Town and Country Planning Act 1990 - Section 77

Town and Country Planning (Inquiries Procedure) (England) Rules 2000

Norwich Cycling Campaign

Rebuttal of Aether's Proof of Evidence

Air Quality

REBUT-CYC/002

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Site	Anglia Square including land and buildings to the north and west
Appeal by	Weston Homes ltd
PINS reference	APP/G2625/V/19/3225505
LPA reference	18/00330/F

1. Introduction

1. This rebuttal has been prepared by The Centre for Health Services Studies on behalf of Norwich Cycling Campaign. The rebuttal is targeted towards Aether Ltd's proof of evidence [1] and the Version 3 of its Air Quality Assessment [2] which that proof of evidence references.

2. This document has been prepared by Professor Stephen Peckham and Dr Ashley Mills. Stephen is Professor of Health Policy and Director of the University of Kent's Centre for Health Services Studies and Professor of Health Policy at the London School of Hygiene and Tropical Medicine. He has been working with local residents groups, Parish Councils and voluntary groups on air quality issues in Kent and Essex to undertake air quality monitoring and support submissions to planning consultations.

3. Dr Ashley Mills has a BSc in Computer Science, an MSc in Natural Computation, and doctorate in Systems Engineering. He has 16 years of experience of mathematical modeling of complex physical systems and statistical analysis of them.

4. The proof of evidence submitted previously by the Centre for Health Services Studies contained criticisms of Aether Ltd's Air Quality Assessment Version 2 [3]. Aether has since submitted a Version 3 of its Air Quality Assessment [2] to accompany its Proof of Evidence [1]. This rebuttal fortifies our proof of evidence where our conclusions have not changed and appraises Aether's new claims in this context.

2. V3 vs V2 of Aether's AQA

5. The most important issue, which Aether's new air quality assessment does not address, is that Aether's own diffusion tube monitoring showed that 4 out of 8 sites measured in the roads around Anglia Square, were estimated to exceed annual limits of 40 ug/m^3 for NO_2. Two values exceeded 60 ug/m^3, and the measurement on Magdalen St had a value of 70 ug/m^3 which is the highest value measured in the whole city.

6. Accordingly, Aether's V2 Air Quality Assessment (page 25, table 6) predicted at the ground floor that out of 9 receptor locations, the development would have a Substantial impact at 5 locations, a Moderate impact at 1 location, a Slight impact at 1 location, and Negligible impact at only two locations.

7. Aether's V3 Air Quality Assessment (page 31, table 10), only gives significance for one ground-floor receptor location, without explanation. We calculate the significance at the ground floor for V3, with no policy applied and with development. Table 1 below shows the results (see Table 2 and Table 3 in Appendix A for calculations):

Receptor	Impact at AQAL of 40 ug/m^3	Impact at AQAL of 60 ug/m^3
A	Substantial	Moderate
B	Moderate	Negligible
C	Negligible	Negligible
D	Negligible	Negligible
E	Negligible	Negligible
F	Moderate	Negligible
G	Substantial	Slight
H	Substantial	Slight
I	Negligible	Negligible

Table 1 - Impact of development at ground floor receptor locations for "no policy applied" scenario for NO_2 for AQAL targets of 40 ug/m^3 and 60 ug/m^3.

8. This gives three substantial locations, two moderate, and four negligible for an AQAL of 40 ug/m^3. It isn't clear why Aether's table 10, in their V3 AQA only shows Receptor H at the ground floor. The most likely explanation seems to be their argument that there are no ground floor flats for the other receptors, and that therefore 40 ug/m^3 is not a valid AQAL to use for them.

9. However, Edward Street contains existing flats at the ground level near to receptor G. See Figure 1 below.

Figure 1 - Ground floor flats on Edward St close to receptor G and on the same road as receptor A. Notice the building facades and rear garden near to the road.

10. Given that receptors A, G, and H all calculate as Substantial impact, and there are existing ground-floor residences on Edward street, it would be precautionary to include these receptors in the impact assessment. Ideally, a receptor located on the ground-floor facade should have been modeled by Aether.

11. The differences between V2 and V3 of Aether's AQAs have been justified on the basis of the model inputs in V3 being more *"up-to-date"* (Aether V3 AQA, paragraph 11), when in fact V3 uses inputs which are only more recent at the cost of being less representative. V3 completely disregards the representative urban diffusion tube measurements Aether made for V2 of its AQA, in favour of three NCC diffusion tubes which are relatively more suburban than urban in nature and which occur on the periphery of the development rather than within it. Whilst the completion date being pushed back to 2031 instead of 2028 has an effect, the most significant changes come from the changes in modeling inputs.

12. Aether may try to argue that their V3 model is more accurate, as it had an RMSE of 2.88 ug/m^3 for NO_2 whereas their V2 model had an RMSE of 10 ug/m^3 for NO_2. But this actually illustrates that the V3 model is likely to be less accurate than the V2 model using the following reasoning: when Aether tried to model NO_2 using 8 heterogenous validation points within the development area in V2, the underlying complexity of the situation resulted in a high RMSE. In V3, only 3 points with similar urban characteristics were used to validate the model and this resulted in a lower RMSE. But none of these points are in the development area, so the complexity of the situation is even less likely to have been captured with the V3 model, despite the lower RMSE since the complexity didn't play into the validation at all.

13. Another way to look at this is the change in the line of fit verification factor, which changes from y=1.79x in V2, to y=1.213x in V3. The implication is that the new V3 model under-predicts less, but since none of the receptor points A-H are included in the verification model in V3 we cannot tell. Looking at the V2 model however, it would be reasonable to assume that points around the development will still be under-predicting to the similar extent.

14. Another reason for the change in impact predictions between V2 and V3 of Aether's AQA is traffic input data. In V2 of Aether's AQA, the with-development scenario in 2031 has a cumulative increase of 23234 vehicles movements per day relative to the without-development scenario (Aether AQA V2, Table B.1, Page 32), but under V3 of Aether's AQA the cumulative increase between the without and with development scenarios is only 13649 vehicle movements per day (Aether AQA V3, Table B.1, Page 36, excluding roads not modeled in V2). That's a reduction of 9585 vehicle movements per day, or 41% of the original predicted increase. No strong justification for this change in traffic inputs is provided other than their traffic consultant recommended it.

15. Such large changes in modeling inputs, and the resulting modeling outputs and development impact assessment should ring alarm bells unless there are strong justifications for the changes.

3. NPPF violations and public health

16. Notwithstanding the criticisms of Aether's V3 AQA outlined in the last section upon which Aether's proof of evidence depends, Aether's proof of evidence still arrives at the conclusion that the "no policy applied" without-development scenario has a negative cumulative impact on air quality.

17. In Aether's V3 AQA, (Table 5, page 17), under the "No Policy Applied" scenario with development, 4 out of 9 receptor sites predict values over the objective limit of 40 ug/m^3 at the ground level, and 2 are within 10% of the objective limit. In addition, 3 sites are within 10% of the 60 ug/m^3 indicator for hourly exceedances.

18. The February 2010 National Planning Policy Framework (NPPF), states in paragraph 170 on page 49 that *"Planning policies and decisions should contribute to and enhance the natural and local environment"* and *"Development should, wherever possible, help to improve local environmental conditions such as air and water quality"*.

19. It is clear that Aether's V2 AQA with development scenario does not meet this criterion, neither does Aethers V3 AQA "no policy applied" with development scenario. Even Aether's V3 AQA most optimistic scenario "policy applied", has two locations within 10% of objective limits (10% is the threshold for at risk roads in screening assessments, LAQM.TG(16) table 7.1), and has a negative cumulative impact relative to "no development". Therefore across a broad range of assumptions, the development still has a negative impact on air quality.

20. Examining Aether's most optimistic scenario: V3 AQA "with policy" scenario. This uses optimistic emissions reductions and optimistic traffic projections relative to other scenarios and V2 predictions. Is this a reasonable scenario? Is it likely that the most optimistic EFT v9 [4] emissions predictions and "road to zero" strategy [5] goals will be met?

21. Taking the EFT V9 predictions, Air Quality Consultant's has analysed historical predictions and found that previous versions of the EFT were overly optimistic. As a result of this Air Quality Consultants (AQC) produced an alternative emissions calculator [6] that is more in-line with measured data for V8.01 of the EFT and appears to be applicable to V9 of the EFT [7].

22. It would be reasonable, and in-line with IAQM guidance to take a precautionary approach and adopt the AQC emissions calculator to perform a sensitivity test for the V3 modeling outputs. The results of this would likely be somewhere between Aether's V2 AQA results and the V3 AQA results.

23. Page 28 of HM Governments "Road to Zero" strategy makes five seperate references to the Clean Air Strategy [8] (at the time the Clean Air Strategy was out for consultation), and on page 47 says: *"As set out in the Clean Air Strategy consultation, we intend to build on our existing regulations to make tampering with an emissions control strategy a legal offence"*.

24. Any justification of optimistic emissions projections based on the “Road to Zero” strategy must therefore also consider the objectives and goals of the government’s Clean Air Strategy too. This implies the future reduction of objective limits, for example, on page 7 of the Clean Air Strategy it states *“By implementing the policies in this Strategy, we will reduce PM2.5 concentrations across the UK, so that the number of people living in locations above the WHO guideline level of 10 µg/m^3 is reduced by 50% by 2025.”*

25. Aether has only modeled PM10, but Defra provides a PM10 multiplier of 0.642 to convert PM10 values to PM2.5 for the purpose of damage cost calculation [9]. Any PM10 point above ~15.58 will convert to a PM2.5 value above 10. Thus we can look at Aether’s PM10 predictions and convert them to PM2.5 using this multiplier and examine them with regards to the Clean Air Strategy target.

26. Every receptor location Aether models has PM2.5 exceeding 10 ug/m^3 in 2018. Looking at Aether’s most optimistic scenario for “with development, policy applied” 5 out of 9 receptor locations at the ground level are likely to exceed a value of 10 ug/m^3 for PM2.5 in 2031, let alone in 2025. Only 3 receptor locations that exceed 10 ug/m^3 for PM2.5 in 2018, are reduced below 10 ug/m^3 in 2031, an 33% reduction in the number of receptors above the WHO guideline of 10 ug/m^3. The situation is identical for 2031 for the “without development, policy applied” scenario, but the reductions occur at an earlier year in this case. The clear implication is that even under the best scenario presented by Aether, the clean air strategy is unlikely to be met.

27. For Aether’s “with development, no policy applied”, no receptor location shows a PM2.5 value below 10 ug/m^3.

28. NCC is therefore at a high risk of not meeting Clean Air Strategy targets, even without development, and therefore should not be considering development which will exacerbate the situation even under Aether’s most optimistic assumptions.

29. Something which is completely overlooked is that levels of pollution below objective limits are harmful to health. The annual regulatory limits for NO_2, PM10, and PM2.5 in the UK (and EU) are 40 ug/m^3, 40 ug/m^3, and 25 ug/m^3 respectively [10]. The World Health Organisation reviewed the health risks associated with key pollutants in 2005 [11] and, adopted 40 ug/m^3 as a guideline for NO_2, the same as the UK limit, but adopted 10 ug/m^3 for PM2.5 and 20 ug/m^3 for PM10, that is half the respective UK limits for particulates.

30. Since 2005 the research picture has changed significantly, and a 2016 comprehensive review by the Royal College of Physicians concluded that *”Neither the concentration limits set by government, nor the World Health Organisation's air quality guidelines, define levels of exposure that are entirely safe for the whole population.”* [12]

31. Public Health England, in a 2018 review of the long-term health effects of NO_2 states that long-term mortality associations have been found in *“cohorts in which the range of outdoor levels reaches as low as 5 ug/m^3 annual average NO_2 concentration.”* [13] (page 14). The author committee was divided on whether to extrapolate mortality coefficients to zero but the report provides mortality coefficients defined per 10 ug/m^3. In addition, the authors estimate that by reducing mean NO_2 by 1 ug/m^3 that *“1.6 million life years could*

be saved in the UK over the next 106 years, associated with an increase in life expectancy of around 8 days." (page 9).

32. In both Norwich City Council's planning officer report [16], Aether's proof of evidence, and Aether's air quality assessment V3, reference is made to an annual NO_2 measurement of 60 ug/m^3 being a marker for the likelihood of 18 or more hourly limit exceedances for NO_2. Aether uses the lack of a receptor with a modeled value of 60 ug/m^3 in its "with policy applied" scenario in its proof of evidence to argue that the observance of more than 18 hourly limit exceedances is not a concern.

33. This argument is derived from Defra's LAQM.TG(16) [15] which itself is based upon analysis performed by Air Quality Consultants for Defra [17]. The latter report however shows in Figure B1 on page 17 and Figure B10 on page 21 that there are sites which have annual averages less than 60 ug/m^3 that have 18 or more hourly exposure exceedances per year. One cannot say therefore for certain that hourly limit exceedance is not a concern.

34. These factors combine to weaken Aether's argument that it is appropriate to use an AQAL of 60 ug/m^3 against which to assess development impact at the ground level for cases where there are no residences. See for example page 27 of Aether's AQA where they state "*the annual mean objective will not apply at this location as there will be no residential use of the ground floor"*. A precautionary approach would adopt a value of 40 ug/m^3 across the board.

35. The interpretation of the law by NCC and by Aether, is toward the favour of development rather than public health or a common understanding. Regulation 4 of the Air Quality (England) Regulations 2000 [14] sets out the conditions against which air quality objectives should be judged:

    "(2) The achievement or likely achievement of an air quality objective prescribed by paragraph

    (1) shall be determined by reference to the quality of air at locations–

    (a)which are situated outside of buildings or other natural or man-made structures above or below ground; and

    (b) where members of the public are regularly present."

36. It is clear that point b *"where members of the public are regularly present"* could (and in our view should) be interpreted to mean for example a busy shopping street, or a busy public area. Clearly the area around Anglia square would meet this definition under any sensible interpretation.

37. In conclusion, objective limits do not protect public health so concern should be given for areas of high pollution below objective limits, 60 ug/m^3 is only an indicator for hourly exceedance and not a guarantee, and the law could be interpreted to apply the 40 ug/m^3 limit to the whole development area. These factors combine to urge a precautionary approach to be taken, which should lead to the rejection of Aether's arguments based around their very optimistic *"policy applied"* scenario.

4. Aether's V3 AQA claims

38. Version 2 of Aether's AQA made estimates based on the conservative assumption that emissions factors would not change between the 2017 baseline and the future operational year (2028), and as a result, values of NO_2 measured in excess of the objective limit were assumed to persist through to the operational phase, and the development had a negative contribution towards air quality relative to the no-development scenario.

39. Version 3 of Aether's AQA assumes an extremely optimistic reduction in emissions factors under its "policy applied" scenario, under the assumption that vehicular fleet composition will be in line with aggressive government targets for decarbonisation of transport. In addition, Aether has created a more favorable future "no-development" scenario that it calls a "proxy scenario" which assumes that Anglia square will reopen as a shopping centre and that the multi-storey carpark will also reopen.

40. Using optimistic emissions factor reductions is not a reasonable case for a "sensitivity test" with regards to air quality since the purpose of a sensitivity test is to, in the words of the IAQM from their guidance on dealing with uncertainty in NOx emissions is to *"take a precautionary approach"* [15]. In the first page of the latter it says *"It is important that air quality practitioners acknowledge the uncertainty in the EFT emissions factors"* and follow that up with one approach being to consider *"applying a sensitivity test that assumes NOx emissions will not reduce as rapidly as shown by the EFT".* It is important that language is not misleading. A sensitivity test in the context of air pollution means to examine a more pessimistic scenario; using the term to introduce an optimistic scenario might mislead people.

41. It is unreasonable to use the proxy policy as an argument to downplay the impact of the "with-development" scenario because this violates IAQM's guidance to take a precautionary approach. We could equally argue that the entire area be turned into a green park and use that as a comparison, and that would be equally unfair, since there is no concrete evidence to suggest either way whether the site will be returned to its former use or some other use.

42. In Version 2 of Aether's AQA, Aether verified its air quality model using eight diffusion tube measurements, taken in 2017, which were all within the development area. In version 3 of Aether's AQA they switch to verifying their air quality model with diffusion tube measurements made by NCC in 2018 at three sites, only one of which falls within the development area at the northern outskirts.

43. So whilst it is true as Aether states in paragraph 11 of its proof of evidence that decision makers should "operate on the most up-to-date evidence", this must be balanced against the relevance of the receptor sites, and Defra's LAQM.TG(16) guidance [16] dictates a clear preference for local sites, even encouraging (para 7.527) under the heading *"What Type of Monitoring Data Should be used for Verification and Adjustment?"* that *"local*

authorities implement more diffusion tube monitoring in locations identified as requiring detailed dispersion modelling".

44. And in para 7.524 of Defra's LAQM.TG(16) guidance it states that *"In some cases, local authorities may also identify some urban sites such as street canyons, which perform differently to more typical urban locations. Where large differences in an adjustment factor are determined for different types of location, local authorities should consider undertaking separate adjustments within a model area in order to avoid over or underpredicting at the different types of location. "*

45. The pertinence of this point was demonstrated clearly in Version 2 of Aether's AQA, where the verification error had an RMSE of 10 ug/m^3 because there was such large variation of model error when multiple heterogeneous sites were used for validation. Therefore, Aether has reduced RMSE in Version 3 of its AQA by using verification sites that are not representative of the development area.

46. In paragraph 19 of Aether's proof of evidence they state that *"NCC have highlighted that their 2018 diffusion tube monitoring results have indicated significantly lower NO_2 concentrations than the results from the original diffusion tube survey"*.

47. This is misleading as NCC have not provided any new measurements at the locations of the original diffusion tube monitoring carried out by Aether. The nearest NCC measurement locations are DT6, DT9, and DT11 which fall outside of the development area as can be seen in Aether's Figure 5 on page 14 of its proof of evidence. There is no basis to claim *"significantly lower NO_2"* given that no direct comparisons are available.

48. This premise is used by Aether to imply that new more relevant evidence has been used in version 3 of their AQA which has lead to more favourable outcomes for the developer, but in fact less relevant evidence has been used and the original version 2 report is likely to be more accurate in our opinion.

49. On page 6, paragraph 22 of Aether's proof of evidence, Aether attempts to rebuke Dr Andrew Boswell's claim that Aether measured NO_2 in excess of objective limits on Magdalen Street. Aether cites 2018 data from Norwich City Council's diffusion tube (DT6) which is also on Magdalen street to argue that levels on Magdalen street are below objective limits. This is a false deduction since values of NO_2 on a given street can vary significantly at different locations depending on traffic behaviour and building architecture. In fact, as if to illustrate the point, Aether predicts a baseline value of 54.2 ug/m3 for its modeled location "B" which is also on Magdalen street and clearly above objective limits. This is the second time (see paragraph 39 of this document for the first) that Aether makes the false implication that 2018 NCC DT data implies a reduction in NO_2 in the development area, when in fact there is no evidence to suggest this.

5. Withstanding issues

50. There are a number of areas that remain unaddressed by Aether's proof of evidence, these are briefly summarised below.

51. Aether's modeled values are less relevant than their measured values. Aether measured NO_2 directly in 2017 at the development site, and produced a 2017 annual estimates of 70 ug/m^3 at Magdalen St, and 61 ug/m^3 on Edward St. Thus the only primary evidence available on NO_2 levels within the development area, indicates a problem.

52. No hourly measurements of NO_2 have been taken in the development area, and given that estimates of annual NO_2 measured by Aether themselves showed values in excess of 60 ug/m^3 it would be wise to take a precautionary approach and assume that there may indeed be 18 or more hourly exposure exceedances on Magdalen Street and Edward Street.

53. Aether has not addressed the issue of street canyon creation that we outlined in our proof of evidence: namely that the development will create canyons at Edward St and Pitt St, and that these have not been modeled as canyons. This is particularly important since Aether measured a value of 70 ug/m^3 at Edward St. In Section 2.2.1 of V3 of Aether's air quality assessment, street canyon modeling is outlined and shows that Edward St and Pitt St have not been modeled.

54. The NICE guideline violations we outlined in Section 4 of our proof of evidence are still valid.

55. NCCs mitigation strategy has not been addressed and is still of concern (See section 6 of our proof of evidence).

Appendix A - Impact calculations

NO2 Impact calculations for no-policy applied scenario with an AQAL target of 40								
Receptor	**Without Dev 2031**	**With Dev 2031**	**% Change**	**% increase**	**% Increase (rounded)**	**AQAL % (rounded)**	**AQAL Category**	**Impact**
A	**56.8**	**58.9**	103.70%	3.70	4	147.00%	110% or more	Substantial
B	**53.9**	**54.2**	100.56%	0.56	1	136.00%	110% or more	Moderate
C	26.6	27.1	101.88%	1.88	2	68.00%	75% or less	Negligible
D	25.6	25.9	101.17%	1.17	1	65.00%	75% or less	Negligible
E	35.8	36.1	100.84%	0.84	1	90.00%	76-94%	Negligible
F	38.1	39	102.36%	2.36	2	98.00%	95-102%	Moderate
G	**54.1**	**55.3**	102.22%	2.22	2	138.00%	110% or more	Substantial
H	**44.4**	**45.5**	102.48%	2.48	2	114.00%	110% or more	Substantial
I	26.2	26.7	101.91%	1.91	2	67.00%	75% or less	Negligible

Table 2 - Impact calculations for “no policy applied” scenario according to Aether AQA V3 figures for NO_2 and an AQAL target of 40 ug/m^3.

Impact calculations for no-policy applied scenario with an AQAL target of 60								
Receptor	**Without Dev 2031**	**With Dev 2031**	**% Change**	**% increase**	**% Increase (rounded)**	**AQAL % (rounded)**	**AQAL Category**	**Impact**
A	**56.8**	**58.9**	103.70%	3.70	4	98.00%	95-102%	Moderate
B	**53.9**	**54.2**	100.56%	0.56	1	90.00%	76-94%	Negligible
C	26.6	27.1	101.88%	1.88	2	45.00%	75% or less	Negligible
D	25.6	25.9	101.17%	1.17	1	43.00%	75% or less	Negligible
E	35.8	36.1	100.84%	0.84	1	60.00%	75% or less	Negligible
F	38.1	39	102.36%	2.36	2	65.00%	75% or less	Negligible
G	**54.1**	**55.3**	102.22%	2.22	2	92.00%	76-94%	Slight
H	**44.4**	**45.5**	102.48%	2.48	2	76.00%	76-94%	Slight
I	26.2	26.7	101.91%	1.91	2	45.00%	75% or less	Negligible

Table 3 - Impact calculations for “no policy applied” scenario according to Aether AQA V3 figures for NO_2 and an AQAL target of 60 ug/m^3.

6. References

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