London Borough of Havering Air Quality Annual Status Report for 2021

Date of publication: 31st May 2022

This report provides a detailed overview of air quality in the London Borough of Havering during 2021. It has been produced to meet the requirements of the London Local Air Quality Management (LLAQM) statutory process[1].

[1] LLAQM Policy and Technical Guidance 2019 (LLAQM.TG(19))

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Abbreviations

Abbreviation	Description
AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
AQO	Air Quality Objective
BEB	Buildings Emission Benchmark
CAB	Cleaner Air Borough
EV	Electric Vehicle
GLA	Greater London Authority
LAEI	London Atmospheric Emissions Inventory
LAQM	Local Air Quality Management
LLAQM	London Local Air Quality Management
NRMM	Non-Road Mobile Machinery
PM_{10}	Particulate matter less than 10 micron in diameter
$PM_{2.5}$	Particulate matter less than 2.5 micron in diameter
TEB	Transport Emissions Benchmark
TfL	Transport for London

Table A. Summary of National Air Quality Standards and Objectives

Pollutant	Standard / Objective (UK)	Averaging Period	Date[(1)]
Nitrogen dioxide (NO_2)	200 µg m^{-3} not to be exceeded more than 18 times a year	1-hour mean	31 Dec 2005
Nitrogen dioxide (NO_2)	40 µg m^{-3}	Annual mean	31 Dec 2005
Particles (PM_{10})	50 µg m^{-3} not to be exceeded more than 35 times a year	24-hour mean	31 Dec 2004
Particles (PM_{10})	40 µg m^{-3}	Annual mean	31 Dec 2004
Particles ($PM_{2.5}$)	25 µg m^{-3}	Annual mean	2021
Particles ($PM_{2.5}$)	Target of 15% reduction in concentration at urban background locations	3-year mean	Between 2010 and 2021
Sulphur dioxide (SO_2)	266 µg m^{-3} not to be exceeded more than 35 times a year	15-minute mean	31 Dec 2005
Sulphur dioxide (SO_2)	350 µg m^{-3} not to be exceeded more than 24 times a year	1-hour mean	31 Dec 2004
Sulphur dioxide (SO_2)	125 µg m^{-3} mot to be exceeded more than 3 times a year	24-hour mean	31 Dec 2004

Notes:

(1) Date by which to be achieved by and maintained thereafter

1. Air Quality Monitoring

1.1 Locations

Table B. Details of Automatic Monitoring Sites for 2021

Site ID	Site Name	X (m)	Y (m)	Site Type	In AQMA? If so, which AQMA?	Distance to Relevant Exposure (m)	Distance to Kerb of Nearest Road (N/A if not applicable) (m)	Inlet height (m)	Pollutants monitored	Monitoring technique
HV1	Rainham	553127	182506	Roadside	Y (LB Havering)	3	10	3	NO_2, $PM_{10,}$ $PM_{2.5}$	Chemiluminescent; TEOM, FDMS
HV3	Romford	551108	188257	Roadside	Y (LB Havering)	3	8	3	NO_2, PM_{10}	Chemiluminescent; FDMS

Table C. Details of Non-Automatic Monitoring Sites for 2021

Site ID	Site Name	X (m)	Y (m)	Site Type	In AQMA? If so, which AQMA?	Distance to Relevant Exposure (m)	Distance to Kerb of Nearest Road (N/A if not applicable) (m)	Inlet height (m)	Pollutants monitored	Tube co-located with an automatic monitor. (Y/N)
HAV2, HAV5, HAV6	Mercury Gardens	551488	188993	Urban Centre	Y (LB Havering)	1	3	2	NO_2	N
HAV1, HAV7, HAV8	Waterloo Road	551108	188257	Urban Centre	Y (LB Havering)	3	8	2	NO_2	Y
HAV3	Nelson Road	551726	183462	Urban Background	Y (LB Havering)	3	1	2	NO_2	N
HAV4	Langtons	553724	187560	Urban Background	Y (LB Havering)	1	N/A	2	NO_2	N
HAV9, HAV10, HAV11	Alexandra Road	551629	188296	Urban Centre	Y (LB Havering)	3	1	2	NO_2	N
HAV12	Main Road GPPS	552096	189619	Roadside	Y (LB Havering)	4	1	2	NO_2	N
HAV13, HAV14, HAV15	A12 Junction with North Street	550607	189685	Roadside	Y (LB Havering)	5	5	2	NO_2	N
HAV16, HAV17, HAV18	Rom Valley Way	551414	187802	Roadside	Y (LB Havering)	1	1	2	NO_2	N
HAV19, HAV20, HAV21	Collier Row	549837	191109	Kerbside	Y (LB Havering)	3	0.5	2	NO_2	N
HAV22, HAV23, HAV24	Ravensbourne School	553707	190817	Urban Background	Y (LB Havering)	1	1	2	NO_2	N

Site ID	Site Name	X (m)	Y (m)	Site Type	In AQMA? If so, which AQMA?	Distance to Relevant Exposure (m)	Distance to Kerb of Nearest Road (N/A if not applicable) (m)	Inlet height (m)	Pollutants monitored	Tube co-located with an automatic monitor. (Y/N)
HAV25	Wincanton Road	553727	193161	Urban Background	Y (LB Havering)	1	3	2	NO_2	N
HAV26	Adj. 109 Cross Road	549532	189777	Urban Background	Y (LB Havering)	3	1	2	NO_2	N
HAV27, HAV28, HAV29	Rush Green Road	550942	187420	Kerbside	Y (LB Havering)	5	0.5	2	NO_2	N
HAV30	Marlborough Road	549318	189384	Urban Background	Y (LB Havering)	3	1	2	NO_2	N
HAV31	Danes Road	550197	187908	Industrial	Y (LB Havering)	4	1	2	NO_2	N
HAV32, HAV33, HAV34	Gallows Corner	553410	190558	Kerbside	Y (LB Havering)	4	0.5	2	NO_2	N
HAV35	Church Road	554204	193795	Urban Background	Y (LB Havering)	3	1	2	NO_2	N
HAV36	Bedford Park Entrance	551755	193022	Rural	Y (LB Havering)	1	N/A	2	NO_2	N
HAV37	Colchester Road	555723	191750	Kerbside	Y (LB Havering)	3	0.5	2	NO_2	N
HAV 38	Myrtle Road	553434	191656	Roadside	Y (LB Havering)	1	1	2	NO_2	N
HAV39	Rise Park Boulevard	551616	190622	Roadside	Y (LB Havering)	3	1	2	NO_2	N
HAV40	Main Road	553174	190306	Roadside	Y (LB Havering)	9	1	2	NO_2	N
HAV41	Main Road	552517	189826	Roadside	Y (LB Havering)	8	1	2	NO_2	N
HAV42	Mawney School	550623	188890	Kerbside	Y	2	1	2	NO_2	N

Site ID	Site Name	X (m)	Y (m)	Site Type	In AQMA? If so, which AQMA?	Distance to Relevant Exposure (m)	Distance to Kerb of Nearest Road (N/A if not applicable) (m)	Inlet height (m)	Pollutants monitored	Tube co-located with an automatic monitor. (Y/N)
					(LB Havering)					
HAV43	Upminster School	556072	186539	Roadside	Y (LB Havering)	2	2	2	NO_2	N
HAV44	Ardleigh Green School	553952	189731	Kerbside	Y (LB Havering)	5	1	2	NO_2	N
HAV45	St. Marys School RC	552327	187422	Kerbside	Y (LB Havering)	10	1	2	NO_2	N
HAV46	Rainham Village School	552441	182337	Kerbside	Y (LB Havering)	1	1	2	NO_2	N
HAV47	Campion School off A127	554730	189487	Roadside	Y (LB Havering)	7	2	2	NO_2	N
HAV48	Parkland School	550602	189990	Urban Background	Y (LB Havering)	1	1	2	NO_2	N
HAV49	Newton's School	550722	183294	Roadside	Y (LB Havering)	2	1	2	NO_2	N
HAV50	Blewitts Cottages	551526	182672	Kerbside	Y (LB Havering)	12	0.5	2	NO_2	N
HAV51	St. Edwards School	551180	189432	Urban Background	Y (LB Havering)	1	1	2	NO_2	N
HAV52	Opp. Harold Wood Stn.	554741	190626	Roadside	Y (LB Havering)	0	2	2	NO_2	N
HAV53	R.J. Mitchell School	552841	184966	Roadside	Y (LB Havering)	15	2	2	NO_2	N
HAV54	Hilldene Infant School	553135	191674	Roadside	Y (LB Havering)	5	1	2	NO_2	N
HAV55	Butts Green Road	553830	188314	Kerbside	Y (LB Havering)	1	0.5	2	NO_2	N
HAV56	Rainham Broadway	552045	182222	Kerbside	Y (LB Havering)	1	0.5	2	NO_2	N

Site ID	Site Name	X (m)	Y (m)	Site Type	In AQMA? If so, which AQMA?	Distance to Relevant Exposure (m)	Distance to Kerb of Nearest Road (N/A if not applicable) (m)	Inlet height (m)	Pollutants monitored	Tube co-located with an automatic monitor. (Y/N)
HAV57	Romford Taxi Rank	551420	188526	Urban Centre	Y (LB Havering)	1	0.2	2	NO_2	N
HAV58, HAV59, HAV60	Romford Battis	551397	188509	Urban Centre	Y (LB Havering)	1	0.2	2	NO_2	N
HAV61	Wennington Road	553719	180987	Urban Background	Y (LB Havering)	1	1	2	NO_2	N
HAV62	New Road Junction with South Street	550462	183013	Kerbside	Y (LB Havering)	10	0.5	2	NO_2	N
HAV63	New Road Junction with Spencer Road	550888	182884	Kerbside	Y (LB Havering)	10	0.5	2	NO_2	N
HAV64	New Road Junction with Betterton Road	551112	182811	Kerbside	Y (LB Havering)	10	0.5	2	NO_2	N
HAV65	Front Lane/Jnct Brunswick Ave LP40	557323	187932	Urban Centre	Y (LB Havering)	1	0.2	2	NO_2	N
HAV66	Station Lane LP6	554013	187001	Urban Centre	Y (LB Havering)	1	0.5	2	NO_2	N

The locations of the above sites are shown on maps in Appendix C.

1.2 Comparison of Monitoring Results with AQOs

The results presented are after adjustments for “annualisation” and for distance to a location of relevant public exposure (if required), the details of which are described in Appendix A.

Table D. Annual Mean NO_2 Ratified and Bias-adjusted Monitoring Results

Site ID	Site type	Valid data capture for monitoring period %[(a)]	Valid data capture 2021 %[(b)]	2015	2016	2017	2018	2019	2020	2021
HV1	Automatic	-	99	32	34	34.3	30	29.1	23	23
HV3	Automatic	-	99	35	38	**40**	38	35.8	29	28
HAV 2, 5, 6	Diffusion tube	-	100	**51.7**	**55.9**	**51.1**	**47.9**	**42**	38.2	38.8
HAV 1, 7, 8	Diffusion tube	-	100	39.0	**40.7**	**40.3**	39.6	36.7	38.6	32.8
HAV 3	Diffusion tube	-	100	28.3	29	31.7	26.5	26	25.1	19.8
HAV 4	Diffusion tube	-	100	20.1	26	20.1	17.3	19.7	16.7	14.7
HAV 9, 10, 11	Diffusion tube	-	100	30.7	33.1	29.6	29	26.1	26.7	23
HAV 12	Diffusion tube	-	100	37.4	**43**	**41.6**	36.6	32.4	28.3	29.1
HAV 13, 14, 15	Diffusion tube	-	100	39.4	**41.7**	**40.5**	38.7	35.4	32.2	31.1
HAV 16, 17, 18	Diffusion tube	-	100	34.7	36.5	39.8	34.8	33.6	29.1	28.8
HAV 19, 20, 21	Diffusion tube	-	100	**44.8**	**44.8**	**49.2**	**40.4**	37.2	35.7	33.7
HAV 22, 23, 24	Diffusion tube	-	100	26.6	28.3	30.4	25.3	24.5	16.6	19.9
HAV 25	Diffusion tube	-	100	22.9	24.7	26.6	22.1	20.8	19.7	18.4
HAV 26	Diffusion tube	-	100	22.7	23.8	27.3	21.4	21.3	19.5	17.1

Site ID	Site type	Valid data capture for monitoring period %[a]	Valid data capture 2021 %[b]	2015	2016	2017	2018	2019	2020	2021
HAV 27, 28, 29	Diffusion tube	-	100	**47.6**	**52.3**	**54.1**	**51.4**	**47.3**	**44.4**	**40.4**
HAV 30	Diffusion tube	-	91.7	24.8	24	29.1	21.6	21.9	21.3	18.6
HAV 31	Diffusion tube	-	100	27.1	29.1	30.6	26.4	25.2	22	20.3
HAV 32, 33, 34	Diffusion tube	-	100	**55.0**	**53.2**	**52.9**	**50.3**	**49.4**	**45.2**	**40.6**
HAV 35	Diffusion tube	-	100	24.2	27.7	27.2	26.2	23	19.8	20.1
HAV 36	Diffusion tube	-	100	21.1	21.8	23.9	18.3	18.9	20.9	13.8
HAV 37	Diffusion tube	-	100	**48.2**	**55.3**	**55.3**	**48.0**	**41.6**	34.5	36.1
HAV 38	Diffusion tube	-	100	21.5	24.8	25.3	22.2	21	20.5	16.4
HAV 39	Diffusion tube	-	100	33.3	31.3	38.8	29.0	28.9	30.9	23.5
HAV 40	Diffusion tube	-	100	**49.5**	**45.1**	**52.1**	**49.2**	**44.4**	36.8	31.7
HAV 41	Diffusion tube	-	100	**45.0**	**46.2**	**49.6**	**40.9**	39.3	32.2	32.4
HAV 42	Diffusion tube	-	100	31.4	31.7	31.6	30.8	29.7	26.5	23.9
HAV 43	Diffusion tube	-	100	38.2	35.9	35.6	32.2	34.3	27.2	25.7
HAV 44	Diffusion tube	-	100	37.1	37.9	36.7	34.4	31.6	30.1	28.5
HAV 45	Diffusion tube	-	91.7	35.7	**40.7**	37.7	35.6	31.8	26.5	26.7
HAV 46	Diffusion tube	-	100	31.3	34.5	33	32.2	30	27.8	24.4
HAV 47	Diffusion tube	-	100	**42.0**	**46.5**	**42.3**	36.8	**41**	35.6	36.5

Site ID	Site type	Valid data capture for monitoring period %[a]	Valid data capture 2021 %[b]	2015	2016	2017	2018	2019	2020	2021
HAV 48	Diffusion tube	-	91.7	28.4	30.7	37.8	25	26.4	21.4	19.8
HAV 49	Diffusion tube	-	83.3	26.8	27.9	28	34.3	26.6	23.6	22
HAV 50	Diffusion tube	-	100	**41.1**	**42.2**	**46.1**	39.8	36.6	32.5	30.5
HAV 51	Diffusion tube	-	100	24.3	24.1	24.9	23.4	21.6	20.7	17.9
HAV 52	Diffusion tube	-	100	34.3	37.3	**47.8**	**41.1**	32.2	26.1	29.5
HAV 53	Diffusion tube	-	100	-	-	-	-	-	29.1	24.6
HAV 54	Diffusion tube	-	100	-	-	-	-	-	21.4	22
HAV 55	Diffusion tube	-	100	-	-	-	-	-	35.9	**40.2**
HAV 56	Diffusion tube	-	100	-	-	-	-	-	35.7	32.7
HAV 57	Diffusion tube	-	100	**59.0**	**62.9**	**61**	**64.7**	**53.1**	**52.9**	**53.4**
HAV 58, 59, 60	Diffusion tube	-	75	**75.2**	**69.1**	**71.7**	**71.4**	**71.3**	**66.9**	**71.3**
HAV 61	Diffusion tube	-	100	-	-	-	27.5	26.2	22.8	20.9
HAV62	Diffusion tube	-	91.7	-	-	-	-	-	34.1	28.8
HAV63	Diffusion tube	-	100	-	-	-	-	-	30.5	31
HAV64	Diffusion tube	-	100	-	-	-	-	-	30.9	29.3
HAV65	Diffusion tube	-	100	-	-	-	-	-	28.8	26.4
HAV66	Diffusion tube	-	91.7	-	-	-	-	-	34.6	31.6

Notes:

The annual mean concentrations are presented as µg m^{-3}.

Exceedances of the NO_2 annual mean AQO of 40 µg m^{-3} are shown in **bold**.

NO_2 annual means in excess of 60 µg m^{-3}, indicating a potential exceedance of the NO_2 hourly mean AQS objective are shown in **bold and underlined**.

Means for diffusion tubes have been corrected for bias.

All means have been "annualised" in accordance with LLAQM Technical Guidance if valid data capture for the calendar year is less than 75% and greater than 25%.

Results have been distance corrected where applicable.

(a) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(b) data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%).

Summary

Having reviewed the NO_2 annual means for the past seven years (2015 - 2021), the following observations have been made:

- Of the 36 sites for which data are available for the past seven years, the NO2 annual means have been consistently decreasing for 17 sites since 2017. For 32 of the 36 sites the NO2 annual means in 2021 are at least 15% less than the 2015 levels.
- The number of sites exceeding the annual mean objective remained low in 2021, although it increased by one from 2020. In total five sites in 2021 exceeded the objective (two of which only marginally), comparing to sixteen in 2017.
- Given that for a second consecutive year, the NO2 annual means at most of the sites remained at lower levels to those in previous years, it can be assumed that the 2020 and 2021 data are representative of long-term trends and that air quality has been improving in the borough. However, the impact of Covid-19 restrictions on air quality over the past two years is still uncertain and, therefore, data in the following years will be needed, to be able to confirm this assumption.

Table E. NO_2 Automatic Monitoring Results: Comparison with 1-hour Mean Objective, Number of 1-Hour Means > 200 µg m^{-3}

Site ID	Valid data capture for monitoring period %([a])	Valid data capture 2021 %([b])	2015	2016	2017	2018	2019	2020	2021
HV1	-	99%	0	0	0	0	0	0	0
HV3	-	99%	0	0	1	0	0	0	0

Notes

Results are presented as the number of 1-hour periods where concentrations greater than 200 µg m^{-3} have been recorded.

Exceedance of the NO_2 short term AQO of 200 µg m^{-3} over the permitted 18 hours per year are shown in **bold**.

If the period of valid data is less than 85%, the 99.8th percentile of 1-hour means is provided in brackets.

(a) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year

(b) Data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%)

Summary

The hourly mean objective of 200 µg m^{-3} was exceeded only once at the HV3 monitoring site in 2017, which is significantly less than the permitted 18 days per year. No exceedances have been identified at the HV1 monitoring site.

Table F. Annual Mean PM_{10} Automatic Monitoring Results (µg m^{-3})

Site ID	Valid data capture for monitoring period %([a])	Valid data capture 2021 %([b])	2015	2016	2017	2018	2019	2020	2021
HV1	-	71	18	19	18	17	17.4	15	13.6
HV3	-	58	24	15	19	20	20.5	21	18.9

Notes

The annual mean concentrations are presented as µg m^{-3}.

Exceedances of the PM_{10} annual mean AQO of 40 µg m^{-3} are shown in **bold**.

All means have been "annualised" in accordance with LLAQM Technical Guidance, if valid data capture is less than 75% and more than 25%.

(a) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(b) Data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%).

Summary

No significant trend (positive or negative) in PM_{10} levels has been identified at both sites over the 7-year period. PM_{10} levels are well below the annual mean objective of 40 µg m^{-3}.

Table G. PM_{10} Automatic Monitoring Results: Comparison with 24-Hour Mean Objective, Number of PM_{10} 24-Hour Means > 50 µg m^{-3}

Site ID	Valid data capture for monitoring period %[(a)]	Valid data capture 2021 %[(b)]	2015	2016	2017	2018	2019	2020	2021
HV1	-	71	3	6	4	1	4	1	0 (23.8)
HV3	-	58	9	5	N/A	2	9	5	0 (29.6)

Notes

Exceedances of the PM_{10} 24-hour mean objective (50 µg m^{-3} over the permitted 35 days per year) are shown in **bold.**

Where the period of valid data is less than 85% of a full year, the 90.4th percentile is provided in brackets.

(a) data capture for the monitoring period, in cases where monitoring was only carried out for part of the year

(b) data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%).

Summary

Exceedances of the 24-hour mean at both sites have been significantly less than the annual objective of 35 exceedances. 2021 was the first year that no exceedances of the 24-hour mean were recorded for none of the automatic sites.

Table H. Annual Mean $PM_{2.5}$ Automatic Monitoring Results (µg m^{-3})

Site ID	Valid data capture for monitoring period %[(a)]	Valid data capture 2021 %[(b)]	2015	2016	2017	2018	2019	2020	2021
HV1	-	72	11	12	12	11	11.1	9	8.8

Notes

The annual mean concentrations are presented as µg m^{-3}.

Exceedances of the $PM_{2.5}$ annual mean AQO of 25 µg m^{-3} are shown in **bold**.

All means have been "annualised" in accordance with LLAQM Technical Guidance, if valid data capture is less than 75% and more than 25%.

(a) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(b) Data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%).

Summary

Annual Mean $PM_{2.5}$ concentrations remain at a steady level over the 7-year period and well below the annual mean AQO of 25 µg m^{-3}.

2. Action to Improve Air Quality

2.1 Air Quality Action Plan Progress

Table I provides a brief summary of the London Borough of Havering progress against the Air Quality Action Plan, showing progress made this year.

Table I. Delivery of Air Quality Action Plan Measures

Measure	LLAQM Action Matrix Theme	Action	Progress • Emissions/Concentration data • Benefits • Negative impacts / Complaints
1.1	Monitoring and other core statutory duties	Undertake detailed computer modelling of air quality in Havering.	*Action completed*, as reported in 2021.
1.2	Monitoring and other core statutory duties	Use AQ Mesh Pods to provide real time air quality measurements for schools to use as part of air quality publicity campaigns and to encourage walking to school.	*Action ongoing*. AQ Mesh pods are used to support local projects (e.g. School Streets), as well as when dealing with complaints / requests. In 2021, baseline monitoring was carried out at selected school locations, to support the expansion of the Council's School Streets Scheme. Once the scheme is in place at the new locations, further monitoring will be carried out, in order to be able to compare the 'before' and 'after' data and quantify the benefits of the scheme to local air quality. Although it is recognised that the accuracy of the AQMesh pods readings is not as high as other monitoring equipment, which has been officially approved by DEFRA, the use of the AQMesh pods gives a picture of air quality and has been found useful for keeping the public up to date on local air quality and raise awareness and

Measure	LLAQM Action Matrix Theme	Action	Progress • Emissions/Concentration data • Benefits • Negative impacts / Complaints
			knowledge. Also getting continuous readings allows us to correlate NO2 levels with potential causes (e.g. higher NO2 levels at pick up/drop of times on the school run) and identify areas of poor air quality outside of schools that were previously unknown.
1.3	Monitoring and other core statutory duties	Undertake feasibility study into the location and start-up of a new permanent continuous monitoring location.	*Action completed*, as reported in 2021.
1.4	Monitoring and other core statutory duties	Expand the current Diffusion Tube Network.	*Action completed*, as reported in 2021.
1.5	Monitoring and other core statutory duties	Model likely air quality impact of planned major strategic schemes.	*Action ongoing*. All major strategic developments required to do air quality modelling (part of a detailed Air Quality Assessment at the planning application stage).
2.1	Public health and awareness raising	Promote walking and cycling. Engage with over 50's forum to form a walking club and organised led rides	*Action ongoing*. The over 50s programme is run by trained volunteers with support from the Council's Sports Development Service. In 2021, no face to face sessions and events were held. Once TfL funding is available to organise led rides, they could be arranged again for the Over 50's Forum and other groups in the borough.
2.2	Public health and awareness raising	Continue to use Miles the Mole as an air quality champion and educational prop.	*Action ongoing*. Miles the Mole continues visiting schools as part of the Council's Air Quality Campaign. Active travel and air quality themed Theatre in Education production is an interactive programme aimed at year 6 pupils. Due to Covid-19 restrictions, Miles the Mole has been out to schools twice in 2021 to promote air quality and the Walking Zone map initiative. The campaign increases awareness and knowledge of children/staff/parents around air quality and promotes small changes

Measure	LLAQM Action Matrix Theme	Action	Progress • Emissions/Concentration data • Benefits • Negative impacts / Complaints
			people can make to reduce their contribution to air pollution and reduce their exposure to poor air quality.
2.3	Public health and awareness raising	Support Transport for London led initiative to commission a cross borough bus rapid transit study which would include looking at options for improving access to the London Riverside BID.	*Action on hold.* No progress was made in 2021 due to financial constraints. The continuation of the project will depend on the ability of TfL to support it.
2.4	Public health and awareness raising	Public Health input into delivery of AQAP.	*Action ongoing*. The Public Health Service supports the Council to achieve its aims to improve air quality. This has included (a) contributing to the evidence base for the local strategy and (b) actively participating in the Council's Air Quality Working Group meetings. Havering's JSNA includes a recommendation that health and care partners should '*work together to minimise the direct contribution of health and social care services to air pollution; put in place the infrastructure / encourage residents to switch to electric vehicles and public transport, or better still, walk and cycle, choosing routes that minimise their exposure to pollutants*'
2.5	Public health and awareness raising	Continue to promote the TfL STARS (Sustainable Travel: Active, Responsible, Safe) accredited travel planning programme with schools to reduce car use on school run.	*Action ongoing*. All schools in Havering are encouraged to maintain active School Travel Plans (STP) and report their activities annually via the Transport for London STARS Accreditation Programme website. In 2021, 47 schools out of 85 are accredited under the TfL STARS Accreditation scheme. Of these, 40 are at the highest Gold level, one at Silver and the remainder at Bronze. Promotion of STARS is ongoing, despite the impacts of Covid-19, with around 60 out of the 85 schools engaged with the team on the programme.

Measure	LLAQM Action Matrix Theme	Action	Progress • Emissions/Concentration data • Benefits • Negative impacts / Complaints
			In 2021 £17k Small Grants were offered to 7 schools which included bikes, balanced bikes, safety equipment, cycle tracks bike storage facilities and scooter parking. In 2021, over £30k was spent on cycle parking facilities at 6 schools providing over 180 cycle parking spaces.
2.6	Public health and awareness raising	Promote Smarter Travel initiatives with businesses and encourage local business to adopt workplace travel plans.	*Action partly on hold*. The lack of funding from TfL to support business engagement in recent years has put activities on hold. If funding is available then meaningful engagement can resume. Without funding it makes progress significantly harder to achieve. Contact with CEME and the NHS has resumed though progress is again hindered by a lack of funding. Talks with CEME about a site wide Travel Plan will resume in 2022.
2.7	Public health and awareness raising	Continue to promote airTEXT to make sure vulnerable residents are aware of the tool and how to use it.	*Action ongoing*. Havering has signed up to provide information via SMS on air pollution episodes through the AirTEXT software. We promote AirTEXT through the Council's social media platforms a few times per year, particularly in winter, as well as on Havering's website. Also Havering's Communication team puts out alerts on social media when we get notified of pollution episodes by Imperial College.
2.8	Public health and awareness raising	Investigate the feasibility of introducing Car Clubs and associated facilities in Havering.	*Action on hold*. Havering is not taking forward the plan for a Council run Car Club programme, as it has not been considered a priority right now. There are currently a few car clubs operating around new developments, sourced by the developers.
2.9	Public health and awareness raising	Support the LIP cycle training budget to promote "bike ability" in schools and also to adults and families.	*Action ongoing*. Despite low levels of funding from TfL the borough was still able to deliver bikeability training to a large number of residents (pupils and adults). In total, bikeability training was carried out for 932 pupils and cycle skills training for 392 adults.

Measure	LLAQM Action Matrix Theme	Action	Progress • Emissions/Concentration data • Benefits • Negative impacts / Complaints
2.10	Public health and awareness raising	Encourage greater use of the Council's staff travelling to work sustainably through adequate provision of cycle infrastructure at Council buildings.	*Action completed,* as reported in 2021.
2.11	Public health and awareness raising	Successful delivery of annual Local Implementation Plan (LIP) programme to deliver schemes that support the Healthy Streets agenda and provide options for people to travel sustainably.	*Action ongoing*. Two walking zone maps for two schools (Drapers Pyrgo and Harold Wood primary) were developed and successfully launched in 2021, encouraging pupils to travel to school actively. Cycle Parking has been delivered at Hall Mead school to support this secondary school working towards Bronze STARS Accreditation.
2.12	Public health and awareness raising	Offer workplace grants to businesses for infrastructure (e.g. cycle parking, lockers and showering facilities)	*Action on hold*. Active travel grants were put on hold because of the limited LIP funding from TfL. The continuation of the scheme will depend on financial resources available.
3.1	Emissions from developments and buildings	Creation of an Air Quality Supplementary Planning Guidance (SPG).	*Action partly on hold*. A Draft SPG has been created, but it could not be progressed until Havering's Local Plan was adopted in November 2021. Next steps will be determined in 2022.
3.2	Emissions from developments and buildings	Review current planning conditions, in relation to air quality, to ensure they are fit for purpose.	*Action completed*. Planning conditions have been reviewed and are in line with the requirements set out in the New London Plan.
3.3	Emissions from developments and buildings	Adopt and implement planning controls on combined heat and power (CHP) or biomass systems	*Action ongoing*. Havering uses a condition requiring the emissions limits for CHP and Biomass set out in Appendix 7 of the GLA Sustainable Design and Construction SPG. For all new developments Havering requires ultra low NOx boilers to be installed.
3.4	Emissions from developments and buildings	Adopt and implement planning controls on air quality neutral development.	*Action ongoing*. Havering requires all new developments to undertake an air quality neutral assessment, in line with the New London Plan and the Draft Air Quality Neutral London Plan Guidance.

Measure	LLAQM Action Matrix Theme	Action	Progress • Emissions/Concentration data • Benefits • Negative impacts / Complaints
3.5	Emissions from developments and buildings	To ensure that new Housing Estate Regeneration Programme for LBH housing developments obtain the commitment from developers to a strategy of future reduction of reduced carbon foot print and minimal impact on air quality.	*Action ongoing*. Havering's regeneration team is committed to reduced carbon foot print and air quality neutral development. Public Protection, Regeneration Services and the appointed consultants and contractors collaborate and are aware that an air quality assessment is required on validation of any regeneration planning applications.
3.6	Emissions from developments and buildings	Adopt and implement planning controls for innovative and recognised green space and planting in new developments. Planning to work with grounds maintenance and parks at design stage for advice on greening and planting	*Action ongoing*, through inter-departmental work with Havering's Strategic Development and Public Realm. Both the London Plan 2021 and Local Plan 2021 have policies relating to green infrastructure. London Plan policy now requires minimum achievement against the Urban Greening Factor (UGF). The Council tries to strike a balance between decent green infrastructure on sites and their associated maintenance costs.
3.7	Emissions from developments and buildings	Promote and enforce the Smoke Control Areas to reduce the amount of unlicensed burning.	*Action ongoing*. Havering provides information to residents about Smoke Control Areas on its website https://www.havering.gov.uk/airquality Chimney smoke complaints are investigated to determine if authorised fuels are being used by the resident. If non-authorised fuels are being used, our enforcement officers educate the residents and for a first time complaint, provide details from the DEFRA website. If further complaints are made and substantiated, then enforcement action is taken.
3.8	Emissions from developments and buildings	Monitoring and implementation of Non Road Mobile Machinery (NRMM)	*Action ongoing*. A planning condition with the NRMM requirements is applied to all major developments in Havering. As part of the London-wide NRMM scheme, 19 audits were undertaken in 2021. All sites

Measure	LLAQM Action Matrix Theme	Action	Progress • Emissions/Concentration data • Benefits • Negative impacts / Complaints
			were compliant (45% self-compliant, 55% compliant following engagement with inspectors).
3.9	Emissions from developments and buildings	Promote public sector landlords (homes and public buildings) to take air quality and energy efficiency advice before refits, via the GLA RE:NEW and RE:FIT Programmes.	*Action ongoing*. The Council's Asset Management Strategy 2021-26, was adopted in November 2021. 2,620 homes have been found below the standard required by 2030 (based on a SAP - Standard Assessment Procedure - rating below 69). The solutions for these properties will vary based on different property types. An Energy Management Plan is expected to be finalised in 2022.
3.10	Emissions from developments and buildings	Deliver infrastructure to ensure that Romford, Rainham and Beam Park Housing Zones are accessible by means other than the car and that residents are provided with options to travel sustainably (Including the Beam Parkway Major scheme and Beam Park station)	*Action ongoing*. The design for the proposed A1306 has been completed. It has not however been possible to implement the scheme due to: (a) The uncertainty around the delivery of the proposed Beam Parkway Station, which amongst other things, has had on impact on planning and the availability of S106 funding contributions; (b) TfL advising that due to their wider financial position it is not able to provide grant funding to the scheme. There is also uncertainty concerning the delivery of the proposed Beam Park Station. The GLA/DfT are working to resolve this issue. Whilst some design work has been undertaken on Romford Ring Road, the pace of progress has lessened due to TfL not being able to provide further funding to support the scheme because of its wider financial situation.
3.11	Emissions from developments and buildings	Identify previously unknown and new premises that require permitting under PPC.	*Action on hold*. Due to impacts of Covid-19 on staff welfare and diversion to other urgent duties this work was place on hold in 2021. There will be a further review to decide whether capacity or resources allow progression of this action in 2022.

Measure	LLAQM Action Matrix Theme	Action	Progress • Emissions/Concentration data • Benefits • Negative impacts / Complaints
		Determine these properties that require permitting for Pollution Prevention Control (PPC).	
3.12	Emissions from developments and buildings	Signpost business contact and residents to the appropriate boiler scrappage schemes and energy efficiency grants; Promote businesses and residents to take air quality and energy efficiency advice; embed this practice as part of business as usual activity of the department	*Action ongoing*. The LB Havering website https://www.havering.gov.uk/info/20013/environment/137/energy currently signposts businesses and residents to the following schemes: Big London Energy Switch; Warm Home Discount; Solar Together; Green Homes Grant; Cleaner Heat Cashback for Small or Medium-Size Businesses and information about other energy advice and grants. There is no capacity at present within the Energy Management service to provide advice to businesses and residents on air quality and energy efficiency advice. The focus of the service is on the delivery of Havering's corporate energy contract.
4.1	Emissions from transport (covers the Matrix themes: Delivery servicing and freight, borough fleet actions, localised solutions and cleaner transport)	Include requirement for suppliers of large council contracts that they have attained silver or gold FORS accreditation for their organisation and vehicles	*Action completed*, as reported in 2021.
4.2	Emissions from transport (covers the Matrix themes: Delivery servicing and freight, borough fleet actions, localised	Investigate the feasibility of introducing dedicated drop off zones outside all schools for buses & coaches.	*Action cancelled,* as reported in 2021.

Measure	LLAQM Action Matrix Theme	Action	Progress • Emissions/Concentration data • Benefits • Negative impacts / Complaints
	solutions and cleaner transport)		
4.3	Emissions from transport (covers the Matrix themes: Delivery servicing and freight, borough fleet actions, localised solutions and cleaner transport)	Renewal of Taxi Framework, with suppliers complying to the Ultra Low Emission Zone (ULEZ) & exploring ZEC (Zero Emission Capable) Standards	*Action ongoing*. The ULEZ has now been implemented and TfL was liaising with organisations such as taxi companies prior to the ULEZ being enforced to make sure vehicles are compliant.
4.4	Emissions from transport (covers the Matrix themes: Delivery servicing and freight, borough fleet actions, localised solutions and cleaner transport)	Provide Smarter Driver Training for all vocational drivers of the Council's fleet vehicles. Delivered by CPC training and FTA Van excellence accreditation	*Action ongoing*. The Council intends to recommence driver Certificate of Professional Competence (CPC) and LoCity training in 2022-23. It is also intending to investigate investment in fleet vehicles which can use electric power. The Council's current fleet uses fuel Gas-to-liquid fuel (GTL) and this is not expected to change in the short-term, as (Green) Hydrogen and Hydrogen powered vehicles are not yet widely available for fleet use. The Mayoral Diesel Car has now been replaced with a full Battery Electric Vehicle (BEV).
4.5	Emissions from transport (covers the Matrix themes: Delivery servicing and freight, borough fleet actions, localised solutions and cleaner transport)	Investigate the feasibility on the delivery of Electric Vehicle Charging Point (EVCP) infrastructure across the borough.	*Action ongoing*. The Council was allocated £170k of OZEV funding to deliver 68 EVCPs across 12 council car parking areas. Procurement process commenced in 2021. The Council was also allocated £176k of OZEV funding to deliver 80 on-street EVCPs across the borough that will be connected to the lamp columns. Implementation for both programmes is expected by the end of 2022 calendar year.

Measure	LLAQM Action Matrix Theme	Action	Progress • Emissions/Concentration data • Benefits • Negative impacts / Complaints
			The Council's draft Electric Vehicle Charging Strategy is currently being reviewed by the Energy Savings Trust. Further work will take place on the strategy before it is taken to Councillors for approval. The aim is for the strategy to be adopted in 2022.
4.6	Emissions from transport (covers the Matrix themes: Delivery servicing and freight, borough fleet actions, localised solutions and cleaner transport)	Review parking charges policy (controlled parking zones)	*Action cancelled*, as reported in 2021.
4.7	Emissions from transport (covers the Matrix themes: Delivery servicing and freight, borough fleet actions, localised solutions and cleaner transport)	Engage with businesses in the borough through business forums to discuss the options for upgrading/retrofitting to accommodate ULEZ requirements.	*Action on hold*. TfL are proposing to expand the ULEZ out to the GLA boundary and will be consulting on this proposal in May 2022. Officers are currently assessing what the likely impact of this would be on the borough and businesses. Once the consultation is published the Council will ensure businesses are aware of it and have an opportunity to respond.
4.8	Emissions from transport (covers the Matrix themes: Delivery servicing and freight, borough fleet actions, localised solutions and cleaner transport)	Plant greenery and trees (e.g. hedgerows and trees such as ash, common alder, field maple, larch, Norway maple, scots pine and silver birch) along main roads and town centres, which can lead to an improvement in air quality based on available evidence	*Action on hold*. Planting was not carried out in 2021 due to lack of funding, however, there is a plan to plant 250 trees per year, as part of Havering's Climate Change Action Plan, which was adopted in 2021. Where possible, trees will be sought that have a positive impact on carbon and particulates capture.

Measure	LLAQM Action Matrix Theme	Action	Progress • Emissions/Concentration data • Benefits • Negative impacts / Complaints
4.9	Emissions from transport (covers the Matrix themes: Delivery servicing and freight, borough fleet actions, localised solutions and cleaner transport)	Develop Local Implementation Plan to support improvements in local air quality; together with working with TfL to ensure pollution sources outside of local control i.e. buses and commuter traffic are dealt with.	*Action completed*, as reported in 2021.
4.10	Emissions from transport (covers the Matrix themes: Delivery servicing and freight, borough fleet actions, localised solutions and cleaner transport)	Undertake feasibility work to examine the air quality implications of re-routing of bus services away from Romford town centre and look options for improving sustainable travel access into Romford town centre.	*Action on hold*. This is an action that was tied to the Romford Masterplan. Action to be reviewed to establish whether it should continue to be part of the AQAP.
4.11	Emissions from transport (covers the Matrix themes: Delivery servicing and freight, borough fleet actions, localised solutions and cleaner transport)	Continue to routinely check the weighbridges used commercially by (usually large) vehicles	*Action ongoing*. This action aims to reduce the number of overloaded vehicles and is expected to lead to a reduction in emissions. Due to restrictions, no inspections were carried out in 2021.

3. Planning Update and Other New Sources of Emissions

Table J. Planning requirements met by planning applications in London Borough of Havering in 2021

Condition	Number
Number of planning applications where an air quality impact assessment was reviewed for air quality impacts	18
Number of planning applications required to monitor for construction dust	8
Number of CHPs/Biomass boilers refused on air quality grounds	0
Number of CHPs/Biomass boilers subject to GLA emissions limits and/or other restrictions to reduce emissions	0
Number of developments required to install Ultra-Low NO_x boilers	81
Number of developments where an AQ Neutral building and/or transport assessments undertaken	14
Number of developments where the AQ Neutral building and/or transport assessments not meeting the benchmark and so required to include additional mitigation	10
Number of planning applications with S106 agreements including other requirements to improve air quality	0
Number of planning applications with CIL payments that include a contribution to improve air quality	0
NRMM: Central Activity Zone and Canary Wharf Number of conditions related to NRMM included. Number of developments registered and compliant. Please include confirmation that you have checked that the development has been registered with the GLA through the relevant NRMM website and that all NRMM used on-site is compliant with Stage IIIB of the Directive and/or exemptions to the policy.	N/A
NRMM: Greater London (excluding Central Activity Zone and Canary Wharf) Number of conditions related to NRMM included. Number of developments registered and compliant. Please include confirmation that you have checked that the development has been registered at www.nrmm.london and that all NRMM used on-site is compliant with Stage IIIA of the Directive and/or exemptions to the policy.	 14 conditions included 11 registered and compliant 2 unregistered initially, but compliant following engagement

The Council's Planning Service consults the Public Protection Service on all valid planning applications received, including major developments. Public Protection Officers then review and assess these applications recommending air quality conditions where required. Once a planning consultation response has been sent the progress of the planning application is not monitored by Public Protection (e.g.

whether the application has been granted planning permission or not, whether the recommended conditions have been attached or not etc.).

However the Planning Service will, usually, adopt our recommendations and the relevant conditions are attached to the planning decisions. Once an application for discharge of condition has been submitted, Public Protection is consulted again and the submitted documentation is reviewed and assessed. The condition is discharged once the documentation has been considered sufficiently in line with current guidance.

Inspections and engagement activities, in relation to NRMM are carried out by the London Borough of Merton, as part of the London wide scheme.

3.1 New or significantly changed industrial or other sources

No new sources identified

4. Additional Activities to Improve Air Quality

4.1 London Borough of Havering Fleet

London Borough of Havering currently has only one electric vehicle in its fleet. However, it is currently being investigated to switch the grounds maintenance vehicles to electric and hybrid vehicles. Available options of switching the Council's pool cars to electric are also being considered.

4.2 NRMM Enforcement Project

London Borough of Havering will continue to support the NRMM scheme for the current financial year 2022/23.

4.2 Air Quality Alerts

London Borough of Havering supports airTEXT (https://www.airtext.info/) as well as the London Air website. The airTEXT application is regularly promoted, as part our communications campaign and the air pollution alerts which are provided by the Mayor of London are shared on our social media.

Appendix A Details of Monitoring Site Quality QA/QC

A.1 Automatic Monitoring Sites

HV1 and HV3 are representative of roadside exposure within the Borough. All the sites are part of the London Air Quality Network and therefore the standards of QA/QC are similar to those of the government's AURN sites. Regular monthly calibrations are carried out, with subsequent data ratification undertaken by ERG at Imperial College London. The data for 2021 have been ratified.

Data capture from the NOx analysers at HV1 and HV3 in 2021 were 99% for both sites.

PM_{10} Monitoring Adjustment

PM_{10} at HV3, and PM_{10} and $PM_{2..5}$ at HV1 are measured by FDMS, consequently correction is not necessary.

A.2 Diffusion Tubes

Diffusion Tubes are supplied and analysed by Socotec, Didcot. For 2021 tubes are prepared by spiking acetone: triethanolamine (50:50) onto grids prior to the tubes being assembled. The tubes are desorbed with distilled water and the extract analysed using a segmented flow autoanalyser with ultraviolet detection. The tubes were analysed in accordance with Socotec's standard operating procedure ANU/SOP/1015. This method meets the guidelines set out in DEFRA's 'Diffusion Tubes for Ambient NO2 Monitoring: Practical Guidance'. As set out in the practical guidance, the results were initially calculated assuming an ambient temperature of 11^{o}C, the reported values have been adjusted to 20^{o}C to allow for direct comparison with EU limits. As set out in the current Precision Summary Table, Socotec Didcot is listed in the table of laboratories with Good Precision. In the AIR PT intercomparison scheme for comparing spiked Nitrogen Dioxide diffusion tubes, SOCOTEC currently holds the highest rank of a Satisfactory laboratory.

The bias adjustment factor for Socotec, for the 50% TEA in Acetone preparation method in 2021, taken from the National Bias Adjustment Factor Spread sheet (v03_22) is 0.78.

The London Borough of Havering has a triplicate diffusion tube co-location study at one of the roadside automatic monitoring sites, operational since 2015. Due to

Waterloo Road being a high concentration site (roadside site) any bias adjustment factors derived should not be used for any low concentration monitoring sites.

Discussion of Choice of Factor to Use

Table K. Bias Adjustment Factor

Year	Local or National	If National, Version of National Spreadsheet	Adjustment Factor
2021	National	03/22	0.78
2020	National	06/21	0.77
2019	National	09/20	0.77
2018	National	06/19	0.76
2017	National	03/18	0.77
2016	National		0.77
2015	National		0.79

A.3 Adjustments to the Ratified Monitoring Data

Short-term to Long-term Data Adjustment

Capture rates for NO2 at our two continuous monitoring stations and diffusion tubes were above 75% therefore annualisation was not necessary for 2021.

Annualisations for PM10 at both continuous monitoring stations and for PM2.5 at the HV1 monitoring station were required. Two background continuous monitoring sites with data capture greater than 85% were used for the annualisation of PM10; Bexley – Belvedere and Newham – Wren Close. For the annualisation of PM2.5, Bexley - Slade Green FDMS and City of London – The Aldgate School background sites were used. The annualisation results are provided in Table L.

Distance Adjustment

The data presented in Table M has been adjusted for distance, using the LAQM Diffusion Tube Data Processing Tool. Local Annual Mean Background NO2 Concentrations have been identified using the 2021 Defra reference background maps and in some instances background diffusion tube data.

Table L. Short-Term to Long-Term Monitoring Data Adjustment

PM10								
Site ID	**Annualisation Factor Bexley - Belvedere**	**Annualisation Factor Newham - Wren Close**	**Annualisation Factor**	**Annualisation Factor**	**Average Annualisation Factor**	**Raw Data Annual Mean (µg m^{-3})**	**Annualised Annual Mean (µg m^{-3})**	**Comments**
HV1	0.947	0.997	-	-	0.972	14	13.6	
HV3	1.004	0.987	-	-	0.996	19	18.9	
PM2.5								
Site ID	**Annualisation Factor Bexley – Slade Green FDMS**	**Annualisation Factor City of London – The Aldgate School**	**Annualisation Factor**	**Annualisation Factor**	**Average Annualisation Factor**	**Raw Data Annual Mean (µg m^{-3})**	**Annualised Annual Mean (µg m^{-3})**	**Comments**
HV1	0.965	0.993	-	-	0.979	9	8.8	

Table M. NO_2 Fall off With Distance Calculations

Site ID	Distance (m): Monitoring Site to Kerb	Distance (m): Receptor to Kerb	Monitored Concentration (Annualised and Bias Adjusted (µg m^{-3})	Background Concentration (µg m^{-3})	Concentration Predicted at Receptor (µg m^{-3})	Comments
HAV6, HAV5, HAV2	3.0	4.0	38.8	17.9	*37.3*	*Predicted concentration at Receptor within 10% the AQS objective.*
HAV27, HAV28, HAV29	0.5	5.5	**40.4**	20.1	31.8	
HAV32, HAV33, HAV34	0.5	4.5	**40.6**	18.1	31.8	
HAV37	0.5	3.5	36.1	16.3	29.3	
HAV47	2.0	9.0	36.5	16	29.3	
HAV55	0.5	1.5	**40.2**	15.5	35.4	
HAV57	0.2	1.2	**53.4**	17.9	**43.7**	*Predicted concentration at Receptor above AQS objective.*
HAV58, HAV59, HAV60	0.2	1.2	**71.3**	17.9	**56.8**	*Predicted concentration at Receptor above AQS objective.*

Appendix B Full Monthly Diffusion Tube Results for 2021

Table N. NO_2 Diffusion Tube Results

Site ID	Valid data capture for monitoring period %[(a)]	Valid data capture 2021 %[(b)]	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec	Annual mean – raw data	Annual mean – bias adjusted
HAV6	-	91.7	57.4	50.4	48.2	48.9	50.5	44.4	45.0	35.4	52.2		54.6	57.8	-	-
HAV5	-	100	53.8	54.2	44.7	51.0	51.0	46.1	36.5	40.0	56.4	57.0	50.5	55.9	-	-
HAV2	-	83.3	48.0	50.2		42.5		41.6	42.3	39.9	56.0	59.2	57.3	58.2	49.8	38.8
HAV7	-	100	46.4	51.3	41.6	33.8	37.5	35.3	34.9	32.8	50.3	55.9	40.2	44.3	-	-
HAV1	-	100	43.2	49.4	41.9	38.0	43.0	32.9	35.6	31.2	45.2	57.0	37.5	51.7	-	-
HAV8	-	83.3		41.3	39.6	35.9	44.2	30.5	37.4		51.2	52.2	43.2	50.4	42.0	32.8
HAV3	-	100	20.6	21.5	27.3	24.3	24.4	19.0	19.6	16.7	29.5	31.1	36.2	34.1	25.4	19.8
HAV4	-	100	14.8	19.3	21.7	17.0	16.2	14.2	14.0	13.2	20.3	24.1	25.5	25.9	18.9	14.7
HAV9	-	100	40.9	31.9	30.6	24.0	26.2	19.8	22.2	17.9	31.2	36.3	35.6	37.4	-	-
HAV10	-	100	42.1	32.0	28.1	26.2	26.1	21.4	21.8	16.0	32.4	37.6	40.2	37.8	-	-
HAV11	-	91.7	35.2	32.0	28.1	21.8	26.3		19.1	16.5	32.6	36.5	38.7	37.2	29.5	23.0
HAV12	-	100	40.1	36.6	40.2	32.7	29.9	28.3	27.9	25.4	46.1	49.9	47.7	43.6	37.4	29.1
HAV13	-	100	44.7	42.1	43.5	41.6	35.4	33.5	33.4	22.3	42.7	40.6	43.8	45.0	-	-
HAV14	-	100	44.1	39.6	44.8	46.0	30.1	37.9	36.1	29.2	43.4	38.7	46.3	39.8	-	-
HAV15	-	100	46.8	43.4	45.4	43.8	34.7	35.8	34.4	28.3	43.0	39.6	50.7	44.6	39.9	31.1
HAV16	-	100	37.6	39.2	34.8	35.3	33.5	30.0	28.7	20.4	42.2	40.8	46.3	46.4	-	-
HAV17	-	100	47.0	32.0	39.9	38.2	32.2	32.9	29.9	24.5	41.0	40.9	44.2	41.9	-	-
HAV18	-	100	44.1	41.5	36.7	32.5	31.9	31.0	29.7	25.9	41.2	41.9	47.0	44.7	36.9	28.8
HAV19	-	91.7	44.5	37.7	39.1	30.0	38.7	34.8	39.4	34.5	48.3		58.0	51.4	-	-
HAV20	-	100	52.0	44.1	44.0	37.7	37.1	36.1	40.0	35.1	50.5	54.5	56.5	51.9	-	-
HAV21	-	100	44.1	38.2	46.1	34.7	39.3	36.8	40.2	33.0	51.1	55.6	48.9	37.8	43.2	33.7
HAV22	-	100	34.8	31.8	30.5	20.2	18.4	14.7	15.7	17.2	27.7	30.0	37.4	31.8	-	-
HAV23	-	100	32.1	27.8	28.0	17.6	19.3	13.1	17.6	16.4	28.5	30.3	35.0	34.3	-	-
HAV24	-	100	36.2	27.8	26.1	18.9	21.4	17.9	17.9	15.4	28.0	30.1	34.4	32.7	25.5	19.9
HAV25	-	100	31.3	28.9	25.5	18.3	18.6	17.7	16.3	16.1	24.4	29.7	25.4	30.9	23.6	18.4
HAV26	-	100	32.5	28.1	31.6	18.1	15.2	11.9	15.0	12.4	19.3	25.5	23.6	29.2	21.9	17.1
HAV27	-	100	57.0	58.5	53.1	46.2	0.9	48.8	47.3	42.3	62.0	59.2	61.7	59.2	-	-

Site ID	Valid data capture for monitoring period %[a]	Valid data capture 2021 %[b]	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec	Annual mean – raw data	Annual mean – bias adjusted
HAV28	-	91.7		57.7	54.0	53.2	47.1	51.1	46.4	42.7	58.9	53.7	60.8	57.4	-	-
HAV29	-	91.7		59.2	53.5	46.1	46.7	50.3	45.8	42.8	59.2	57.3	52.5	57.7	51.8	**40.4**
HAV30	-	91.7	32.6	28.6	27.5	21.5	19.0	15.6		10.8	22.0	24.0	31.6	29.6	23.9	18.6
HAV31	-	100	34.9	29.9	27.2	20.8	23.1	16.0	18.8	15.8	27.0	29.8	35.6	32.8	26.0	20.3
HAV32	-	100	60.6	51.0	61.7	42.7	53.3	45.6	45.8	40.7	57.3	60.7	62.9	60.3	-	-
HAV33	-	100	69.6	58.5	61.8	46.7	53.0	44.2	37.1	33.8	51.1	54.4	62.6	60.8	-	-
HAV34	-	100	59.5	41.9	55.0	37.8	52.5	41.5	31.2	32.6	54.5	60.4	65.8	63.2	52.0	**40.6**
HAV35	-	100	26.3	26.9	26.5	22.4	19.9	19.7	25.3	11.4	46.6	26.6	30.4	27.7	25.8	20.1
HAV36	-	100	0.8	44.0	18.3	14.9	14.0	12.1	13.8	11.7	21.2	20.4	24.5	17.2	17.7	13.8
HAV37	-	100	49.6	44.8	51.5	42.3	40.1	39.6	38.7	34.3	52.3	50.6	61.6	49.6	46.3	36.1
HAV38	-	100	31.7	27.3	21.7	16.6	17.0	15.2	17.1	11.3	24.3	24.7	15.7	29.2	21.0	16.4
HAV39	-	100	28.8	37.2	30.0	23.2	30.3	20.3	25.2	20.3	33.5	35.9	37.6	40.0	30.2	23.5
HAV40	-	100	48.2	42.1	45.2	39.6	36.7	28.6	34.1	32.0	35.7	37.8	59.9	47.2	40.6	31.7
HAV41	-	100	48.7	44.7	41.1	41.2	35.6	37.5	29.8	33.6	44.5	43.7	52.6	45.8	41.6	32.4
HAV42	-	100	40.0	34.1	23.2	31.2	29.6	23.2	23.0	18.5	32.0	34.6	40.4	37.5	30.6	23.9
HAV43	-	100	41.0	33.6	38.4	26.0	25.1	28.3	24.4	26.3	35.4	31.2	46.6	38.5	32.9	25.7
HAV44	-	100	41.8	45.2	31.7	35.5	31.0	28.7	31.6	26.8	41.4	42.0	39.9	42.2	36.5	28.5
HAV45	-	91.7	39.5	32.4	33.6	32.5	31.1	26.5		23.1	37.0	36.7	44.7	40.0	34.3	26.7
HAV46	-	100	39.6	33.4	29.2	28.2	26.4	19.1	23.7	20.0	34.8	37.0	43.8	40.1	31.3	24.4
HAV47	-	100	53.1	47.3	43.8	56.3	48.6	39.8	43.6	32.2	50.7	42.8	52.0	51.8	46.8	36.5
HAV48	-	91.7	31.8	31.2	25.1	21.1	22.2	12.5	17.9		26.6	30.1	30.1	30.0	25.3	19.8
HAV49	-	82.3	32.3	31.5	27.1	24.0	21.6	16.5	27.5		28.0		37.6	36.2	28.2	22.0
HAV50	-	100	49.3	42.1	50.0	32.1	27.1	28.3	30.9	25.3	43.2	45.7	49.6	45.9	39.1	30.5
HAV51	-	100	30.0	28.5	23.1	18.4	20.1	13.9	16.3	11.0	26.2	28.2	32.0	27.9	23.0	17.9
HAV52	-	100	41.7	42.8	37.2	34.2	33.3	29.2	35.6	25.2	43.5	46.0	38.9	45.7	37.8	29.5
HAV53	-	100	29.2	33.2	34.4	23.4	26.9	24.2	23.5	25.4	31.4	35.9	50.9	39.5	31.5	24.6
HAV54	-	100	32.2	37.4	30.1	27.7	22.5	20.6	24.6	18.3	29.9	30.8	33.7	30.9	28.2	22.0
HAV55	-	100	48.0	52.1	40.8	54.8	47.2	54.7	51.4	38.5	61.5	54.0	61.9	54.2	51.6	**40.2**
HAV56	-	100	48.0	40.3	42.2	38.9	36.9	35.6	29.6	26.8	56.3	46.4	55.3	47.0	41.9	32.7
HAV57	-	100	69.0	60.8	60.7	51.3	72.0	52.7	71.3	54.5	87.9	85.9	74.8	81.1	68.5	**53.4**
HAV58	-	66.7	101.7	92.2	86.1	80.9	77.1	70.5	251.7	1.9					-	-
HAV59	-	75	87.0	58.2	83.8	74.0	70.6	69.9	258.4				103.1	97.0	-	-

Site ID	Valid data capture for monitoring period %[a]	Valid data capture 2021 %[b]	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec	Annual mean – raw data	Annual mean – bias adjusted
HAV60	-	75	90.5	81.4	81.1	76.0	70.1	63.6	222.7				97.8	95.9	91.5	**<u>71.3</u>**
HAV61	-	100	36.8	30.4	25.0	21.9	22.7	28.7	17.3	14.0	27.8	30.1	32.0	34.2	26.7	20.9
HAV62	-	91.7		44.9	35.7	39.4	31.3	30.6	30.3	23.4	42.3	42.9	41.0	44.5	36.9	28.8
HAV63	-	100	50.4	42.6	44.6	34.3	26.8	33.1	29.9	31.7	41.9	42.3	51.9	47.2	39.7	31.0
HAV64	-	100	44.1	40.4	38.5	31.2	35.1	31.9	29.5	28.5	40.6	35.5	47.6	47.7	37.6	29.3
HAV65	-	100	42.8	32.6	32.8	28.4	22.2	29.6	27.4	24.7	39.5	41.1	44.6	40.7	33.9	26.4
HAV66	-	91.7	31.8	43.5		38.4	40.7	17.9	37.2	32.5	48.9	50.2	53.4	51.1	40.5	31.6

Notes

Concentrations are presented as µg m^{-3}.

Exceedances of the NO_2 annual mean AQO of 40 µg m^{-3} are shown in **bold**.

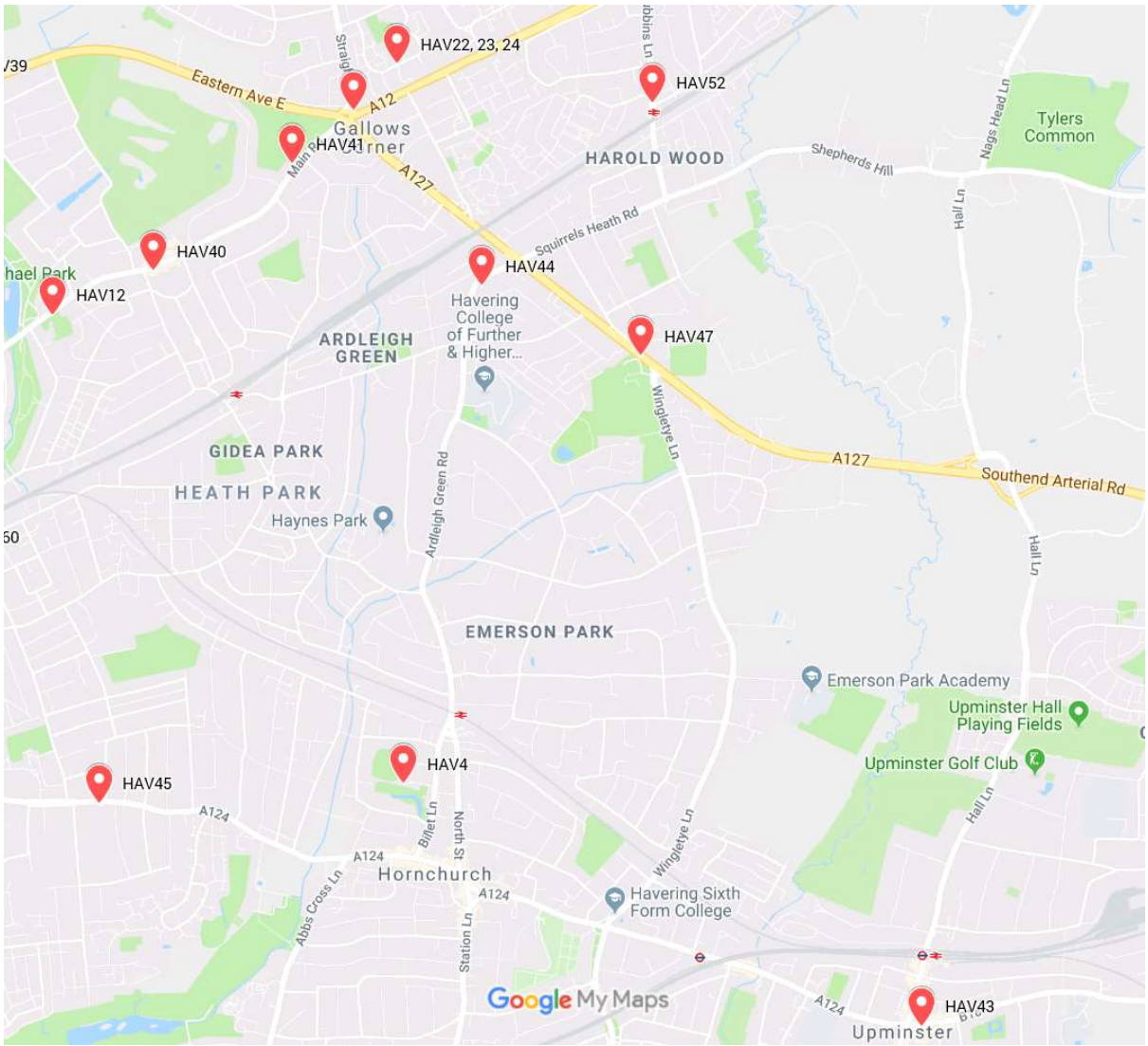
NO_2 annual means in excess of 60 µg m^{-3}, indicating a potential exceedance of the NO_2 hourly mean AQS objective are shown in **<u>bold and underlined</u>**.

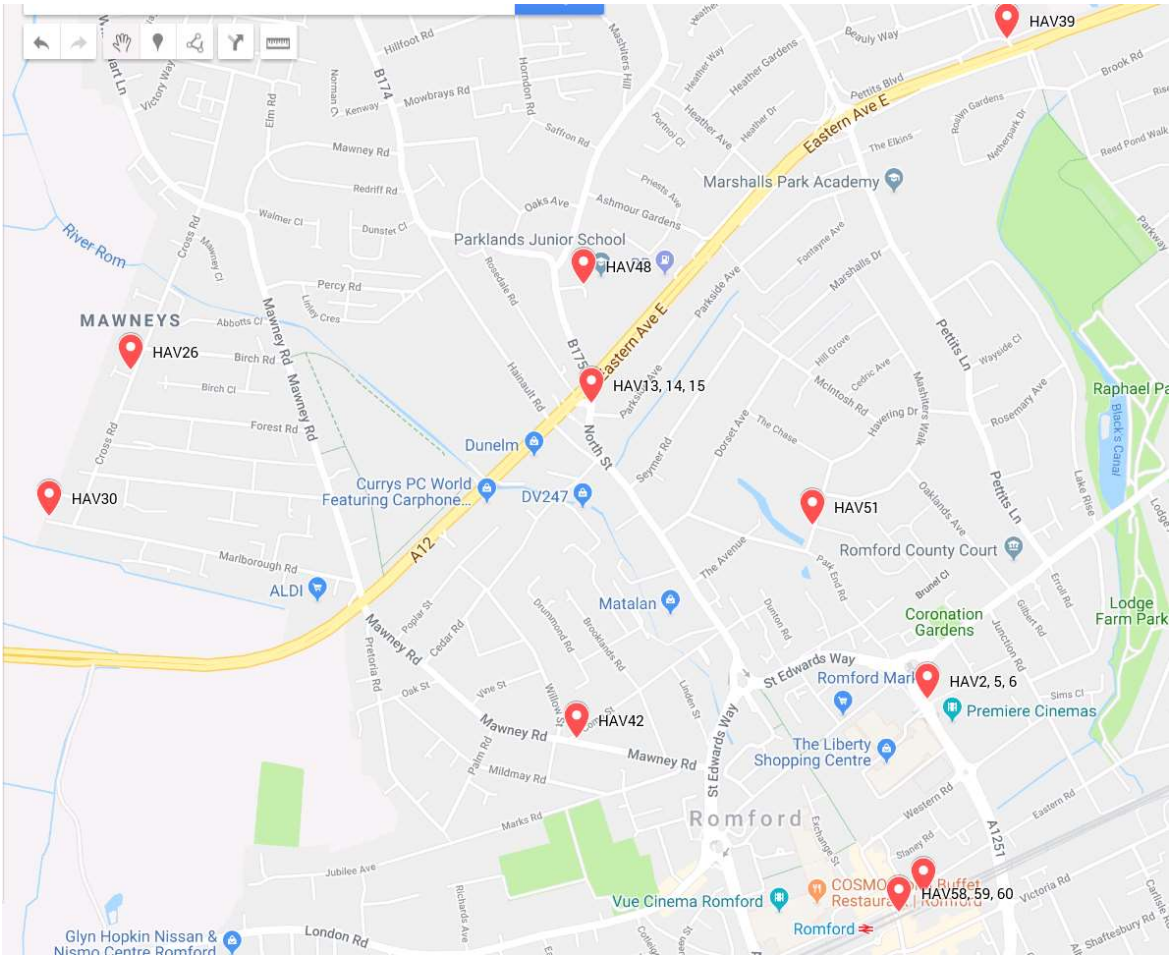
All means have been "annualised" in accordance with LLAQM Technical Guidance if valid data capture for the calendar year is less than 75% and greater than 25%.

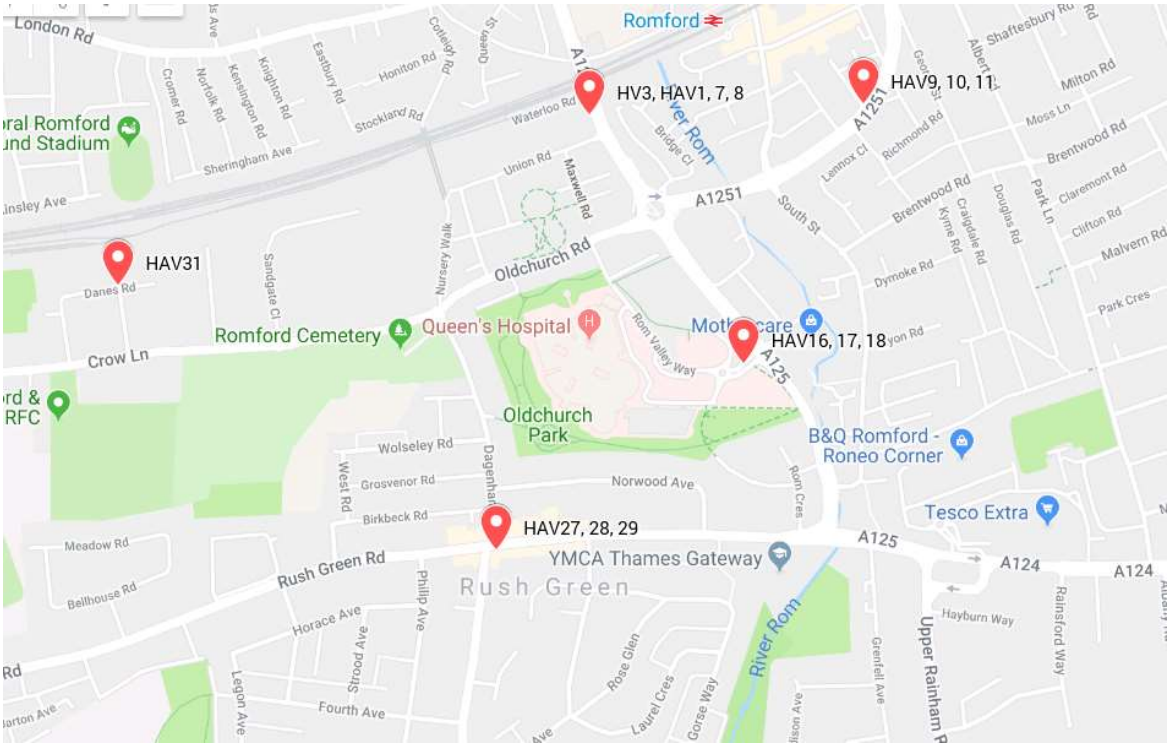
(a) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

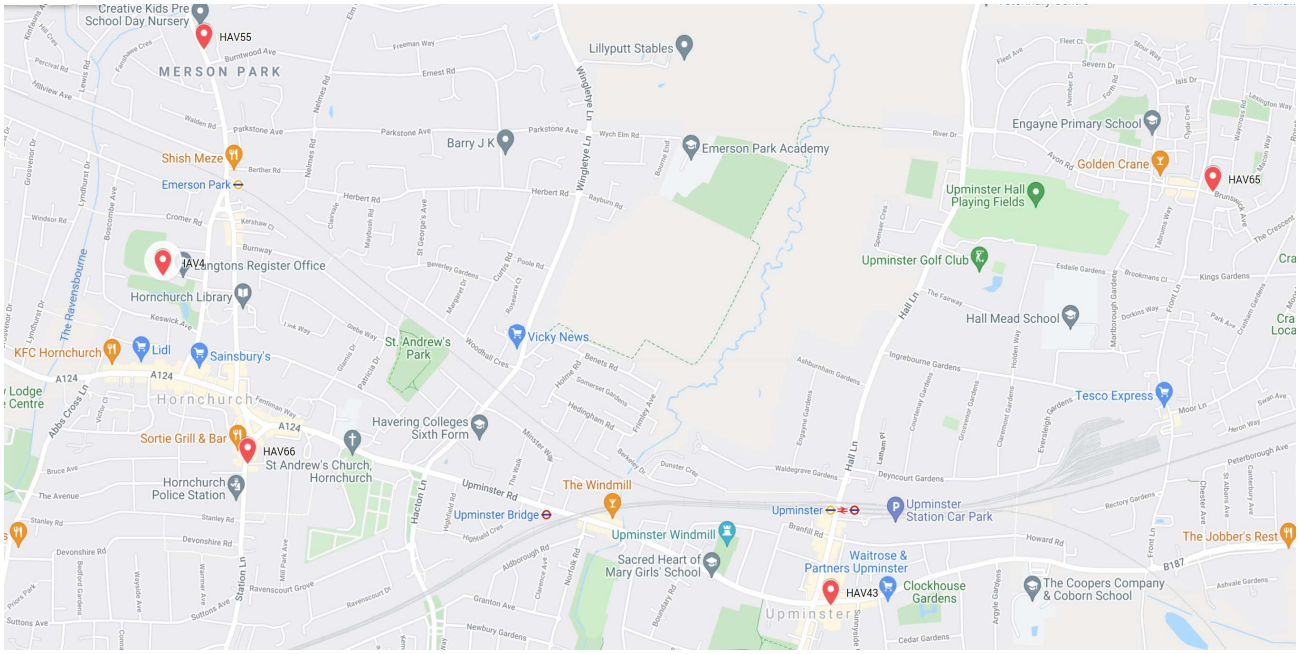
(b) data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%).

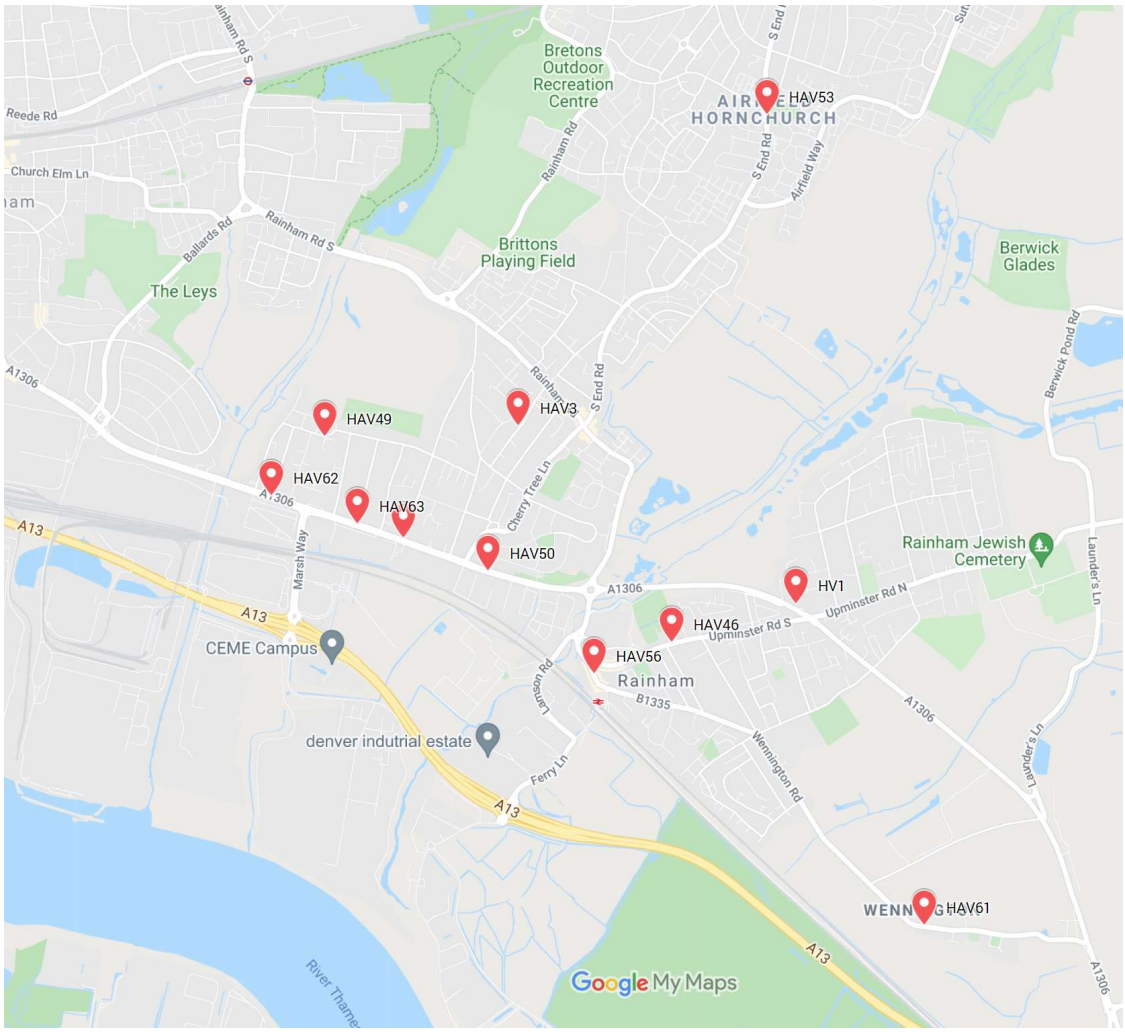
Appendix C Monitoring Sites Maps




HAV39
Eastern Ave E
Marshalls Park Academy
Parklands Junior School
HAV48
River Rom
MAWNEYS
HAV26
HAV13, 14, 15
Dunelm
HAV30
Currys PC World
Featuring Carphone...
DV247
HAV51
A12
Romford County Court
ALDI
Matalan
Coronation
Gardens
Lodge
Farm Park
St Edwards Way
Romford Mari
HAV2, 5, 6
Premiere Cinemas
HAV42
The Liberty
Shopping Centre
Romford
HAV58, 59, 60
Vue Cinema Romford
Romford
Glyn Hopkin Nissan &
London Rd


Romford
London Rd
HV3, HAV1, 7, 8
HAV9, 10, 11
A1251
HAV31
Oldchurch Rd
Romford Cemetery
Queen's Hospital
HAV16, 17, 18
Crow Ln
Oldchurch
Park
B&Q Romford -
Roneo Corner
Tesco Extra
HAV27, 28, 29
YMCA Thames Gateway
A125
A124
Rush Green Rd
Rush Green
River Rom


Creative Kids Pre School Day Nursery
HAV55
MERSON PARK
Lillyputt Stables
Barry J K
Emerson Park Academy
Engayne Primary School
Golden Crane
HAV65
Shish Meze
Emerson Park
Upminster Hall Playing Fields
HAV4
Upminster Golf Club
Hornchurch Library
Vicky News
Hall Mead School
KFC Hornchurch
Lidl
Sainsbury's
St. Andrew's Park
Tesco Express
Hornchurch
Sortie Grill & Bar
HAV66
Havering Colleges Sixth Form
St Andrew's Church, Hornchurch
Hornchurch Police Station
The Windmill
Upminster Bridge
Upminster
Upminster Station Car Park
Upminster Windmill
The Jobber's Rest
Sacred Heart of Mary Girls' School
Waitrose & Partners Upminster
HAV43
Clockhouse Gardens
The Coopers Company & Coborn School
Upminster
A124
B187


Bretons Outdoor Recreation Centre
HAV53
HORNCHURCH
Reede Rd
Church Elm Ln
Rainham Rd S
Ballards Rd
Brittons Playing Field
The Leys
Berwick Glades
Berwick Pond Rd
A1306
HAV49
HAV3
HAV62
HAV63
HAV50
Cherry Tree Ln
S End Rd
Airfield Way
A13
Marsh Way
CEME Campus
Rainham Jewish Cemetery
Launder's Ln
HV1
Upminster Rd N
HAV46
Upminster Rd S
HAV56
Rainham
B1335
denver indutrial estate
Ferry Ln
Wennington Rd
WENNINGTON
HAV61
River Thames
Google My Maps