London Borough of Camden

26 Rosslyn Hill

Proof of Evidence - Dr Michael Bull, Air Quality

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Summary

1. My name is Michael Andrew Bull, my qualifications and experience are provided in detail in my main proof. In my main proof I consider in more detail relevant air quality standards, the health impact of air pollutants, relevant planning policy and guidance, the information available on existing air quality at the proposed school site at 26 Rosslyn Hill and the suitability of the site for the proposed use.

2. Air quality standards have been introduced in England as a result of UK and European legislation. These standards were introduced to protect human health, however, there is evidence that health impacts occur even where these standards are met. The two pollutants of most importance for this assessment are nitrogen dioxide (NO_2) and fine particulate matter (PM_{10} and $PM_{2.5}$) although these may also act as markers for the health impacts of other traffic related pollutants.

3. Children are one group of the population that are particularly vulnerable to health impacts from air pollutants. Studies have shown that exposure to traffic related pollution reduces the lung function of young children.

4. Planning policy at national, regional and local scale all has a general aim to locate sensitive uses away from more polluted areas to reduce exposure of vulnerable groups to air pollutants. Schools are specially noted as one type of use that is particularly sensitive to air pollutants.

5. Guidance on air quality and planning specifically recommends that new schools should be located more than 100m from busy roads.

6. The air quality report submitted with the planning application concludes that parts of the site are likely to exceed the annual mean air quality standard for nitrogen dioxide. This conclusion is confirmed by modelling carried out on behalf of the GLA which also demonstrates that parts of the site exceed air quality standards.

7. The Appellant has also provided the results of air quality monitoring at the site which shows that nitrogen dioxide concentrations are very close to the standard on the parts of the site nearer to (busy roads.) However, this monitoring has been carried out for a limited period that is not compliant with guidance and uses a method with a potential error of up to 20%. The monitoring therefore provides no

confidence that the site meets air quality standards although it does confirm that traffic related pollutant concentrations are elevated by the nearby busy road.

8. The Appellant's proposals to provide no mitigation at first floor level and above are based on modelling that is not appropriate for the complex urban environment. Other assessments of the changes in pollutant levels with height shows that air quality models do not predict the actual observed concentrations well and pollutant concentration can increase with height. With the current proposals, the occupants of upper floors are therefore at risk of being exposed to NO_2 levels above standards and increased concentrations of other traffic related pollutants.

9. The air quality neutral assessment provided in the Appellant's air quality report assumes that there is no use of the school outside of term time. If there is traffic associated with out of term time use, then the development will not be air quality neutral as required by GLA policy.

10. Having considered the above, I conclude that the proposed development is in an area where there is a risk that NO_2 concentrations are currently above the relevant air quality standard and that there will be increased concentrations of other traffic related pollutants. The proposed development therefore does not meet policy objectives to site sensitive uses such as schools in areas to minimise exposure of the occupants to air pollution. The location does not meet the recommendations of the Environmental Protection UK/Institute of Air Quality Management guidance to site schools more than 100m from busy roads.

11. I also conclude that the proposed mitigation is not adequate to protect the occupants of the building and will not protect users of the building in external areas of the site and travelling to and from the school.

12. I therefore conclude that this development is not in accordance with policy to site sensitive land uses in areas that will minimise exposure to air pollutants.

1 Introduction

Michael Andrew Bull will say:

1. I hold a BSc in Chemical Engineering from Exeter University and PhD in Public Health Engineering from Imperial College, London. I am a Chartered Engineer, Chartered Scientist and Chartered Environmentalist, a Fellow of the Institute of Air Quality Management, a Member of the Institute of Environmental Sciences and a corporate member of the Institution of Chemical Engineers. I sat on the council of the Institute of Air Quality Management (IAQM) since its formation until 2018 and was the Vice Chairman of the Institute for 3 years until 2018. I am a Director of Ove Arup & Partners Ltd and particularly responsible for directing the air quality and odour assessments undertaken by the company.

2. I have worked as a professional environmental scientist for approximately 34 years having previously conducted research in environmental science for three years. I have held posts both within industry and as a consulting scientist. I have been responsible for conducting environmental studies for major road improvement and construction schemes, power stations, mineral extraction sites and other major industrial complexes. In addition, I have carried out numerous air quality assessments of retail, commercial and housing proposals and am one of the co-authors of the RTPI Good Practice Guide on Air Quality and Land Use Planning, was a contributing author to versions of the National Society of Clean Air's Panel guidance regarding Air Quality and Planning and the chair of the working group for the IAQM Guidance on the Assessment of Odour for Planning produced in 2014 and updated in 2018.

3. I have undertaken numerous air quality assessments in my career. These studies have been carried out for Environmental Statements, planning applications, for presentation as evidence at public inquiries and in association with civil action

regarding statutory nuisance. I have also published papers concerning air quality, odour and planning issues.

4. In this instance I have been retained by the London Borough of Camden to advise on air quality issues associated with the proposed development and use of the former police station at 26 Rosslyn Hill, Hampstead, London, NW3 1PD.

5. In this Proof I provide some background information concerning air quality assessment, consider relevant standards, policy and guidance, describe the air quality environment in the vicinity of the school and consider the suitability of the site for the proposed use particularly in the context of relevant guidance.

6. A Summary is provided at the start of my Proof.

7. As a member of the IAQM I am bound by its Code of Professional Conduct which requires that members "*Maintain professional integrity at all times and be guided by the principle of applying the most appropriate science/practice for any given task. This requires members to display objectivity and refrain from being selective or partial when presenting data or facts for a written report or in oral form*". I confirm that I have complied with this professional obligation in preparing this proof of evidence.

2 Relevant Standards, Policy and Guidance

2.1 Relevant Pollutants and Health Effects

13. Although there are air quality standards for several pollutants in the UK, when considering air quality in an urban area there are only two pollutants that are normally at risk of breaching statutory air quality standards – namely nitrogen dioxide (also known as NO_2) and fine particulate matter.

14. Nitrogen dioxide is one of a group of substances known as nitrogen oxides or NOx. Nitrogen oxides are formed when fossil fuels are burned at high temperatures. Nitrogen dioxide is the most harmful of the nitrogen oxides and is directly emitted from engines and can also be formed in the atmosphere by the reaction between the (generally) more common nitric oxide and ozone. The Committee on the Medical Effects of Air Pollutants (COMEAP)[1] has noted that "*evidence of associations of ambient concentrations of NO_2 along with a range of effects on health has strengthened in recent years*" and that "*it would be sensible to regard NO_2 as causing some of the health impact*" associated with traffic related pollutants. In their more recent 2018 report[2] COMEAP noted that there does not appear to be a threshold for adverse health effects – i.e. there is no lower level where health impacts are not observed (Appendix A provides extracts from COMEAP Statement and Report).

15. As the name implies, fine particulate matter consists of small particles below a specified aerodynamic diameter. There are air quality standards for PM_{10} (particles with a diameter below 10 microns) and $PM_{2.5}$ (particles with a diameter below 2.5 microns). Although there are no standards, there is increasing interest in so called "Ultra Fine Particulates" (UFPs). These are small particulates with a diameter below 100 nanometres; it is considered possible that their small size and large surface area may make them particularly harmful to health but, as yet, the available evidence is limited. Fine particulate matter is of interest as it is small enough to penetrate into the lungs and can then be transported around the body.

[1] COMEAP Statement of the evidence for the effects of nitrogen dioxide on health, 12 March 2015

[2] COMEAP Associations of long term average concentrations of nitrogen dioxide with mortality, 22 August 2018

The Government's Clean Air Strategy 2019[3] (Appendix B) states "*Particulate matter can have short term health impacts over a single day when concentrations are elevated, and long term impacts from lower level exposure over the life-course. Effects are amplified in vulnerable groups including young children*".

16. The World Health Organisation (Appendix C) acknowledges that there is no lower threshold where fine particulate pollution has no health effects[4].

17. Although there are several other air pollutants associated with urban environments NO_2 and fine particulate matter are considered to be useful analogues for their health impacts.

2.2 Air Quality Standards and Human Health

18. Air quality standards have been introduced in the UK and are intended to protect human health. In England there is a two-level system of air quality standards; there are air quality objectives set by the UK Government and limit values set through European Union directives. Air Quality Objectives are values to be achieved by a target date. Local authorities are required to review air quality in their area and where the objectives are not met, then they must declare an Air Quality Management Area (AQMA) and prepare a plan to improve air quality. EU limit values are legally binding values for each pollutant that must not be exceeded. Numerically in England, objectives and limit values have the same value.

19. For NO_2 and fine particulate matter, standards have been set for annual mean concentrations and for short term exposure (1 hour or 24 hour average). These are shown in Table 1. Air quality can be considered to be poor when concentrations are above the air quality standards.

[3] Defra Clean Air Strategy, 2019
[4] https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health

Table 1 Air Quality Standards

Pollutant	8. **Averaging period**	9. **Air quality standard**
Human health		
Nitrogen Dioxide (NO_2)	Annual mean	$40\mu g/m^3$
	1-hour mean	$200\mu g/m^3$ [1]
Fine Particulate Matter (PM_{10})	Annual mean	$40\mu g/m^3$
	24-hour mean	$50\mu g/m^3$ [2]
Very Fine Particulate Matter ($PM_{2.5}$)	Annual mean	$25\mu g/m^3$
[1] not to be exceeded more than 18 times a year (99.79th percentile) *[2] not to be exceeded more than 35 times a year (90.41th percentile)*		

10. Although air quality standards are designed to protect the most vulnerable members of the population, there is evidence that children are more vulnerable to the effects of from air pollution than adults and the World Health Organisation[5] (Appendix D) suggested in 2015 that they may recommend a more stringent annual mean air quality standard for NO_2 noting that studies have shown associations with adverse effects on respiratory symptoms and lung function. This report also notes that in the context of long term exposure, NO_2 may represent other constituents in the mixture of traffic related air pollutants – i.e. some of the observed health impacts may result from exposure to other pollutants.

11. A study in London reported in The Lancet[6] (Appendix E) has demonstrated that a smaller lung volume in children was associated with higher annual air pollutant exposure. It was found that for children in London the impact of exposure to NO_2 equated to a loss of between 4.8% and 5.3% of lung function. This reduction was related to the exposure to NO_2 and therefore reducing exposure would reduce the impact on lung function. This study also notes that NO_2 is a marker for other traffic related pollutants.

[5] WHO Expert Consultation: Available evidence for the future update of the WHO Global Air Quality Guidelines (AQGs), https://www.euro.who.int/__data/assets/pdf_file/0013/301720/Evidence-future-update-AQGs-mtg-report-Bonn-sept-oct-15.pdf?ua=1
[6] https://www.thelancet.com/journals/lanpub/article/PIIS2468-2667(18)30202-0/fulltext

12. On behalf of the Department of Health, Public Health England has reviewed the evidence on practical interventions to reduce harm from outdoor air pollution[7] (Appendix F). They note that it is better to reduce air pollution at source rather than mitigate the consequences. They suggest using the spatial planning system to reduce exposure to pollution including interventions that separate people from pollution. The document suggests a particular focus on children and air quality around schools noting:

"*Children are particularly vulnerable to the effects of air pollution. Exposure to air pollution in early life can have a long-lasting effect on lung function. There is evidence that the process of normal lung function growth in children is suppressed by long-term exposure to air pollution. Throughout childhood, there is a natural development of lung function and maximising this is important, as low lung function leads to less reserve if lung disease develops.*

We therefore recommend taking a particularly focused approach on reducing the impact of air pollution on children. This would suggest that local authorities, as part of their local air quality management assessments, consider a range of interventions including working with children and their parents to implement no-idling zones outside schools, make it easy for children to walk or cycle to school and increase public awareness in relation to air pollution and children. This will reduce air pollution in the vicinity of schools and reduce children's exposure accordingly".

13. Given the concern regarding the impact of air pollution on children's heath, the Mayor of London has established an air quality audit programme for schools, the project report[8] for this programme noting that 400 primary schools are located in areas which exceed legal pollution levels (Appendix G). It also notes that "*Primary school children are amongst the most vulnerable of the at risk groups, as their lungs are still developing, and toxic air can stunt their growth, causing*

[7] Public Health England, Review of interventions to improve outdoor air quality and public health, March 2019 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/795185/Review_of_interventions_to_improve_air_quality.pdf Accessed July 2020.
[8] Mayor of London, The Mayor's School Air Quality Audit programme, May 2018

significant health problems in later life. Long-term exposure to air pollution stunts children's lung development, and in polluted areas of London, children's lungs have up to 10% lower capacity than usual".

14. In the London Environment Strategy the Mayor makes a commitment to "*reducing exposure of Londoners to harmful pollution across London – especially at priority locations like schools,*" further noting that schools are places where those most vulnerable to the health impacts of air pollution episodes spend time.

2.3 Policy

2.3.1 National Planning Policy Framework

15. The National Planning Policy Framework (NPPF) was updated in February 2019 with the purpose of planning to achieve sustainable development. Paragraph 181 of the NPPF on air quality states that "*Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan.*"

16. National Planning Practice guidance (PPG) on various topics, including air quality, was developed in order to support the NPPF. The guidance provides a concise outline as to how air quality should be considered in order to comply with the NPPF and states when air quality is considered relevant to a planning application. This document notes that PPG on various topics, including air quality, was developed in order to support the NPPF. The guidance provides a concise outline as to how air quality should be considered in order to comply with the NPPF and states when air quality is considered relevant to a planning application,

one of these considerations is "*Air quality may also be a material consideration if the proposed development would be particularly sensitive to poor air quality in its vicinity*".

17. In considering the specific issues that need to be addressed in this appeal, the following extract from the guidance is specifically relevant to this case "*Expose people to harmful concentrations of air pollutants, including dust. This could be by building new homes, schools, workplaces or other development in places with poor air quality*".

2.3.2 London Plan

18. The current London Plan contains Policy 7.14 "Improving Air Quality". In relation to planning decisions policy B(a) states the development proposals should "*minimise increased exposure to existing poor air quality and make provision to address local problems of air quality (particularly within Air Quality Management Areas (AQMAs) and where development is likely to be used by large numbers of those particularly vulnerable to poor air quality, such as children or older people)*".

19. Policy 7.14 B(c) states that proposed development should be at least "*air quality neutral*". The assessment of air quality neutrality involves calculating the traffic and building related emissions and comparing these with relevant benchmark levels in the guidance. If the calculated emissions are below these benchmarks, then the development is considered to be air quality neutral. The comparison of building and transport emissions is carried out separately – i.e. both benchmarks must be complied with separately to be air quality neutral. The methodology is detailed in a guidance document[9].

20. Para 7.51 of the Plan states "*Increased exposure to existing poor air quality should be minimised by avoiding introduction of potentially new sensitive receptors in locations where they will be affected by existing sources of air pollution (such as road traffic and industrial processes). Particular attention*

[9] Air Quality Neutral Planning Support: GLA 80371, Air Quality Consultants Ltd in association with ENVIRON UK Ltd, 2014.

should be paid to development proposals such as housing, homes for elderly people, schools and nurseries".

21. The proposed new London Plan also considers that schools should be located away from busy roads (Policy S3 B3), paragraph 5.3.10 of the Plan states that "*facilities should be located away from busy roads, with traffic calming at entrances, to benefit from reduced levels of air pollution*". The definition of busy roads is considered by my colleague Steven Burke in his Proof of Evidence on Transport.

2.3.3 London Borough of Camden Local Plan

22. The Camden Local Plan includes various policies relevant to this application. Policy A1 Managing the impact of development looks to protect the quality of life of occupiers and neighbours – it seeks "*to ensure that the amenity of communities, occupiers and neighbours is protected and will take into account factors such as odour, fumes and dust"*.

23. Policy CC4 states that "*The Council will ensure that the impact of development on air quality is mitigated and ensure that exposure to poor air quality is reduced in the borough*". Specifically, it states "*developments that introduce sensitive receptors (i.e. housing, schools) in locations of poor air quality will not be acceptable unless designed to mitigate the impact*".

2.4 Relevant Guidance

2.4.1 Environmental Protection UK/Institute of Air Quality Management

24. The EPUK/IAQM document Land-Use Planning & Development Control: Planning for Air Quality (Appendix H) was produced to ensure that air quality is adequately considered in the land-use planning and development control process. It is the only guidance document specifically focussed on air quality and planning. It provides general advice on air quality issues and planning, advice on how an assessment should be carried out and how significance can be assessed. Although this guidance document is produced by a professional body it is widely used and accepted within the air quality community and can be considered to represent

good practice in air quality assessment. This guidance was widely consulted on with the membership of EPUK and IAQM and I believe is followed in nearly every air quality assessment carried out by consultancies for planning in England.

25. The IAQM guidance (Section 5.5) states that "*The land use planning system has significant potential to influence local air quality positively through the careful design of neighbourhoods, some actions which are strongly encouraged are …. Where particularly sensitive members of the population are likely to be present, e.g school buildings should generally be sited 100m or more away from busy roads, in areas where pollution concentrations are high*". This proposal clearly does not comply with this recommendation.

26. The guidance also provides specific advice on air quality assessment methodology that I shall refer to where relevant in my proof.

2.4.2 Defra Local Air Quality Management Technical Guidance TG16

27. The Defra Technical Guidance document (known as TG16) (Appendix I) provides guidance to local authorities in the local air quality management duties. However, it is also widely used as guidance in air quality assessments carried out for planning. It provides detailed advice on air quality monitoring and modelling methodologies to ensure a robust assessment. I shall refer to a specific extract concerning model verification from this document where relevant in my proof.

2.4.3 London Councils Air Quality and Planning Guidance

28. This guidance was produced in 2007 and is "aimed at developers, their consultants and local authorities" and aims to provide technical advice on how to deal with planning application that could have an impact on air quality. It provides some detailed advice on issues associated with air quality modelling and assessment of model performance. On the latter point it notes the following should be provided in the assessment report:

    - Evidence of model performance must be provided;

- The accuracy in terms of margin of error or uncertainty of the results must be stated; and
- The model's effectiveness at predicting statistics relevant to the air quality objective must be demonstrated.

29. The guidance also provides the following Air Pollution Exposure Criteria (APEC) for use when assessing air quality modelling results.

Table 2 Air Pollution Exposure Criteria

Category	Applicable Range	Recommendation
APEC – A	Below 5% of the annual mean objective (AQO)	No air quality grounds for refusal; however, mitigation of any emissions should be considered
APEC – B	Between 5% below or above the annual mean AQO	May not be sufficient air quality grounds for refusal, however appropriate mitigation must be considered e.g. maximise distance from pollutant source, proven ventilation systems, parking considerations, winter gardens, internal layout considered and internal pollutant emissions minimised
APEC - C	Above 5% of the annual mean AQO	Refusal on air quality grounds should be anticipated, unless the LA has a specific policy enabling such land use and ensure best endeavours to reduce exposure are incorporated. Worker exposure in commercial/industrial land uses should be considered further. Mitigation measures must be presented with air quality assessment, detailing anticipated outcomes of mitigation measures

36. Although this guidance provides very specific recommendations to guide planning decisions, in practice, in my experience they have not been followed exactly. The main problem is that, since the publication of this guidance, much of London has experienced NO_2 concentrations that are 5% above the objective and hence these

criteria could sterilise development. However, they do provide useful guidance on where air quality should perhaps be given greater weight in the planning process.

3 Air Quality Conditions

37. Information on existing air quality in an area can be found from local monitoring data and air quality modelling information. Available information is reviewed below.

3.1 Air Quality Monitoring

38. The London Borough of Camden carry out monitoring using both automatic (or continuous) monitoring equipment and passive devices known as diffusion tubes. Automatic monitoring equipment has the highest accuracy and diffusion tubes are considered suitable for "indicative monitoring" but must be corrected to allow for so-called laboratory bias. If less than 75% of monitoring data in a year is available then a further correction known as annualisation is required. Overall the accuracy of diffusion tube monitoring has been estimated in an earlier version of the Defra technical guidance document TG16 as being ±20%[10] (Appendix J).

39. No automatic monitoring takes place near to the proposed development site. One diffusion tube is located relatively nearby in Fitzjohn's Road (see Figure 1). The air quality assessment provided by the Appellant reports that annual mean NO_2 concentrations were between 55.5-60.3µg/m^3 in the years 2014-2016. There are four months of missing data in 2016 and therefore these results can only be considered indicative. In the years 2017 and 2018, LBC inform me, the annual mean concentrations were 66.3µg/m^3 and 48.2µg/m^3 respectively. It should be noted that there appears to be no consistent downward trend in these concentrations although in 2018 there does appear to have been a drop in concentrations. This monitoring site illustrates that NO_2 concentration near to busier roads in Camden will often exceed the annual mean objective of 40µg/m^3.

40. The Appellant's consultant REC has also carried out air quality monitoring near to the site using diffusion tubes. This monitoring was carried out for a three-month period at locations on the site and in locations varying from façade to about 30m from the road. It showed concentrations close to the objective level at over 38µg/m^3 on the building façade and concentrations reducing with distance from

[10] Defra LAQM Technical Guidance TG09, 2009

the road. This monitoring was not carried out in accordance with the EPUK/IAQM guidance (Appendix H) which suggests a minimum period of 6 months to assess annual mean concentrations. Although the process of annualisation can assist, this reduced monitoring period results in greater uncertainty regarding the results.

3.2 Air quality modelling

41. There are two sources of air quality modelling information for this site, firstly the modelling carried out by the applicant's consultant's REC and secondly the annual mean pollutant maps produced on behalf of the GLA on the LondonAir website.

3.2.1 Appellant's air quality modelling

42. REC has modelled pollutant levels using the ADMS-Roads model. The approach used in terms of input data and model options is agreed to be appropriate for this type of modelling. The REC modelling (reproduced in Figures 2 and 3 showing predicted concentrations at ground and first floor level respectively) shows that predicted concentrations at ground level exceed the air quality objective over parts of the building and the playground site, with concentrations varying from around 44µg/m^3 at the building façade to 34µg/m^3 on parts of the site most distant from the main road.

43. REC also calculated NO_2 concentrations at first floor level (Figure 3), these predict lower concentrations of pollutants. In an open area (i.e. one without any buildings or other obstructions) this would be expected since pollutant concentrations reduce owing to dispersion as you move away from the source both vertically and horizontally. However, this is not necessarily the case in an urban setting where dispersion is affected by the complex configuration of buildings. In urban streets, pollutants become trapped within the street canyon and concentrations do not decline as quickly with height. This was highlighted in research in the first Quality of Urban Air Review Group (QUARG) report[11] that

[11] QUARG (1993) Urban Air Quality in the United Kingdom, First Report of the Quality of Urban Air Review Group, QUARG, London

included a profile of NO_2 concentrations within and above a street canyon (see Figure 4). This shows that the pattern of concentrations is very complex and, in this instance, the highest concentrations were found above the building. In a report prepared by the consultancy WSP[12] (Appendix K) it was shown that modelling results poorly represent the actual change in concentration by height. In the two examples provided, NO_2 concentrations at the top of the building were nearly the same as at street level. In one case, NO_2 concentrations increased with height i.e. they were higher at first floor level than at ground floor. Therefore, I consider that the estimates at first floor level are unreliable and are not representative of actual concentrations.

44. The REC modelling has followed the process of model verification that is standard practice and recommended by TG16 and the EPUK/IAQM Guidance. Model verification is a process that compares predicted pollutant concentrations with measured values at a suitable monitoring site. Where the difference is greater than 25% or there is a consistent under or over prediction, then it is recommended that the results are adjusted to reduce the difference. Guidance suggests that this process be carried out with several monitoring sites and it is specifically stated in TG16 that the use of one site alone is not recommended (Appendix J). One reason for this is there can be considerable variation between individual data points. I can illustrate this with an example extracted from a recent assessment in London carried out by Arup. Figure 5 plots the measured and monitored concentrations, in this example the correction factor for each individual site varied from 1.2-3.3, using all the sites and following the TG16 approach results in an adjustment factor of 2.1. This illustrates the potential error if only one site were used (for instance, if a factor of 1.2 had been applied, the road contribution to pollution levels would have been underestimated by 75%).

45. A further important point to note is that if a single site is used for model verification, then it is inevitable that the verified model will appear to be 100%

[12] WSP, City Air at Height Lessons for Developers & Planners https://www.camden.gov.uk/documents/20142/18667687/8-1+City+Air+Quality+at+Height.pdf/5cfb1877-c72c-869b-23e1-32f06a3cd642

accurate at the monitoring site location. No weight should therefore be applied to the reported model performance if this is the case.

3.3 LondonAir annual mean maps

46. Another source of information regarding this site are the annual mean concentration maps on the LondonAir webpage (www.londonair.org.uk). Annual mean NO_2 concentrations for the year 2016 are shown in Figure 6. These are largely in agreement with the REC modelling showing concentrations above the annual mean air quality standard near to the road and reducing to lower levels away from the road.

47. Figure 7 provides a wider area view of the predicted NO_2 annual mean concentrations. As can be seen the pollutant concentrations near to the main roads are much higher than those more distant from roads. Pupils arriving at the school will almost inevitably have to take some parts of their route along the main roads and be exposed to higher air pollutant concentrations on their journey.

3.4 Summary of monitoring and modelling results

48. Both the REC air quality modelling results and the those available on the LondonAir website show that concentrations of NO_2 exceed the annual mean air quality objective on the parts of the site near to the roads. Air quality monitoring carried out by the Appellant was only undertaken for three months and this does not comply with the recommendation in the EPUK/IAQM guidance for at least a six month monitoring period. Taking into account the uncertainty due to the use of the simple diffusion tube method and the limited monitoring period, the monitoring also suggests that NO_2 concentrations are close to the annual mean air quality objective.

3.5 Future air quality

49. Air quality is expected to improve in future years as a result of ongoing improvements in vehicle emissions and interventions such as Low Emission Zones. It can be expected in future years that this site will meet current air quality standards, however, given its roadside location, it will always be expected to experience higher levels of air pollution than sites located away from main roads.

50. The reduction in activity owing to the current Covid 19 pandemic has also led to very large improvements in air quality in London. This is clearly the impact of the government restrictions on movement starting in March this year. Any measurements of air quality this year will not be representative of "normal" conditions. Where other countries have eased their lockdown measures, this has been accompanied by increasing air pollution levels, for instance, it has been reported that air pollution in China is back to pre-lockdown levels[13] (Appendix L).

51. I have also looked at trends in air pollution this year at the roadside in north London. The trends in roadside air pollution can be approximated by calculating a parameter known as road-NOx. This is done by subtracting the recorded concentrations measured at a nearby background monitoring site (i.e. not directly affected by nearby road emissions) from those measured at a roadside monitoring site. This provides an approximation of the contribution from vehicle emissions on the road (i.e. it removes the contribution from other pollution sources). I have calculated Road-NOx by using the Holloway Road and Arsenal monitoring sites in Islington (no suitable sites were available in Camden). The locations of these sites are shown on Figure 1. The resulting trends in weekly average Road-NOx are shown in Figure 8. This shows that Road-NOx emissions are rapidly returning to pre lockdown conditions.

52. It is not possible to predict with any certainty the impact of the Covid 19 lockdown measures on future air quality. However, the current approach my company is taking with carrying out air quality assessments is to assume no impact of lockdown measures in 2020 and beyond.

3.6 Air Quality Neutral

53. The REC air quality report presents the results of the air quality neutral assessment as required by the London Plan. I have examined this assessment and consider that it potentially underestimates the road emissions from the site because it assumes no traffic outside of term time and in any event, it is very marginal whether the road emissions meet the benchmark. The NOx and PM_{10}

[13] https://www.theguardian.com/environment/2020/jun/03/air-pollution-in-china-back-to-pre-covid-levels-and-europe-may-follow

road emission benchmarks for the development are 24.9kg/year and 4.4 kg/year respectively. The calculated development road emissions are 23.9kg/year and 4.3 kg/year respectively which are around 96% of the benchmark.

54. The development transport flows are estimated as 23 AADT, which only need to be underestimated by one vehicle to result in a breach in the benchmark. However, this figure of 23 AADT is based on term time traffic only. It would seem reasonable to assume that the school buildings would be used for other purposes outside of the school term and therefore the overall traffic appears to have been underestimated and it is likely that this proposal is not air quality neutral.

3.7 Mitigation

55. The Appellant suggests that the occupants of the building could be protected by installing mitigation through sealing and filtration, though this is only proposed at ground floor level. As I note in paragraph 43, I consider that it is likely that the Appellant has underestimated pollutant concentrations at first floor and the proposal to allow these areas to be naturally ventilated could expose pupils to poor air quality. Mitigation measures installed on the building do not protect pupils in the external areas of the site and travelling to and from the school.

4 Conclusions

56. Air quality standards have been introduced in the UK to protect human health. However, for some pollutants there are no lower thresholds where health effects are not observed and there is good evidence that exposure to higher levels of traffic fumes can impact on human health.

57. Children are one group of the population that is particularly vulnerable to the effects of air pollutants. Adverse health impacts in children are correlated with exposure to traffic related pollutants and consequently there would be health benefits by placing buildings where children spend a significant proportion of time in areas of lower air pollution. This is recognised in a recent review by Public Health England.

58. Research examining the relationship between NO_2 and health acknowledge that other traffic related pollutants may be important and NO_2 may be a marker for these. Locating sensitive uses away from higher levels of traffic pollution is therefore desirable and compliance with air quality standards does not imply no adverse health impacts.

59. There are policies at national, regional and local level that aim to reduce the exposure of building occupants to air pollution. These policies aim to place new development that is more sensitive to air pollution (such as schools) in less polluted areas. The proposed development does not comply with this aim.

60. The EPUK/IAQM guidance which is accepted by the Appellant as relevant to this application advises that new schools should be located more than 100m from busy roads. The proposed development does not comply with this advice.

61. The assessment that accompanied the planning application for the proposed development reports that parts of the site experience NO_2 concentrations that are ((greater than)) the annual mean air quality objective. These would be considered to be areas of poor air quality. Locating a school in this area would not be in compliance with the aim of planning policies to reduce exposure to poor air quality.

62. The Appellant's assessment that air quality will improve at higher levels of the building has not taken into account dispersion in complex urban environments. There can be less confidence in their conclusions that air quality will improve at first floor level particularly at the building façade.

63. Modelling carried out on behalf of the GLA also shows that parts of the site are likely to experience pollutant levels above the air quality objective confirming the conclusions of the Appellant's own report.

64. Air quality monitoring carried out by the Appellant is limited and not fully compliant with the EPUK/IAQM guidance. It has used an accepted method of measurement but one with limited accuracy and for a limited monitoring period. The monitoring results do not provide any confidence that the air quality on the site meets UK air quality objectives.

65. The air quality neutral assessment provided by the Appellant appears to have potentially underestimated traffic related emissions and the site is likely not to be in compliance with GLA guidance.

66. Having examined the above I consider that air quality issues should be a significant factor in the planning balance decision for this proposal. This is because :

- Planning policies suggest locating sensitive uses away from busy roads and areas of poor air quality;
- Schools are a sensitive location and children are one group of the population that is particularly affected by air pollution;
- Guidance suggests placing new schools more than 100m away from polluted areas and busy roads;
- The Appellant's own assessment demonstrates that this site is in an area of poor air quality with concentrations of NO_2 being above the objective;
- Research suggests that NO_2 is a marker for other traffic related pollutants that also contribute to adverse health impacts;

- The assumption that air quality will improve above ground level is uncertain and some evidence shows increased NO_2 concentrations at higher building levels in urban environments; and
- Mitigation measures may improve air quality within the building but cannot protect pupils from exposure while in the external areas of the site and while travelling to and from the school.

Figures

Figure 1 Location of Monitoring Sites

Figure 2 Predicted concentrations by REC - Ground Floor

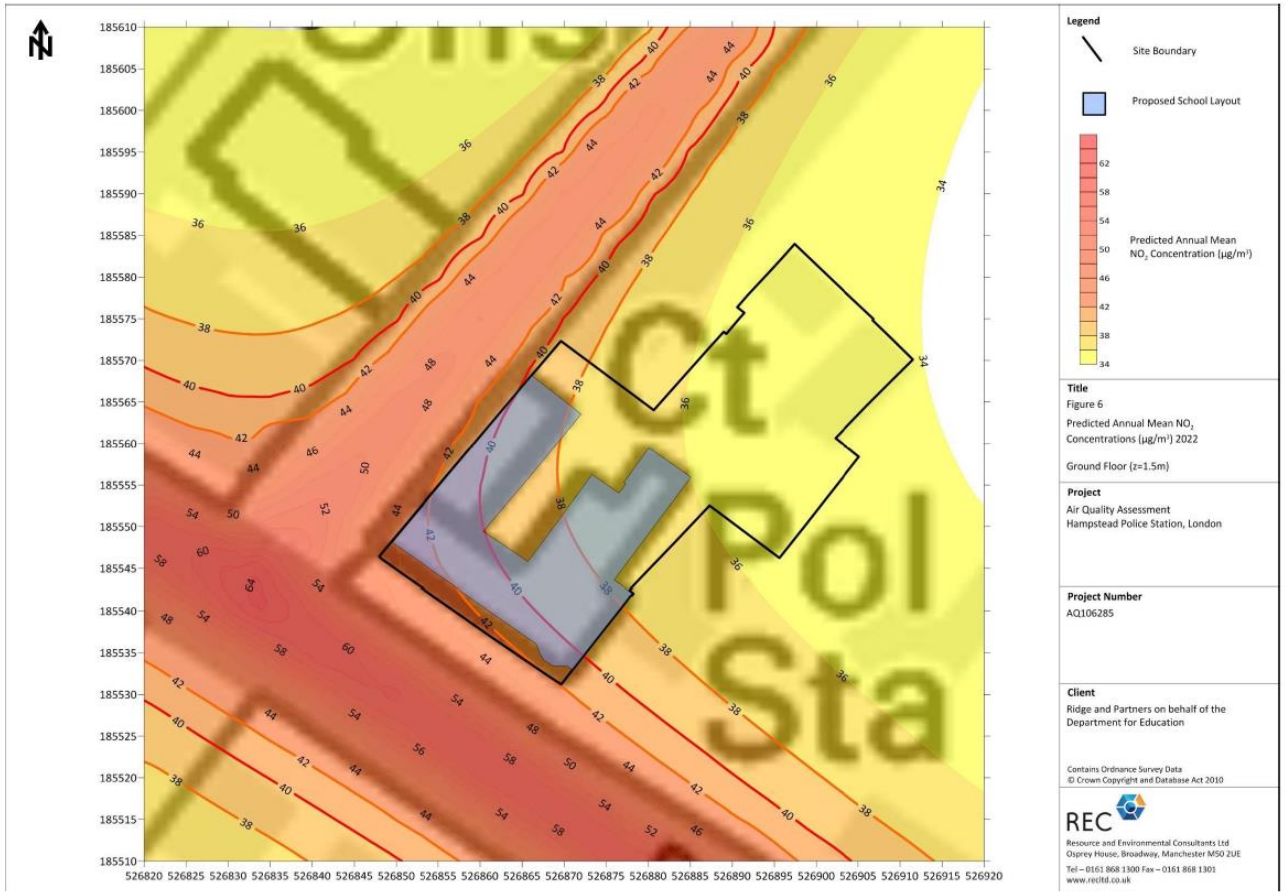


Figure 3 Predicted Concentrations by REC, First Floor

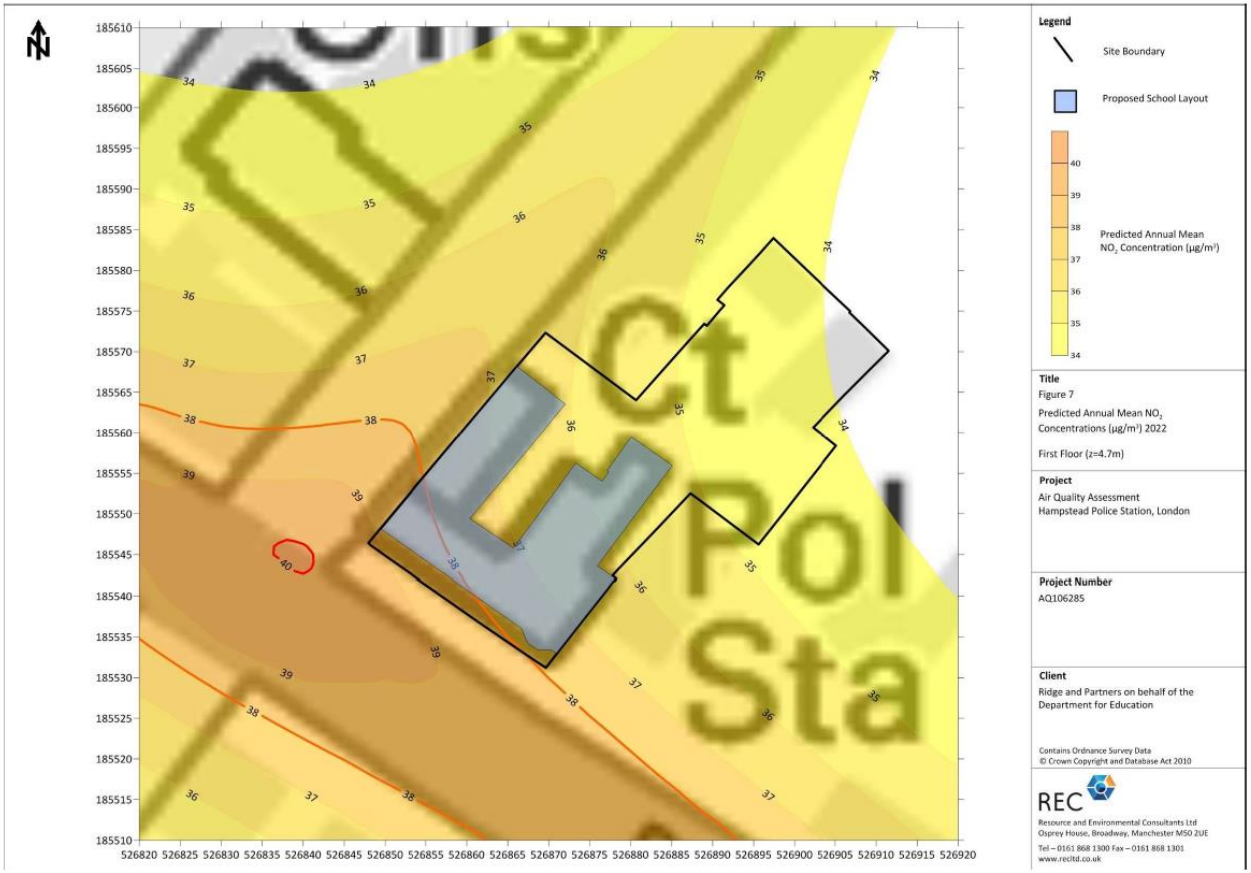


Figure 4 Spatial Profile of NO_2 concentrations around a building

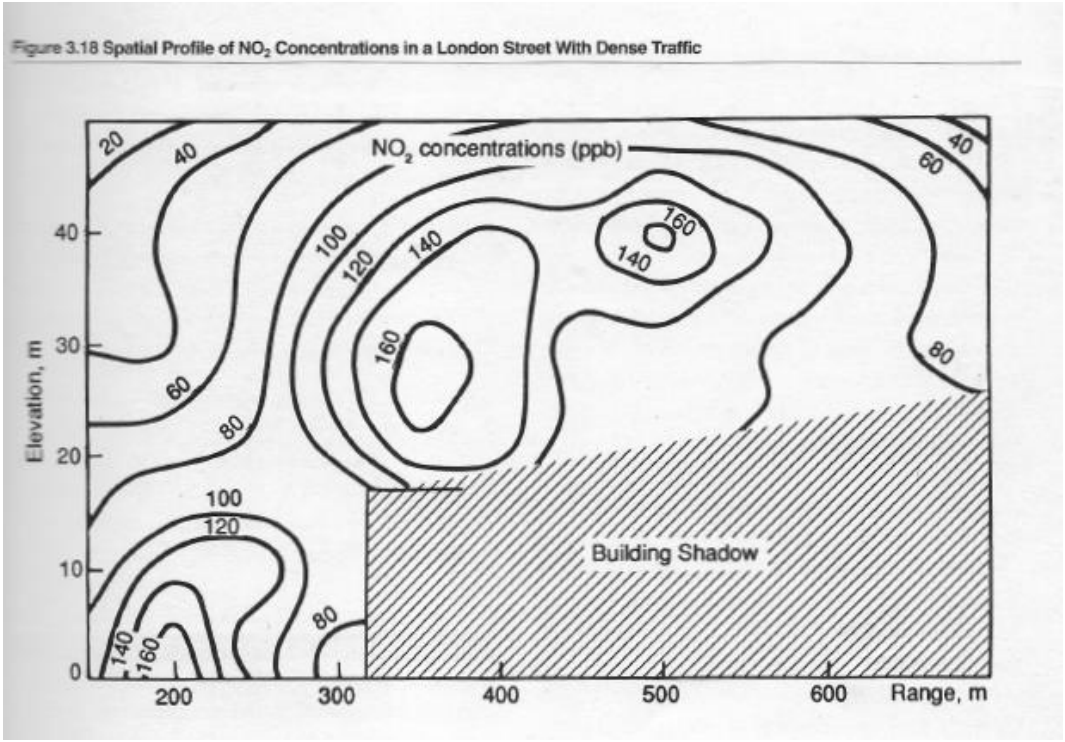


Figure 5 Model verification results from recent Arup study

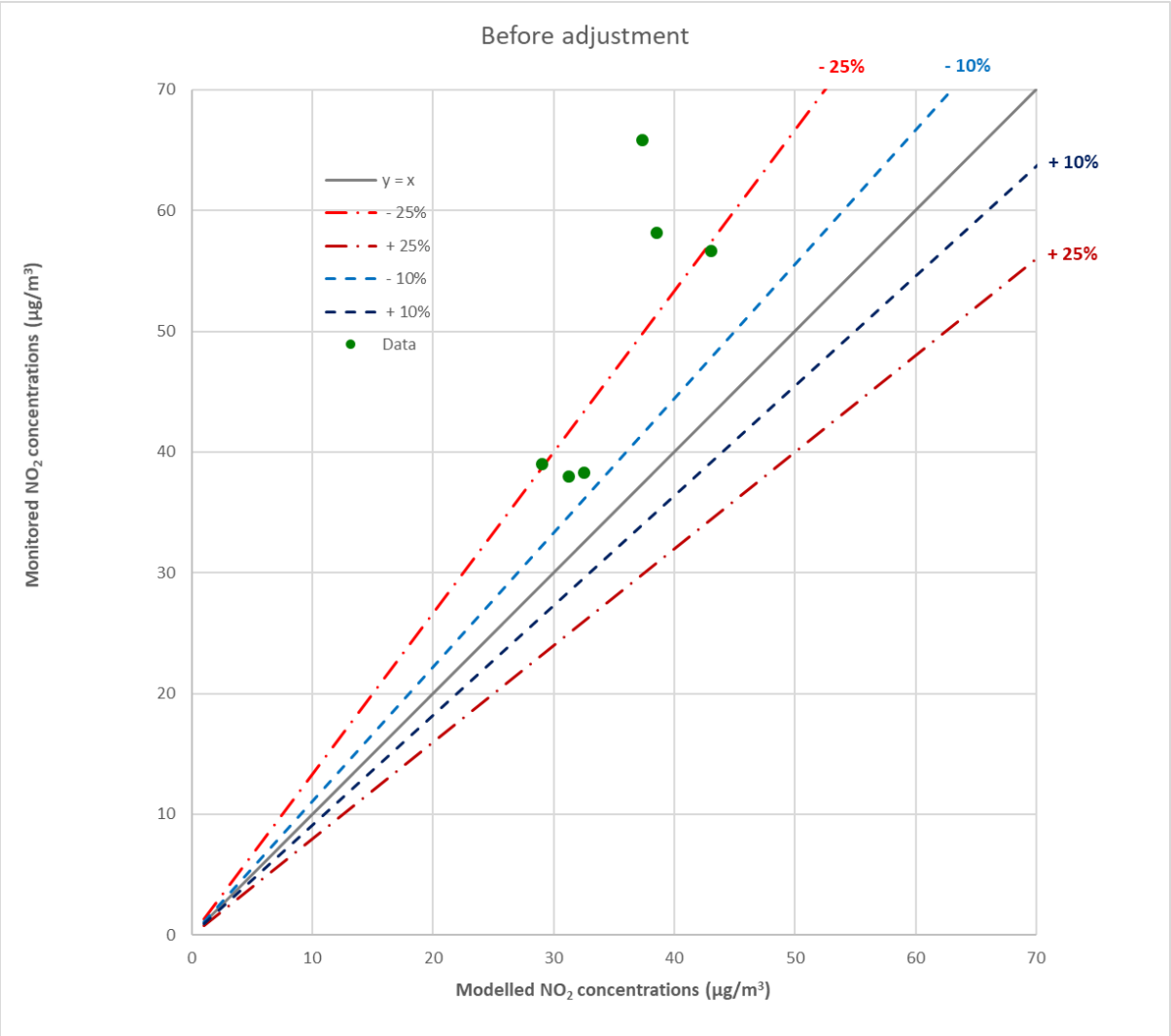
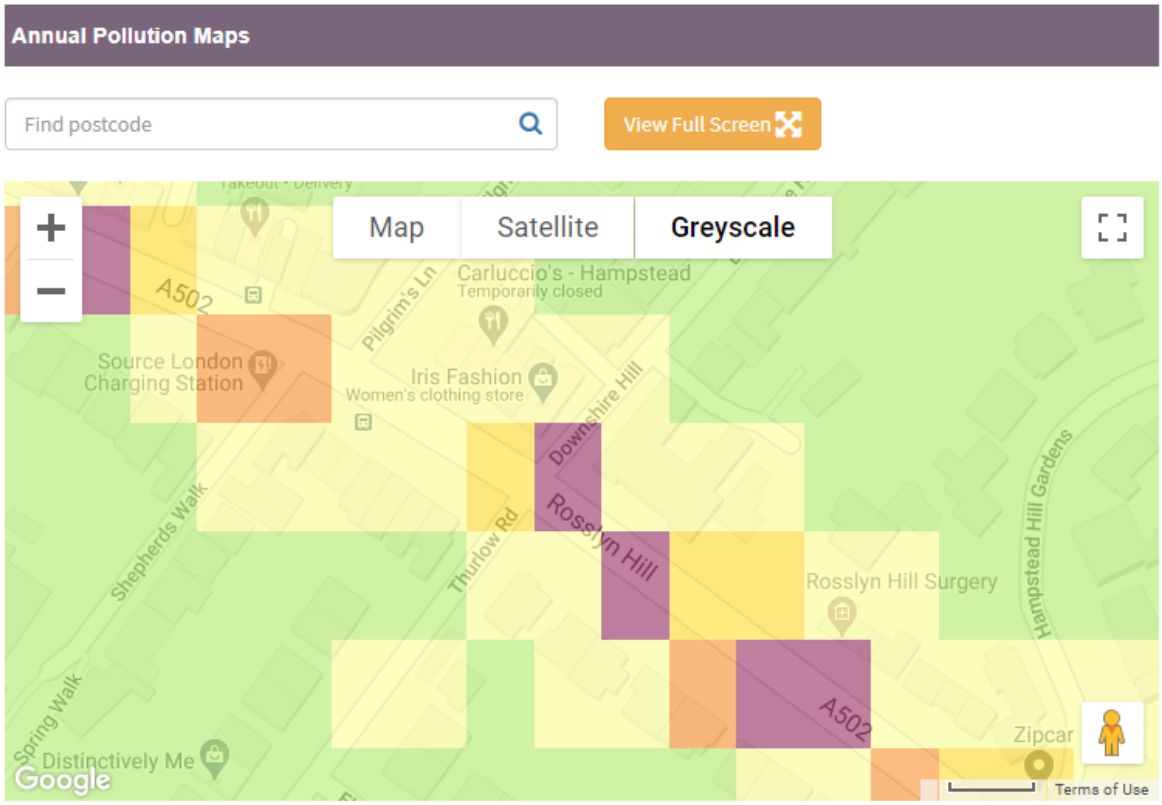


Figure 6 Annual NO_2 concentrations reported on LondonAir website - 2016



Modelled annual mean NO2 air pollution, based on measurements made during *2016*.

This map was used with permission from The Greater London Authority and Transport for London, who fund, develop and maintain the London Atmospheric Emissions Inventory. For more information please visit data.london.gov.uk

Key: Annual mean NO2 air pollution for 2016, in microgrammes per metre cubed (ug/m3)

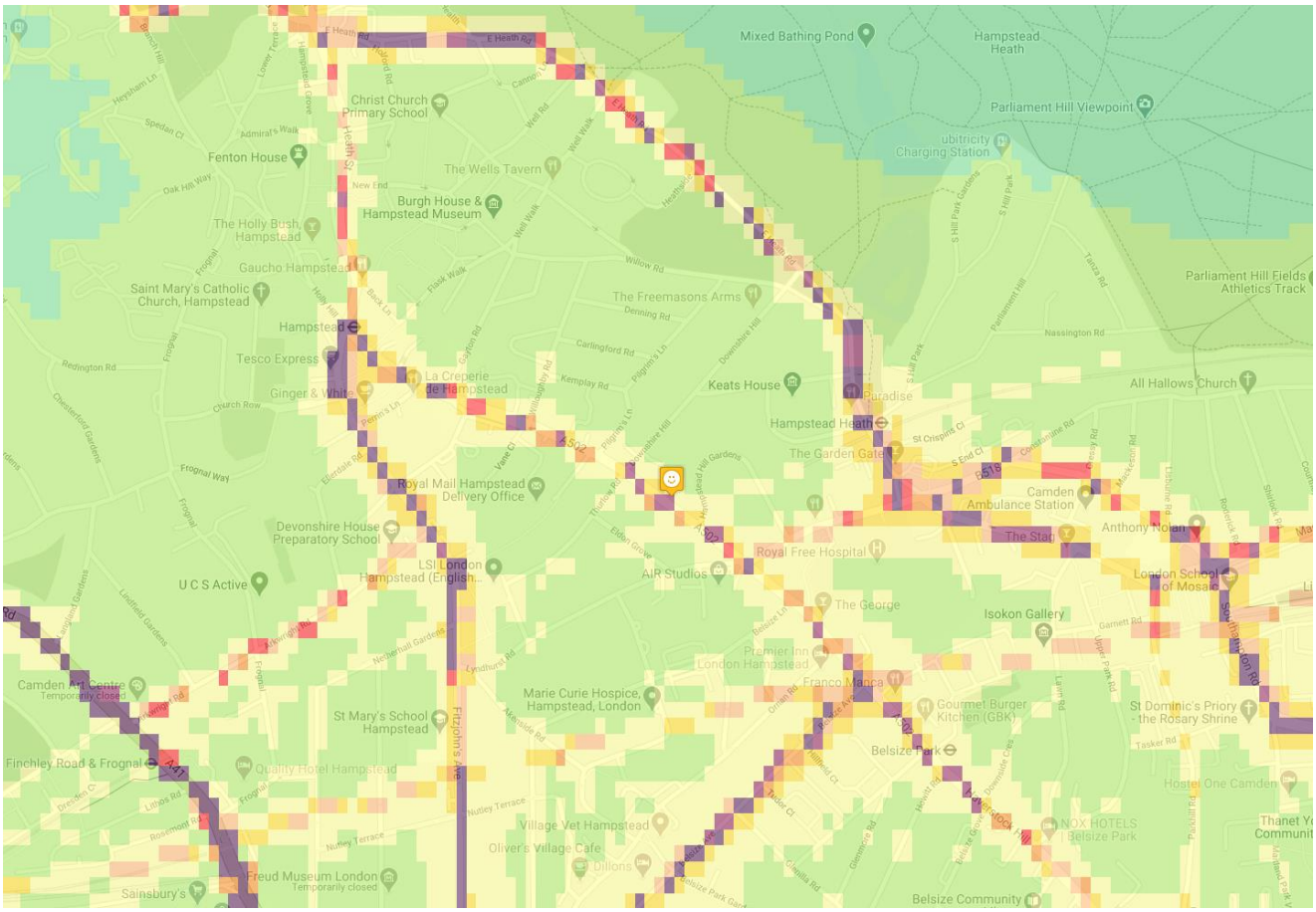
Passes annual mean objective Fails annual mean objective

Select species: Nitrogen Dioxide (NO2)

Select visibility: 75%

Update

Figure 7 LondonAir annual mean NO_2 map over wider area



Key as Figure 5

Figure 8 Rolling weekly average Road-NOx in north London