London Borough of Newham School Nitrogen Dioxide Monitoring

Monthly Monitoring Report

March 2020

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Contact Details		
Company Name	Bureau Veritas UK Limited	London Borough of Newham
Contact Name	Vincent Yeung	Sue Weinand
Position	Consultant	Environmental Health Officer
Address	5th Floor 66 Prescot Street London E1 8HG	IBU-Environmental Control Regeneration and Planning London Borough of Newham First Floor West Wing Newham Dockside, 1000 Dockside Road, London E16 2QU
Telephone	0207 661 0766	0207 126 2690
e-mail	vincent-ws.yeung@uk.bureauveritas.com	sue.weinand@newham.gov.uk
Websites	www.bureauveritas.co.uk	https://www.newham.gov.uk

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Completed By	P Stockton	Graduate Consultant	
Approved By	P Bentley	Senior Consultant	

Bureau Veritas UK Limited
5th Floor, 66 Prescot Street
London
E1 8HG

Telephone: +44 (0) 207 6610700
Fax: +44 (0) 207 6610741
Registered in England 1758622
www.bureauveritas.co.uk

Registered Office
Suite 206 Fort Dunlop
Fort Parkway
Birmingham B24 9FD

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1 Introduction

1.1 Overview

Bureau Veritas UK Ltd have been commissioned by the London Borough of Newham ('the Council') to present ongoing monthly NO_2 diffusion tube monitoring results from 99 monitoring sites located at existing schools within the Borough, with each school included within the study having one diffusion tube deployed within its grounds.

Following the exposure of the diffusion tubes within each monthly monitoring period, the diffusion tubes are analysed and the monitored monthly concentrations of NO_2 recorded at all monitoring locations are detailed within an updated monthly report. Within each monthly report there will be an overview of monitoring trends, the identification of any possible hotspots or outliers, and a comparison of the monitored NO_2 concentrations with both Defra background mapping resources, and monthly comparable NO_2 concentrations recorded from automatic monitoring sites located within the Borough.

A number of maps presenting the diffusion tube monitoring locations are included within Appendix A.

1.2 Background

Historically, improvements in air quality within London had previously been driven through the 2010 Mayor's Air Quality Strategy[1], with a framework set out for improving air quality across the capital. These was superseded in 2018 with the publishing of the London Environment Strategy[2], within which air quality is detailed as one aspect of the environment identified as posing a major risk to the health and well-being of London's population. Air quality is a main focus within the strategy, with the stated overall aim for London to have the cleanest air of any major city by 2050, going beyond the legal requirements to protect human health and minimise inequalities.

Currently as part of London Local Air Quality Management (LLAQM) requirements, The Council complete monitoring of both NO_2 and particulate matter (PM) at a number of locations across the Borough. Monitoring is completed using both NO_2 diffusion tubes, as well as automatic monitoring. During 2018 there were 18 NO_2 diffusion tubes located across the Borough and two automatic monitoring stations in operation.

There has been an emphasis over recent years within scientific research on the identification of effects of air pollution on certain population demographics, with an identification that school children are amongst the most vulnerable within the risk groups to detrimental effects caused through exposure to air pollution. Due to the incomplete development of children's lungs, they have been shown to be more prone to develop cardiovascular diseases later in life and association with reduced neurodevelopment[3,4].

Therefore the Mayor's School Air Quality Audit Programme[5] was launched in 2017 with the aim to reduce emissions and primary school children's exposure to air pollution. Audits were carried out

[1] The Air Quality Standards Regulations (England) 2010, Statutory Instrument No 1001, The Stationary Office Limited

[2] Mayor of London, London Environment Strategy, available at https://www.london.gov.uk/what-we-do/environment/london-environment-strategy

[3] Johnson, N.M., Carrillo, G. and Mehta, R.K., 2016. Academic and psychosocial impact of air pollution on children. In Pediatric Neurotoxicology (pp. 167-180). Springer, Cham.

[4] Mak, K.L., 2017. Relationship between Air Pollution Exposure in Daily Travelling Activities and Health Impact on Primary School Children. Journal of Transportation and Logistics, 2(2), pp.21-32.

[5] Mayor of London, Mayor's School Air Quality Audit Programme, available at https://www.london.gov.uk/what-we-do/environment/pollution-and-air-quality/mayors-school-air-quality-audit-programme#acc-i-52546

across 50 schools across Greater London, in which two of the primary schools (Keir Hardie Primary School and Salisbury Primary School) from Newham participated in the audits. The audit identified that for both primary schools the majority of NO_2 emissions arise from vehicles, mainly cars, along main roads that are close by to the school, A13 and A18 respectively. The study has been continued with a research project completed in 2019 whereby students at five schools were given wearable sensors to carry to and from their school for a period of five days. Currently this has not been completed at any schools within Newham.

NO_2 emissions, both short term and annual mean concentrations, have been identified alongside PM as one of the two main pollutants of concern within London. Through research identifying children as more susceptible to the health impact of air pollution, the Council have proposed to carry out a Borough wide schools NO_2 diffusion tubes survey.

1.3 Scope of Monitoring Survey

The project deliverables in relation to the NO_2 Newham schools monitoring survey are as follows:

- The supply and analysis of 99 NO_2 diffusion tubes per month for a 12 month period to enable air quality monitoring at a single location at 99 schools across Newham;

- Provision of a monthly report presenting monthly concentration results from the diffusion tubes, the identification of any recognisable trends and completing a comparison of NO_2 concentrations with both modelled background concentrations and monthly data from the Council's two automatic monitoring stations; and

- Provision of a summary report upon conclusion of the monitoring survey to include fully processed diffusion tube monitoring results for the 12 months of monitoring based upon LAQM best practice guidance. These will be assessed against the UK air quality objectives, and compared against both modelled concentrations, and monthly data from the Councils two automatic monitoring stations.

2 Health Effects of NO_2

Emissions from road traffic contribute significantly to ambient pollutant concentrations in urban areas. The main constituents of vehicle exhaust emissions, produced by fuel combustion are carbon dioxide (CO_2) and water vapour (H_2O). However, combustion engines are not 100% efficient and partial combustion of fuel results in emissions of a number of other pollutants, including carbon monoxide (CO), particulate matter (PM), Volatile Organic Compounds (VOCs) and hydrocarbons (HC). For HC, the pollutants of most concern are 1,3 - butadiene (C_4H_6) and benzene (C_6H_6). In addition, some of the nitrogen (N) in the air is oxidised under the high temperature and pressure during combustion; resulting in emissions of oxides of nitrogen (NO_x). NO_x emissions from vehicles predominately consist of nitrogen oxide (NO), but also contain nitrogen dioxide (NO_2). Once emitted, NO can be oxidised in the atmosphere to produce further NO_2.

The quantities of each pollutant emitted depend upon a number of parameters; including the type and quantity of fuel used, the engine size, the vehicle speed, and the type of emissions abatement equipment fitted. Once emitted, these pollutants disperse in the air. Where there is no additional source of emission, pollutant concentrations generally decrease with distance from roads, until concentrations reach those of the background.

The air quality monitoring completed within this report focuses on NO_2 as this is the main pollutants of concern at this site. This has been confirmed over recent years by the outcome of the Local Air Quality Management (LAQM) regime. Recent statistics[6] regarding Air Quality Management Areas (AQMAs) show that over 600 AQMAs are declared in the UK. The majority of existing AQMAs have been declared in relation to NO_2 air quality objective exceedances sourced from road traffic emissions.

An overview of this pollutant, describing briefly the sources and processes influencing the ambient concentrations, is presented below.

NO and NO_2, collectively known as NO_x, are produced during the high temperature combustion processes involving the oxidation of N. Initially, NO_x are mainly emitted as NO, which then undergoes further oxidation in the atmosphere, particularly with ozone (O_3), to produce secondary NO_2. Production of secondary NO_2 could also be favoured due to a class of compounds, VOCs, typically present in urban environments, and under certain meteorological conditions, such as hot sunny days and stagnant anti-cyclonic winter conditions.

Of NO_x, it is NO_2 that is associated with health impacts. Exposure to NO_2 can bring about reversible effects on lung function and airway responsiveness. It may also increase reactivity to natural allergens, and exposure to NO_2 puts children at increased risk of respiratory infection and may lead to poorer lung function in later life.

[6] Statistics from the UK AQMA website available at http://aqma.defra.gov.uk – Figures as of January 2017

3 Monitoring Methodology

3.1 Nitrogen Dioxide Diffusion Tubes

Palmes type diffusion tubes have been used throughout Newham at 99 locations within school properties to monitor annual mean NO_2 concentrations. Passive diffusion tubes are widely used throughout the UK as a simple method to monitor long term NO_2 concentrations with averaging periods typically of four or five weeks (i.e. for an annual mean monitoring survey, 12 x 4/5 week exposure periods are required).

The sampler is composed of an acrylic tube that is initially sealed at both ends. One end of the tube (red cap) contains two stainless steel mesh discs coated with triethanolamine (TEA) that absorbs NO_2 to produce a nitrate salt that can be determined through the process of colorimetry. After exposure, the total quantity of gas transferred along the tube is determined by chemical analysis, commonly using ultra-violet spectrometry.

Gradko International, a UKAS accredited laboratory, have been used to supply and analyse the diffusion tubes used within the study. Quality assurance / quality checking (QA/QC) is provided through Gradko's participation in the AIR-PT Scheme which is designed to help laboratories meet the European Standard EN482[7]. For the 2018 round of results, AIR-PT Rounds 24 to 28[8], Gradko International scored 100% on all results having a deviation of less than 2, meaning all results were satisfactory. Further details on the QA/QC framework can be found through the Local Air Quality Management (LAQM) Helpdesk[9].

The diffusion tubes used within the monitoring survey are the 50% TEA in Acetone method, with the diffusion tubes prepared and analysed by the UKAS accredited Gradko International Ltd. The analysis is carried out in accordance with industry best practice and the results are then sent to Bureau Veritas, where a formal report is completed on a monthly basis.

It should be noted that the NO_2 diffusion tube results have been presented without correction for bias. Bias represents the overall tendency of the diffusion tubes to under or over-read relative to the more accurate reference method of NO_2 measurement, undertaken by chemiluminescence analysers. A bias correction is calculated by co-locating diffusion tubes with NO_2 analysers and comparing the monitored concentrations over a year period. This bias factor is then applied to the annual mean diffusion tube concentration to correct the concentration.

At the end of year monitoring report all annual means will be processed in accordance with LLAQM guidance to be bias adjusted, annualised and corrected to nearest receptor locations where necessary.

The diffusion tube sampling periods are planned to align with the suggested UK National Diffusion Tube Calendar, as presented in Figure 3.1, to be in the interest of alignment with wider diffusion tube analysis across the UK.

[7] European Committee for Standardisation (CEN) Workplace Atmospheres, General requirements for the performance of procedures for the chemical measurement of chemical agents, EN482, Brussels, CEN 1994

[8] Summary of Laboratory Performance in AIR NO2 Proficiency Testing Scheme (April 2016 – February 2018), LAQM Helpdesk – March 2018

[9] https://laqm.defra.gov.uk/diffusion-tubes/qa-qc-framework.html

Figure 3.1 – Diffusion Tube Calendar 2020

Month		Start Date	Duration (weeks)
2019	November	06-Nov	4
	December	04-Dec	5
2020	January	08-Jan	4
	February	05-Feb	4
	March	04-Mar	4
	April	01-Apr	4
	May	29-Apr	5
	June	03-Jun	4
	July	01-Jul	4
	August	29-Jul	5
	September	02-Sep	4
	October	30-Sep	5
	November	04-Nov	4
	December	02-Dec	5
2021	January	06-Jan	-

NO_2 diffusion tubes are an indicative monitoring technique commonly used to investigate the temporal and spatial trends in NO_2 concentrations. These devices do not perform to the same accuracy as an automatic chemiluminescent analyser, which is identified by EU Standards as the reference method of measurement for nitrogen dioxide. It is stated within the NO_2 Diffusion Tube Practical Guidance[10] that the uncertainty of the measurements taken by NO_2 diffusion tubes should be recognised as ±25%.

The siting requirements relating to diffusion tube monitoring are outlined in AEA Energy Environment's Diffusion Tubes for Ambient NO_2 Monitoring: Practical Guidance[10] which all diffusion tubes should be installed in line with. The tubes should be exposed for the same sampling period across the site, within +/- 2 days, and ideally these exposure periods should follow the annual diffusion tube calendar presented in Figure 3.1 above.

The diffusion tubes should be installed vertically, with the open end of the tube pointed downwards during the sampling period. They should be installed on a bracket or plastic holder and mounted in a relevant location within the school grounds of each school. Whilst tubes must be located in an area of free air circulation, equally it is important that they are not installed in areas of higher than usual air flow. Tubes should not be placed less than 10m from the following;

- Heater flues;
- Bushes or trees overhanging or surrounding the tube location;
- Air condition outlets or extractor vents; and
- Underground ventilation shafts.

[10] AEA Energy & Environment, 2008, Diffusion Tubes for Ambient NO_2 Monitoring: Practical Guidance

4 Assessment Criteria

4.1 Ambient Air Quality Objectives

The Air Quality Strategy[11] (AQS) provides the over-arching strategic framework for air quality management in the UK and contains national air quality standards and objectives to protect human health. The air quality objectives incorporated in the AQS are derived from Limit Values prescribed in the EU Directives transposed into national legislation by Member States.

The AQS objectives for NO_2, as presented within Table 4.1 apply at locations outside buildings or other natural or man-made structures above or below ground, where members of the public are regularly present and might reasonably be expected to be exposed to pollutant concentrations over the relevant averaging period. Typically these include residential properties and schools/care homes for long-term (i.e. annual mean) pollutant objectives and high streets for short-term (i.e. 1-hour) pollutant objectives.

Table 4.2 taken from LLAQM.TG(19)[12] provides an indication of those locations that may, or may not be relevant for each averaging period. This assessment focuses on NO_2 as this is the pollutant of principal concern arising from busy roads and stopping vehicles during pick up and drop offs around the school grounds.

Although not all of the AQS objectives are applicable to schools and their adjacent locations, a comparison can still be made between these limits and the monitoring results to ascertain the compliance of the location with the relevant NO_2 objectives.

Table 4.1 – Relevant AQS Objectives for the Assessed Pollutants in England

Pollutant	AQS Objective	Concentration Measured as:	Date for Achievement
Nitrogen dioxide (NO_2)	200µg/m³ not to be exceeded more than 18 times per year	1-hour mean	31st December 2005
	40µg/m³	Annual mean	31st December 2005

[11] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (2007), Published by Defra in partnership with the Scottish Executive, Welsh Assembly Government and Department of the Environment Northern Ireland

[12] Mayor of London, London Local Air Quality Management, 2019, Technical Guidance 19 https://www.london.gov.uk/what-we-do/environment/pollution-and-air-quality/working-london-boroughs

Table 4.2 – Examples of where the AQS Objectives should apply

Averaging Period	AQS Objectives should apply at:	AQS Objectives should generally not apply at:
Annual mean	All locations where members of the public might be regularly exposed Building façades of residential properties, schools, hospitals, care homes etc.	Building facades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
24-hour mean and 8-hour mean	All locations where the annual mean objectives would apply, together with hotels. Gardens of residential properties[1].	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
1-hour mean	All locations where the annual mean and 24 and 8-hour mean objectives would apply. Kerbside sites (e.g. pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where the public might reasonably be expected to spend one hour or more. Any outdoor locations at which the public may be expected to spend one hour or longer.	Kerbside sites where the public would not be expected to have regular access.
15-minute mean	All locations where members of the public might reasonably be expected to spend a period of 15 minutes or longer.	

Note [1] For gardens and playgrounds, such locations should represent parts of the garden where relevant public exposure is likely, for example where there is seating or play areas. It is unlikely that relevant public exposure would occur at the extremities of the garden boundary, or in front gardens, although local judgement should always be applied.

5 Local Pollutant Concentrations

The London Borough of Newham is one of the 32 London Boroughs (excluding the City of London) and is located to the East of central London bounding to four other London Boroughs; Redbridge and Waltham Forest to the north, Barking and Dagenham to the East, Greenwich to the south along with Tower Hamlets and Hackney to the West. Presented below is an overview of available existing air quality data for Newham (both modelled background concentrations, and 2019 monitored concentrations) from available information sources.

5.1 Local Authority Pollutant Monitoring

The Council currently operates two automatic monitoring sites, both of which monitor concentrations of NO_2 PM_{10} and $PM_{2.5}$. In addition there are 18 NO_2 diffusion tubes that are deployed across the Borough, three of which are co-located with an automatic monitoring station (Cam Road) to enable the calculation of a local specific bias adjustment factor.

Details of each monitoring site, in addition to the 2019 NO_2 annual means of each, as well as number of exceedances to the NO_2 short term objective, are presented in Table 5.1 and their locations are presented in Appendix A.

The Council declared an Air Quality Management Area (AQMA) along the major roads within the Borough in 2002 due to the prediction of exceedances of the NO_2 annual mean objective. In response to the air quality issues across Newham, the Council published an Air Quality Action Plan (AQAP) in 2003 that set out the Council's objectives for lowering pollutant emissions. A revised AQAP was published in 2019[13] to replace the previous version and cover the period of 2019-2024. In conjunction with the update of the AQAP the Council have revised the AQMA boundary to incorporate the entire Borough.

The AQAP outlines proposed measures that are to be implemented to improve and avoid further degradation of air quality. It was noted as part of the source apportionment exercise completed to inform the AQAP that the significant sources of NO_x emissions within the borough stems from road transport (along A13), aviation (from London City Airport) and building and construction actives.

Table 5.1 – Council Automatic Monitoring (2019)

Site ID	Site Location	OS Grid Ref (E, N)	Within an AQMA	Distance to Site / Nearest Kerb (m)	2019 Annual Mean NO_2 Concentration ($\mu g/m^3$)	Number of 1-hour Means Greater Than 200$\mu g/m^3$
NM2	Cam Road (RD)	538661, 183969	Y	5	27.4	0
NM3	Wren Close (UB)	539889, 181469	N	N/A	26.7	0
The 2019 monitoring results have been sourced through www.airqualityengland.co.uk, some data is provisional, annual averages will be updated when the data has been ratified UB – Urban Background, RD – Roadside Exceedances of the annual mean NO_2 AQS objective in **Bold**.						

[13] https://www.newham.gov.uk/Documents/Council%20and%20Democracy/DraftAirQualityActionPlan201924.pdf

6 School Monitoring Survey

A single diffusion tube has been installed at 99 separate schools across the Borough, with 12 months of monitoring to be completed running from August 2019 until July 2020. The details of each individual monitoring site are provided in Table 6.1 and their locations are presented in Appendix A. The UK Department for Environment, Food and Rural Affairs (Defra) maintains a national model of existing and future background air quality concentrations at a 1km grid square resolution. The data sets include annual average concentration estimates for NO_2, using a base year of 2017.

Annual mean background concentrations have been obtained from the Defra published background maps, based on the 1km grid squares which cover the modelled area and the affected road network. The predicted Defra mapped background concentrations, for the grid squares of each school, across the 2019 period are presented in Table 6.1.The tubes have been installed following siting guidance outlined in LLAQM.TG(19)[12] and within the current best practice diffusion tube operation document[10].

Due to the differential dates and times arising from the changeover of diffusion tubes, diffusion tubes results will be calculated by number of hours exposed, whilst the monthly period means for the automatic monitoring data has been calculated from midday to midday of the changeover dates in accordance to the national diffusion tubes calendar for consistency and ease of comparison. Monitoring data from the automatic monitoring has been processed in accordance with these dates to ensure that a direct comparison can be made between the sets of monitoring data. Where the data capture of the monitoring period at an automatic monitoring site is below 75%, a period average concentration has not been presented.

Defra maintains a national model of existing and future background air quality concentrations at a 1km grid square resolution. The data sets include annual average concentration estimates for NO_2, using a base year of 2017.

Annual mean background concentrations have been obtained from the Defra published background maps, based on the 1km grid squares which cover the modelled area and the affected road network. The predicted Defra mapped background concentrations, for the grid squares of each school, across the 2019 period are presented in Table 6.1.

Table 6.1 – NO_2 Diffusion Tube Locations

Tube ID	Location Description	OS Grid Reference		Defra Annual Mean 2019 Background Concentration ($\mu g/m^3$)
		E	N	
NHM-S 1	Salisbury Primary School	542089	185416	24.9
NHM-S 2	Avenue Primary School	542319	185428	24.9
NHM-S 3	Sir John Heron Primary School	542564	185642	24.9
NHM-S 4	Sheringham Primary School	542922	185830	24.9
NHM-S 5	Susan Lawrence Nursery	543086	185713	28.3
NHM-S 6	Dersingham Primary School	543086	185713	28.3
NHM-S 7	St Winefride's RC Primary School	542880	185321	24.9
NHM-S 8	Little Ilford School	542734	185179	24.9
NHM-S 9	Essex Primary School	542549	185070	24.9
NHM-S 10	Kensington Primary School	542701	184632	25.0
NHM-S 11	Plashet School	542262	184348	25.0
NHM-S 12	William Davies Primary School	541681	184582	25.3

NHM-S 13	Monega Primary School	541797	184904	25.3
NHM-S 14	Shrewsbury Nursery	541562	185194	24.3
NHM-S 15	Sandringham Primary School	541172	185041	24.3
NHM-S 16	Shaftesbury Primary School	541368	184294	25.3
NHM-S 17	St Stephen's Nursery School	541543	184112	25.3
NHM-S 18	Cleves Primary School	541828	183772	26.1
NHM-S 19	Hartley Primary School	542253	183708	26.6
NHM-S 20	Lathom Junior School	542492	184111	25.0
NHM-S 21	Altmore Infant School	542831	183954	26.6
NHM-S 22	Langdon Academy	543501	183538	28.4
NHM-S 23	Nelson Primary School	543143	183468	28.4
NHM-S 24	St Michael's Catholic Primary School	542827	183286	26.6
NHM-S 25	Oliver Thomas Children's Centre	543279	183097	28.4
NHM-S 26	Vicarage Primary School	542858	182778	29.2
NHM-S 27	Roman Road Primary School	542858	182778	29.2
NHM-S 28	Brampton Manor Academy	541628	182342	27.5
NHM-S 29	Central Park Primary School	541919	183099	26.1
NHM-S 30	St Edward's Catholic Primary School	541384	183505	26.1
NHM-S 31	Selwyn Primary School	540494	183908	25.7
NHM-S 32	Upton Cross Primary School	540915	183744	25.7
NHM-S 33	St Antony's Catholic Primary School	540502	184400	26.2
NHM-S 34	Stratford School Academy	540391	184416	26.2
NHM-S 35	Elmhurst Primary School	540811	184261	26.2
NHM-S 36	St Bonaventure's RC School	540592	184162	26.2
NHM-S 37	St Angela's Ursuline School	540665	184510	26.2
NHM-S 38	Park Primary School	539849	184421	26.6
NHM-S 39	Earlham Primary School	540001	185106	24.9
NHM-S 40	Kay Rowe Nursery School	540595	185247	24.9
NHM-S 41	Woodgrange Infant School	540764	185503	24.9
NHM-S 42	Godwin Junior School	540838	185646	24.9
NHM-S 43	Forest Gate Community School	540359	185338	24.9
NHM-S 44	Odessa Infant School	540099	185343	24.9
NHM-S 45	St James' C of E Junior School	540011	185274	24.9
NHM-S 46	Maryland Primary School	539326	185305	24.5
NHM-S 47	Colegrave Primary School	538857	185210	27.4
NHM-S 48	Education Links	538856	185408	27.4
NHM-S 49	Ronald Openshaw Nursery School	538715	185203	27.4
NHM-S 50	Chobham Academy	538263	185253	27.4
NHM-S 51	Bobby Moore Academy (primary school)	537439	184122	28.2
NHM-S 52	Bobby Moore Academy (secondary school)	537836	183828	31.5
NHM-S 53	John F Kennedy Special School	538984	184024	28.3
NHM-S 54	School 21	538964	184062	28.3
NHM-S 55	Sarah Bonnell School	539379	184683	26.6
NHM-S 56	West Ham Church Primary School	539469	183937	26.4
NHM-S 57	Portway Primary School	539955	183624	26.4
NHM-S 58	Ranelagh Primary School	539444	183264	26.4
NHM-S 59	Manor Primary School	539265	183375	26.4
NHM-S 60	East London Science School	538336	182808	29.4
NHM-S 61	Abbey Lane Children's Centre	538373	183461	27.9

NHM-S 62	Carpenters Primary School	538455	183877	27.9
NHM-S 63	Curwen Primary School	540193	183176	25.7
NHM-S 64	Eleanor Smith School	540581	183217	25.7
NHM-S 65	Lister Community School	540793	183493	25.7
NHM-S 66	Plaistow Primary School	540813	183333	25.7
NHM-S 67	Southern Road Primary School	540944	183245	25.7
NHM-S 68	Tollgate Primary School	541216	182059	27.5
NHM-S 69	The Cumberland School	541272	182349	27.5
NHM-S 70	Brampton Primary School	541989	182568	27.5
NHM-S 71	New City Primary School	541501	182588	27.5
NHM-S 72	Tunmarsh School	541094	182694	27.5
NHM-S 73	Gainsborough Primary School	539258	182560	26.9
NHM-S 74	Star Primary School	539315	182104	26.9
NHM-S 75	Eastlea Community School	539561	182374	26.9
NHM-S 76	Grange Primary School	539983	182470	26.9
NHM-S 77	St Helen's Catholic Primary School	540108	182314	27.0
NHM-S 78	Kaizen Primary School	540701	182157	27.0
NHM-S 79	Ravenscroft Primary School	540443	182132	27.0
NHM-S 80	Rokeby School	539893	181888	33.0
NHM-S 81	St Luke's Primary School	539842	181328	33.0
NHM-S 82	Hallsville Primary School	540113	181170	30.4
NHM-S 83	Keir Hardie Primary School	540275	181638	30.4
NHM-S 84	Rosetta Primary School	540855	181595	30.4
NHM-S 85	Edith Kerrison Nursery School	540742	181507	30.4
NHM-S 86	St Joachim's Catholic Primary School	540961	181074	30.4
NHM-S 87	Britannia Village Primary	540676	180279	27.1
NHM-S 88	New Directions	543536	180065	27.7
NHM-S 89	Oasis Academy Silvertown	543202	180069	27.7
NHM-S 90	Drew Primary School	542197	180233	28.8
NHM-S 91	Royal Docks Academy	541233	181069	28.3
NHM-S 92	Calverton Primary School	541712	181187	28.3
NHM-S 93	Scott Wilkie Primary School	541504	181370	28.3
NHM-S 94	Ellen Wilkinson Primary School	542061	181645	24.7
NHM-S 95	Beckton and Royal Docks Children's Centre	541928	181706	28.3
NHM-S 96	Kingsford Community School	542603	181523	24.7
NHM-S 97	North Beckton Primary School	542805	181812	24.7
NHM-S 98	Gallions Primary School	543635	181422	25.4
NHM-S 99	Winsor Primary School	543208	181147	25.4

6.1 Monitoring Survey Results

Table 6.2 presents the raw NO_2 diffusion tube data for the 99 monitoring locations; this table is updated monthly as more data becomes available. In addition to this, Table 6.4 presents the 2019 summary where data has been annualised and bias adjusted using a locally derived factor as presented within Appendix C. Due to the auditing cycle of automatic monitoring sites, some of the hourly data used within the annualisation and bias adjustment calculations is still provisional, these calculations will be updated once all automatic monitoring data has been ratified. The annualisation and bias adjustment calculations that have been completed are presented in Appendix C.

Table 6.2 – Raw NO_2 Diffusion Tube Monitoring Results (µg/m^3)

Site ID	M1 - Aug	M2 - Sep	M3 - Oct	M4 - Nov	M5 - Dec	M6 - Jan	M7 - Feb	M8 - Mar	M9 - Apr	M10 - May	M11 - Jun	M12 - Jul	Rolling Average
NHM-S 1	31.8	33.6	33.0	-	25.8	38.6							32.3
NHM-S 2	23.9	22.2	30.7	28.7	31.6	35.6							28.8
NHM-S 3	25.1	24.9	28.6	42.0	32.2	36.6							31.6
NHM-S 4	-	26.7	34.3	45.4	31.7	40.2							35.7
NHM-S 5	25.8	26.2	29.2	44.8	32.2	34.6							32.1
NHM-S 6	34.0	28.6	35.9	49.5	34.3	44.0							37.7
NHM-S 7	45.6	39.1	46.1	64.3	46.3	49.8							48.5
NHM-S 8	30.7	26.6	37.7	55.5	36.1	44.5							38.5
NHM-S 9	25.8	25.1	28.7	39.4	31.5	36.5							31.2
NHM-S 10	25.9	23.6	31.1	39.2	31.6	37.1							31.4
NHM-S 11	37.1	29.6	38.3	52.7	40.5	43.7							40.3
NHM-S 12	24.5	19.2	30.0	43.9	32.9	34.7							30.9
NHM-S 13	-	26.0	32.7	47.8	32.4	41.0							36.0
NHM-S 14	31.2	27.6	33.9	39.9	27.7	42.0							33.7
NHM-S 15	27.6	22.8	32.4	43.2	29.7	36.2							32.0
NHM-S 16	29.1	23.4	33.4	39.8	34.7	42.6							33.8
NHM-S 17	22.8	20.7	-	38.9	30.6	33.0							29.2
NHM-S 18	24.0	21.3	28.9	41.2	24.0	32.3							28.6
NHM-S 19	28.2	26.7	-	43.3	30.3	40.2							33.7
NHM-S 20	37.8	29.3	36.0	46.1	34.4	41.1							37.5
NHM-S 21	31.4	27.0	36.3	48.6	35.6	40.8							36.6
NHM-S 22	-	25.2	31.3	46.1	31.8	38.3							34.6
NHM-S 23	24.5	25.0	29.8	36.8	30.3	38.9							30.9
NHM-S 24	26.7	25.0	26.0	42.8	29.3	38.4							31.4
NHM-S 25	22.0	18.7	30.1	42.0	25.2	32.3							30.3
NHM-S 26	34.8	29.2	34.1	46.5	40.4	45.3							38.4
NHM-S 27	33.1	25.3	35.1	43.5	37.5	36.6							35.2
NHM-S 28	-	23.7	-	-	29.8	31.9							28.5
NHM-S 29	28.3	28.1	33.0	51.5	33.7	36.7							35.2
NHM-S 30	38.8	32.8	35.5	55.7	42.0	48.8							42.3
NHM-S 31	24.3	24.2	-	52.1	32.9	40.0							34.7
NHM-S 32	23.6	21.2	-	-	21.9	31.4							24.5
NHM-S 33	24.5	23.1	28.3	42.2	31.4	-							29.9
NHM-S 34	29.6	25.6	32.1	0.8*	33.0	40.5							32.2
NHM-S 35	27.9	22.8	31.7	44.8	31.3	36.8							32.5
NHM-S 36	26.6	24.6	33.6	43.0	34.6	-							32.5
NHM-S 37	27.2	26.5	29.4	44.9	32.6	34.9							32.6
NHM-S 38	24.0	23.6	-	41.0	30.9	31.6							30.2

NHM-S 39	19.6	22.7	26.8	42.1	30.2	31.5							29.2
NHM-S 40	29.7	23.4	30.2	-	31.8	40.7							31.2
NHM-S 41	29.2	26.8	34.7	45.5	32.6	39.1							34.7
NHM-S 42	21.1	21.2	14.9	36.6	27.8	33.2							25.8
NHM-S 43	29.9	29.1	-	50.7	35.2	-							36.2
NHM-S 44	23.7	22.2	27.6	36.7	31.0	36.4							29.6
NHM-S 45	24.7	18.9	27.7	39.0	19.7	34.9							27.5
NHM-S 46	23.9	24.0	31.3	41.6	30.0	33.0							30.5
NHM-S 47	24.7	24.6	34.0	43.0	32.7	36.1							32.5
NHM-S 48	25.5	23.0	29.6	43.8	32.3	32.9							31.2
NHM-S 49	26.4	27.0	29.9	41.4	31.8	33.5							31.6
NHM-S 50	26.3	25.5	33.2	43.5	31.8	35.7							32.7
NHM-S 51	29.2	29.3	38.2	-	36.1	43.2							35.2
NHM-S 52	26.3	24.4	29.4	38.9	33.1	33.4							31.2
NHM-S 53	23.0	24.2	33.1	43.3	31.5	38.7							32.3
NHM-S 54	23.4	25.9	33.4	47.1	34.1	36.4							33.4
NHM-S 55	-	24.7	42.5	46.2	37.6	44.5							39.1
NHM-S 56	37.9	-	36.5	48.0	37.7	46.9							41.4
NHM-S 57	23.2	22.8	32.0	40.9	33.4	35.9							31.4
NHM-S 58	25.5	24.3	31.0	40.3	30.7	35.8							32.7
NHM-S 59	23.3	22.8	7.6*	45.9	-	36.3							32.1
NHM-S 60	28.4	27.9	37.4	45.0	26.1	44.3							34.8
NHM-S 61	27.2	24.6	36.9	46.8	38.2	43.0							36.1
NHM-S 62	30.0	28.8	38.2	44.5	36.5	41.3							36.6
NHM-S 63	24.5	25.6	32.6	47.5	32.1	34.4							32.8
NHM-S 64	22.8	20.7	28.5	39.3	30.8	32.1							29.0
NHM-S 65	26.1	-	-	50.3	25.0	59.5							40.2
NHM-S 66	23.4	22.6	34.9	37.5	32.6	38.1							31.5
NHM-S 67	-	-	30.1	41.3	-	34.1							35.2
NHM-S 68	33.5	28.9	27.7	42.2	41.8	42.2							36.1
NHM-S 69	32.1	26.9	-	-	34.3	38.9							33.1
NHM-S 70	24.7	-	30.5	42.4	34.2	42.8							34.9
NHM-S 71	27.6	26.2	38.3	44.5	37.1	44.8							36.4
NHM-S 72	-	25.0	-	-	-	41.1							33.1
NHM-S 73	29.5	25.3	32.9	38.0	33.7	38.3							33.0
NHM-S 74	26.7	26.8	36.1	44.0	36.5	44.3							35.7
NHM-S 75	25.9	-	38.3	-	33.1	-							32.4
NHM-S 76	24.0	24.6	30.8	33.2	26.0	34.5							28.8
NHM-S 77	32.2	24.7	39.0	45.8	37.6	40.1							36.6
NHM-S 78	29.4	-	37.7	40.3	35.5	38.2							36.2
NHM-S 79	27.5	26.9	35.8	41.8	32.1	37.9							33.7
NHM-S 80	41.6	38.1	37.8	37.9	47.4	51.9							42.5
NHM-S 81	30.2	26.2	36.9	42.9	33.9	39.7							34.9
NHM-S 82	24.8	27.8	35.0	39.7	34.0	40.4							33.6
NHM-S 83	24.6	-	36.1	38.6	22.1	30.9							30.5
NHM-S 84	22.4	25.9	32.8	39.4	27.8	33.2							30.2
NHM-S 85	23.7	26.4	35.0	37.0	31.2	32.5							31.0

NHM-S 86	23.0	26.0	29.6	38.5	28.4	34.8							30.0
NHM-S 87	26.3	15.2	29.8	-	6.8*	33.5							26.2
NHM-S 88	23.2	26.1	33.8	38.2	29.8	36.4							31.2
NHM-S 89	29.2	27.2	32.9	44.9	35.6	42.7							35.4
NHM-S 90	26.0	27.8	37.3	45.2	27.3	40.8							34.0
NHM-S 91	40.8	33.6	44.1	55.6	39.6	56.0							44.9
NHM-S 92	21.2	25.8	-	33.7	27.3	29.8							27.6
NHM-S 93	21.6	26.5	25.3	34.6	30.3	29.5							27.7
NHM-S 94	19.6	20.6	27.6	38.9	28.6	32.7							28.0
NHM-S 95	39.1	34.3	40.2	57.9	41.9	52.7							44.4
NHM-S 96	23.1	24.0	29.0	38.0	29.3	30.5							29.0
NHM-S 97	22.1	21.9	12.1	36.3	24.8	31.7							24.8
NHM-S 98	24.6	25.9	-	-	33.9	-							28.1
NHM-S 99	26.0	28.4	30.6	40.3	32.7	37.5							33.4

Notes:

No bias adjustment or annualisation has not been completed for monthly results shown above.

'-' shows that result is not available, this is because tube was missing when collection attempted at the end of the monitoring period.

'*' shows that the result appears to be anomalous although no comments were made during laboratory analysis, due to this the result has been excluded in rolling average calculations.

Values stated in red indicate that the results are compromised due to the diffusion tube containing spiders/nests/webs or other materials, due to this the result has been excluded in rolling average calculations.

Table 6.3 – Automatic Monitoring Monthly Results

Site ID	M1 - Aug	M2 - Sep	M3 - Oct	M4 - Nov	M5 - Dec	M6 - Jan	M7 - Feb	M8 - Mar	M9 - Apr	M10 - May	M11 - Jun	M12 - Jul	Rolling Average
Cam Road	21.6	27.9	26.6	30.9	21.3	33.2							26.9
Wren Close	20.7	23.4	25.9	33.4	23.4	29.4							26.0

Notes:

At the current time of writing all data presented for Wren Close and Cam Road is ratified up to 31/12/2019 and provisional thereafter.

The time used for taking automatic monitoring data will be 12:00pm – 12:00pm of the changeover date as stated in the national calendar.

Table 6.4 – 2019 Summary of NO_2 Diffusion Tube Monitoring Results (µg/m^3)

Site ID	M1 - Aug	M2 - Sep	M3 - Oct	M4 - Nov	M5 - Dec	Raw data Average	Annualised and Bias Adjusted (0.81) Average
NHM-S 1	31.8	33.6	33.0	-	25.8	30.2	26.8
NHM-S 2	23.9	22.2	30.7	28.7	31.6	27.4	22.4
NHM-S 3	25.1	24.9	28.6	42.0	32.2	30.6	25.0
NHM-S 4	-	26.7	34.3	45.4	31.7	34.5	26.5
NHM-S 5	25.8	26.2	29.2	44.8	32.2	31.7	25.9
NHM-S 6	34.0	28.6	35.9	49.5	34.3	36.5	29.8
NHM-S 7	45.6	39.1	46.1	64.3	46.3	48.3	*39.5*
NHM-S 8	30.7	26.6	37.7	55.5	36.1	37.3	30.5
NHM-S 9	25.8	25.1	28.7	39.4	31.5	30.1	24.6
NHM-S 10	25.9	23.6	31.1	39.2	31.6	30.3	24.8
NHM-S 11	37.1	29.6	38.3	52.7	40.5	39.6	32.4
NHM-S 12	24.5	19.2	30.0	43.9	32.9	30.1	24.6
NHM-S 13	-	26.0	32.7	47.8	32.4	34.7	26.6
NHM-S 14	31.2	27.6	33.9	39.9	27.7	32.1	26.2
NHM-S 15	27.6	22.8	32.4	43.2	29.7	31.1	25.5
NHM-S 16	29.1	23.4	33.4	39.8	34.7	32.1	26.2
NHM-S 17	22.8	20.7	-	38.9	30.6	28.3	23.1
NHM-S 18	24.0	21.3	28.9	41.2	24.0	27.9	22.8
NHM-S 19	28.2	26.7	-	43.3	30.3	32.1	26.3
NHM-S 20	37.8	29.3	36.0	46.1	34.4	36.7	30.0
NHM-S 21	31.4	27.0	36.3	48.6	35.6	35.8	29.2
NHM-S 22	-	25.2	31.3	46.1	31.8	33.6	25.8
NHM-S 23	24.5	25.0	29.8	36.8	30.3	29.3	23.9
NHM-S 24	26.7	25.0	26.0	42.8	29.3	30.0	24.5
NHM-S 25	22.0	18.7	30.1	42.0	25.2	29.8	23.3
NHM-S 26	34.8	29.2	34.1	46.5	40.4	37.0	30.2
NHM-S 27	33.1	25.3	35.1	43.5	37.5	34.9	28.5
NHM-S 28	-	23.7	-	-	29.8	26.8	21.7[#]
NHM-S 29	28.3	28.1	33.0	51.5	33.7	34.9	28.5
NHM-S 30	38.8	32.8	35.5	55.7	42.0	41.0	33.5
NHM-S 31	24.3	24.2	-	52.1	32.9	33.4	27.3
NHM-S 32	23.6	21.2	-	-	21.9	22.2	21.4
NHM-S 33	24.5	23.1	28.3	42.2	31.4	29.9	24.4
NHM-S 34	29.6	25.6	32.1	0.8*	33.0	30.1	27.6
NHM-S 35	27.9	22.8	31.7	44.8	31.3	31.7	25.9
NHM-S 36	26.6	24.6	33.6	43.0	34.6	32.5	26.6
NHM-S 37	27.2	26.5	29.4	44.9	32.6	32.1	26.2
NHM-S 38	24.0	23.6	-	41.0	30.9	29.9	24.5
NHM-S 39	19.6	22.7	26.8	42.1	30.2	28.6	23.4
NHM-S 40	29.7	23.4	30.2	-	31.8	28.8	26.4
NHM-S 41	29.2	26.8	34.7	45.5	32.6	33.8	27.6
NHM-S 42	21.1	21.2	14.9	36.6	27.8	24.3	19.9
NHM-S 43	29.9	29.1	-	50.7	35.2	36.2	29.7
NHM-S 44	23.7	22.2	27.6	36.7	31.0	28.3	23.1
NHM-S 45	24.7	18.9	27.7	39.0	19.7	26.0	21.3
NHM-S 46	23.9	24.0	31.3	41.6	30.0	29.9	24.4
NHM-S 47	24.7	24.6	34.0	43.0	32.7	31.8	26.0
NHM-S 48	25.5	23.0	29.6	43.8	32.3	30.8	25.2
NHM-S 49	26.4	27.0	29.9	41.4	31.8	31.3	25.6
NHM-S 50	26.3	25.5	33.2	43.5	31.8	32.1	26.2
NHM-S 51	29.2	29.3	38.2	-	36.1	33.2	30.4
NHM-S 52	26.3	24.4	29.4	38.9	33.1	30.7	25.1
NHM-S 53	23.0	24.2	33.1	43.3	31.5	31.0	25.4
NHM-S 54	23.4	25.9	33.4	47.1	34.1	32.6	26.7
NHM-S 55	-	24.7	42.5	46.2	37.6	37.8	29.0
NHM-S 56	37.9	-	36.5	48.0	37.7	40.0	31.3
NHM-S 57	23.2	22.8	32.0	40.9	33.4	30.5	24.9
NHM-S 58	25.5	24.3	31.0	40.3	30.7	31.9	24.9
NHM-S 59	23.3	22.8	7.6*	45.9	-	30.7	25.1
NHM-S 60	28.4	27.9	37.4	45.0	26.1	33.0	26.9
NHM-S 61	27.2	24.6	36.9	46.8	38.2	34.7	28.4
NHM-S 62	30.0	28.8	38.2	44.5	36.5	35.6	29.1
NHM-S 63	24.5	25.6	32.6	47.5	32.1	32.5	26.5
NHM-S 64	22.8	20.7	28.5	39.3	30.8	28.4	23.2
NHM-S 65	26.1	-	-	50.3	25.0	33.8	26.0
NHM-S 66	23.4	22.6	34.9	37.5	32.6	30.2	24.7
NHM-S 67	-	-	30.1	41.3	-	35.7	28.9[#]
NHM-S 68	33.5	28.9	27.7	42.2	41.8	34.8	28.5
NHM-S 69	32.1	26.9	-	-	34.3	31.1	30.0

NHM-S 70	24.7	-	30.5	42.4	34.2	33.0	25.8
NHM-S 71	27.6	26.2	38.3	44.5	37.1	34.7	28.4
NHM-S 72	-	25.0	-	-	-	25.0	20.3#
NHM-S 73	29.5	25.3	32.9	38.0	33.7	31.9	26.1
NHM-S 74	26.7	26.8	36.1	44.0	36.5	34.0	27.8
NHM-S 75	25.9	-	38.3	-	33.1	32.4	28.7
NHM-S 76	24.0	24.6	30.8	33.2	26.0	27.7	22.7
NHM-S 77	32.2	24.7	39.0	45.8	37.6	35.9	29.3
NHM-S 78	29.4	-	37.7	40.3	35.5	35.7	27.9
NHM-S 79	27.5	26.9	35.8	41.8	32.1	32.8	26.8
NHM-S 80	41.6	38.1	37.8	37.9	47.4	40.6	33.2
NHM-S 81	30.2	26.2	36.9	42.9	33.9	34.0	27.8
NHM-S 82	24.8	27.8	35.0	39.7	34.0	32.2	26.4
NHM-S 83	24.6	-	36.1	38.6	22.1	30.4	23.7
NHM-S 84	22.4	25.9	32.8	39.4	27.8	29.7	24.2
NHM-S 85	23.7	26.4	35.0	37.0	31.2	30.7	25.1
NHM-S 86	23.0	26.0	29.6	38.5	28.4	29.1	23.8
NHM-S 87	26.3	15.2	29.8	-	6.8*	23.8	22.7
NHM-S 88	23.2	26.1	33.8	38.2	29.8	30.2	24.7
NHM-S 89	29.2	27.2	32.9	44.9	35.6	34.0	27.8
NHM-S 90	26.0	27.8	37.3	45.2	27.3	32.7	26.7
NHM-S 91	40.8	33.6	44.1	55.6	39.6	42.7	34.9
NHM-S 92	21.2	25.8	-	33.7	27.3	27.0	22.1
NHM-S 93	21.6	26.5	25.3	34.6	30.3	27.7	22.6
NHM-S 94	19.6	20.6	27.6	38.9	28.6	27.1	22.1
NHM-S 95	39.1	34.3	40.2	57.9	41.9	42.7	34.9
NHM-S 96	23.1	24.0	29.0	38.0	29.3	28.7	23.4
NHM-S 97	22.1	21.9	12.1	36.3	24.8	23.4	19.2
NHM-S 98	24.6	25.9	-	-	33.9	28.1	27.1
NHM-S 99	26.0	28.4	30.6	40.3	32.7	32.4	25.3

Notes:
Bias adjustment was carried out using a local bias adjustment factor obtained from a co-location study at Cam Road. Annualisation was completed using four nearby, urban background sites with >85% data capture: Wren Close – Newham, Camden – Bloomsbury, Tower Hamlets – Millwall Park, Tower Hamlets – Victoria Park and Waltham Forest Leyton.
'-' shows that result is not available, this is because tube was missing when collection attempted at the end of the monitoring period.
'*' shows that the result appears to be anomalous although no comments were made during laboratory analysis, due to this the result has been excluded in average calculations.
'#' shows that the result was not annualised due to low data capture, therefore only bias adjusted.
Values stated in red indicate that the results are compromised due to the diffusion tube containing spiders/nests/webs or other materials, due to this the result has been excluded in average calculations.
Values in *italics* are within 10% of the annual mean objective of 40µg/m^3, values in **bold** are exceeding the annual mean objective of 40µg/m^3.

7 Discussion

7.1 Assessment of Nitrogen Dioxide (NO_2)

Within this section a brief discussion of the NO_2 monitoring results will be completed, with trends identified throughout the year as more monitoring data becomes available. January is the sixth month of monitoring completed, therefore some trends are becoming apparent but a limited amount of analysis is able to be completed. Out of the 99 school locations with monitoring locations, during the Month 6 monitoring period results were returned for 94 schools. Results were not returned at five schools due to diffusion tubes having been removed during the monitoring period.

Within the Month 6 monitoring period, 60 of the monitoring locations recorded concentrations greater than 36µg/m^3 (within 10% of the annual mean NO_2 objective), with 34 of the locations exceeding the annual mean objective of 40µg/m^3. NHM-S 65 and NHM-S 11 (Lister Community School and Plashet School respectively) are now recording rolling averages greater than the annual mean objective, in addition to the six locations that were already exceeding the annual mean objective in rolling averages during the Month 5 monitoring period (NHM-S 95, NHM-S 91, NHM-S 80, NHM-S 56, NHM-S 30, NHM-S 7).

NHM-S 65 recorded the highest concentration during the Month 6 monitoring period of 59.5µg/m^3. There are no nearby junctions in close proximity to the monitoring location, however the narrow road and on-street parking may increase levels of congestion and the volume of slow moving or idling vehicles, leading to a higher concentration of NO_2 in the vicinity of the school. There were no exceedances of 60µg/m^3 during the M6 period. A concentration greater than 60µg/m^3, as per LAQM.TG(16)[14] guidance, implies that there may have been exceedances of the short term AQS objective of 200µg/m^3 during that period.

NHM-S 7 (St Winefride's RC Primary School) continues to record the highest rolling average of 48.5µg/m^3. It should be noted that this is based upon six months of data and without any bias adjustment completed. NHM-S 7 is located on the corner of a junction, although it is not on a major road, the monitoring location is adjacent to a cross junction which has street parking on all four access roads as well as a kerb extension that reduces traffic flow to one lane. Therefore this monitoring location is more likely than other monitoring locations to be influenced by idling vehicles and congestion.

Table 6.4 shows the annualised and bias adjusted averages at each of the 99 schools during 2019, following calculation of a local bias adjustment factor (0.81) from a co-location study at Cam Road automatic monitoring station. None of the monitoring locations exceed the annual mean NO_2 objective and only one location is within 10% following annualisation and bias adjustment (NHM-S 7) in line with TG(16) guidance. At this time, a proportion of the continuous monitoring data used in annualisation calculations is provisional, therefore calculations will be updated once all data has been ratified.

The average concentration recorded across all monitoring locations in the Month 6 monitoring period was 38.5µg/m^3, approximately a 6µg/m^3 increase compared to the average concentration recorded in Month 5 of 32.5µg/m^3. This increase was also recorded at the nearby automatic monitoring stations, Cam Road and Wren Close, where average concentrations of 33.2µg/m^3 and 29.4µg/m^3 were recorded in the Month 6 monitoring period. This was an increase of approximately 40% from the Month 5 monitoring period, which corresponds to the increases noticed across almost all monitoring locations that returned results this month. There was a clear spike in results during the Month 6 monitoring period, similar to the spike in results seen during November (Month 4). This increase seen during January (Month 6) compared to December (Month 5) could be attributed to

[14] Defra, 2018. Local Air Quality Management, Technical Guidance TG(16) available at: https://laqm.defra.gov.uk/documents/LAQM-TG16-February-18-v1.pdf

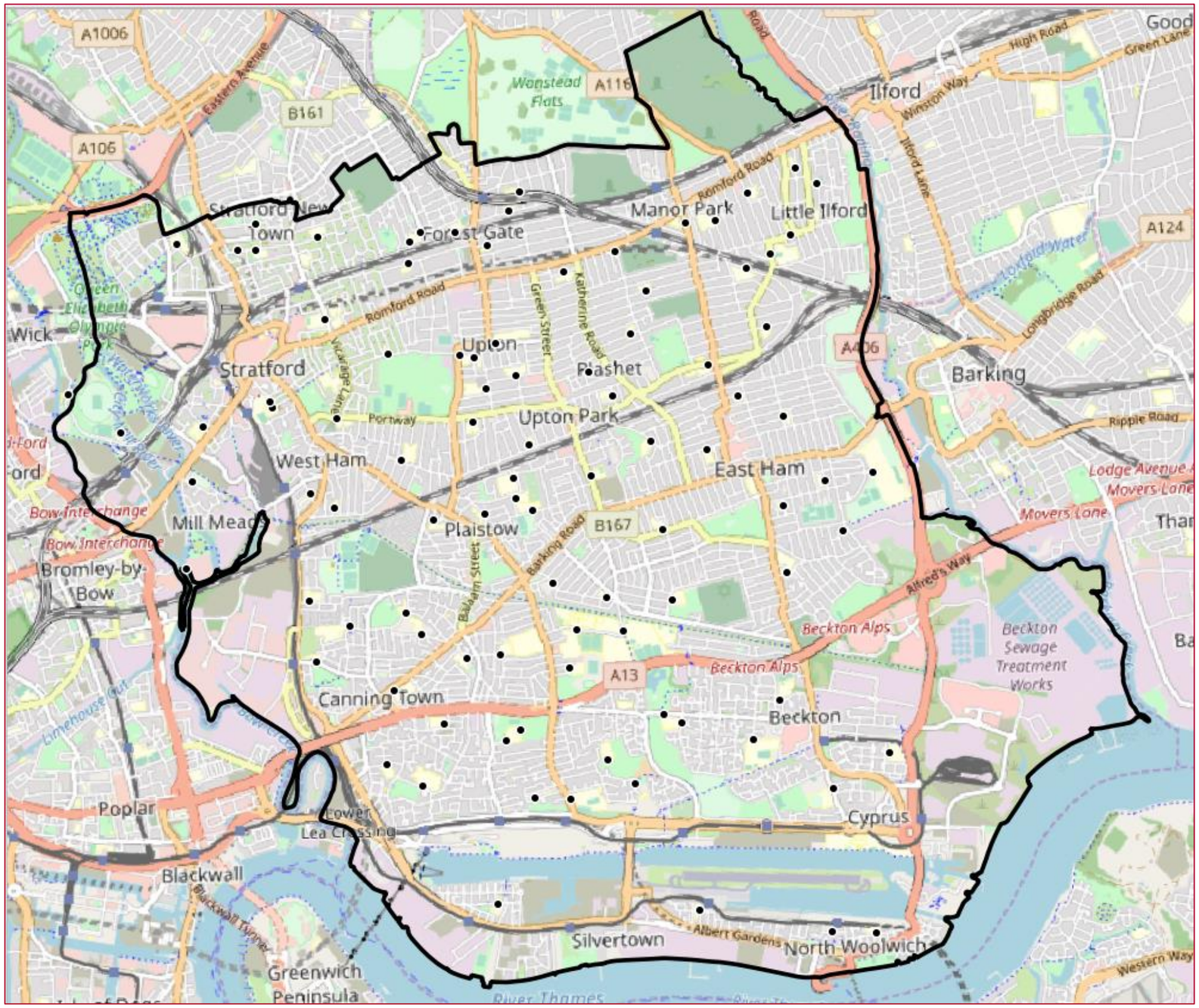
the school holiday period over Christmas that will have led to a decrease in the amount of cars on the roads around the schools.

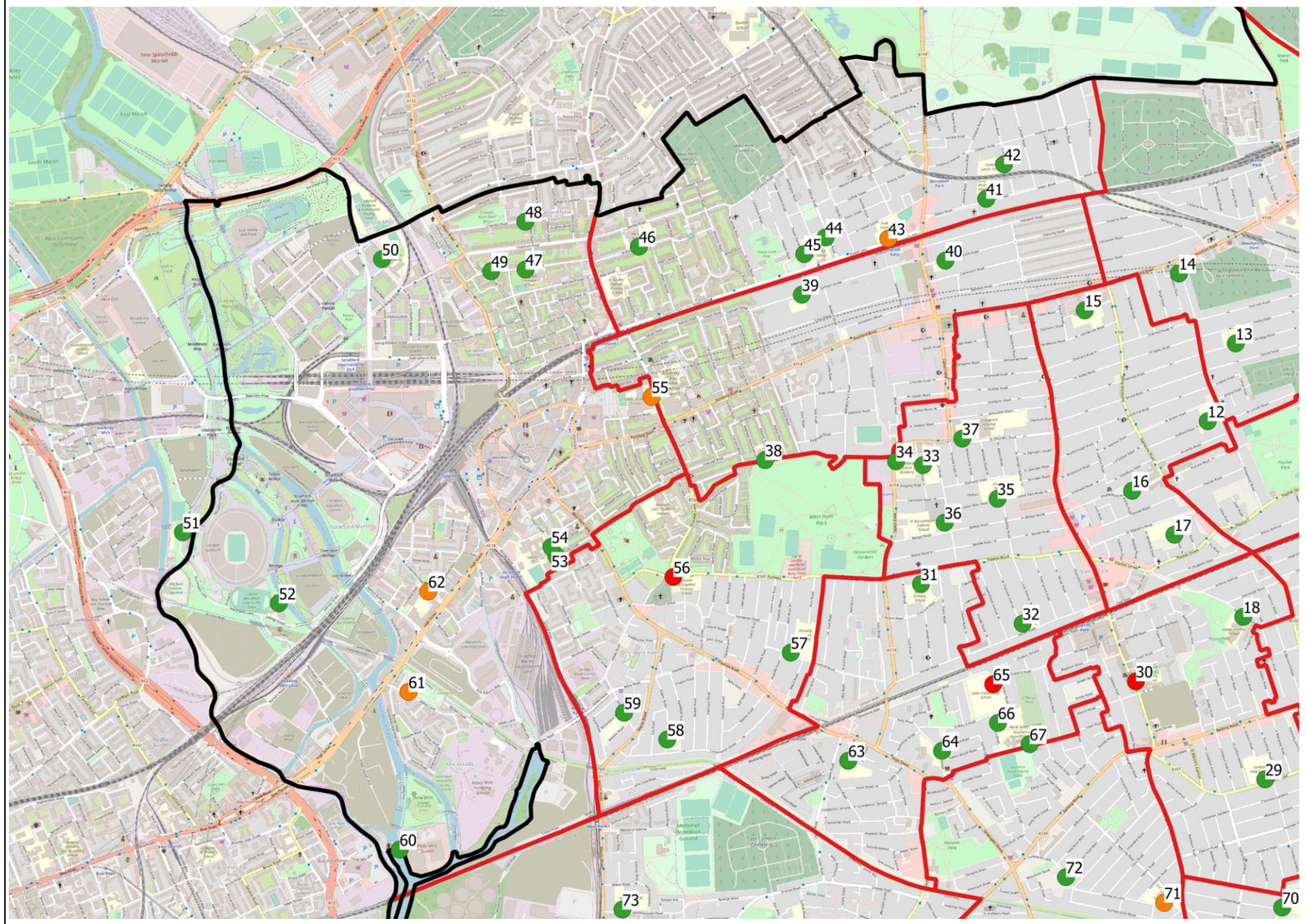
There were no pollution episodes recorded during the January monitoring period. It can be seen that the school locations have an average concentration higher than both the roadside and background monitoring stations, suggesting that the NO_2 measured at the monitoring locations is partly originating from localised sources.

In Appendix A, all 99 monitoring locations are shown in a map plot with the borough boundary as the black outline and the monitoring locations represented as black dots. A further four maps are included that present the rolling annual mean monitoring results in reference to the annual mean NO_2 objective. The monitoring sites are labelled by their site code as per Fig. A1, 2, 3 & 4, they are colour coded to represent different NO_2 concentration brackets (green - <36µg/m^3, amber - 36 - 40µg/m^3, red - >40µg/m^3). It should be noted that due to the figure split that a number of monitoring locations appear within more than one chart. In addition, trend charts are presented for all monitoring sites split across the ward boundaries from where they are located within Newham.

Appendix A - Monitoring Locations

London Borough of Newham School Monitoring Locations





Legend

NO2 Rolling Average Concentration (µg/m3)

- <36.0
- 36.0 - 40.0
- >40.0

Newham Borough Boundary

Newham Ward Boundaries

Air Quality
Bureau Veritas
5th Floor
66 Prescot Street
London, E1 8HG

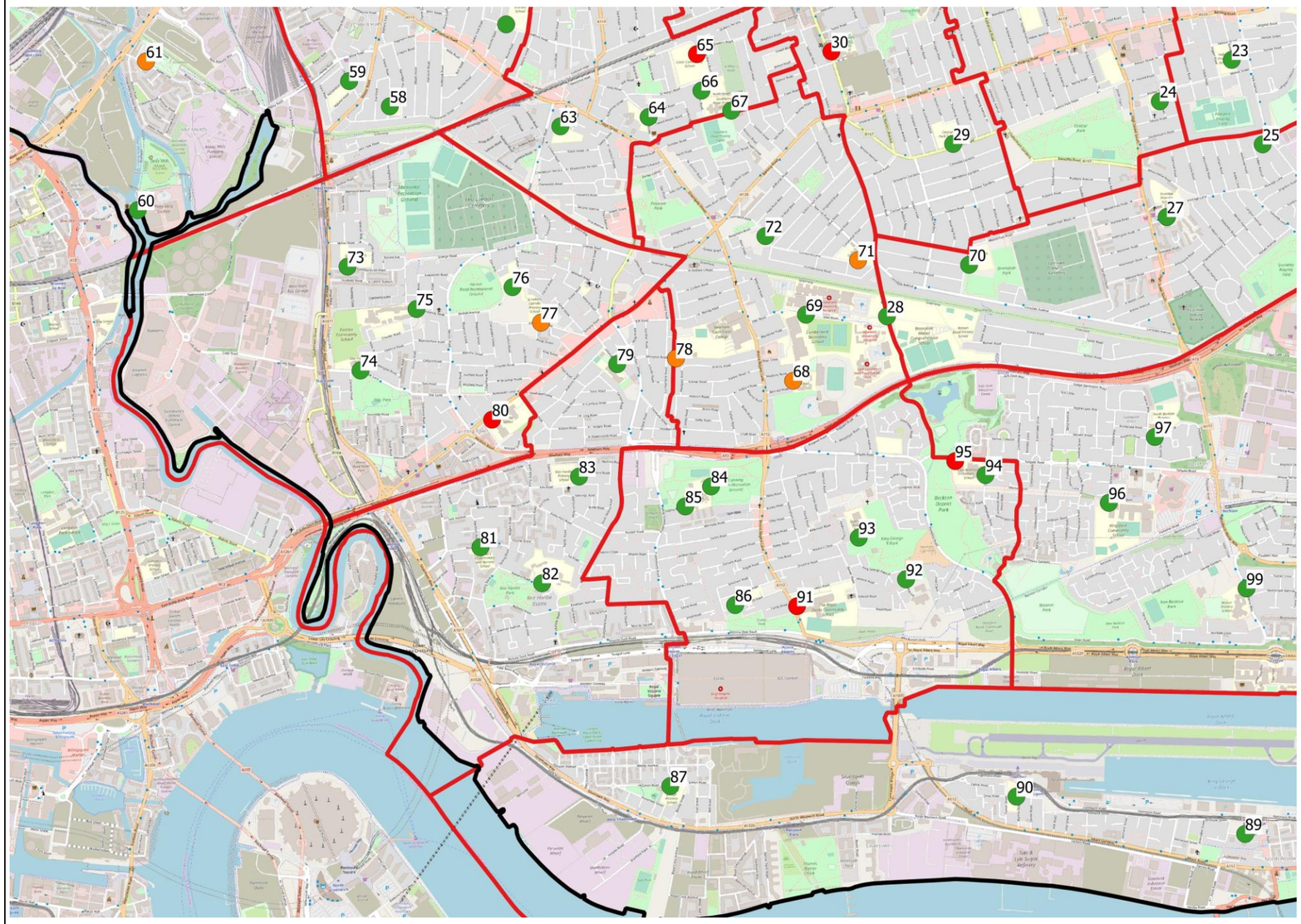
Location

London Borough of Newham

Title

Rolling Averages as of January 2020: North West Newham School Monitoring locations

By	Approved
PS	PB
Scale	**Job Ref**
1:16000	6487713
Date	**Figure No.**
March 2020	A.1



Legend

NO2 Rolling Average Concentration (µg/m3)

- <36.0
- 36.0 - 40.0
- >40.0

Newham Borough Boundary

Newham Ward Boundaries

Air Quality
Bureau Veritas
5th Floor
66 Prescot Street
London, E1 8HG

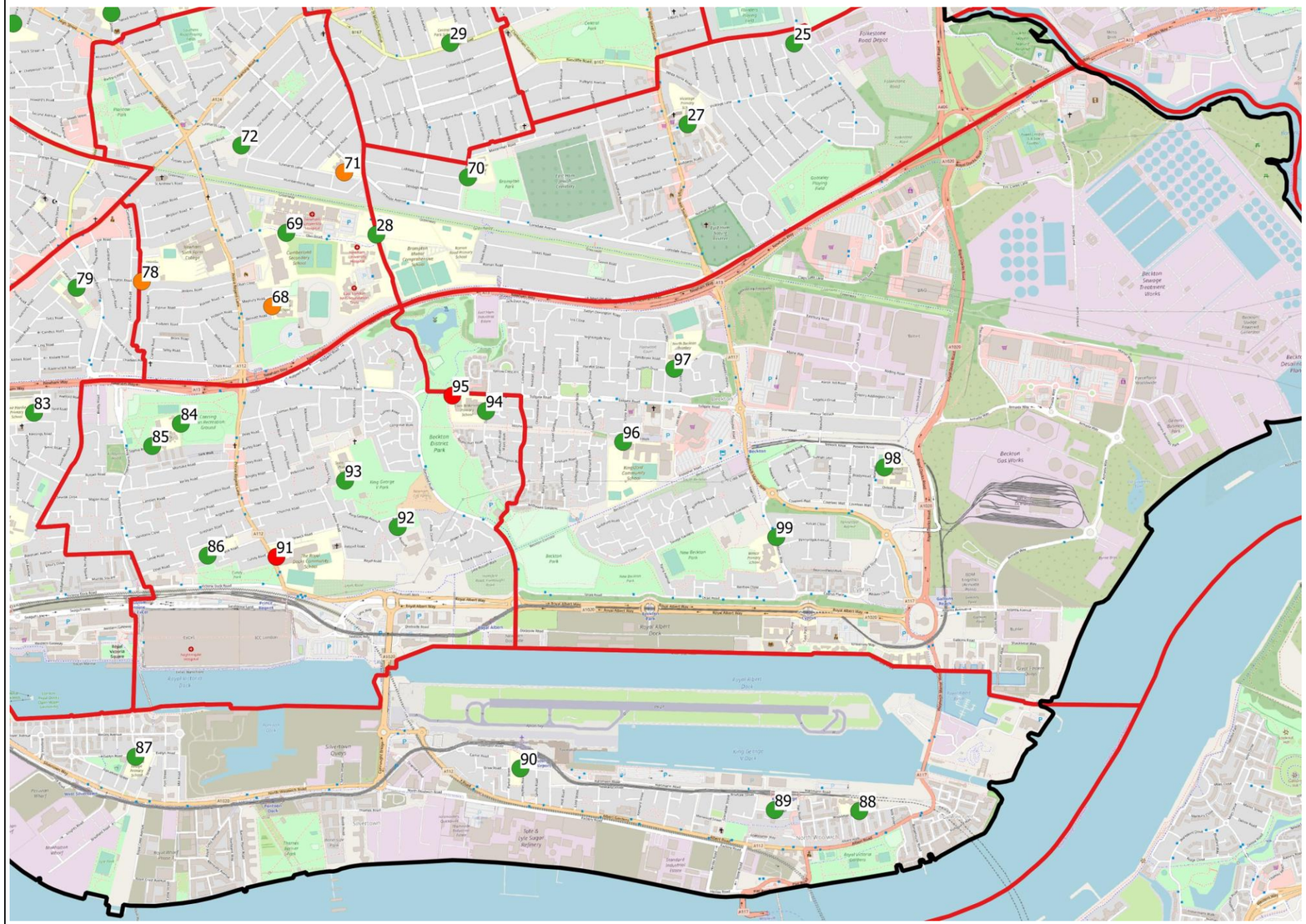
Location

London Borough of Newham

Title

Rolling Averages as of January 2020: South West Newham School Monitoring locations

By	Approved
PS	PB
Scale	**Job Ref**
1:16000	6487713
Date	**Figure No.**
March 2020	A.2



Legend

NO2 Rolling Average Concentration (µg/m3)

- <36.0
- 36.0 - 40.0
- >40.0

Newham Borough Boundary

Newham Ward Boundaries

Air Quality
Bureau Veritas
5th Floor
66 Prescot Street
London, E1 8HG

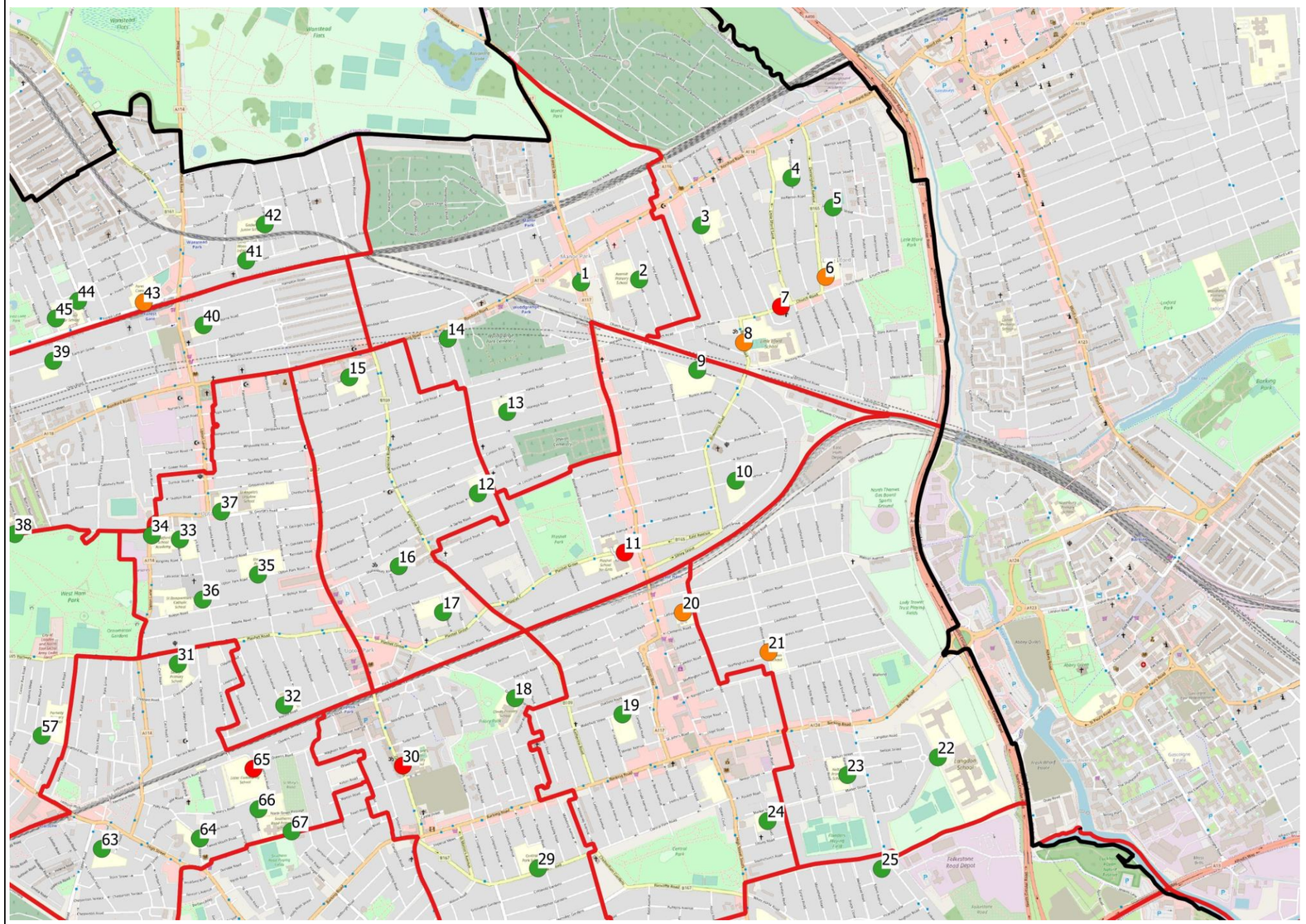
Location

London Borough of Newham

Title

Rolling Averages as of January 2020: South East Newham School Monitoring locations

By	Approved
PS	PB
Scale	**Job Ref**
1:16000	6487713
Date	**Figure No.**
March 2020	A.3



Legend

NO2 Rolling Average Concentration (µg/m3)

- <36.0
- 36.0 - 40.0
- >40.0
- Newham Borough Boundary
- Newham Ward Boundaries

Air Quality
Bureau Veritas
5th Floor
66 Prescot Street
London, E1 8HG

Location

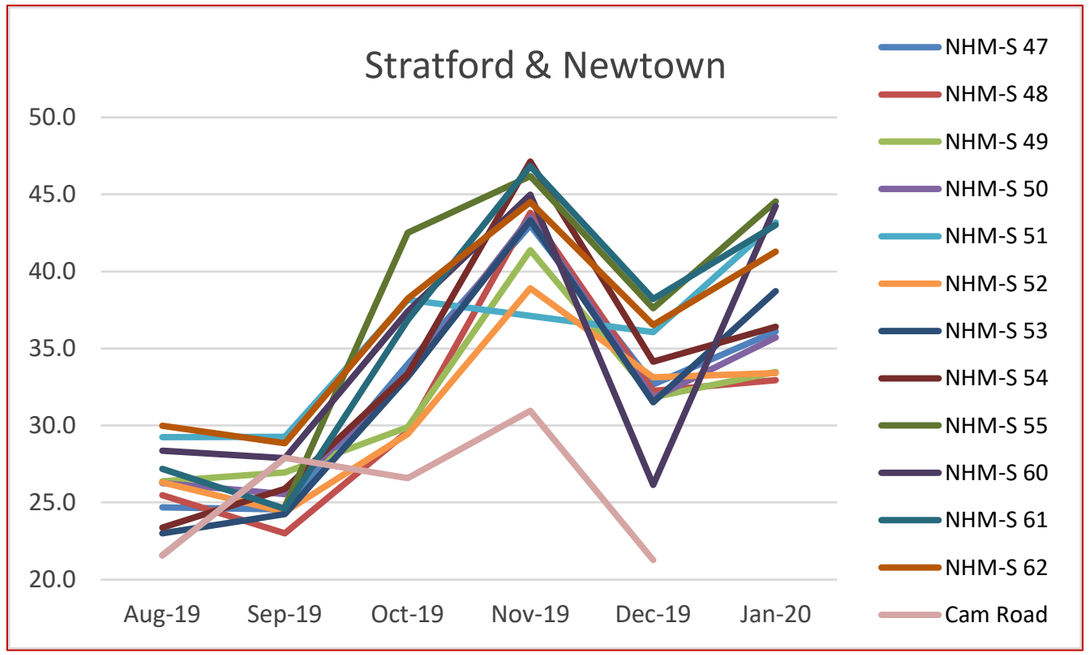
London Borough of Newham

Title

Rolling Averages as of January 2020: North East Newham School Monitoring locations

By	Approved
PS	PB
Scale	**Job Ref**
1:16000	6487713
Date	**Figure No.**
March 2020	A.4

Appendix B - London Borough of Newham School Diffusion Tubes Trend Graphs by Wards


Stratford & Newtown
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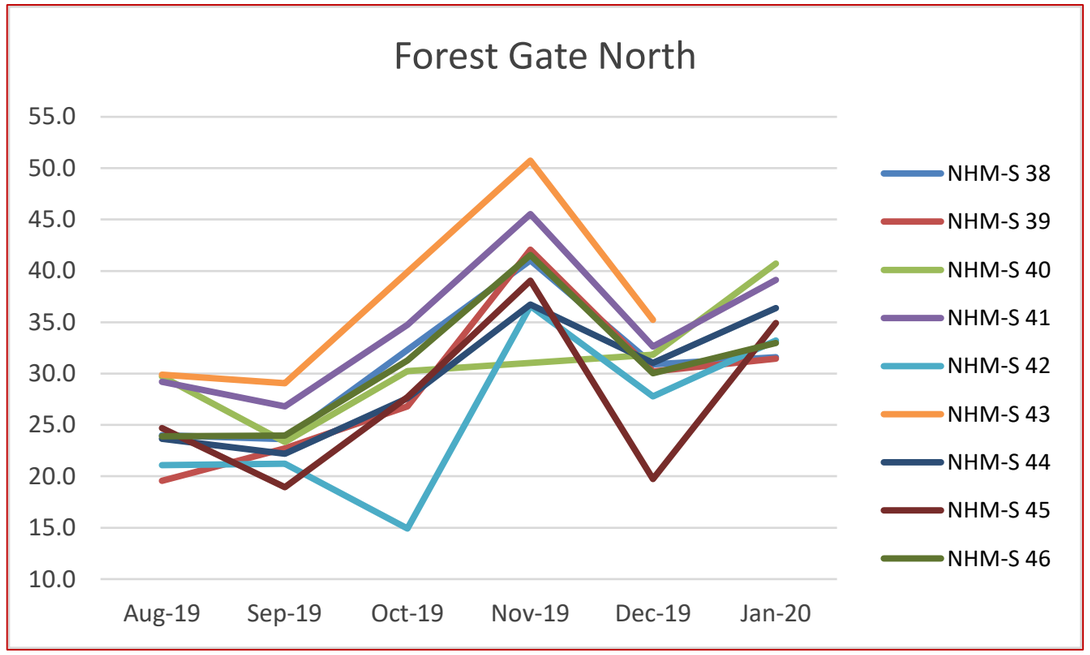
45.0
40.0
35.0
30.0
25.0
20.0
Aug-19
Sep-19
Oct-19
Nov-19
Dec-19
Jan-20
NHM-S 47
NHM-S 48
NHM-S 49
NHM-S 50
NHM-S 51
NHM-S 52
NHM-S 53
NHM-S 54
NHM-S 55
NHM-S 60
NHM-S 61
NHM-S 62
Cam Road


Forest Gate North
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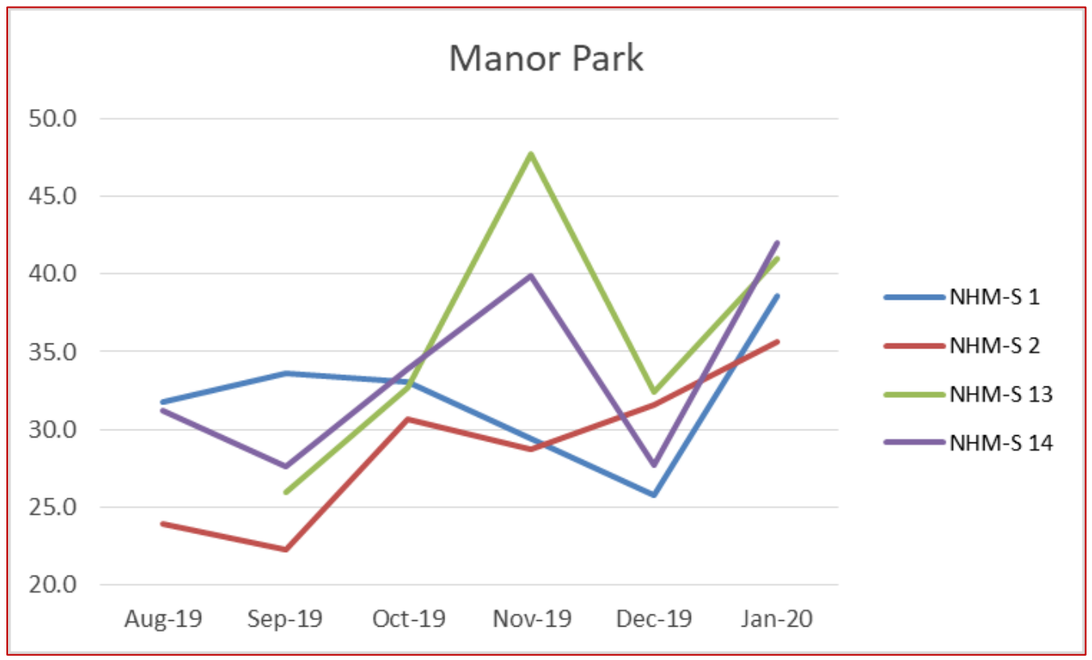
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
Aug-19
Sep-19
Oct-19
Nov-19
Dec-19
Jan-20
NHM-S 38
NHM-S 39
NHM-S 40
NHM-S 41
NHM-S 42
NHM-S 43
NHM-S 44
NHM-S 45
NHM-S 46


Manor Park
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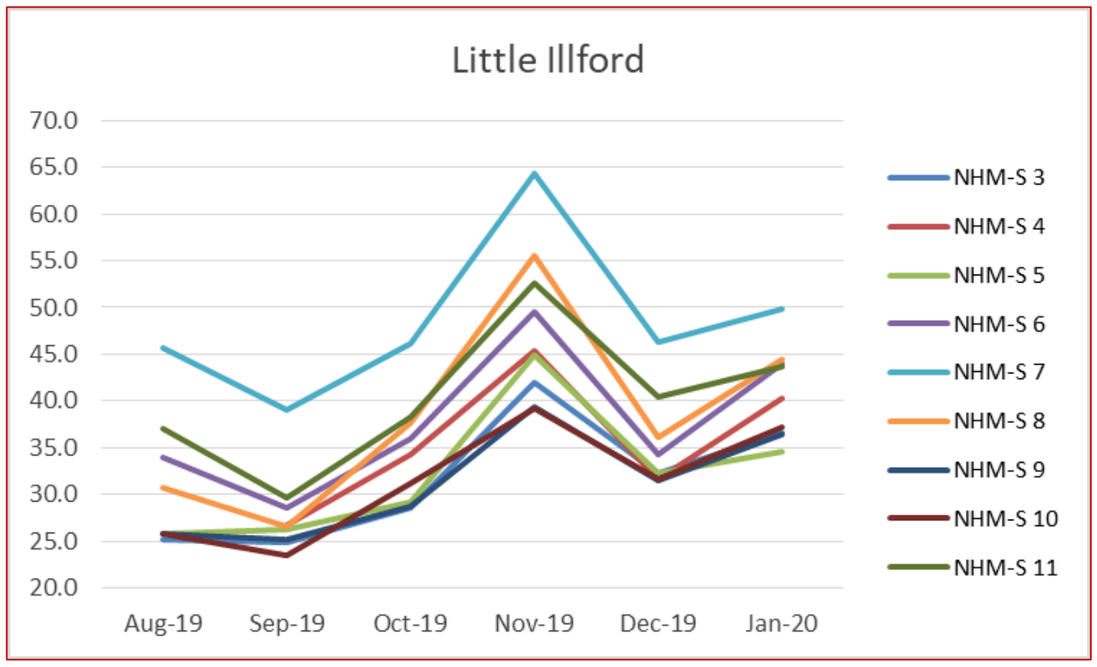
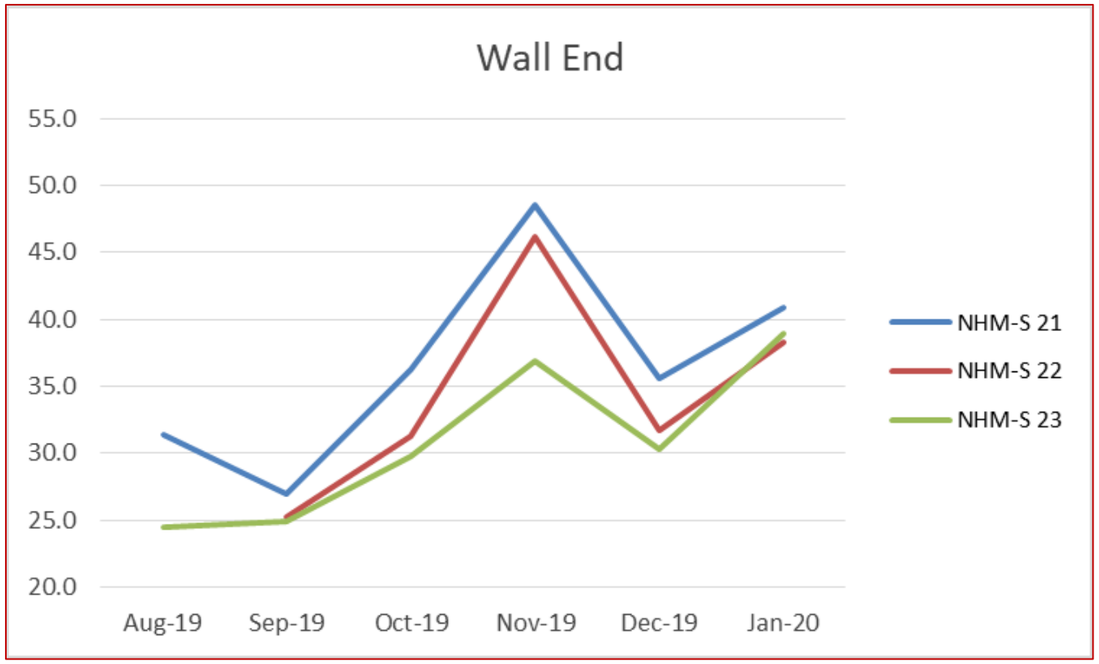
45.0
40.0
35.0
30.0
25.0
20.0
Aug-19
Sep-19
Oct-19
Nov-19
Dec-19
Jan-20
NHM-S 1
NHM-S 2
NHM-S 13
NHM-S 14


Little Illford
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
Aug-19
Sep-19
Oct-19
Nov-19
Dec-19
Jan-20
NHM-S 3
NHM-S 4
NHM-S 5
NHM-S 6
NHM-S 7
NHM-S 8
NHM-S 9
NHM-S 10
NHM-S 11


Wall End
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50.0
45.0
40.0
35.0
30.0
25.0
20.0
Aug-19
Sep-19
Oct-19
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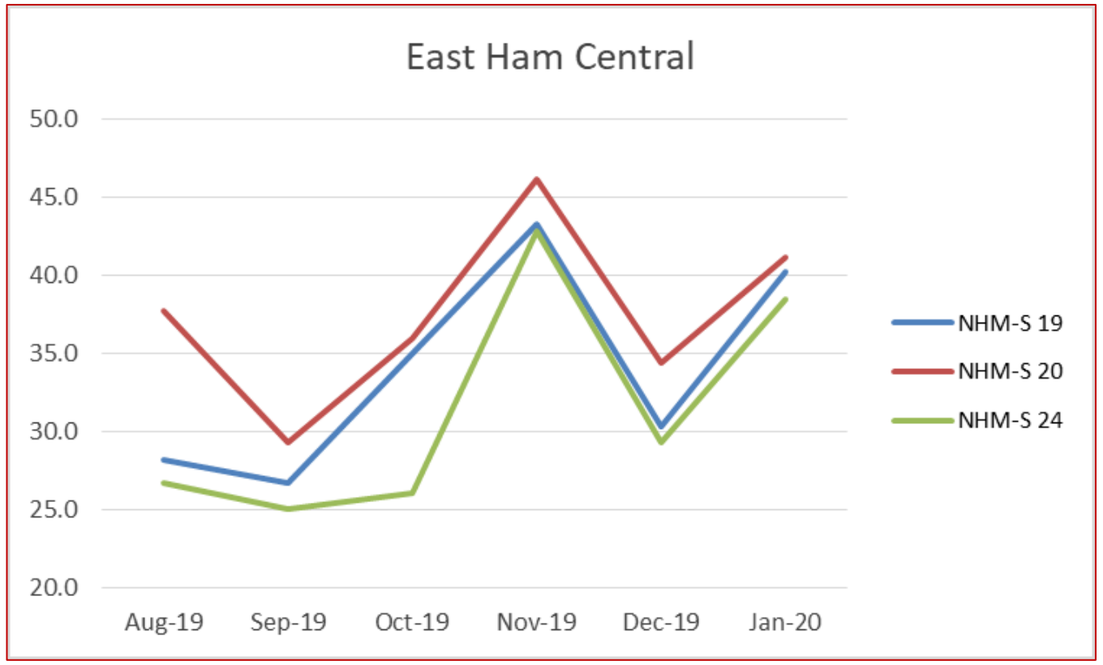
Jan-20
NHM-S 21
NHM-S 22
NHM-S 23


East Ham Central
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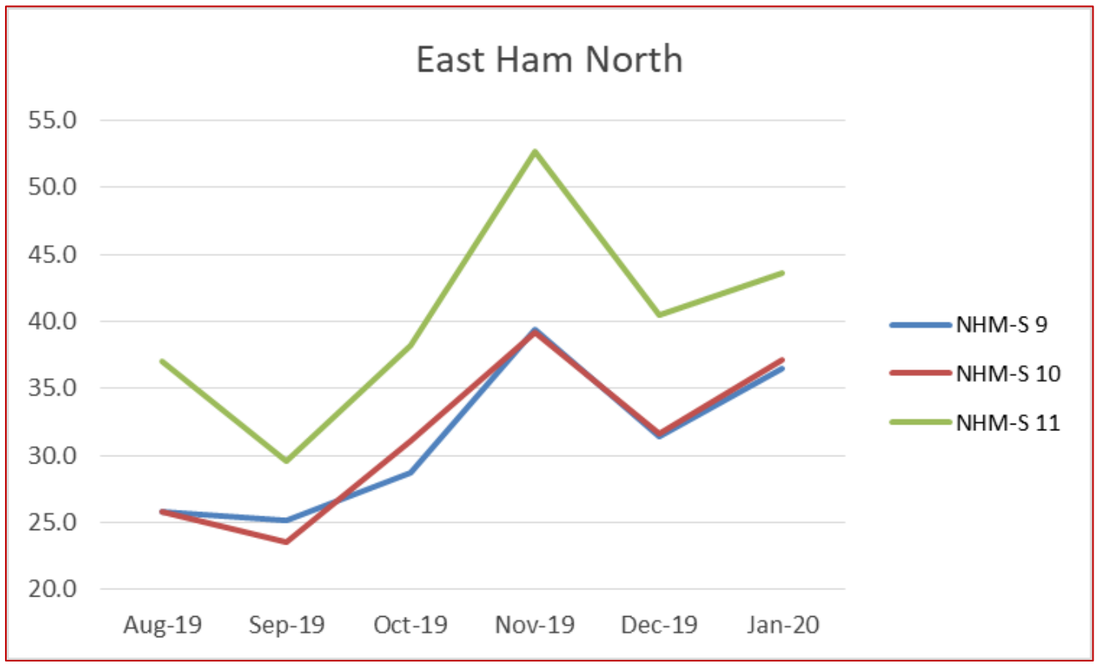
35.0
30.0
25.0
20.0
Aug-19
Sep-19
Oct-19
Nov-19
Dec-19
Jan-20
NHM-S 19
NHM-S 20
NHM-S 24


East Ham North
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50.0
45.0
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35.0
30.0
25.0
20.0
Aug-19
Sep-19
Oct-19
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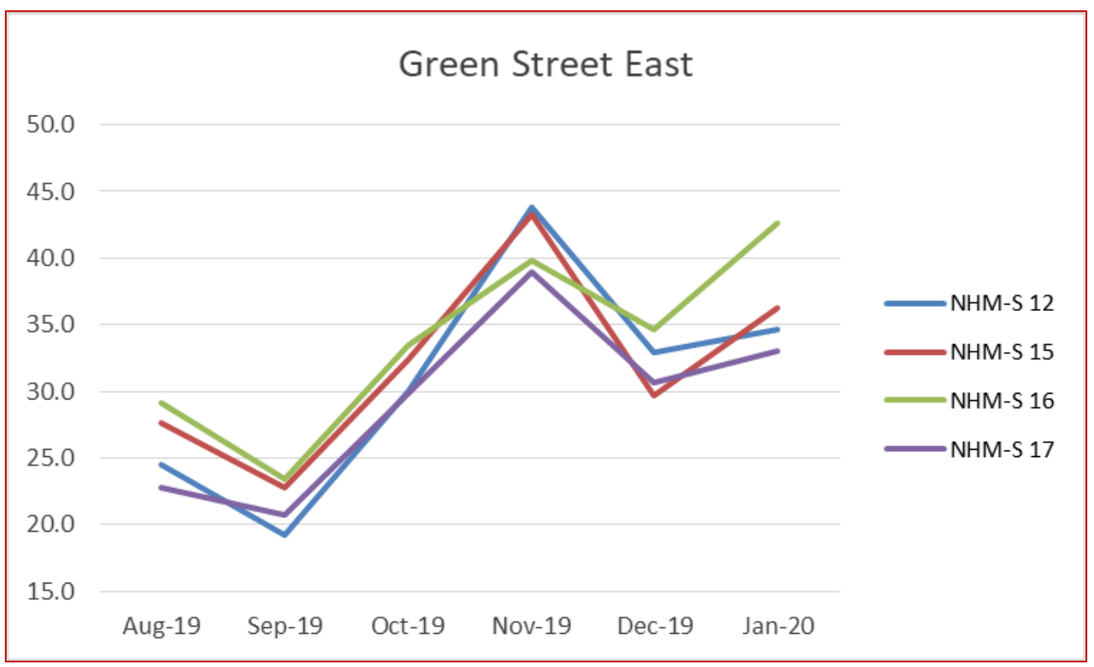
Dec-19
Jan-20
NHM-S 9
NHM-S 10
NHM-S 11


Green Street East
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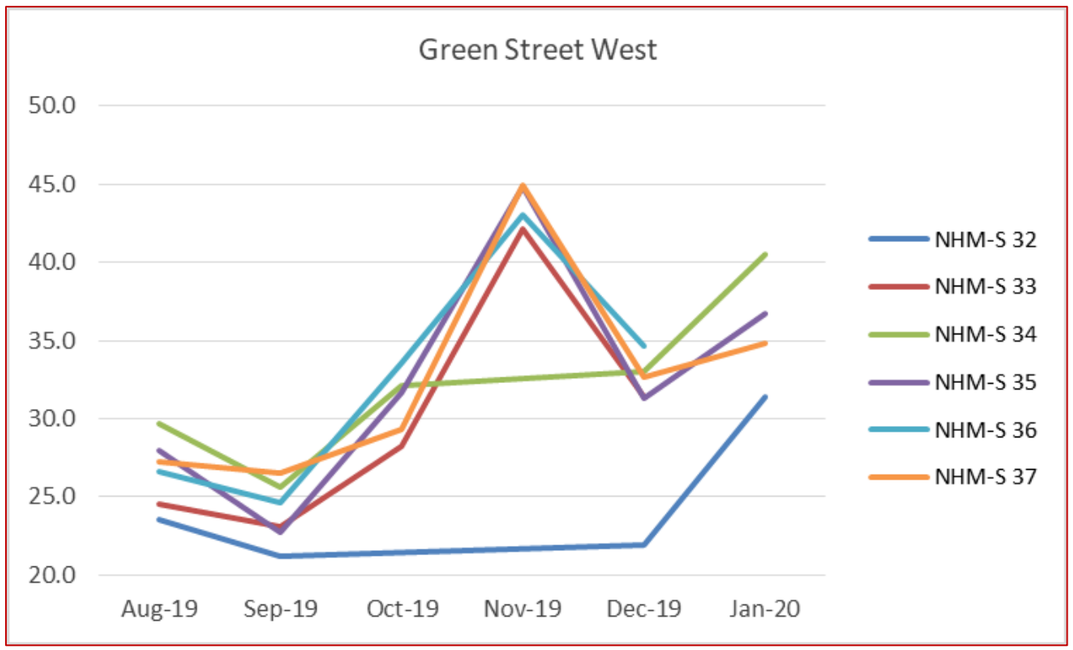
45.0
40.0
35.0
30.0
25.0
20.0
15.0
Aug-19
Sep-19
Oct-19
Nov-19
Dec-19
Jan-20
NHM-S 12
NHM-S 15
NHM-S 16
NHM-S 17


Green Street West
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45.0
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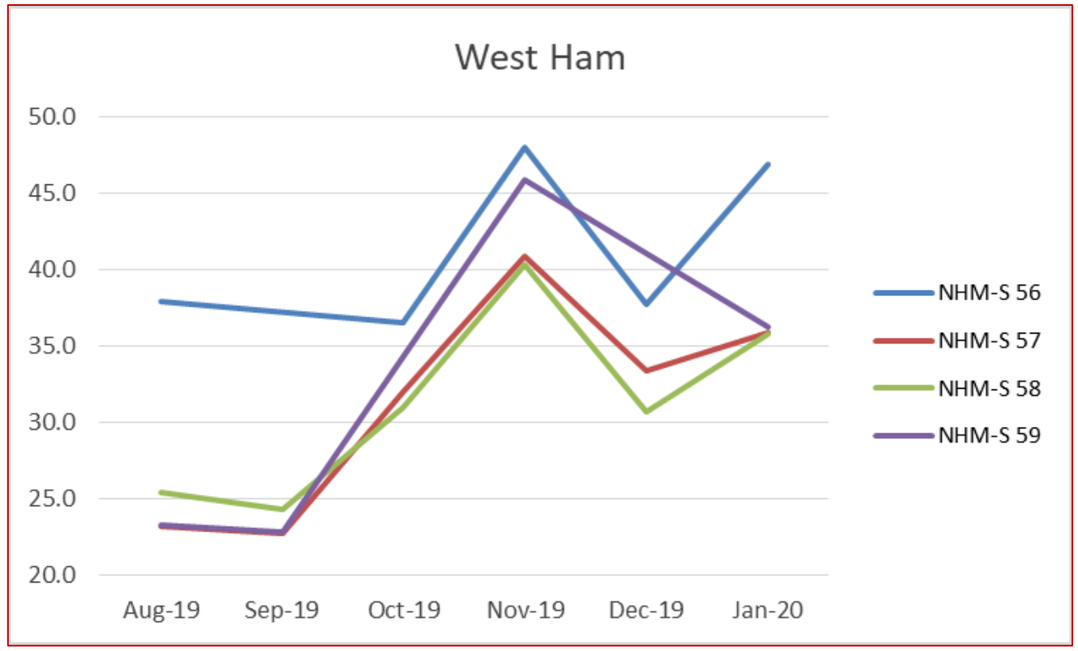
35.0
30.0
25.0
20.0
Aug-19
Sep-19
Oct-19
Nov-19
Dec-19
Jan-20
NHM-S 32
NHM-S 33
NHM-S 34
NHM-S 35
NHM-S 36
NHM-S 37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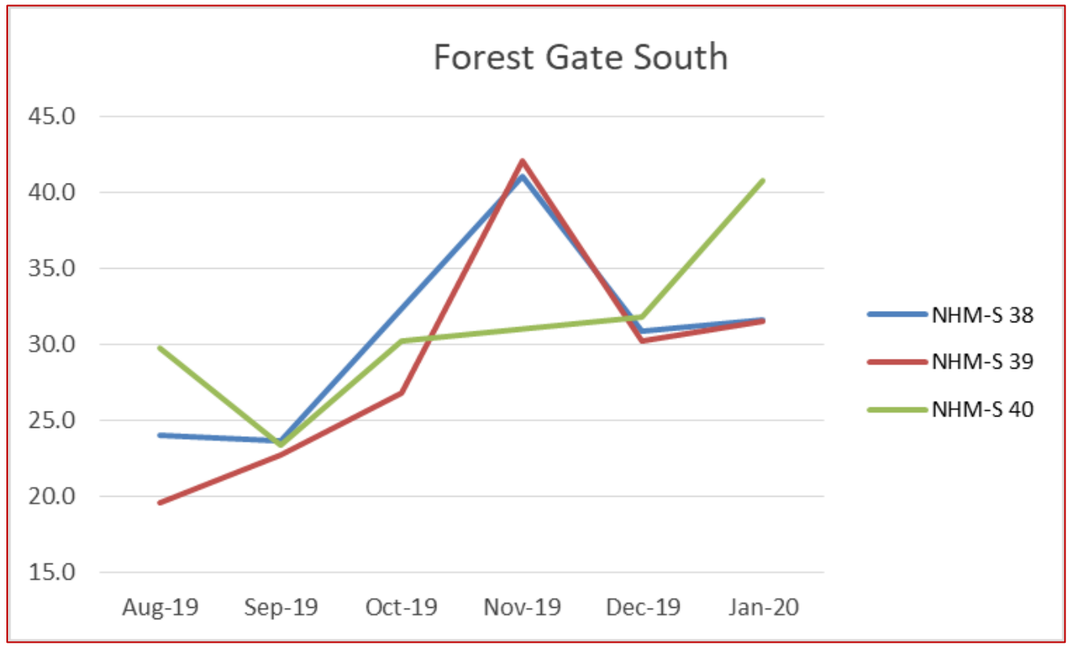
30.0
25.0
20.0
Aug-19
Sep-19
Oct-19
Nov-19
Dec-19
Jan-20
NHM-S 56
NHM-S 57
NHM-S 58
NHM-S 59


Forest Gate South
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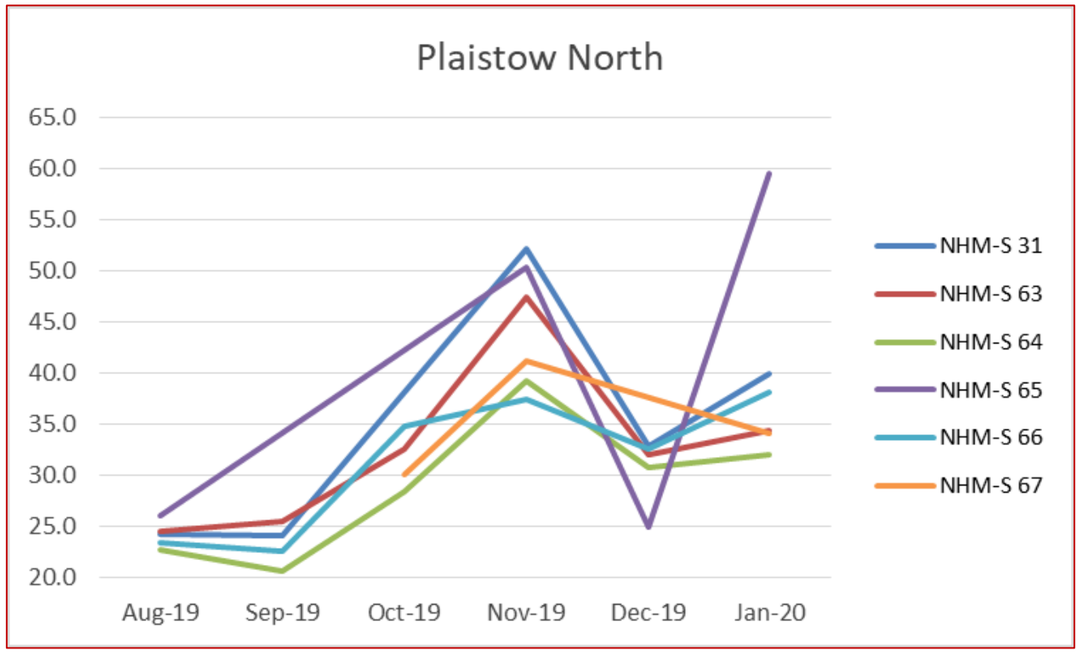
40.0
35.0
30.0
25.0
20.0
15.0
Aug-19
Sep-19
Oct-19
Nov-19
Dec-19
Jan-20
NHM-S 38
NHM-S 39
NHM-S 40


Plaistow North
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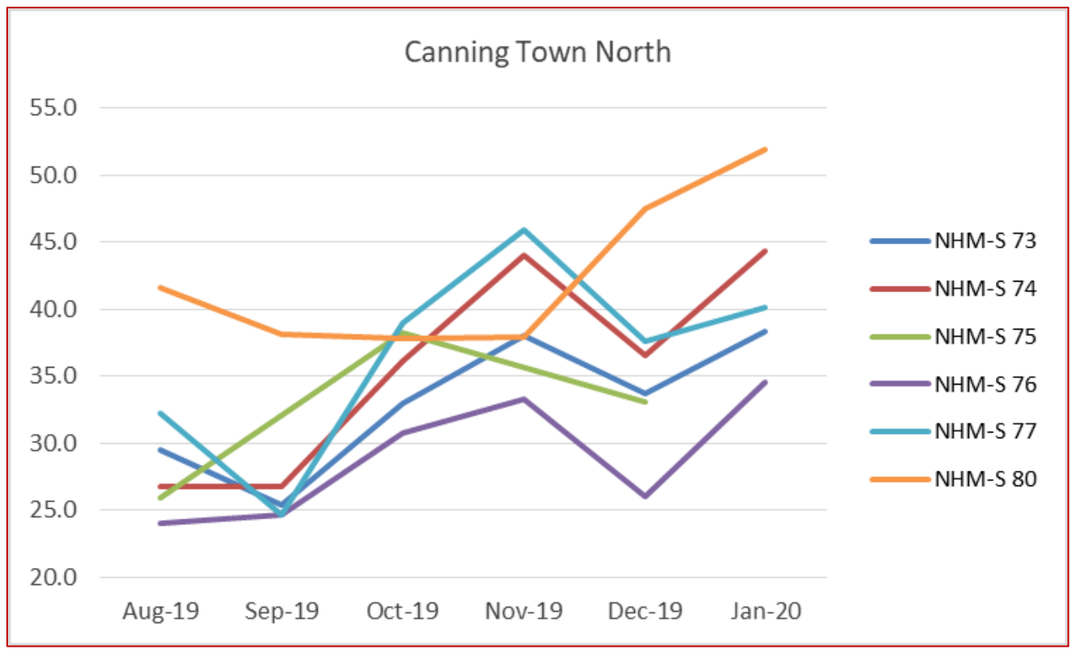
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
Aug-19
Sep-19
Oct-19
Nov-19
Dec-19
Jan-20
NHM-S 31
NHM-S 63
NHM-S 64
NHM-S 65
NHM-S 66
NHM-S 67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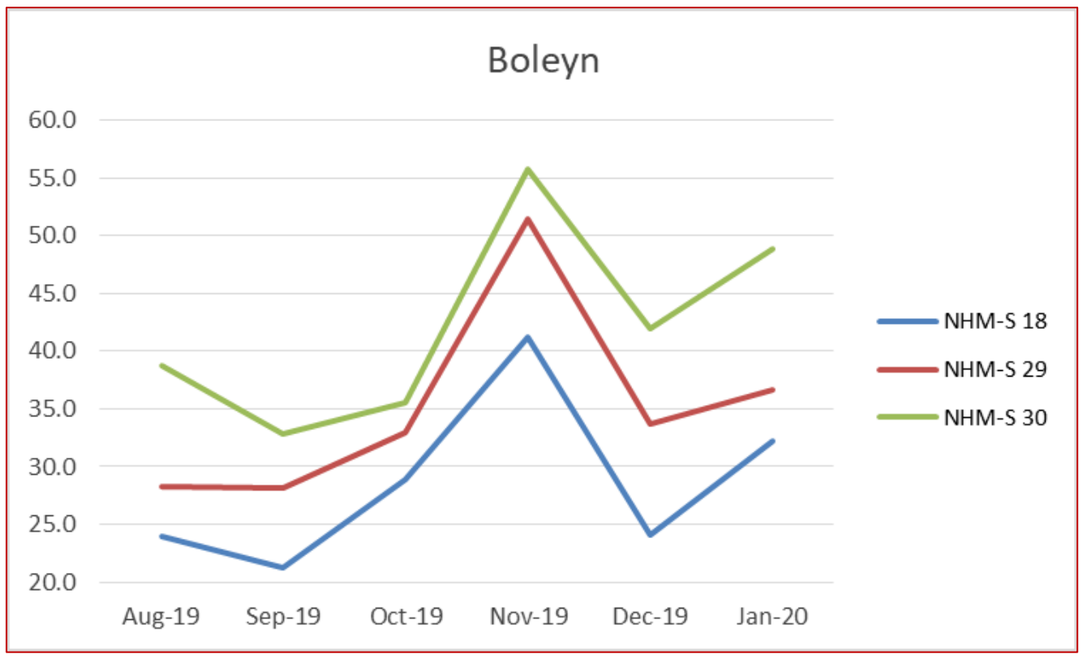
35.0
30.0
25.0
20.0
Aug-19
Sep-19
Oct-19
Nov-19
Dec-19
Jan-20
NHM-S 73
NHM-S 74
NHM-S 75
NHM-S 76
NHM-S 77
NHM-S 80


Boleyn
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30.0
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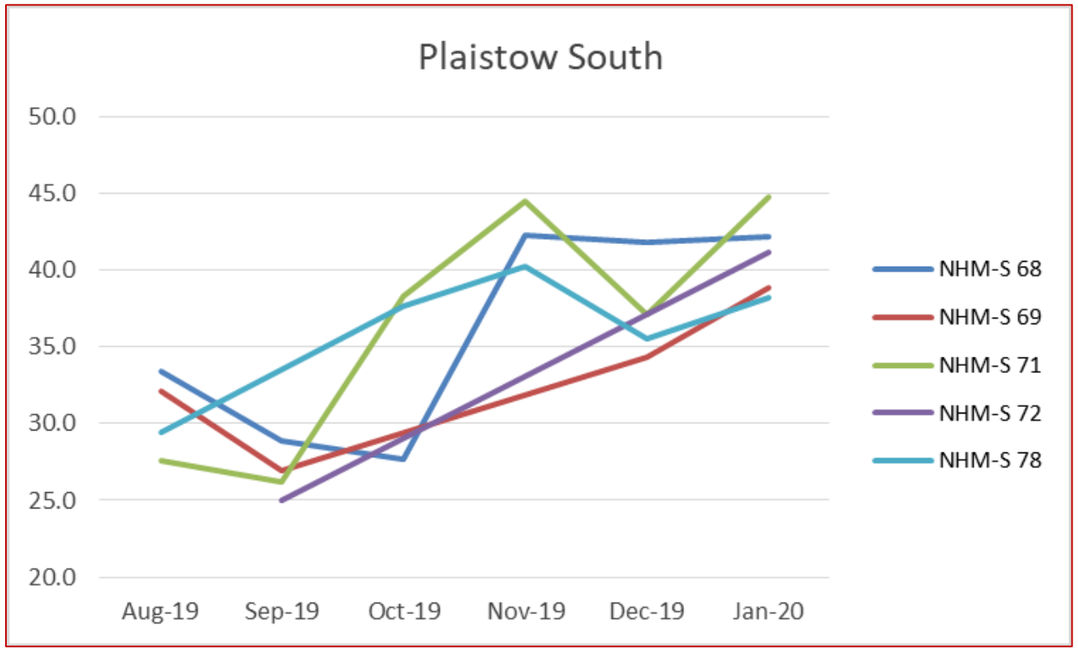
Jan-20
NHM-S 18
NHM-S 29
NHM-S 30


Plaistow South
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25.0
20.0
Aug-19
Sep-19
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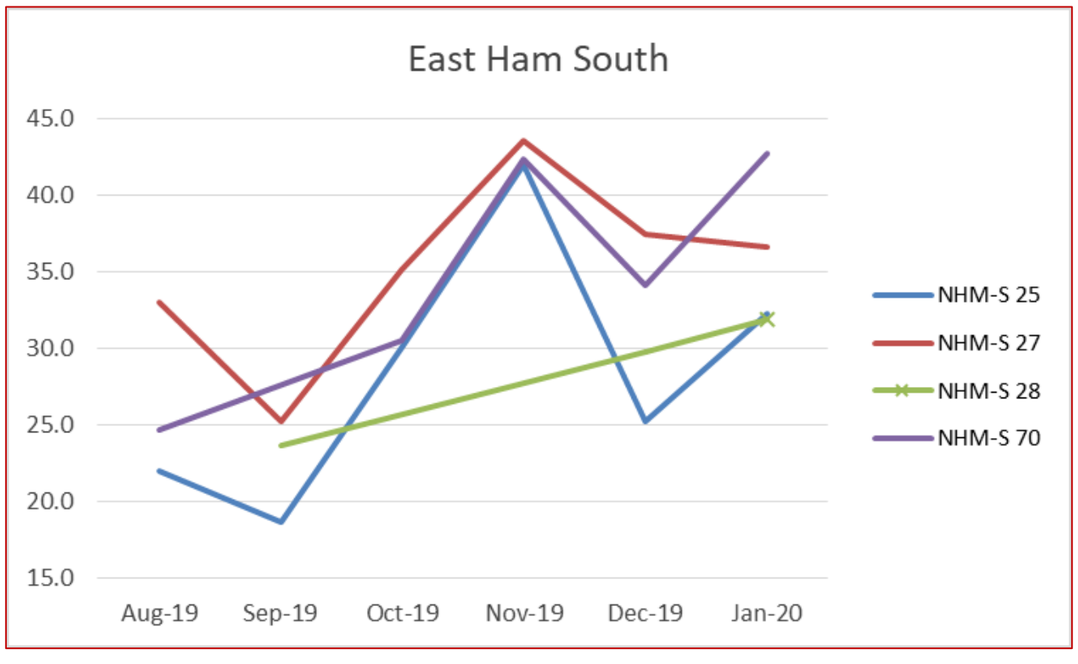
Dec-19
Jan-20
NHM-S 68
NHM-S 69
NHM-S 71
NHM-S 72
NHM-S 78


East Ham South
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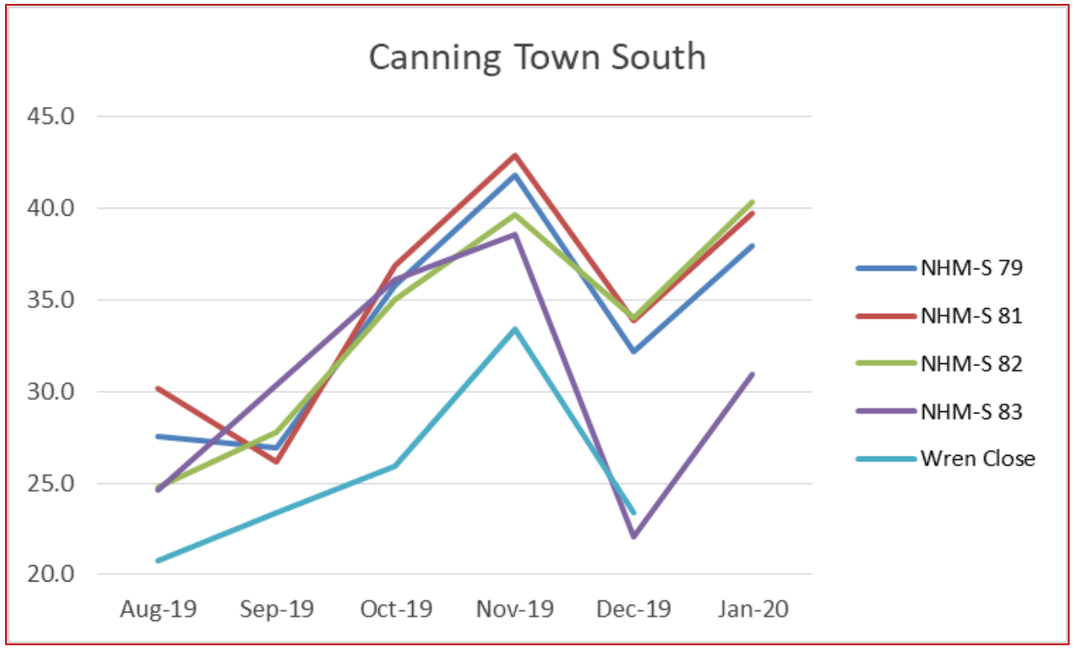
40.0
35.0
30.0
25.0
20.0
15.0
Aug-19
Sep-19
Oct-19
Nov-19
Dec-19
Jan-20
NHM-S 25
NHM-S 27
NHM-S 28
NHM-S 70


Canning Town South
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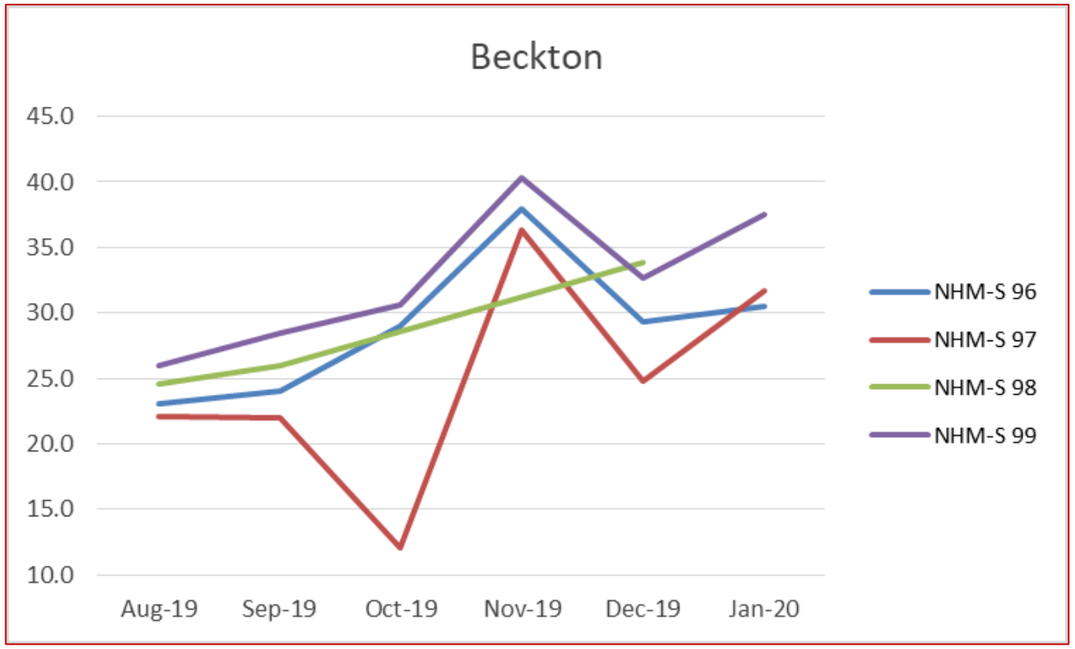
35.0
30.0
25.0
20.0
Aug-19
Sep-19
Oct-19
Nov-19
Dec-19
Jan-20
NHM-S 79
NHM-S 81
NHM-S 82
NHM-S 83
Wren Close


Beckton
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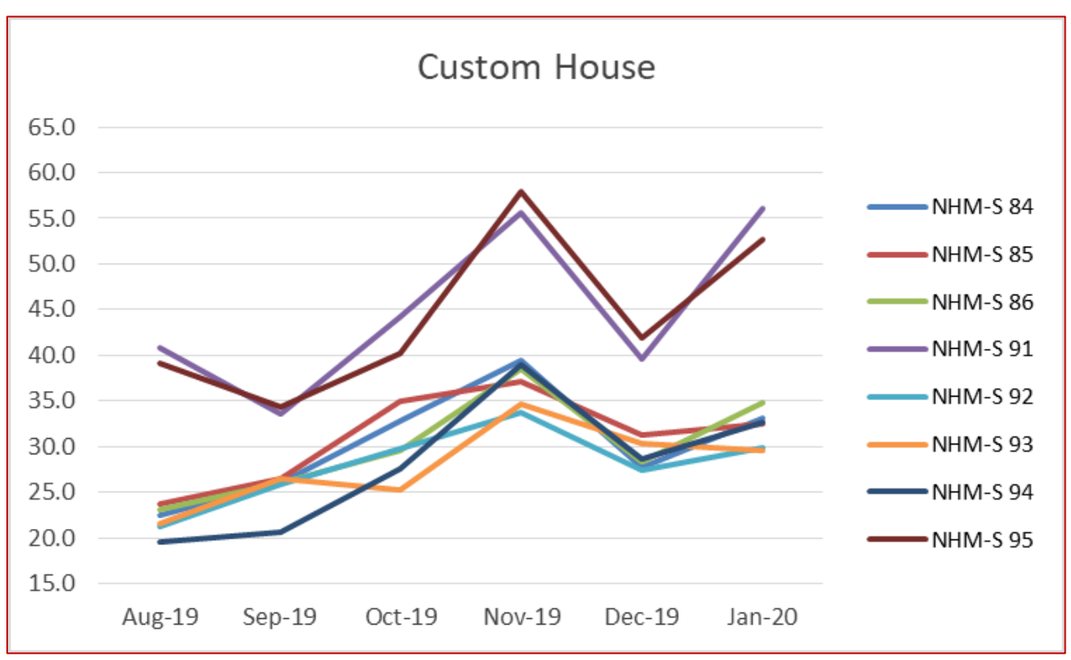
30.0
25.0
20.0
15.0
10.0
Aug-19
Sep-19
Oct-19
Nov-19
Dec-19
Jan-20
NHM-S 96
NHM-S 97
NHM-S 98
NHM-S 99


Custom House
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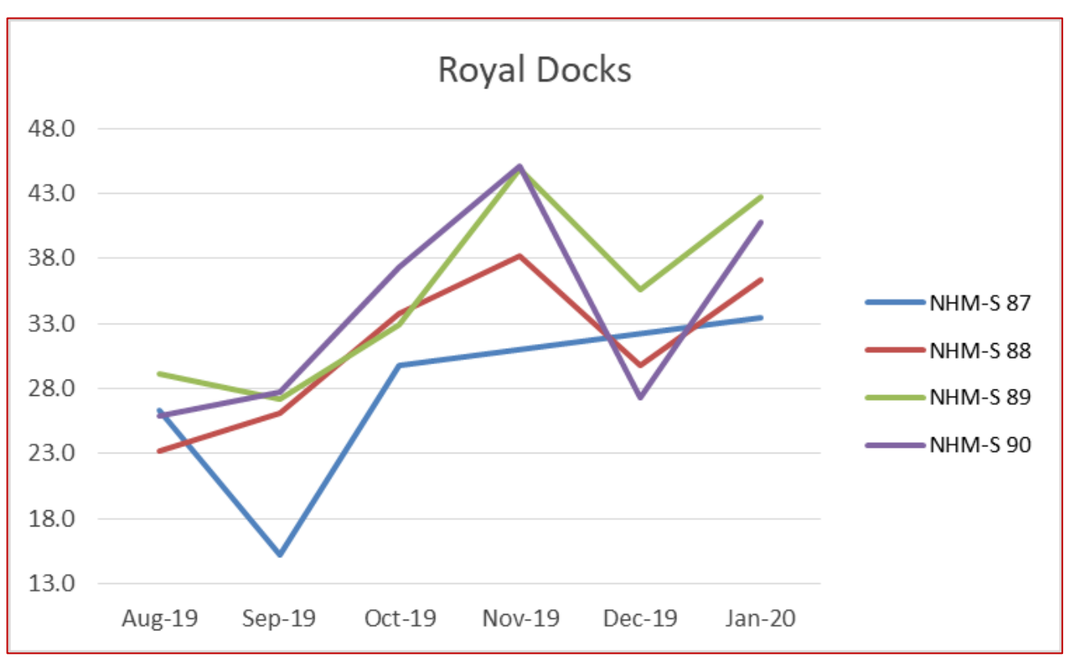
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
Aug-19
Sep-19
Oct-19
Nov-19
Dec-19
Jan-20
NHM-S 84
NHM-S 85
NHM-S 86
NHM-S 91
NHM-S 92
NHM-S 93
NHM-S 94
NHM-S 95


Royal Docks
48.0
43.0
38.0
33.0
28.0
23.0
18.0
13.0
Aug-19
Sep-19
Oct-19
Nov-19
Dec-19
Jan-20
NHM-S 87
NHM-S 88
NHM-S 89
NHM-S 90

Appendix C – Annual Mean Processing Calculations

A local bias adjustment factor has been calculated from the co-location study completed by the Council at the Cam Road monitoring site. The factor of 0.81 was calculated following the completion of the Precision and Bias Adjustment spreadsheet as shown below.

Table C 1 – Local Bias Correction Output: Cam Road

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements										Automatic Method		Data Quality Check	
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	14/01/2019	06/02/2019	46.4	40.6	42.8	43	2.9	7	7.3	38.6133	84.42029	Good	Good
2	06/02/2019	05/03/2019	41.7	47.7	47.4	46	3.4	7	8.5	42.2657	99.691358	Good	Good
3	05/03/2019	11/04/2019	28.6	25.8	22.6	26	3.0	12	7.6	28.1069	99.662162	Good	Good
4	11/04/2019	30/04/2019	37.6	37.1		37	0.4	1	3.1	35.2489	99.780702	Good	Good
5	30/04/2019	04/06/2019	25.4	25.1	21.1	24	2.4	10	6.0	26	98.095238	Good	Good
6	04/06/2019	02/07/2019	25.3	26.8	24.6	26	1.1	4	2.8	22	99.85119	Good	Good
7	02/07/2019	09/08/2019	30.2	29.5	30.0	30	0.3	1	0.8	17	99.890351	Good	Good
8	09/08/2019	03/09/2019	28.0	28.1	28.1	28	0.0	0	0.1	21	100	Good	Good
9	03/09/2019	02/10/2019	34.8	35.5	34.3	35	0.6	2	1.5	27	99.712644	Good	Good
10	02/10/2019	07/11/2019	31.9	39.5	37.8	36	4.0	11	9.9	25	96.759259	Good	Good
11	07/11/2019	04/12/2019	49.9	47.8	49.6	49	1.1	2	2.8	28.4339	96.450617	Good	Good
12	04/12/2019	09/01/2020	35.2	34.9	36.7	36	1.0	3	2.5	24.7621	100	Good	Good
13													
												Good precision	Good Overall

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

Overall survey -->

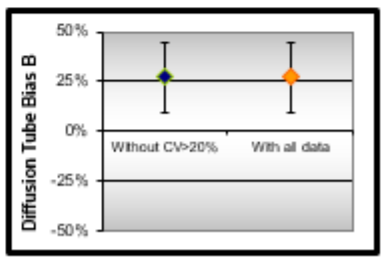
(Check average CV & DC from Accuracy calculations)

Site Name/ ID:

Precision 12 out of 12 periods have a CV smaller than 20%

Accuracy (with 95% confidence interval) without periods with CV larger than 20%	
Bias calculated using 12 periods of data	
Bias factor A	0.81 (0.71 - 0.94)
Bias B	24% (6% - 42%)
Diffusion Tubes Mean:	35 μgm^{-3}
Mean CV (Precision):	5
Automatic Mean:	28 μgm^{-3}
Data Capture for periods used:	98%
Adjusted Tubes Mean:	28 (25 - 33) μgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 12 periods of data	
Bias factor A	0.81 (0.71 - 0.94)
Bias B	24% (6% - 42%)
Diffusion Tubes Mean:	35 μgm^{-3}
Mean CV (Precision):	5
Automatic Mean:	28 μgm^{-3}
Data Capture for periods used:	98%
Adjusted Tubes Mean:	28 (25 - 33) μgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

For the calculation of a 2019 annual mean concentration, annualisation was required at all 99 sites due to data capture being below 75% (the monitoring survey began in August-19). Annualisation has been completed in line with Defra Technical Guidance LAQM.TG(16) Box 7.10 and full working details are provided in Table C 2. At the time of the calculations a proportion of the continuous monitoring data is provisional, therefore calculations will be updated once all data has been ratified. Data capture at three diffusion tube sites was less than 3 months for the calendar year therefore annualisation was not possible at these sites.

Table C 2 – Annualisation Calculations

Site ID	Unadjusted Diffusion Tube Mean ($\mu g/m^3$)	AF Camden - Bloomsbury	AF Tower Hamlets – Millwall Park	AF Tower Hamlets – Victoria Park	AF Waltham Forest Leyton	AF Wren Close	Average AF	Annualised & Bias Adjusted (0.81) Concentration ($\mu g/m^3$)
NHM-S 1	30.2	Insufficient data	1.120	1.094	1.088	1.072	1.094	26.8
NHM-S 2	27.4	1.002	1.035	0.997	1.047	0.963	1.009	22.4
NHM-S 3	30.6	1.002	1.035	0.997	1.047	0.963	1.009	25.0
NHM-S 4	34.5	0.917	0.968	0.937	1.015	0.904	0.948	26.5
NHM-S 5	31.7	1.002	1.035	0.997	1.047	0.963	1.009	25.9
NHM-S 6	36.5	1.002	1.035	0.997	1.047	0.963	1.009	29.8
NHM-S 7	48.3	1.002	1.035	0.997	1.047	0.963	1.009	39.5
NHM-S 8	37.3	1.002	1.035	0.997	1.047	0.963	1.009	30.5
NHM-S 9	30.1	1.002	1.035	0.997	1.047	0.963	1.009	24.6
NHM-S 10	30.3	1.002	1.035	0.997	1.047	0.963	1.009	24.8
NHM-S 11	39.6	1.002	1.035	0.997	1.047	0.963	1.009	32.4
NHM-S 12	30.1	1.002	1.035	0.997	1.047	0.963	1.009	24.6
NHM-S 13	34.7	0.917	0.968	0.937	1.015	0.904	0.948	26.6
NHM-S 14	32.1	1.002	1.035	0.997	1.047	0.963	1.009	26.2
NHM-S 15	31.1	1.002	1.035	0.997	1.047	0.963	1.009	25.5
NHM-S 16	32.1	1.002	1.035	0.997	1.047	0.963	1.009	26.2

Site ID	Unadjusted Diffusion Tube Mean (µg/m^3)	AF Camden - Bloomsbury	AF Tower Hamlets – Millwall Park	AF Tower Hamlets – Victoria Park	AF Waltham Forest Leyton	AF Wren Close	Average AF	Annualised & Bias Adjusted (0.81) Concentration (µg/m^3)
NHM-S 17	28.3	1.008	1.036	1.010	1.036	0.963	1.011	23.1
NHM-S 18	27.9	1.002	1.035	0.997	1.047	0.963	1.009	22.8
NHM-S 19	32.1	1.008	1.036	1.010	1.036	0.963	1.011	26.3
NHM-S 20	36.7	1.002	1.035	0.997	1.047	0.963	1.009	30.0
NHM-S 21	35.8	1.002	1.035	0.997	1.047	0.963	1.009	29.2
NHM-S 22	33.6	0.917	0.968	0.937	1.015	0.904	0.948	25.8
NHM-S 23	29.3	1.002	1.035	0.997	1.047	0.963	1.009	23.9
NHM-S 24	30.0	1.002	1.035	0.997	1.047	0.963	1.009	24.5
NHM-S 25	29.8	0.958	0.977	0.958	1.012	0.921	0.965	23.3
NHM-S 26	37.0	1.002	1.035	0.997	1.047	0.963	1.009	30.2
NHM-S 27	34.9	1.002	1.035	0.997	1.047	0.963	1.009	28.5
NHM-S 28	26.8 (2 months' data)	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	N/A	N/A
NHM-S 29	34.9	1.002	1.035	0.997	1.047	0.963	1.009	28.5
NHM-S 30	41.0	1.002	1.035	0.997	1.047	0.963	1.009	33.5
NHM-S 31	33.4	1.008	1.036	1.010	1.036	0.963	1.011	27.3
NHM-S 32	22.2	Insufficient data	1.245	1.204	1.136	1.171	1.189	21.4
NHM-S 33	29.9	1.002	1.035	0.997	1.047	0.963	1.009	24.4
NHM-S 34	30.1	1.143	1.174	1.120	1.119	1.102	1.132	27.6
NHM-S 35	31.7	1.002	1.035	0.997	1.047	0.963	1.009	25.9
NHM-S 36	32.5	1.002	1.035	0.997	1.047	0.963	1.009	26.6
NHM-S 37	32.1	1.002	1.035	0.997	1.047	0.963	1.009	26.2
NHM-S 38	29.9	1.008	1.036	1.010	1.036	0.963	1.011	24.5
NHM-S 39	28.6	1.008	1.036	1.010	1.036	0.963	1.011	23.4
NHM-S 40	28.8	1.143	1.174	1.120	1.119	1.102	1.132	26.4
NHM-S 41	33.8	1.002	1.035	0.997	1.047	0.963	1.009	27.6
NHM-S 42	24.3	1.002	1.035	0.997	1.047	0.963	1.009	19.9
NHM-S 43	36.2	1.008	1.036	1.010	1.036	0.963	1.011	29.7
NHM-S 44	28.3	1.002	1.035	0.997	1.047	0.963	1.009	23.1
NHM-S 45	26.0	1.002	1.035	0.997	1.047	0.963	1.009	21.3
NHM-S 46	29.9	1.008	1.036	1.010	1.036	0.963	1.011	24.4
NHM-S 47	31.8	1.002	1.035	0.997	1.047	0.963	1.009	26.0
NHM-S 48	30.8	1.002	1.035	0.997	1.047	0.963	1.009	25.2
NHM-S 49	31.3	1.002	1.035	0.997	1.047	0.963	1.009	25.6
NHM-S 50	32.1	1.002	1.035	0.997	1.047	0.963	1.009	26.2
NHM-S 51	33.2	1.143	1.174	1.120	1.119	1.102	1.132	30.4
NHM-S 52	30.7	1.008	1.036	1.010	1.036	0.963	1.011	25.1
NHM-S 53	31.0	1.002	1.035	0.997	1.047	0.963	1.009	25.4
NHM-S 54	32.6	1.008	1.036	1.010	1.036	0.963	1.011	26.7
NHM-S 55	37.8	0.917	0.968	0.937	1.015	0.904	0.948	29.0
NHM-S 56	40.0	0.958	0.977	0.958	1.012	0.921	0.965	31.3
NHM-S 57	30.5	1.002	1.035	0.997	1.047	0.963	1.009	24.9

Site ID	Unadjusted Diffusion Tube Mean (µg/m^3)	AF Camden - Bloomsbury	AF Tower Hamlets – Millwall Park	AF Tower Hamlets – Victoria Park	AF Waltham Forest Leyton	AF Wren Close	Average AF	Annualised & Bias Adjusted (0.81) Concentration (µg/m^3)
NHM-S 58	31.9	0.958	0.977	0.958	1.012	0.921	0.965	24.9
NHM-S 59	30.7	1.021	1.051	0.989	1.050	0.942	1.010	25.1
NHM-S 60	33.0	1.002	1.035	0.997	1.047	0.963	1.009	26.9
NHM-S 61	34.7	1.002	1.035	0.997	1.047	0.963	1.009	28.4
NHM-S 62	35.6	1.002	1.035	0.997	1.047	0.963	1.009	29.1
NHM-S 63	32.5	1.002	1.035	0.997	1.047	0.963	1.009	26.5
NHM-S 64	28.4	1.002	1.035	0.997	1.047	0.963	1.009	23.2
NHM-S 65	33.8	Insufficient data	0.957	0.957	0.985	0.904	0.951	26.0
NHM-S 66	30.2	1.002	1.035	0.997	1.047	0.963	1.009	24.7
NHM-S 67	35.7 (2 months' data)	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	N/A	N/A
NHM-S 68	34.8	1.002	1.035	0.997	1.047	0.963	1.009	28.5
NHM-S 69	31.1	Insufficient data	1.245	1.204	1.136	1.171	1.189	30.0
NHM-S 70	33.0	0.958	0.977	0.958	1.012	0.921	0.965	25.8
NHM-S 71	34.7	1.002	1.035	0.997	1.047	0.963	1.009	28.4
NHM-S 72	25.0 (1 months' data)	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	N/A	N/A
NHM-S 73	31.9	1.002	1.035	0.997	1.047	0.963	1.009	26.1
NHM-S 74	34.0	1.002	1.035	0.997	1.047	0.963	1.009	27.8
NHM-S 75	32.4	Insufficient data	1.120	1.094	1.088	1.072	1.094	28.7
NHM-S 76	27.7	1.002	1.035	0.997	1.047	0.963	1.009	22.7
NHM-S 77	35.9	1.002	1.035	0.997	1.047	0.963	1.009	29.3
NHM-S 78	35.7	0.958	0.977	0.958	1.012	0.921	0.965	27.9
NHM-S 79	32.8	1.002	1.035	0.997	1.047	0.963	1.009	26.8
NHM-S 80	40.6	1.002	1.035	0.997	1.047	0.963	1.009	33.2
NHM-S 81	34.0	1.002	1.035	0.997	1.047	0.963	1.009	27.8
NHM-S 82	32.2	1.002	1.035	0.997	1.047	0.963	1.009	26.4
NHM-S 83	30.4	0.958	0.977	0.958	1.012	0.921	0.965	23.7
NHM-S 84	29.7	1.002	1.035	0.997	1.047	0.963	1.009	24.2
NHM-S 85	30.7	1.002	1.035	0.997	1.047	0.963	1.009	25.1
NHM-S 86	29.1	1.002	1.035	0.997	1.047	0.963	1.009	23.8
NHM-S 87	23.8	1.175	1.255	1.145	1.170	1.138	1.176	22.7
NHM-S 88	30.2	1.002	1.035	0.997	1.047	0.963	1.009	24.7
NHM-S 89	34.0	1.002	1.035	0.997	1.047	0.963	1.009	27.8
NHM-S 90	32.7	1.002	1.035	0.997	1.047	0.963	1.009	26.7
NHM-S 91	42.7	1.002	1.035	0.997	1.047	0.963	1.009	34.9
NHM-S 92	27.0	1.008	1.036	1.010	1.036	0.963	1.011	22.1
NHM-S 93	27.7	1.002	1.035	0.997	1.047	0.963	1.009	22.6

Site ID	Unadjusted Diffusion Tube Mean (µg/m^3)	AF Camden - Bloomsbury	AF Tower Hamlets – Millwall Park	AF Tower Hamlets – Victoria Park	AF Waltham Forest Leyton	AF Wren Close	Average AF	Annualised & Bias Adjusted (0.81) Concentration (µg/m^3)
NHM-S 94	27.1	1.002	1.035	0.997	1.047	0.963	1.009	22.1
NHM-S 95	42.7	1.002	1.035	0.997	1.047	0.963	1.009	34.9
NHM-S 96	28.7	1.002	1.035	0.997	1.047	0.963	1.009	23.4
NHM-S 97	23.4	1.002	1.035	0.997	1.047	0.963	1.009	19.2
NHM-S 98	28.1	Insufficient data	1.245	1.204	1.136	1.171	1.189	27.1
NHM-S 99	32.4	0.958	0.977	0.958	1.012	0.921	0.965	25.3