Wealden District Council
Local Plan - Comments on Regulation 19
Response of:
Lewes District Council, Tunbridge Wells Borough Council, South Downs National Park Authority, and AECOM

November 2018

Experts in air quality management & assessment
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1 Introduction

1.1 Air Quality Consultants Ltd. (AQC) has reviewed the Joint response of South Downs National Park Authority, Tunbridge Wells Borough Council and Lewes District Council on the Proposed Submission Wealden Local Plan August 2018 (Regulation 19) Consultation (hereafter called the 'joint response'), as well as the review of the Wealden Local Plan HRA by AECOM (28 September 2018) (hereafter called the ‘AECOM review’). This note provides AQC’s comments on what appear to be the key areas of difference between AQC’s position and that expressed in the joint response and the AECOM review. These areas have been discussed within this note under the following headings:

- trends over time, and future-year emissions scenarios;
- reliance on autonomous improvements to offset locally-generated impacts;
- potential for impacts more than 200 m from roads;
- “standard” vs “bespoke” methods and reliance on Natural England guidance;
- NH$_3$ emissions related to combustion processes;
- critical level for NH$_3$ concentrations;
- critical level for 24-hour NOx concentrations;
- treatment of uncertainty in critical levels and critical loads;
- use of APIS source-apportionment statistics; and
- further points specific to Pevensey levels and Lewes Downs.

1.2 At the present time, AQC has not commented on points related to mitigation. This note draws on the material contained in the following reports:

- Ashdown Forest SAC Air Quality Monitoring and Modelling (Volume 1). Air Quality Consultants Ltd. August 2018 (hereafter called the “AQC Ashdown Forest report”);
- Air Quality Input for Habitats Regulations Assessment: Lewes Downs SAC. Air Quality Consultants Ltd. August 2018 (hereafter called the “AQC Lewes Downs report”); and
- Air Quality Input for Habitats Regulations Assessment: Pevensey Levels. Air Quality Consultants Ltd. August 2018 (hereafter called the “AQC Pevensey Levels report”).
2 Trends over Time, and Future-year Emissions Scenarios

Trends over Time

NOx and Oxidised Nitrogen

Historic Trends

2.1 The AECOM review makes frequent mention of "existing improving trends in NOx and oxidised nitrogen deposition" (e.g. Paragraph 1.1.4). AECOM supports this with screenshots of the trends graphs from APIS\(^1\) (these are only shown for oxidised nitrogen. The concurrent predicted upward trend for total nitrogen deposition is not shown). AECOM describes these as "local manifestations of a broader long-term national trend". The trends presented by AECOM are modelled data\(^2\) and are not informed by local measurements. In practice, they are local-scale projections based on broader national trends and are thus uncertain. They also only show background values (i.e. those well away from roads). There are good reasons to expect trends in roadside concentrations to be different from those at background locations because the former are more heavily influenced by, and thus sensitive to, changes in traffic emissions. There is substantial evidence that previously-predicted reductions in traffic-related NOx emissions have not been realised, but it is usually accepted that the predicted concurrent reductions in emissions from other sectors (e.g. power stations), which affect background concentrations, have been successful.

2.2 AECOM also refers to reductions in NOx concentrations achieved prior to 2000 but presents these as if they have continued uninterrupted since then\(^3\). In particular, AECOM notes that the improvements have occurred "particularly since 1990" (Paragraph 1.3.11). It would be more precise to state "particularly in the period between 1990 and 2000". It is well-documented that the substantial rates of improvement achieved during the 1990’s have not been repeated since then.

2.3 This is not, however, to say that there have been no improvements since 2000. AQC has looked at trends in measured NOx and NO\(_2\) concentrations across the UK (AQC, 2018). This has shown that, averaged across a large number of UK monitoring sites, NOx and NO\(_2\) concentrations have fallen, on average, by around 1.5% per year between 2005 and 2016\(^4\). There has, however, been

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\(^1\) The data for 2015 presented by AECOM have subsequently been withdrawn because they contain an error.

\(^2\) The trend in NOx concentrations which AECOM has presented comes from Defra’s Pollution Climate Mapping (PCM) model and covers the period 2003 to 2015. The PCM model has been widely criticised for predicting rates of improvement over the period 2003 to 2015 which were not realised, but it is important to note that the PCM data as used in APIS are not these same projections; they are the base-year PCM results which have been calibrated (on a national level) against measurements. For this reason, the criticisms which are usually levelled against PCM for being over-optimistic over the 2003 to 2015 period should not be applied to the data presented by AECOM.

\(^3\) The statement that AECOM has taken from Rowe et. al (2014) regarding a reduction in NOx emissions since 1988 was part of a discussion of why nitrogen deposition fluxes have NOT fallen as dramatically as basic projections might have suggested.

\(^4\) Which is very welcome but much smaller than the concurrent rate of improvement that had been predicted by Defra’s PCM model and its other tools.
significant spatial variability around this average trend. At many sites there has been no significant trend at all over this period, while at others a significant upward trend has been recorded (AQC, 2018).

2.4 This spatial variability is exemplified by measurements collected in and around Wealden. Chapter 3 (in particular Figure 3.1) of the AQC Ashdown Forest report summarises the annual mean NO$_2$ concentrations measured at Lullington Heath since 1991. As explained in Paragraph 3.3 of the AQC Ashdown Forest report, the data show "a trend of falling concentrations since 1991, which plateaued between 2004 and 2010 but have since begun to fall slightly again, although concentrations in 2017 were roughly the same as those in 2011."

2.5 There are eight diffusion tube monitoring sites in Wealden which have measured NO$_2$ concentrations each year from 2012 to 2017, but one of these sites was moved in 2017 and the data thus cannot be used to assess long-term trends. The published results for the seven sites which have not been relocated over this period are summarised in Figure 1. The sites closest to Ashdown Forest are those in Crowborough, which are shown in bold orange and red. Measured concentrations in Crowborough town centre have increased slightly over the period 2012 – 2017, while those at the Crowborough background site appear to be relatively unchanged over this period. Figure 1 also shows the average concentration across all eight of these long-term sites, which has increased slightly over this six year period. NO$_2$ is a principal component of nitrogen deposition and a key indicator of temporal patterns in other oxidised nitrogen species. NO$_2$ is also a key indicator of NOx concentrations (NOx = NO$_2$ + NO). Thus, trends in annual mean NOx and oxidised nitrogen deposition over time are likely to closely follow those in annual mean NO$_2$.

2.6 Appendix A2 summarises the annual mean nitrogen dioxide measurements reported by nearby local authorities; which includes Lewes District Council and Tunbridge Wells Borough Council. Some of the monitoring sites show patterns of reducing concentrations over time, others show no obvious pattern, and some show increasing concentrations. What is also apparent from the data in Appendix A2 is that year-on-year variability (which is likely to be driven by meteorology rather than changes in emissions) is often greater than any systematic trends (which would be driven by changes in emissions) over the periods shown.

2.7 There is thus evidence that concentrations of NOx and NO$_2$ have been falling, ‘on average’, when viewed nationally, but there is also good evidence that recent concentrations have not been falling everywhere and that they have been increasing in many locations; including those sites closest to Ashdown Forest.

2.8 Chapter 3 of the Ashdown Forest report also presents historic measurements of NO$_3^-$ in precipitation and HNO$_3$ from Barcombe Mills. There is no obvious downward trend in the NO$_3^-$ measurements, but there is evidence that HNO$_3$ concentrations have fallen.
**Figure 1:** Measured Annual Mean NO\textsubscript{2} Concentrations at WDC LAQM Diffusion Tube Monitoring Sites over Six Years (Wealden District Council, 2016) (Wealden District Council, 2017) (Wealden District Council, 2018). Also Showing the Average Concentration across the 8 Sites.

**Future Trends**

2.9 AECOM presents the argument that the predicted reductions in NO\textsubscript{x} and NO\textsubscript{2} in the future will be a simple extension of existing trends; for example in Paragraph 1.1.4 - that emissions scenario A: “would require the long-established existing positive trends in key background pollutant concentrations and deposition rates to reverse” and Paragraph 1.7.2 which states that the three alternative emissions scenarios “vary greatly in the extent to which they acknowledge existing improving trends in NO\textsubscript{x} and oxidised nitrogen deposition and the likelihood of them continuing”.

2.10 The improvements predicted in scenarios B and C are NOT a continuation of the status quo. Quite the opposite, they assume the effective delivery of a great deal of hard work to ensure that the previous failings of type-approval emissions standards are NOT repeated.

2.11 The reduction in modelled background NO\textsubscript{x} concentrations presented by AECOM was a 1.6% per year reduction in concentrations (~0.7% if the rescinded 2015 data are included\textsuperscript{5}). AQC (2018) showed a 1.5% per year reduction in NO\textsubscript{x} and NO\textsubscript{2} on average between 2005 and 2016. Table 1 summarises the predicted rates of change in NO\textsubscript{x} concentrations in the three AQC emissions scenarios.

\textsuperscript{5} Data have been bias adjusted and, where required, adjusted to annual mean equivalent data by the Council.
scenarios. It does this by showing the rate of change in the average concentration, the maximum predicted concentration (which occurs at the kerbside) and in the minimum predicted concentration (which occurs well away from any roads). Scenario B predicts a reduction of 2.4% per year on average, with a fall of 3.3% per year at the kerbside. This is significantly greater than the historic reductions reported by either AECOM or AQC (2018).\(^6\)

### Table 1: Change in Annual Mean NOx Concentration per year Comparing Existing Baseline with Future Without WDC-Growth\(^{ab}\)

<table>
<thead>
<tr>
<th>Emission Scenario</th>
<th>Average(^c)</th>
<th>Maximum(^c)</th>
<th>Minimum(^c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>+0.2%</td>
<td>+1.3%</td>
<td>+0.1%</td>
</tr>
<tr>
<td>B</td>
<td>-2.4%</td>
<td>-3.3%</td>
<td>-2.2%</td>
</tr>
<tr>
<td>C</td>
<td>-2.5%</td>
<td>-4.5%</td>
<td>-2.3%</td>
</tr>
</tbody>
</table>

\(^a\) Including amended Tempro 7.2 growth without any growth within Wealden, i.e. the results presented in Chapter 11 of the AQC Ashdown Forest report.

\(^b\) Derived by comparing the results in Table 9.3 with those in Tables 11.1, 11.15, and 11.27 of the AQC Ashdown Forest report.

\(^c\) “Average” is the rate of change in the SAC-wide average NOx concentration, “Maximum” is the rate of change in the maximum predicted concentration across the SAC, and “Minimum” is the rate of change in the minimum predicted concentration across the SAC.

2.12 Figure 2 shows these predicted changes graphically. It shows the predicted NOx concentrations each year as a percentage of those predicted in 2015; assuming a linear change between 2015 and 2028\(^7\). It does this for the scenarios that are summarised in Table 1. In order to provide some context, Figure 2 also includes the measured changes in NO\(_2\) concentrations recorded at the two sites which are closest to Ashdown Forest.

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\(^6\) As a minor point of clarification, AECOM appears to have misunderstood the nature of Scenario C; assuming that the Design Manual for Roads and Bridges (DMRB) method has been followed. The DMRB method is not considered fit for purpose and so has not been followed.

\(^7\) In practice, the rate of change would not be linear, but this is not relevant given that only one assessment year is being considered.
2.13 Based purely on the measured trend, Figure 2 appears to suggest that, out of scenarios A, B, and C, emissions scenario A presents the most logical continuation of recent local measurements. However, contrary to the implications of AECOM, future trends in NOx emissions cannot be deduced purely from historic patterns. Any reductions in the future will be heavily-dependent on the emissions performance of new road vehicles entering the vehicle fleet and how this compares with the emissions performance of older vehicles which will no longer be used.

2.14 AQC has carried out a detailed analysis of the emissions from early Euro 6 diesel cars and Euro VI heavy duty vehicles and shown that they emit less NOx than earlier models (AQC, 2016). Furthermore, there is now good evidence that the new tranche of Euro 6 diesel cars (Euro 6 d-temp) emit, on average, less NOx than the early Euro 6 variants. While there remains uncertainty regarding the rate of fleet turn-over, and the specific vehicles that will be used in the future, it seems very likely that, over time, the vehicle fleet will evolve to emit less NOx per vehicle (on average) than it does presently.

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Figure 2: Trends in locally-measured Annual Mean (NO₂) and Predicted Annual Mean NOx over Time

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8 Nick Molden, Emissions Analytics, pers comm.
2.15 AQC thus believes that there are good reasons to be optimistic that substantive falls will occur in the future and that, of the three scenarios modelled, Scenario A is the least likely for NOx. The monitoring being carried out within Ashdown Forest is likely to show which (if any) of the trajectories in Figure 2 is correct (or whether different parts of the SAC follow different trajectories), but this monitoring has not yet been running for sufficient time to deduce information on long-term trends. Neither AQC’s nor AECOM’s expectations with respect to future trajectories are, however, considered particularly relevant in relation to applying the habitats regulations. This is because, in her Opinion delivered to the European Court of Justice on 25 July 2018, Advocate General Kokott explained that:

“the autonomous decrease in nitrogen emissions can establish the compatibility of additional nitrogen deposition … only if it is already definitively established … that the total load on the site from nitrogen deposition falls below the threshold for the integrity of the site being adversely affected. On the other hand, it is not sufficient, for the purposes of approval of additional nitrogen deposition, if deposition declines overall, but the land in question is still overloaded with nitrogen. Mere forecasts regarding the future effects of those measures and the expected decrease in nitrogen emissions may not be taken into account in the decision on the approval of additional nitrogen deposition.”

2.16 Thus, in the context of assessing impacts of nitrogen deposition on designated sites, Advocate General Kokott’s position is clear. It is necessary to consider the forecasts with emissions reductions (i.e. either Scenario B or C) only with respect to whether the critical levels or critical loads will continue to be exceeded in the future assessment year. If it is established that they will continue to be exceeded in Scenarios B or C, then subsequent assessment must be on emissions Scenario A. Basing the assessment on emissions scenarios B or C would run directly counter to the clear guidance provided by Advocate General Kokott.

2.17 Advocate General Kokott’s Opinion informed a European Court judgement on Joined Cases C-293/17 and C294/17 handed down on 7th November 2018. This notes (in Ruling 6) that benefits associated with measures which are not a part of the proposal being determined may not be taken into account if they are not certain at the time of the assessment. Scenarios B and C both include predicted benefits associated with national and international measures and trends which are not a part of the Wealden Local Plan. AQC believes that such benefits are likely, but is unable to say that the full extent of benefits in either Scenario B or Scenario C is certain. The practical interpretation of the 7th November judgement is thus the same as that of the Advocate General’s Opinion which informed it: that these benefits may not be taken into account. Scenario A, which does not include these benefits, is thus the scenario which must form the basis of decisions on Natura 2000 ecological sites.
**NH\textsubscript{3} and Reduced Nitrogen (for the sake of completeness)**

**Historic Trends**

2.18 Chapter 3 of the Ashdown Forest report shows that NH\textsubscript{3} has been measured at Lullington Heath. There was an overall increase in concentrations between 1997 and 2016, although this increase was not reflected in the single measurement for 2017, which showed the lowest annual mean concentration since 2009. Measured NH\textsubscript{4}\textsuperscript{+} in precipitation has showed no obvious trends since around 2000.

**Future Trends**

2.19 Uncertainty in the future-year projections for NH\textsubscript{3} and NH\textsubscript{4}\textsuperscript{+} is discussed in Paragraphs 7.13 to 7.15 of the AQC report. It is AQC’s current opinion that agricultural NH\textsubscript{3} emissions in 2028 may be over-predicted but there is a significant risk that traffic-related NH\textsubscript{3} emissions in the future have been under-predicted. There is, however, very little information currently available upon which to make judgements either way with respect to future trends. The projections for NH\textsubscript{3} and NH\textsubscript{4}\textsuperscript{+} are judged to be highly uncertain.
3 Reliance on Autonomous’ Improvements to Offset Locally-generated Impacts

3.1 The AECOM report (e.g. Paragraphs 1.3.17) expresses the view that the predicted benefits associated with technology and international policy, which are unrelated to the Wealden Local Plan, should be used to offset the adverse impacts of the Plan. The argument is thus made that when comparing the different model scenarios, the changes should be viewed as benefits, rather than disbenefits (e.g. that the most relevant assessment is to compare 2028 with the Plan under emissions scenario B against the current situation under emissions scenario A). The comparisons which AECOM has attempted to draw out (e.g. in Paragraph 1.3.16) are actually those which are set out in full within Chapter 15 of the AQC Ashdown Forest report (it is understood that this was not reviewed by AECOM). The point which AECOM appears to be making is thus summarised for them within Paragraph 15.38 of the AQC Ashdown Forest report, which states that:

3.2 “If the technological and policy improvements predicted nationally and internationally all deliver their anticipated benefits, then air quality will be better, and nitrogen deposition fluxes will be smaller, than they are at present. While the Local Plan will cancel out some of these expected benefits, it is still the case that conditions in the future with the Plan and other traffic growth will be better than they are at present if all of the anticipated emissions improvements materialise. All of the results in this chapter are thus presented as benefits.”

3.3 AQC is thus in no disagreement that the future scenarios which contain forecast emissions reductions show improvements when compared with the current situation; indeed an entire chapter of its report is devoted to presenting these improvements. However, the same paragraph continues:

3.4 “These predicted benefits should, however, be understood in the context of an Opinion from the European Court of Justice (see Paragraph 15.4), which is that predicted benefits, such as those associated with technology and national policy, which are unrelated to the Wealden Local Plan (and will happen autonomously with or without the Plan), cannot be used to offset the adverse impacts of the Plan where the critical levels or loads are still exceeded.”

3.5 While AECOM clearly believes that the forecast benefits of these autonomous measures may be used to offset the impact of the Plan, even when continued exceedences are predicted, this does not appear, to AQC, to be consistent with the advice given by Advocate General Kokott or with the 7th November judgement.

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\( ^9 \) i.e. which are unrelated to the Wealden Local Plan.
4 Potential for Impacts More than 200 m from Roads

4.1 The AECOM review notes that the effects of roads decline with distance and that impact assessments will usually focus on the worst-case figures, which are those which usually occur closest to the road. AQC agrees with both of these points.

4.2 AECOM then, however, goes on to suggest firstly (e.g. in Paragraph 1.3.4 – second bullet) that the assessment should be framed solely by the sensitivity of the habitat close to the road (i.e. that the only relevant assessment criteria are those which apply to species which have not been excluded at the roadside), and secondly (e.g. in Paragraph 1.3.24) that impacts to very small areas at the kerbside are of limited relevance. AQC agrees that it is acceptable to focus on the worst-case figures, and also to make caveats about the areas which these figures do, and do not, represent. It would, however, be extremely remiss not to also provide an assessment of those parts of the SAC where the applicability of the worst-case figures has been discounted.

4.3 While it does not appear that there is any substantive disagreement between AQC and AECOM regarding the rate at which concentrations reduce with distance from roads, it is helpful to visualise how these reductions appear in practice within Ashdown Forest. Figure 3 shows a transect of modelled receptor points stretching from the A22 to the B2026. This runs roughly parallel to, and approximately 600 m north of, Crowborough Road. The transect is neither completely straight, nor perpendicular to the A22 because no fresh modelling has been carried out; the transect is simply a subset of the receptors used to generate isopleths presented in the AQC Ashdown Forest report. While it might have been less confusing to present results for a transect which moves away from the road without then passing near any other roads, no such examples exist in Ashdown Forest (i.e. it is not possible to get sufficiently far from all roads).

4.4 Figure 4 shows the annual mean road-NOx (i.e. the NOx originating from explicitly-modelled roads) predicted using the ADMS-Roads dispersion model (see AQC Ashdown Forest report) vs distance from the A22\(^{10}\). The top panel shows that the highest concentrations, by a considerable margin, occur beside the A22 and B2026. This justifies AECOM’s statement that the worst-case impacts will be closest to roads. The second panel shows the rate of reduction out to 250 m from the A22, and shows a steady rate of drop-off over this region. The third panel shows the change between 200 m and 2 km. Concentrations continue to reduce out to about 1 km from the road, and then plateau out at about 1 \(\mu\text{g/m}^3\) of local-traffic-related NOx. The bottom panel then shows concentrations increasing toward the B2026. Figure 5 shows exactly the same pattern, but this time for the change in NOx caused by traffic associated with the Plan in combination with other traffic growth.

\(^{10}\) Each distance is the closest distance to the edge of the A22, and not simply the distance along the transect.
4.5 Within Ashdown Forest, it is impossible to get sufficiently far from roads so as to demonstrate the predicted reduction in concentrations at large distances from roads. This is shown in Figure 6, which shows the rate of fall-off along a transect perpendicular to a single road. Predicted NOx concentrations continue to fall out to (and beyond) 10 km from the road; getting progressively smaller but never reaching zero. While the shape of the curve in Figure 6 may be questioned, the general pattern is very well established and not usually questioned. The effect of one road at a distance of 1 km or more is thus extremely small but not zero. The effect of multiple roads will then be additive (i.e. the impact of 20 roads will, all other things being equal, be 20 times greater than that of one road). Truncating a model at 200 m from roads will not only miss any potential impacts beyond 200 m from any roads, it will also miss the additive effect of lots of small incremental changes in concentration caused by changes in traffic on large numbers of distant roads. This latter point can be very important.

4.6 Returning to Figure 4 and Figure 5, predicted NOx concentrations > 600 m from roads are much smaller than those at the kerbside but clearly not zero. In particular, the predicted change in NOx caused by the Plan in combination with other traffic growth (Figure 5) remains greater than 0.3 \( \mu g/m^3 \) (1% of the critical load) over almost the entire transect\(^{11}\). This is the combined additive effect of changes in traffic on all roads within the study area which, within the AQC model, have NOT been truncated at 200 m.

4.7 AQC wholeheartedly agrees that impacts are greatest close to roads and that focusing on these impacts has the potential to simplify many modelling studies. AQC does not, however, agree that it is appropriate to ignore potential impacts beyond 200 m from roads. The approach which AECOM seems to propose is to only consider the roadside changes, but then discount any potential effects on the basis that the more sensitive habitats are not at the roadside. This is illogical.

4.8 Finally on this point, AECOM’s assumption (e.g. in Paragraph 1.3.30) that the presence of habitat ‘failures’ beyond 200 m from roads indicates that traffic emissions cannot be the cause of these failures, requires further justification given that traffic emissions can clearly affect ambient concentrations beyond 200 m.

\(^{11}\) Unrounded, the minimum predicted concentration is 0.297 \( \mu g/m^3 \), which is reached briefly at around 2 km from the A22.
Figure 3: 3.3 km Transect Eastward from the A22
Figure 4: Predicted Existing Annual Mean Road NOx with Distance from the A22, with Varying X and Y Scales
Figure 5: Predicted Change in Annual Mean Road NOx with Distance from the A22, with Varying X and Y Scales (Plan In-Combination, Emissions Scenario A)
Figure 6: Typical ADMS-Roads Predicted Reduction in Road-NOx Moving Away from a Nominal Road (1 m to 10 km – log/log scale)
5  “Standard” vs “Bespoke” Methods and Reliance on Natural England Guidance

5.1 The joint response notes that the work by AECOM: “used what might be described as “standard methodologies” by air quality experts”. It continues that: “In contrast the Wealden HRA has used bespoke methods and approaches”.

5.2 Given that AECOM and AQC have both used the ADMS-Roads dispersion model, it is assumed that this comment relates principally to AQC’s deposition calculations. There is no single standard approach to calculating nitrogen deposition, although it is very common to use annual average deposition velocities of some kind or other. It is very well established that using annual average deposition velocities cannot provide similar precision to an approach which uses diurnal and seasonal profiles in deposition. Any suggestion that AQC’s modelling is in some way inferior to a study which uses annual average deposition velocities is thus incorrect.

5.3 What is “standard” across most assessments is to rely, to some extent, on the national nitrogen deposition modelling carried out by CEH. The deposition modelling methods used by AQC on behalf of WDC are much closer to this model than any study which uses annual average deposition velocities.

5.4 In any event, while the deposition modelling provided by AQC provides additional detail over that which would have been possible using more basic methods, this additional detail, in and of itself, is unlikely to have significantly shaped the overall conclusions of the air quality assessment.

5.5 Both the joint response and the AECOM review make reference to guidance from Natural England, including commentaries which have been published by WDC, and Natural England’s guidance on advising competent authorities on the assessment of road traffic emission under the Habitats Regulations (Natural England, 2018). Natural England’s position is considered to be ill-informed and also does not appear to take account of UK High Court Case No: CO/3943/2016 and ECJ Joined Cases C-293/17 and C-294/17. As a result of these failings, adherence to Natural England’s published guidance would mean providing an air quality assessment which is not fit for purpose and which risks not providing adequate protection to sensitive ecological sites.

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12 There are also many other areas where the two studies diverge (some of which are discussed elsewhere in this note), but AQC has guessed that the approach to deposition calculation is the focus of the joint review’s point.

13 The qualifications of the authors of this report as air quality experts are given in Appendix A1.
6 NH$_3$ Emissions Related to Combustion Processes

6.1 The suggestion is made in the AECOM review (e.g. in Paragraph 1.3.11) that only oxidised nitrogen is released as a result of combustion processes. This is only correct if the combustion process does not include some form of catalytic NOx control, which many large static combustion processes do; as do many road vehicles. There is good evidence, including within the AQC Ashdown Forest report, that road traffic is a source of NH$_3$ emissions. While this only makes up a small percentage of the total nitrogen emitted from traffic, the relative difference in deposition rates when comparing NOx and NH$_3$ means that these emissions have a disproportionately large effect on roadside nitrogen deposition fluxes. It is thus incorrect to ignore reduced nitrogen emissions from combustion processes, including road traffic.
7 Critical Level for NH₃

7.1 The critical level of 1 µg/m³ for ammonia is relevant where lichens and bryophytes form a key part of the ecosystem integrity. In other locations, a critical level of 3 µg/m³ has been set. The AECOM review reports that no significant lichen currently survive within 200 m of ‘A’ roads in Ashdown Forest and that there is, therefore, no need to consider a critical level that would allow their survival in the future. AQC’s opinion is that the site-specific guidance of Prof. Mark Sutton should be followed in this respect. Prof. Sutton has advised that the critical level of 1 µg/m³ for ammonia should be used for roadside locations in Ashdown Forest. Prof. Sutton has expertise in setting critical levels and critical loads where AQC does not. It is unclear to AQC whether AECOM has such expertise.
8 Critical Level for 24-hour NOx Concentrations

8.1 Assessment has been made against the critical loads, the annual mean critical levels, and the 24-hour critical levels. This is because the value set for this critical level allows for the potential for NOx to have a synergistic effect with, or increase the sensitivity to, the pollutants O₃ and SO₂. AECOM note that, globally, short-term episodes of elevated NOx concentrations are often combined with elevated concentrations of O₃ or SO₂. In making this point, AECOM cite the WHO (2000) guidelines. AECOM then state that elevated concentrations of O₃ or SO₂ are rarely recorded in the UK, meaning that this critical level should be ignored.

8.2 AQC does not have expertise in setting critical levels and so cannot comment definitively on this issue. It is, however, noted that the WHO guidelines cited by AECOM¹⁴ include a range of evidence, some of which is summarised in Figure 7 below. For ease of reference, recent ozone measurements made at Lullington Heath are given in Figure 8 (shown here as a rolling 24-hour mean since this discussion relates to the coincidence of peaks with the 24-hour mean NOx critical level¹⁵). Given that the 24-hour NOx critical level remains an official assessment criterion¹⁶, it is considered that further justification is needed from AECOM as to why 24-hour mean NOx concentrations are not a relevant metric to assess against.

8.3 Until formal guidance is issued to the effect that the critical levels published on APIS should NOT be assessed against, AQC believes that it is safest to continue to consider these critical levels. This does not, however, mean that assessment will ONLY be carried out against the 24-hour critical level, simply that it forms one of several assessment metrics.

¹⁴ http://www.euro.who.int/__data/assets/pdf_file/0005/123098/AQG2ndEd_11no2level.pdf
¹⁵ There are no critical levels that have been set for 24-hour mean O₃ concentrations.
¹⁶ And in particularly in the context of AECOM’s statement regarding deviating from agreed critical levels which is repeated in 9.2, below, of this current note.
The lowest exposure levels of NO\textsubscript{2} affecting biochemical processes, physiology or growth. Curves are drawn below the lowest effective exposure levels. Black squares show the first edition of the WHO air quality guidelines X and Y axes are in log scale.

The lowest exposure levels at which NO\textsubscript{2} increases the effect of SO\textsubscript{2}, O\textsubscript{3} or SO\textsubscript{2} + O\textsubscript{3}. The curve is drawn below the lowest effective exposure levels. Black squares show the first edition of the WHO air quality guidelines X and Y axes are in log scale.

**Figure 7:** Copy of Figures 2, 3, and 7 of Chapter 11 of the WHO (2000) Air Quality Guidelines\textsuperscript{14}
**Figure 8: Rolling 24-hour Mean O$_3$ Concentrations Measured at Lullington Heath in 2017**

8.4 While AQC is not in a position to comment on the relative certainty of the different critical levels, it is able to comment on the relative certainty in its own modelling. The AQC report makes clear that the predictions for 24-hour maximum NOx concentrations are highly uncertain. Thus, even assuming that both the 24-hour and annual mean critical levels have been set with equal certainty, AQC would suggest that greater weight should be placed on the predicted exceedences of the annual mean critical level for NOx than on the predicted exceedences of the 24-hour critical level for NOx.

8.5 It should be clear that providing an assessment against the official 24-hour critical level does not preclude the annual mean metrics from also being considered. However, AQC’s reading of the 10th paragraph of the joint response suggests that all impacts on the Lewes Downs SAC should be discounted because the 24-hour critical level is not considered relevant. This is despite the fact that the annual mean critical load for nitrogen deposition is also predicted to be exceeded across the site and that changes in fluxes greater than 1% as a result of the Plan in combination with other traffic are predicted.
9 Treatment of Uncertainty in Critical Levels and Critical Loads

9.1 Critical Loads are defined as: “a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge”\(^\text{17}\). Critical levels are defined as: “concentrations of pollutants in the atmosphere above which direct adverse effects on receptors, such as human beings, plants, ecosystems or materials, may occur according to present knowledge”.

9.2 The AQC report acknowledged that as well as uncertainty in the predicted concentrations and fluxes, there is also uncertainty in the published critical levels and critical loads. AECOM disagrees with this approach, stating: “AECOM do not consider it advisable for bodies undertaking air quality impact assessments to determine for themselves (even using information provided by the likes of CEH) whether to deviate from the critical levels which have been agreed internationally until an appropriate scientific standard-setting organisation (e.g. UNECE), government agency or representative professional body (e.g. the Institute of Air Quality Management) take a consensus view that such a change should be made. This is because the major advantage to the use of critical levels is their international consistency. If organisations choose alternative reference levels for individual assessments it undermines the ability of anybody to undertake a meaningful air quality impact assessment.”

9.3 Elsewhere, the AECOM report relies heavily on the work of Caporn et al 2016; one of the key conclusions of which is that: “the response of species richness to long-term N deposition is curved, with sharper losses in diversity from well below the habitat-specific critical load range”.

9.4 The conclusions of the work upon which AECOM relies are thus that effects can occur below the published critical loads. This does not seem to be consistent with AECOM’s suggestion that the potential for such effects should be ignored.

9.5 It is AQC’s opinion that acknowledging uncertainty and testing the sensitivity of conclusions to that uncertainty can only be helpful, but that this is a moot point where the published critical levels and critical loads are predicted to be exceeded.

\(^{17}\) https://www.icpmapping.org/Definitions_and_abbreviations
10 Use of APIS Source-apportionment Statistics

10.1 The AECOM review presents a screenshot from APIS of a pie chart showing how the SAC-average deposition flux, when calculated using the FRAME model, is source-apportioned\(^\text{18}\). The relative contribution from different sources is not, however, spatially constant. The AQC modelling\(^\text{19}\) predicts that the deposition flux to dry heath at the worst-case roadside location will be some 8.5 kg-N/ha/yr higher than the SAC-average flux to dry heath. This difference is almost entirely the result of road traffic\(^\text{20}\). If the FRAME-predicted source-apportionment is assumed to be correct for the SAC-average result, then this means that road traffic makes up ~43% of the total flux at the worst-case roadside location\(^\text{21}\), which is more than the next three largest components (in the FRAME data) combined. This is shown graphically in Figure 9. AECOM’s argument (in Paragraph 1.3.33) that road traffic contributes such a small component of the total deposition flux as to make it unworthy of inclusion in action planning, is thus flawed.

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\(^{18}\) APIS explains that the values predicted by FRAME may be different from those in the CBED model.

\(^{19}\) existing baseline, AQC deposition method, Tables 9.16 and 9.17 of the AQC Ashdown Forest report.

\(^{20}\) Spatial variation in mapped wet deposition will also have a minor effect.

\(^{21}\) i.e. simply taking the % data presented by APIS (and AECOM), and assuming that this relates to AQC’s SAC-average data, adding on the additional traffic-related component at the worst-case location for dry heath, and recalculating the percentage break-down.
Figure 9: Indicative Source-apportionment of Total Nitrogen Deposition to Dry Heath in Ashdown Forest SAC: A) SAC-average (FRAME) values, and B) at the worst-case roadside location.
11 Further Points

11.1 Both the joint response and the AECOM review take the position that the critical levels and loads which have been set to protect features for which the Pevensey Levels have been designated as a SSSI are of no relevance to the assessment. In particular, the AECOM review suggests that the “grazing marsh (seasonally flooded pasture), which makes up the majority of the site by area but plays a minimal role in supporting the SAC and Ramsar interest features” (paragraph 1.3.41) does not require consideration. Advice from CEH on this point would be welcome.

11.2 More generally, AQC also does not have the expertise to determine where within each designated sites different features are currently present. Neither is AQC able to contribute to debate about whether/if a feature which has been excluded because of prior human activity should be afforded protection in the future.

11.3 In Paragraph 1.4.1 of the AECOM review, referring to Lewes Downs, it is suggested that the AQC modelling shows “that the SAC is not currently suffering a problem regarding traffic on the road”. This is despite this modelling showing that the critical levels for NOx and the critical load for nitrogen deposition are being exceeded alongside both roads being considered and, in the case of nitrogen deposition, across the entire site. The basis of AECOM’s statement seems to be that, beyond 20 m from the A26, while the critical load is exceeded, the annual mean NOx critical level is not. Elsewhere, however (3rd paragraph of Paragraph 1.3.4) AECOM argue that the focus of assessment should be on nitrogen deposition and not on NOx concentrations. They also note in relation to a different road and site (Paragraph 1.3.29) “nitrogen deposition will be elevated locally due to the presence of the road and this influence declines with distance from the road. No-one disputes this”. Insufficient evidence is provided by AECOM as to why the predicted exceedences of the critical levels and critical loads at Lewes Downs, which are worst closest to the roads, indicate that there is not a problem regarding traffic emissions.
12 References


Eastbourne Borough Council (2018) '2018 Air Quality Annual Status Report (ASR)'.

Lewes District Council (2018) '2018 Air Quality Annual Status Report (ASR)'.

Mid Sussex District Council (2016) '2016 Air Quality Annual Status Report (ASR)'.


Rother District Council (2017) '2017 Air Quality Annual Status Report (ASR)'.


Sevenoaks District Council (2017) '2017 Air Quality Annual Status Report (ASR)'.

Tunbridge Wells Borough Council (2018) '2018 Air Quality Annual Status Report (ASR)'.


### 13 Appendices

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A1 Professional Experience

Prof. Duncan Laxen, BSc (Hons) MSc PhD MIEnvSc FIAQM

Prof Laxen is an Associate of Air Quality Consultants, a company which he founded in 1993. He has over forty years’ experience in environmental sciences and has been a member of Defra’s Air Quality Expert Group and the Department of Health’s Committee on the Medical Effects of Air Pollution. He has been involved in major studies of air quality, including nitrogen dioxide, lead, dust, acid rain, PM\textsubscript{10}, PM\textsubscript{2.5} and ozone and was responsible for setting up the UK’s urban air quality monitoring network. Prof Laxen has been responsible for appraisals of all local authorities' air quality Review & Assessment reports and for providing guidance and support to local authorities carrying out their local air quality management duties. He has carried out air quality assessments for power stations; road schemes; ports; airports; railways; mineral and landfill sites; and residential/commercial developments. He has also been involved in numerous investigations into industrial emissions; ambient air quality; indoor air quality; nuisance dust and transport emissions. Prof Laxen has prepared specialist reviews on air quality topics and contributed to the development of air quality management in the UK. He has been an expert witness at numerous Public Inquiries, published over 70 scientific papers and given numerous presentations at conferences. He is a Fellow of the Institute of Air Quality Management.

Dr Ben Marner, BSc (Hons) PhD CSci MIEnvSc MIAQM

Dr Marner is a Technical Director with AQC and has twenty years' experience in the field of air quality. He has been responsible for air quality and greenhouse gas assessments of road schemes, rail schemes, airports, power stations, waste incinerators, commercial developments and residential developments in the UK and abroad. He has been an expert witness at several public inquiries, where he has presented evidence on health-related air quality impacts, the impacts of air quality on sensitive ecosystems, and greenhouse gas impacts. He has extensive experience of using detailed dispersion models, as well as contributing to the development of modelling best practices. Dr Marner has arranged and overseen air quality monitoring surveys, as well as contributing to Defra guidance on harmonising monitoring methods. He has been responsible for air quality review and assessments on behalf of numerous local authorities. He has also developed methods to predict nitrogen deposition fluxes on behalf of the Environment Agency, provided support and advice to the UK Government's air quality review and assessment helpdesk, Transport Scotland, Transport for London, and numerous local authorities. He is a Member of the Institute of Air Quality Management and a Chartered Scientist. Dr Marner is a member of Defra's Network of Evidence Experts and a member of Defra's Air Quality Expert Group.

Full CVs are available at www.aqconsultants.co.uk.
A2 **Recent Reported Trends in Measured NO\(_2\) Concentrations in Nearby Local Authorities**

A2.1 The following sections reproduce figures showing trends in measured annual mean NO\(_2\), taken from the most recent air quality Review and Assessment reports published by those local authorities which share a boundary with Wealden District Council. Review and Assessment records NO\(_2\) concentrations principally for comparison with the annual mean objective set to protect human health, which is currently set at 40 \(\mu\text{g/m}^3\). This objective is thus shown in many of the figures, but this objective is not relevant for ecosystem impacts. NO\(_2\) is a principal component of nitrogen deposition and a key indicator of temporal patterns in other oxidised nitrogen species. NO\(_2\) is also a key indicator of NOx concentrations (NOx = NO\(_2\) + NO). Thus, trends in annual mean NOx and oxidised nitrogen deposition over time are likely to closely follow those in annual mean NO\(_2\).

**Lewes District Council**

![Figure A2.1: Annual average NO\(_2\) concentration in \(\mu\text{g/m}^3\) measured at automatic monitoring sites in the Lewes district 2013-2017 (Lewes District Council, 2018)](image)

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*Figure A2.1:* Annual average NO\(_2\) concentration in \(\mu\text{g/m}^3\) measured at automatic monitoring sites in the Lewes district 2013-2017 (Lewes District Council, 2018)
Figure A2.2: Annual average NO$_2$ concentration (diffusion tubes) located within the A259 Newhaven Ring Road AQMA from 2012-2016 (Lewes District Council, 2018)
Figure A2.3: Annual average NO$_2$ concentration (diffusion tubes) located within the Lewes Town Centre AQMA from 2013-2017 (Lewes District Council, 2018)
Figure A2.4: Annual average NO₂ concentration (diffusion tubes) located within the Newhaven area but not in the AQMA and one tube in Telscombe from 2013-2017 (Lewes District Council, 2018)
Figure A2.5: Annual average NO$_2$ concentration (diffusion tubes) located within the Lewes area but not in the AQMA from 2013-2017 (Lewes District Council, 2018)
Figure A2.6: Annual average NO$_2$ concentration (diffusion tubes) located within the Lewes area but not in the AQMA from 2013-2017 (Lewes District Council, 2018)
Figure A2.7: Annual average NO$_2$ concentration (diffusion tubes) located within the Lewes District area as a whole and not in the AQMA’s from 2013-2017 (Lewes District Council, 2018)
Mid Sussex District Council

Nitrogen Dioxide Monitoring Trends at 4 Urban Centres 2003 - 2015

Figure A2.8: Annual mean concentrations (bias corrected) 2003 to 2015 of nitrogen dioxide diffusion tube measurements at four urban centre sites (Mid Sussex District Council, 2016)
Figure A2.9: Annual mean concentrations (bias corrected) 2003 to 2014 of nitrogen dioxide diffusion tube measurements at two village, one hamlet and one rural background site (Mid Sussex District Council, 2016)
Figure A2.10: Annual mean concentrations (bias corrected) 2003 to 2015 of nitrogen dioxide diffusion tube measurements at Hassocks (Mid Sussex District Council, 2016)

Eastbourne Council
Figure A2.11: Annual average NO₂ concentration measured at automatic monitoring sites in Eastbourne from 2013 – 2017 (Eastbourne Borough Council, 2018)

Figure A2.12: Annual average NO₂ concentration measured at diffusion tube monitoring sites in Eastbourne from 2013 – 2017 (Eastbourne Borough Council, 2018)
Figure A2.13: Trends in Annual Mean NO\textsubscript{2} Concentrations (continuous monitoring stations) (Rother District Council, 2017)

Figure A2.14: Trends in Annual Mean NO\textsubscript{2} Concentrations (diffusion tube sites) (Rother District Council, 2017)
Figure A2.15: Trends in Annual Mean NO\textsubscript{2} Concentrations Automatic Monitoring (Sevenoaks District Council, 2017)

Figure A2.16: Trends in Annual Mean NO\textsubscript{2} Concentrations Sevenoaks High Street (Sevenoaks District Council, 2017)
Figure A2.17: Trends in Annual Mean NO₂ Concentrations Sevenoaks (Sevenoaks District Council, 2017)

Figure A2.18: Trends in Annual Mean NO₂ Concentrations Bat and Ball (Sevenoaks District Council, 2017)
Figure A2.19: Trends in Annual Mean NO$_2$ Concentrations Riverhead (Sevenoaks District Council, 2017)

Figure A2.20: Trends in Annual Mean NO$_2$ Concentrations Seal (Sevenoaks District Council, 2017)
Figure A2.21: Trends in Annual Mean NO\textsubscript{2} Concentrations Dunton Green (Sevenoaks District Council, 2017)

Figure A2.22: Trends in Annual Mean NO\textsubscript{2} Concentrations Bessels Green (Sevenoaks District Council, 2017)
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Figure A2.26: Trends in Annual Mean NO$_2$ Concentrations Sundridge (Sevenoaks District Council, 2017)
Figure A2.27: Trends in Annual Mean NO₂ Concentrations Measured at the Automatic Monitoring Site (Tunbridge Wells Borough Council, 2018)
Figure A2.28: Trends in Annual Mean NO₂ Concentrations Measured at Diffusion Tube Monitoring Sites within the Existing AQMA (Tunbridge Wells Borough Council, 2018)
Figure A2.29: Trends in Annual Mean NO\textsubscript{2} Concentrations Measured at Diffusion Tube Monitoring Sites outside the Existing AQMA (Tunbridge Wells Borough Council, 2018)