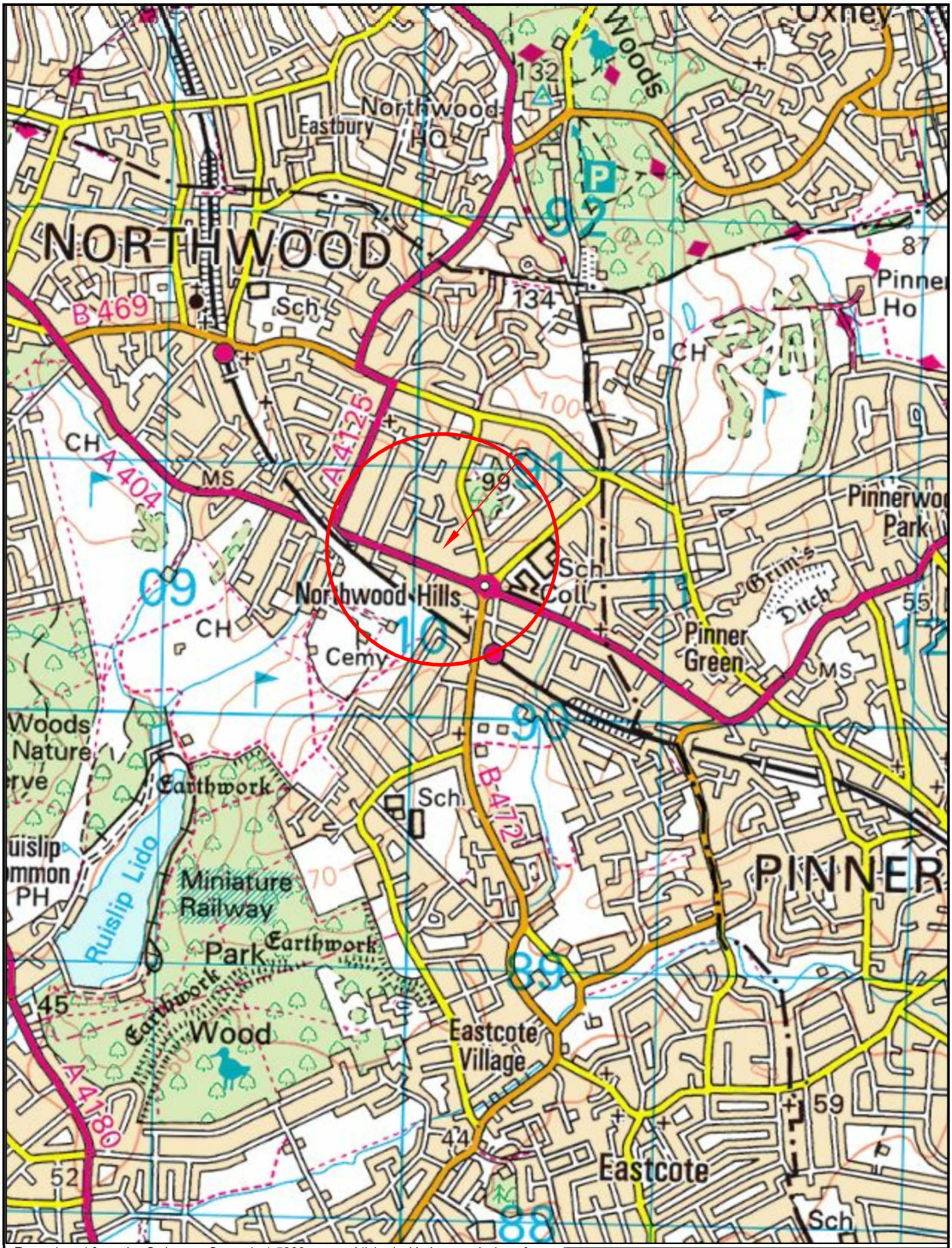
11.5 Dispersion modelling of traffic emissions has been undertaken using ADMS Roads to predict concentrations of NO_2, PM_{10} and $PM_{2.5}$ at selected receptors adjacent to the modelled road network. The modelling exercise predicts that the scheme will result in a 'negligible' impact at all modelled receptors and concentrations are predicted to be below the relevant AQO.

11.6 The proposed development has also been demonstrated to be 'Air Quality Neutral', however, due to the site's partial location within an AQFA, mitigation over and over the minimum standard is required. As agreed with Dr Ana Grossinho on behalf of LBH, damage costs associated with the proposed development will be calculated during the determination period and further discussions will be held with LBH to agree specific mitigation measures and quantify any residual financial contribution required.

11.7 It is understood the residential blocks are to be served via ASHPs located on the roof of each building. The healthcare centre will have external VRF units to provide heating / hot water. As existing gas-fired boilers are to be removed from the site and no new point sources of emissions are to be introduced, this is considered to beneficial in air quality terms.

11.8 It is considered that the development proposals adhere to policy guidance and that there is no reason falling within the scope of this report, that precludes the granting of planning permission for the development as proposed.

APPENDIX 1 ▪ Drawings



Issue Details		Dwn	Chd	App'd
First Issue		26-05-2020		-
		TPC	EW	EW

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NHS Property Services
Northwood and Pinner NHS Site
Site Location Plan

Job No.	Dwg No.	Revision
22143	001-001	-
Scale	**Date**	**Frame Dimensions mm**
N.T.S	May 2020	(A4) 250x181
Drawn	**Checked**	**Approved**
TPC	EW	EW

APPENDIX 2 ▪ Model inputs

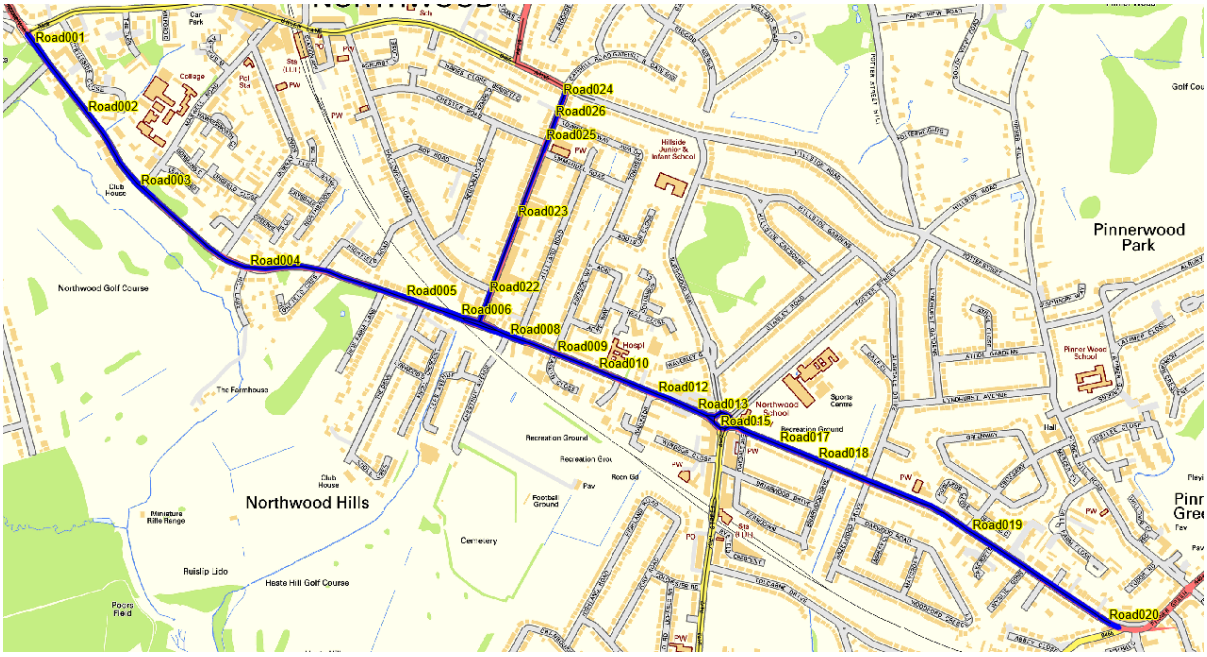

Figure 1: Modelled road links (Contains Ordnance Survey data © Crown copyright and database right 2020)

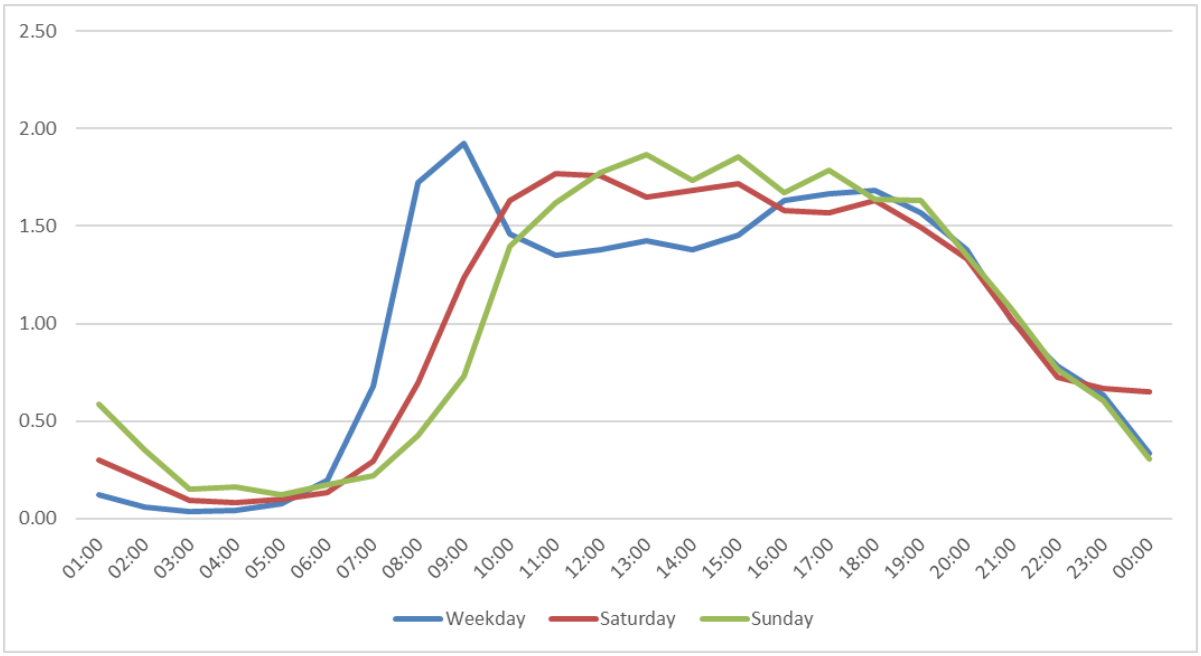

Figure 2: Variation of traffic flows by hour of the day and day of the week (from ATC carried out on Pinner Road)

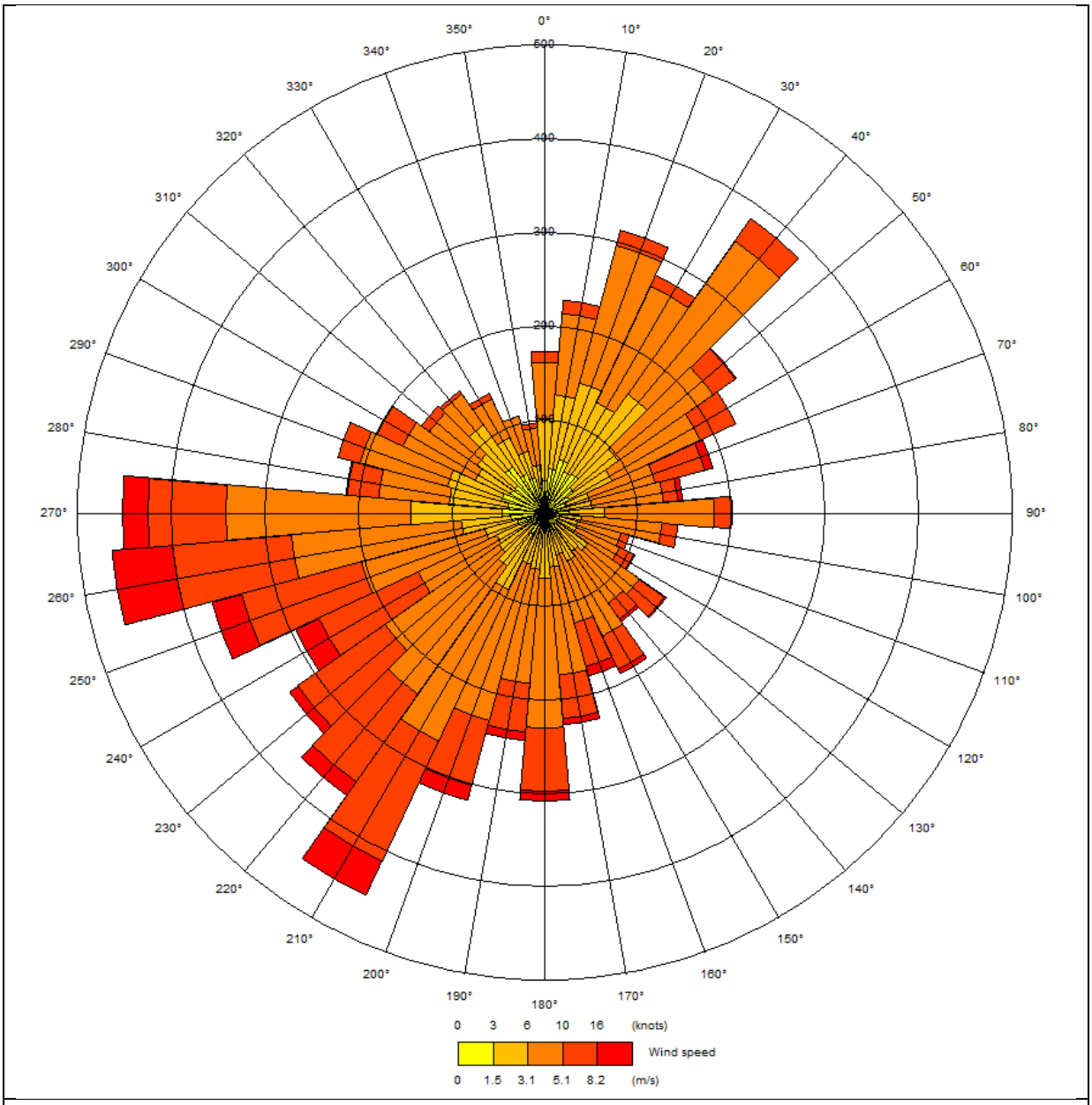

Figure 3: Wind rose showing meteorological dataset for Heathrow Airport (2018)

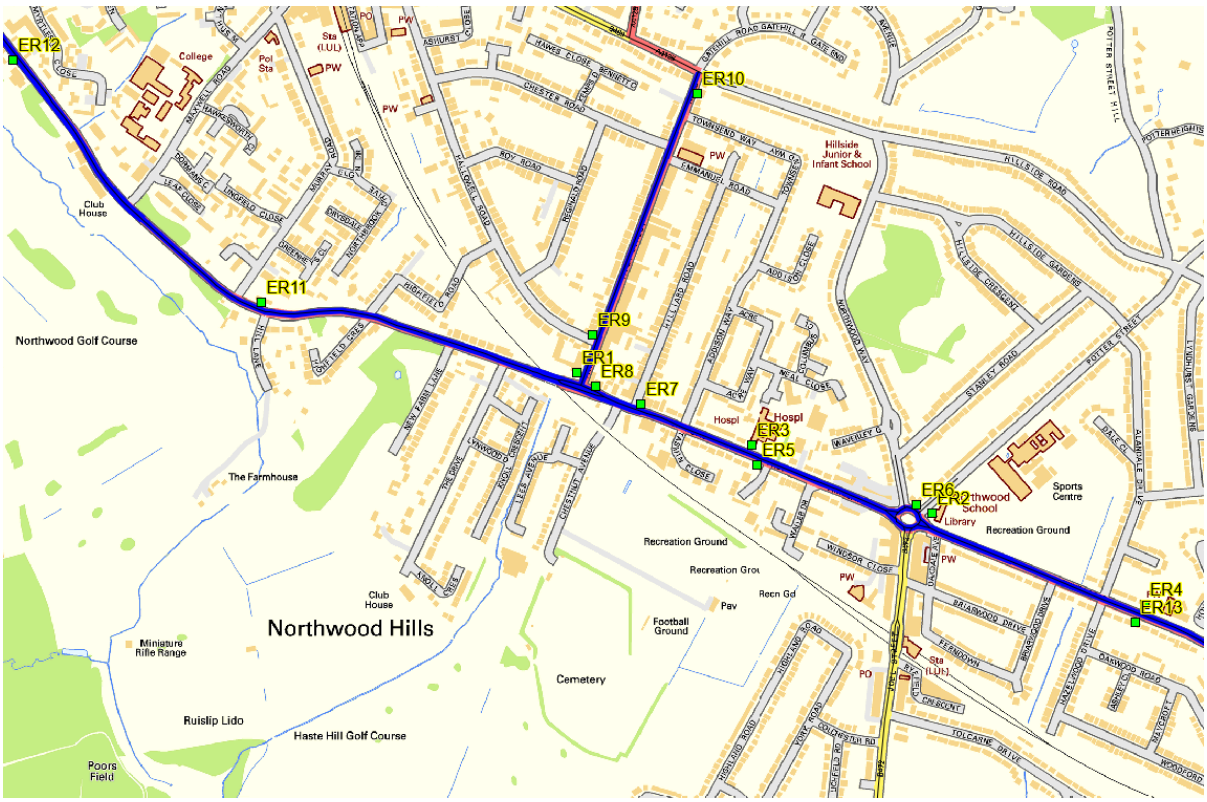

Figure 4: Modelled receptor locations (Contains Ordnance Survey data © Crown copyright and database right 2020)

Figure 5: Model verification sites (Contains Ordnance Survey data © Crown copyright and database right 2020)

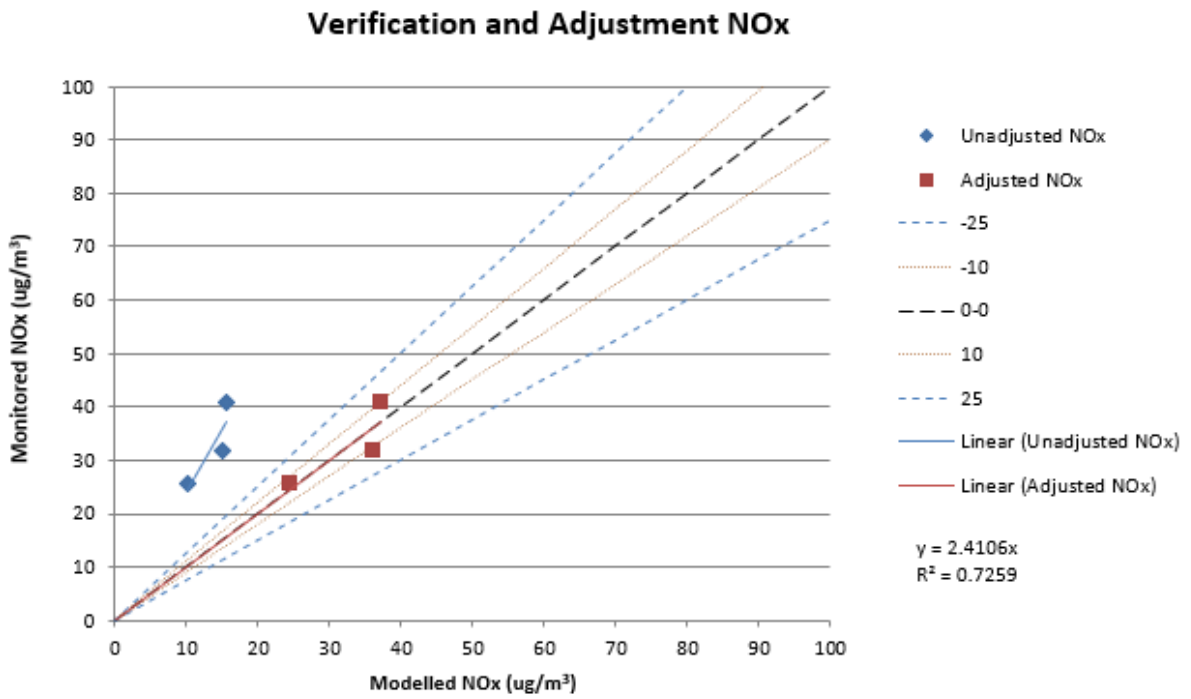

Figure 6: Comparison of modelled and monitored road NOx

Table A1: Traffic input data

Road Link ref	Road width (m)	Average speed (km/hr)	Road Name	Description	Base year 2018						Future year 2023						Future year 2023 with Development					
					Total AADT	% AADT					Total AADT	% AADT					Total AADT	% AADT				
						Motorcycle	Car	Bus and Coach	LGV	HGV		Motorcycle	Car	Bus and Coach	LGV	HGV		Motorcycle	Car	Bus and Coach	LGV	HGV
Road001	11	20	A404	West of A4125	16249	0.47	87.41	0.22	10.99	0.91	17117	0.47	87.41	0.22	10.99	0.91	17221	0.46	87.49	0.22	10.92	0.91
Road002	9	40	A404	West of A4125	16249	0.47	87.41	0.22	10.99	0.91	17117	0.47	87.41	0.22	10.99	0.91	17221	0.46	87.49	0.22	10.92	0.91
Road003	10.5	30	A404	West of A4125	16249	0.47	87.41	0.22	10.99	0.91	17117	0.47	87.41	0.22	10.99	0.91	17221	0.46	87.49	0.22	10.92	0.91
Road004	8	40	A404	West of A4125	16249	0.47	87.41	0.22	10.99	0.91	17117	0.47	87.41	0.22	10.99	0.91	17221	0.46	87.49	0.22	10.92	0.91
Road005	9.5	40	A404	West of A4125	16249	0.47	87.41	0.22	10.99	0.91	17117	0.47	87.41	0.22	10.99	0.91	17221	0.46	87.49	0.22	10.92	0.91
Road006	14	30	A404	West of A4125	16249	0.47	87.41	0.22	10.99	0.91	17117	0.47	87.41	0.22	10.99	0.91	17221	0.46	87.49	0.22	10.92	0.91
Road007	14	30	A404	East of A4125	29517	0.36	88.11	1.35	9.42	0.76	31093	0.36	88.11	1.35	9.42	0.76	31351	0.36	88.20	1.34	9.34	0.76
Road008	12	40	A404	East of A4125	29517	0.36	88.11	1.35	9.42	0.76	31093	0.36	88.11	1.35	9.42	0.76	31351	0.36	88.20	1.34	9.34	0.76
Road009	7.5	40	A404	East of A4125	29517	0.36	88.11	1.35	9.42	0.76	31093	0.36	88.11	1.35	9.42	0.76	31351	0.36	88.20	1.34	9.34	0.76
Road010	7.5	30	A404	East of A4125	29517	0.36	88.11	1.35	9.42	0.76	31093	0.36	88.11	1.35	9.42	0.76	31351	0.36	88.20	1.34	9.34	0.76
Road011	7.5	30	A404	East of A4125	29517	0.36	88.11	1.35	9.42	0.76	31093	0.36	88.11	1.35	9.42	0.76	31351	0.36	88.20	1.34	9.34	0.76
Road012	8.3	40	A404	East of A4125	29517	0.36	88.11	1.35	9.42	0.76	31093	0.36	88.11	1.35	9.42	0.76	31351	0.36	88.20	1.34	9.34	0.76
Road013	9	20	A404	East of A4125	29517	0.36	88.11	1.35	9.42	0.76	31093	0.36	88.11	1.35	9.42	0.76	31351	0.36	88.20	1.34	9.34	0.76
Road014	7.5	20	A404	A404 roundabout	14759	0.36	88.11	1.35	9.42	0.76	15547	0.36	88.11	1.35	9.42	0.76	15676	0.36	88.20	1.34	9.34	0.76
Road015	7.5	20	A404	A404 roundabout	14759	0.36	88.11	1.35	9.42	0.76	15547	0.36	88.11	1.35	9.42	0.76	15676	0.36	88.20	1.34	9.34	0.76
Road016	8.8	40	A404	East of Local Authority boundary	16509	0.59	87.61	1.01	9.66	1.13	17390	0.59	87.61	1.01	9.66	1.13	17648	0.58	87.79	1.00	9.52	1.12
Road017	8.8	30	A404	East of Local Authority boundary	16509	0.59	87.61	1.01	9.66	1.13	17390	0.59	87.61	1.01	9.66	1.13	17648	0.58	87.79	1.00	9.52	1.12
Road018	8.5	30	A404	East of Local Authority boundary	16509	0.59	87.61	1.01	9.66	1.13	17390	0.59	87.61	1.01	9.66	1.13	17648	0.58	87.79	1.00	9.52	1.12
Road019	8.5	40	A404	East of Local Authority boundary	16509	0.59	87.61	1.01	9.66	1.13	17390	0.59	87.61	1.01	9.66	1.13	17648	0.58	87.79	1.00	9.52	1.12
Road020	9	20	A404	East of Local Authority boundary	16509	0.59	87.61	1.01	9.66	1.13	17390	0.59	87.61	1.01	9.66	1.13	17648	0.58	87.79	1.00	9.52	1.12
Road021	8	20	A4125 High Street	North of A404	16155	0.67	86.04	2.07	10.15	1.06	17017	0.67	86.04	2.07	10.15	1.06	17172	0.66	86.17	2.05	10.06	1.05
Road022	7	30	A4125 High Street	North of A405	16155	0.67	86.04	2.07	10.15	1.06	17017	0.67	86.04	2.07	10.15	1.06	17172	0.66	86.17	2.05	10.06	1.05
Road023	5.5	40	A4125 High Street	North of A406	16155	0.67	86.04	2.07	10.15	1.06	17017	0.67	86.04	2.07	10.15	1.06	17172	0.66	86.17	2.05	10.06	1.05
Road024	6	40	A4125 High Street	North of A407	16155	0.67	86.04	2.07	10.15	1.06	17017	0.67	86.04	2.07	10.15	1.06	17172	0.66	86.17	2.05	10.06	1.05
Road025	8	30	A4125 High Street	North of A408	16155	0.67	86.04	2.07	10.15	1.06	17017	0.67	86.04	2.07	10.15	1.06	17172	0.66	86.17	2.05	10.06	1.05
Road026	6	40	A4125 High Street	North of A409	16155	0.67	86.04	2.07	10.15	1.06	17017	0.67	86.04	2.07	10.15	1.06	17172	0.66	86.17	2.05	10.06	1.05

APPENDIX 3

- Model results

Table A2: Future year (2023) impact at individual existing receptors - PM_{10}

Receptor	Base year (2018) annual mean ($\mu g.m^{-3}$)	Future year (2023) annual mean ($\mu g.m^{-3}$)		Impact of the proposed scheme			
		Without scheme	With scheme	Annual mean as % of AQO	Change in PM_{10} concentration ($\mu g.m^{-3}$)	% increase relative to AQO	Significance
R1.0	17.41	16.39	16.41	41	0.02	0	Negligible
R2.0	16.84	15.84	15.86	40	0.01	0	Negligible
R3.0	17.47	16.46	16.48	41	0.02	0	Negligible
R3.2	16.42	15.46	15.47	39	0.02	0	Negligible
R4.0	17.82	16.79	16.81	42	0.02	0	Negligible
R4.2	17.51	16.47	16.49	41	0.02	0	Negligible
R5.0	18.24	17.22	17.24	43	0.02	0	Negligible
R6.0	18.48	17.42	17.45	44	0.02	0	Negligible
R6.2	16.95	15.97	15.98	40	0.01	0	Negligible
R7.0	16.76	15.78	15.80	39	0.01	0	Negligible
R7.2	16.73	15.75	15.76	39	0.01	0	Negligible
R8.0	16.93	15.95	15.96	40	0.01	0	Negligible
R8.2	16.40	15.43	15.45	39	0.02	0	Negligible

Table A3: Future year (2023) impact at individual existing receptors -$PM_{2.5}$

Receptor	Base year (2018) annual mean ($\mu g.m^{-3}$)	Future year (2023) annual mean ($\mu g.m^{-3}$)		Impact of the proposed scheme			
		Without scheme	With scheme	Annual mean as % of AQO	Change in NO_2 concentration ($\mu g.m^{-3}$)	% increase relative to AQO	Significance
R1.0	12.03	11.13	11.14	28	0.01	0	Negligible
R2.0	11.68	10.81	10.82	27	0.01	0	Negligible
R3.0	12.06	11.16	11.17	28	0.01	0	Negligible
R3.2	11.40	10.57	10.58	26	0.01	0	Negligible
R4.0	12.28	11.35	11.36	28	0.01	0	Negligible
R4.2	12.11	11.18	11.19	28	0.01	0	Negligible
R5.0	12.52	11.58	11.60	29	0.01	0	Negligible
R6.0	12.69	11.72	11.73	29	0.01	0	Negligible
R6.2	11.73	10.87	10.88	27	0.01	0	Negligible
R7.0	11.61	10.76	10.77	27	0.01	0	Negligible
R7.2	11.60	10.75	10.75	27	0.01	0	Negligible
R8.0	11.72	10.86	10.87	27	0.01	0	Negligible
R8.2	11.39	10.56	10.57	26	0.01	0	Negligible

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