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Tunbridge Wells Local Plan Appendix 3: Ashdown Forest Air Quality Impact Assessment 2020

Traffic-Related Effects on Ashdown Forest SAC

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Rev No	Comments	Date
1	First issue	17/11/17
2	Revised issue	03/03/18
3	Final issue	20/03/18
4	Updates to text	26/04/19
5	Updated modelling	14/12/20

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December 2020

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Contents

1 Introduction

1.1.1 Ashdown Forest is an extensive area of common land lying between East Grinstead and Crowborough entirely within Wealden District. The soils are derived from the predominantly sandy Hastings Beds. It is one of the largest single continuous blocks of heath, semi-natural woodland and valley bog in south-east England, and it supports several uncommon plants, a rich invertebrate fauna, and important populations of heath and woodland birds. It is both a Special Area of Conservation (SAC) and Special Protection Area (SPA)

1.1.2 The SPA is designated for its populations of breeding Dartford Warbler *Sylvia undata* and Nightjar *Caprimulgus europaeus*. The SAC is designated for its Annex I habitats, namely Northern Atlantic wet heaths with *Erica tetralix* and European dry heaths; as well as for its Annex II species, namely Great Crested Newts.

1.1.3 Exhaust emissions from vehicles are capable of adversely affecting the protected heathland found in Ashdown Forest. Accordingly, in September 2017 AECOM undertook an air quality impact assessment for Lewes District Council and South Downs National Park Authority, which modelled forecast traffic growth on key roads within 200m of Ashdown Forest SAC over the period 2017 to 2033, including that expected due to the quantum and distribution of growth in the adopted Lewes Joint Core Strategy (as it relates to Lewes District outside the South Downs National Park) and the South Downs Local Plan. Tunbridge Wells Borough Council subsequently commissioned AECOM to use the same traffic and air quality models to undertake an analysis for the emerging Tunbridge Wells Local Plan. Sevenoaks District Council also commissioned an analysis.

1.1.4 Since that time, several methodological elements from the original assessments have changed (such as the release of a new version of the Emission Factor Toolkit and Air Quality Consultants CREAM tool for forecasting ammonia emissions from traffic). As such, the assessment exercise for Tunbridge Wells Local Plan has been comprehensively updated. The methodology used in this analysis is compliant with the requirement of the Conservation of Habitats and Species Regulations 2017 (as amended) to consider whether an adverse effect on the integrity of a European site will result either alone, or in combination with other plans and projects.

1.1.5 In addition to determining the total cumulative 'in combination' effect on roadside air quality at Ashdown Forest SAC, the calculations presented in this analysis also consider the contribution of Tunbridge Wells Local Plan to that 'in combination' effect. This is necessary to determine whether the contribution is ecologically material and thus whether mitigation of that contribution is required.

2 Methodology

2.1.1 Vehicle exhaust emissions generally only have a local effect within a narrow band along the roadside, within 200m of the centreline of the road. Beyond 200m emissions are considered to have dispersed sufficiently that atmospheric concentrations are essentially background levels. Within 200m, the rate of decline is steeply curved rather than linear. In other words, concentrations will decline rapidly as one begins to move away from the roadside, slackening to a more gradual decline over the rest of the distance up to 200m. This means that the impacts are always worse at the side of key roads, so by focussing there a worst-case assessment is undertaken using long road lengths (800m to 4,000m).

2.1.2 Traffic on every road will make a very small contribution to the 'background' air pollution across a large geographic area, as well as its much greater contribution to changes in roadside air quality. AECOM have represented this background component through the use of background pollutant maps in line with Defra guidance. However, these emissions can disperse hundreds of kilometres from the source. As such, the incremental contribution that all vehicles make to background NOx and nitrogen deposition is properly considered at the national and international scale and is being addressed through national and international initiatives such as improved emissions technology and the government's Clean Air Strategy. AECOM takes the view that the purpose of a plan-level HRA is to determine whether there is a significantly elevated local effect which therefore needs addressing at the local level above and beyond the national/international measures that are being implemented.

2.1.3 There are two measures of particular relevance regarding air quality impacts from vehicle exhausts and which are modelled using standard forecasting. The first is the concentration of oxides of nitrogen (known as NOx) in the atmosphere. At high concentrations NOx can be directly toxic to vegetation[1] but its main importance is as a source of nitrogen, which is then deposited on adjacent habitats[2]. The guideline atmospheric concentration advocated by Government for the protection of vegetation is 30 micrograms per cubic metre (μgm^{-3}), known as the Critical Level, as this concentration relates to the growth effects of nitrogen derived from NOx on vegetation. There is also a 24hr critical level available but the Centre for Ecology & Hydrology among others have noted that the '*UN/ECE Working Group on Effects strongly recommended the use of the annual mean value, as the long-term effects of NOx are thought to be more significant than the short-term effects*'[3] and Natural England have previously advised that the annual mean should be used.

2.1.4 The second important metric is a measure of the rate of the resulting nitrogen deposition. The addition of nitrogen is a form of fertilization, which can have a negative effect on heathland and other habitats over time by encouraging more competitive plant species that can force out the less competitive species that are more characteristic. Unlike NOx in atmosphere, the nitrogen deposition rate below which we are confident effects would not arise is different for each habitat. The rate (known as the Critical Load) is provided on the UK Air Pollution Information System (APIS) website (www.apis.ac.uk) and is expressed as a quantity (kilograms) of nitrogen over a given area (hectare) per year ($kgNha^{-1}yr^{-1}$).

2.1.5 A third pollutant included in this assessment is ammonia emissions from traffic as recent evidence indicates that vehicles can contribute significantly to ammonia at a very local scale (i.e. very close to the road), although on a larger scale agriculture is a much more significant source of ammonia than traffic. In ecological terms ammonia differs from NOx in that it is not only a

[1] APIS identifies that negative effects of NO_2 in atmosphere (as distinct from its role in nitrogen deposition) are most likely to arise in the presence of equivalent concentrations of sulphur dioxide (SO_2). Vehicle exhausts do not emit SO_2 and APIS indicates that background SO_2 concentrations at the SAC are very low (a maximum of 1 μgm^{-3}) compared to critical levels for SO_2 of 10-20 μgm^{-3}. Since the SO_2 concentrations are so low no synergistic effect with NOx is expected.
[2] For example, the APIS website states that *'It is likely that the strongest effect of emissions of nitrogen oxides across the UK is through their contribution to total nitrogen deposition…'*
http://www.apis.ac.uk/overview/pollutants/overview_NOx.htm
[3] Sutton MA, Howard CM, Erisman JW, Billen G, Bleeker A, Grennfelt P, van Grinsven H, Grizzetti B. 2013. The European Nitrogen Assessment: Sources, Effects and Policy Perspectives. Page 414. Cambridge University Press. 664pp. ISBN-10: 1107006120
June 2011. Manual on Methodologies and Criteria for Modelling and Mapping Critical Loads & Levels and Air Pollution Effects, Risks and Trends. Chapter 3: Mapping Critical Levels for Vegetation

source of nitrogen but can also be directly toxic to vegetation even in very low concentrations. Using the process set out in Design Manual for Roads and Bridges, ammonia emissions for traffic are not normally calculated. However, for completeness, they have been included in this iteration of AECOM's modelling, both in terms of atmospheric concentrations and as a source of nitrogen. To include ammonia emissions from traffic the CREAM tool produced by Air Quality Consultants Ltd has been used.

2.1.6 Finally, and for completeness, rates of acid deposition have also been calculated. Acid deposition derives from both sulphur and nitrogen. It is expressed in terms of kiloequivalents (keq) per hectare per year. The thresholds against which acid deposition is assessed are referred to as the Critical Load Function. The principle is similar to that for a nitrogen deposition Critical Load, but it is calculated very differently.

2.2 Traffic modelling

2.2.1 Two road links within 200m of Ashdown Forest Special Area of Conservation (SAC) were identified for investigation: the A26 and the A275. These links were chosen as they are representative points on the roads through the SAC likely to experience an increase in flows as a result of growth in Tunbridge Wells Borough.

2.2.2 Traffic data were generated for each of these links for three scenarios, described in this report as:

- Base Case
- Do Nothing (DN)
- Do Something (DS)

2.2.3 The Base Case uses measured flows, percentage Heavy Duty Vehicles (HDVs) and average vehicle speeds on the relevant links, either as provided by Wealden District Council (WDC) (for the A275) or based on measured flows from Department for Transport traffic counts (for the A26). The Wealden traffic counts for the A275 were for 2014 (either undertaken in that year or adjusted to that year). For the purposes of consistency with previous Tunbridge Wells Local Plan modelling exercises, which used a base year of 2017 these data were 'grown' by AECOM transport planners to 2017. The DfT counts for the A26 are from 2018 but it is considered that little difference in flows is likely to have occurred between 2017 and 2018 so 2018 counts are used as a proxy for the 2017 base year.

2.2.4 The Do Nothing scenario is the term used in this report to describe the future flows on the same roads at the end of the Tunbridge Wells Local Plan period (2038), without consideration of the role of the Tunbridge Wells Local Plan. This therefore presents the expected contribution of other plans and projects to flows by 2038. The end of the Local Plan period has been selected for the future scenario as this is the point at which the total emissions due to Tunbridge Wells Local Plan will be at their greatest. The scenario is calculated by extrapolating the observed traffic data. The Do Nothing scenario adds all traffic growth expected by 2038 that will result in additional journeys on the modelled road links.

2.2.5 For the purposes of 'in combination' assessment (i.e. incorporating growth into the model due to multiple Local Plans and Core Strategies for surrounding authorities) it was decided that modelling the adopted Local Plans directly would not reflect actual housing growth in those authorities by 2038 because:

1. They include a large number of allocations that are historic (i.e. already delivered and occupied) and these are already part of the measured base flows.
2. Adopted plans for these authorities may not accurately reflect growth to 2038 because all the adopted plans for the boroughs/districts immediately around Ashdown Forest SAC finish considerably before that year. This means that there will be several years of growth which is not covered by most adopted plans.

2.2.6 Expected development in these authorities over the period to 2038 was therefore included in the model by using the National Trip End Model Presentation Program (TEMPRO). TEMPRO produces a growth factor that is applied to the measured flows. It is based on data for each local authority district in the UK (distributed by statistical Middle Layer Super Output Area[4]) regarding

[4] Middle Layer Super Output Areas are a geographical hierarchy designed to improve the reporting of small area statistics in England and Wales. They are a series of areas each of which has a minimum population of 5,000 residents. They have a mean population of 7,200 residents.

future changes in population, households, workforce and employment (in addition to data such as car ownership) but is not limited to a given period of time. Traffic growth factors are utilised for the statistical Middle Layer Super Output Areas (MSOAs) within which the modelled links are located. TEMPRO has the advantages of being forecastable to 2038 and beyond, using growth assumptions that are regularly updated and distributed to the level of Middle-Layer Super Output Area (of which there are 21 in Wealden District alone) and of being an industry standard database tool across England meaning that modelling exercises that use TEMPRO will have a high degree of consistency.

2.2.7 The other authorities immediately surrounding Ashdown Forest are those in which development is most likely to influence annual average daily traffic flows through the SAC. For those authorities (notably Sevenoaks, Tunbridge Wells, Rother, South Downs National Park, Lewes, Wealden, Mid-Sussex and Tandridge) scrutiny of the relevant adopted Local Plans or Core Strategies and the associated housing growth rates in TEMPRO resulted in the conclusion that the adopted plans (and TEMPRO) currently underestimate growth to 2038 and this could in turn materially affect the estimation of 2038 AADT flows on the relevant roads. The decision was therefore made to raise the growth allowances for these authorities to reflect their most recent Objectively Assessed Need (OAN) at time of traffic modelling. The OAN figure was derived from published information released by the Councils themselves or (in the case of Mid-Sussex) by their Local Plan inspector. Although housing growth rates were adjusted upwards, expected broad housing distributions were not altered. Employment growth assumptions in TEMPRO for these authorities were not adjusted. The authorities and their quanta and broad distributions of housing growth as considered in our analysis are as follows:

- Sevenoaks = 698 dwellings per annum
- Rother = 483 dwellings per annum
- Wealden = 949 dwellings per annum
- Tandridge = 645 dwellings per annum
- Mid Sussex = 1,026 dwellings per annum
- SDNP within Lewes District = 78 per annum
- Lewes District outside SDNP = 291 per annum

2.2.8 For all these authorities the forecast delivery of dwellings (per annum) was multiplied by 21 to reflect the period between 2017 (base year) and 2038 (assessment year).

2.2.9 The Do Nothing (and thus Do Something) Scenario is therefore intentionally precautionary and allows for growth over the period to 2038 beyond that in adopted Local Plans in those authorities immediately surrounding Ashdown Forest SAC.

2.2.10 TEMPRO provides a consistent and standard approach to traffic forecasting when a large number of sources (e.g. local authority areas) are involved. However, a more nuanced forecast can be obtained by creating a bespoke model that manually distributes trips according to journey to work data. This approach provides a better understanding of where traffic associated with the proposed Local Plan development is likely to be most concentrated.

2.2.11 Whereas other authorities were captured using TEMPRO, Tunbridge Wells growth was modelled in more detail using site allocations and quanta provided by Tunbridge Wells Borough Council for their Local Plan, as well as an allowance for windfall, distributed based upon historic growth patterns in the borough. Account was also taken of the stock of consented but, as of 1st April 2020, unbuilt developments in the borough. The modelling for 2038 is therefore based on delivery of 13,453 net new dwellings in Tunbridge Wells borough, which exceeds the 12,200 net new dwellings identified in the Local Plan.

2.2.12 The Do Something scenario reflects the role of the Tunbridge Wells Local Plan at 2038, in addition to growth in other authorities. Detailed modelling of Local Plan growth locations undertaken by the AECOM transport planning team was added to the adjusted TEMPRO growth for all other authorities. To build the Local Plan model, housing and employment sites were geographically assigned to ‘distribution groups’ across Tunbridge Wells Borough using GIS software. The distribution of each of these groups was calculated using Census 2011 journey to work data, and the trips associated with each distribution group then manually assigned across the network. Site allocations were grouped by model area, the trip generation calculations (housing and employment) were then updated, the relevant distribution was applied and growth for Tunbridge Wells already allowed for in TEMPro from 2017 onwards was adjusted to avoid double counting.

2.2.13 The 'in combination' growth scenario is therefore the Do Something flows, as these include existing traffic, all future journeys arising from within Tunbridge Wells Borough due to the Local Plan (from AECOM's model), and future traffic arising from all other authorities (from TEMPRO, adjusted for expected higher growth rates in some authorities). The difference between the Do Something scenario and the Do Nothing scenario illustrates the role of the Tunbridge Wells Local Plan including unimplemented permissions as of April 2020 in changing future flows compared to what would be expected without the Local Plan.

2.3 Air quality calculations

2.3.1 Using these scenarios and information on total traffic flow, average vehicle speeds and percentage Heavy Duty Vehicles (which influence the emissions profile), AECOM air quality specialists calculated expected NOx concentrations, nitrogen deposition rates, ammonia concentrations and acid deposition rates at receptor points along each modelled road link. The predictions for NOx and nitrogen deposition are broadly based on the assessment methodology presented in Design Manual for Roads and Bridges document LA105 but with significant modifications, notably the inclusion of ammonia modelling. The methodology is presented in Appendix B.

2.3.2 Given that the assessment year (2038) is a considerable distance into the future, it is important for the air quality calculations to take account of improvements in background air quality and vehicle emissions that are expected nationally over the plan period. Making an allowance for a realistic improvement in background concentrations and deposition rates is in line with the Institute of Air Quality Management (IAQM) position[5] as well as that of central government[6]. Background nitrogen deposition rates were sourced from the Air Pollution Information System (APIS) website[7]. Although in recent years improvements have not kept pace with predictions, the general long-term trend for NOx has been one of improvement (particularly since 1990) despite an increase in vehicles on the roads[8]. In contrast, there is no forecast improving trend for ammonia concentrations.

2.3.3 Examination of background nitrogen dioxide (NO_2) monitoring sites in the region within which Ashdown Forest is situated show a general reduction since 1991. While some background sites in the region show a more static trend since c.2012 (notably Lullington Heath near Eastbourne) this is likely to partially result from differences in climatic/meteorological conditions from year to year, rather than increases in nearby traffic flows as these latter would not be expected to significantly influence an area relatively remote from significant roads. There has also been a long-term improving national trend for nitrogen deposition, although the rate of improvement has been much lower than for NOx[9]. According to Plantlife, '*There is an overall decreasing trend in the percentage of UK habitats affected by nitrogen deposition, with levels exceeding critical loads dropping from 75% of UK sensitive habitats in 1996, to 62.5% in 2011-2013'*[10]. The trend has also been observed and documented by the European Union and has been recently used by them to develop a tool to monetise the biodiversity benefit of such improvements[11]. These results are the (inter)national manifestation of a trend which can also be discerned locally as is shown for example in the graphs below.

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5 http://www.iaqm.co.uk/text/position_statements/vehicle_NOx_emission_factors.pdf

6 For example, The UK Government's recent national Air Quality Plan also shows expected improvements over the relevant time period (up to 2030) https://www.gov.uk/government/publications/air-quality-plan-for-nitrogen-dioxide-no2-in-uk-2017

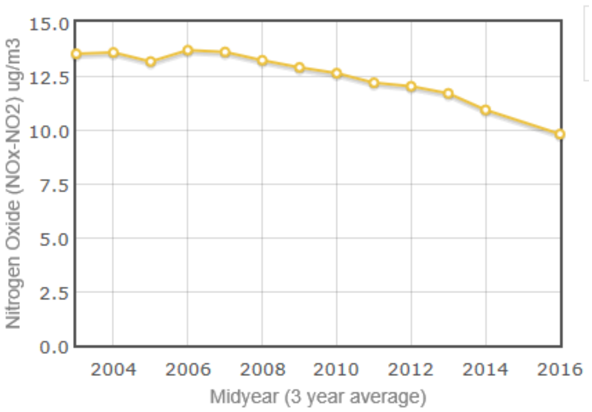
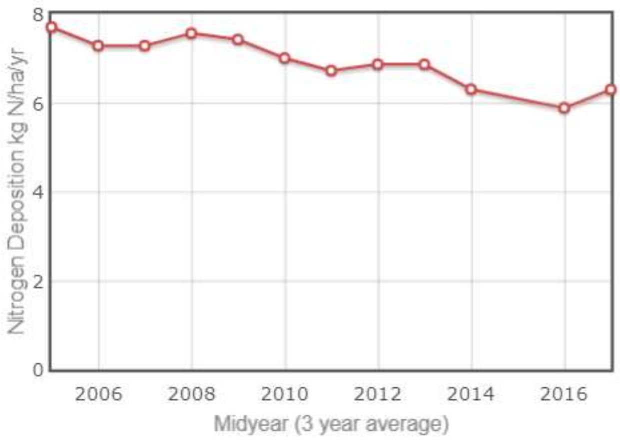
7 Air Pollution Information System (APIS) www.apis.ac.uk

8 Emissions of nitrogen oxides fell by 72% between 1970 and 2017. Source: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/778483/Emissions_of_air_pollutants_1990_2017.pdf [accessed 24/04/19]

9 Total nitrogen deposition (i.e. taking account of both reduced and oxidised nitrogen, ammonia and NOx) decreased by 13% between 1988 and 2010. This is an improvement of 0.59% per annum on average.

10 https://www.plantlife.org.uk/application/files/1614/9086/5868/We_need_to_talk_Nitrogen_webpdf2.pdf

11 Jones, L., Milne, A., Hall, J., Mills, G., Provins, A. and Christie, M. (2018). Valuing Improvements in Biodiversity Due to Controls on Atmospheric Nitrogen Pollution. Ecological Economics, 152: 358-366. http://ec.europa.eu/environment/integration/research/newsalert/pdf/monetising_biodiversity_benefit_of_reducing_nitrogen_pollution_in_air_522na2_en.pdf

	
Graph of the trend in average NOx concentrations for the 1km grid square within which Ashdown Forest SAC is situated, from 2003 to 2016 as presented on www.apis.ac.uk. According to APIS background NOx concentrations at the SAC reduced by 3.7 μgm^{-3} over this 13-year period, notwithstanding traffic growth over that same period.	Graph of the trend in oxidised nitrogen deposition to short vegetation (as opposed to forest) for the 5km grid square within which Ashdown Forest SAC is situated from 2005 to 2017 as presented on www.apis.ac.uk. According to APIS oxidised nitrogen deposition at the SAC reduced by 2kgN/ha/yr over this 12-year period, notwithstanding traffic growth over that same period. Total nitrogen deposition (i.e. oxidised nitrogen from NOx and reduced nitrogen from ammonia) remained stable within the same 5km grid square, but this is likely to be mainly as a result of non-road sources of nitrogen within the wider area, principally livestock and fertiliser. The effects of improving vehicle emissions are felt most strongly close to the road and the trend in total nitrogen is close to the road is thus more likely to reflect the improving trend in oxidised nitrogen across the grid square rather than the more static trend for total nitrogen.

2.3.4 The reductions in NOx and nitrogen deposition occurred notwithstanding increased traffic growth over the same time period and is most likely attributable to improvements in emissions technology in the vehicle fleet (i.e. motorists replacing more polluting vehicles associated with earlier Euro standards with less polluting vehicles associated with more recent Euro standards). This improving trend can be expected to continue, and indeed steepen, as drivers continue to replace older cars with newer vehicles and as further improvements in vehicle emissions technology are introduced. For example, the latest (Euro6/VI) emissions standard only became mandatory in 2014 (for heavy duty vehicles) and 2015 (for cars) and the effects are not therefore visible in the data available from APIS because relatively few people will have been driving vehicles compliant with that standard as early as 2016/17. In contrast, far more drivers can be expected to be using Euro 6 compliant vehicles by 2036 since vehicles that are not compliant with Euro 6 ceased manufacture in 2015.

2.3.5 Both NOx concentrations and the component of deposition most associated with combustion processes such as traffic (oxidised nitrogen) can be expected to continue to fall over the long time period (20 years) covered by the Local Plan even if there may be short periods where concentrations and deposition rates fluctuate. This is because cleaner vehicles are entering the vehicle fleet and are being tested using more stringent procedures as ultra-low emission vehicles increase in numbers. For NOx the improvement predictions in the Emission Factor Toolkit (v. 10.1) have been used. This is due to research published in 2020 which confirmed that the latest EFT is likely to underestimate improvements in NOx[12]. No improvement in background ammonia has been factored into the assessment. Note that the EFT only forecasts to 2030. Therefore, 2030 emission factors have been used with 2038 traffic data. This is likely to overestimate NOx emissions for the assessment year (by omitting 8 years of expected improvements) and is thus considered highly precautionary.

2.3.6 For nitrogen deposition the assessment allows for an improvement in background nitrogen deposition of 1.4 kgN/ha/yr over the period to 2038. This is based upon work undertaken for the Joint Nature Conservation Committee which has published the results of the Nitrogen Futures project[13]. That project investigated whether a net improvement in nitrogen deposition (including expected development over the same period) was expected to occur to 2030 at a national scale, under a range of scenarios. The report concluded that *'The scenario modelling predicts a*

[12] '…*the balance of evidence suggests that, on average, NOx concentrations are likely to decline more quickly in the future than predicted by the EFT'*. Source: https://www.aqconsultants.co.uk/news/march-2020/defra%E2%80%99s-emission-factor-toolkit-now-matching-measu
[13] https://hub.jncc.gov.uk/assets/04f4896c-7391-47c3-ba02-8278925a99c5

substantial decrease in risk of impacts on sensitive vegetation by 2030, under the most likely future baseline [a scenario called '2030 NAPCP+DA (NECR NOx)'[14]]. *This is estimated to achieve the UK Government's CAS target for England, defined as a 17% decrease in total reactive N deposition onto protected priority sensitive habitats, with a predicted 18.9% decrease* [for England] *from a 2016 base year'*. The report predicted a fall in nitrogen deposition by 2030 under every modelled scenario.

2.3.7 Background nitrogen deposition at Ashdown Forest was specifically discussed in Annex 5 of the report as a case study. The report concluded regarding that SAC that *'The emission reductions predicted between the 2017 and 2030 baseline scenarios cover a range of sectors, including road transport, and so improvements are predicted to occur over the whole site, including the worst-affected roadside locations'*. This was the case under all modelled scenarios. The Ashdown Forest modelling predicted a 1-2 kgN/ha/yr reduction in background nitrogen deposition to low growing vegetation between 2016 and 2030 (i.e. 14 years), depending on scenario. It is therefore considered that a 1.4 kgN/ha/yr allowance over the 21 years between 2017 and 2038 is in line with the Nitrogen Futures work and is suitably precautionary.

2.3.8 Not to make *any* allowance for these improvements would result in increased emissions of oxides of nitrogen and nitrogen dioxide concentration over the plan year period as an increased number of vehicles is expected on the roads. This is not expected to occur as can be seen from previous long-term trends in the UK, which at worst show slowing of improvements over extended periods, not worsening. Historical records (e.g. Defra monitoring trends) show that as increased vehicles enter the fleet that these increases are offset by the improvements in the emissions of the newer vehicles and the removal of older vehicles. To avoid showing a worsening between the current and future situation some improvements need to be considered as applied by AECOM.

2.3.9 In 2018 the Court of Justice of the European Union (CJEU) ruled in cases C-293/17 and C-294/17 (often dubbed the Dutch Nitrogen cases). One aspect of that ruling concerned the extent to which autonomous measures (i.e. improvements in baseline nitrogen deposition that are not attributable to the Local Plan) can be taken into account in appropriate assessment, the CJEU ruled that it *was* legally compliant to take such autonomous measures into account provided the benefits were not 'uncertain' (paras. 130&132). Note that previous case law on the interpretation of the Habitats Directive has clarified that 'certain' does not mean absolute certainty but '*where no reasonable scientific doubt remains'*[15] [emphasis added].

2.3.10 The forecasts for improvements in NOx emission factors, background concentrations and background deposition rates used in this report are considered to have the requisite level of certainty. This is because a) to a large extent they build upon established historic trends in NOx and oxidised nitrogen deposition and b) for total nitrogen deposition they are based on a cautious use of evidenced central government forecasts associated with uptake of technology that has either already been introduced or is widely expected within the professional community to be introduced and effective before 2030, as illustrated in the Nitrogen Futures project:

- When it comes to forecasting the NOx emissions of additional traffic, it would overestimate those emissions to assume that by 2036 the emission factors will be no different to those in 2017; to make such an assumption would be to fail to take account of the expected continued uptake of Euro 6 compliant vehicles between 2017 and 2036 and would assume (putting it simply) that no motorists would replace their cars during the entire plan period. For example, the latest (Euro 6/VI) emissions standard only became mandatory in 2014 (for heavy duty vehicles) and 2015 (for cars) and the effects will not therefore be visible in the data available from APIS because relatively few people will have been driving vehicles compliant with that standard as early as 2017. Far more drivers can be expected to be using Euro 6 compliant vehicles by the end of the Local Plan period (2038).
- The air quality modelling tools available only go to 2030. Therefore, the modelling includes an inherent caution as 2030 NOx emissions factors are taken to be a proxy for 2038, whereas NOx emissions are actually likely to be better in 2038 than in 2030. In addition, the modelling does not allow for the recent Government announcement that the

[14] The research team considered this the most likely scenario to occur by 2030 as it would achieve the legally mandated National Air Pollution Control Programme (NECR) targets. It includes policies that had already been adopted or implemented, plus additional measures which are currently in development. These additional measures are represented by the UK's National Air Pollution Control Programme (NAPCP).
[15] Case C-239/04 Commission v Portugal [2006] ECR 10183, para. 24; Holohan et al vs. An Bord Pleanála (C-461/17), para. 33

ban on sales of new petrol and diesel cars and vans will be brought forward from 2035 to 2030. Indeed, the ban is not accounted for in the modelling at all, since robust forecasts for the effects of the ban do not yet exist.

3 Results

3.1 Traffic modelling

3.1.1 The flows forecast by 2038, and how these differ between Do Nothing (without the Local Plans/JCS) and Do Something (*including* the Tunbridge Wells Local Plan) are presented overleaf. Note that only data for A275 and A26 are presented as traffic modelling indicated that Tunbridge Wells Local Plan would make no contribution (in terms of AADT) to changes in traffic flows on the A22 through the SAC.

Table 1. Traffic flow data used in the air quality modelling

A	B	D	E	F	G	H
Link ID	**Link Description**	**2017 Base AADT**	**2038 DN AADT (traffic growth excluding Tunbridge Wells Local Plan)**	**2038 DS AADT (traffic growth including Tunbridge Wells Local Plan)**	**Difference between 2017 Base and DS (i.e. net traffic growth from 2017 to 2038)**	**Difference between DS and DN (i.e. contribution of Tunbridge Wells Local Plan)**
37	A275 Wych Cross	4,542	5,449	5,547	1,005	98
38	A26 Poundgate	12,264[16]	14,715	15,406	3,142	691

[16] Note that these data have been updated from the previous assessment using 2018 Department for Transport counts for location 78156. The count data for that location indicate that the previous baseline flows used in the assessment were significant overestimates of flows since the 2018 count data was more than 25% lower than the baseline that was assumed (rather than based on counts) for 2017 in previous modelling exercises.

3.1.2 Both links are forecast to experience an increase in traffic flows between 2017 and 2038 when all expected traffic growth sources (including the Tunbridge Wells Local Plan) are taken into account (Column G of Table 1).

3.1.3 It can be seen from Table 2 that, on the A275, housing and employment delivery in Tunbridge Wells Borough is forecast to make little contribution in terms of Annual Average Daily Traffic, essentially because that road through Ashdown Forest SAC does not constitute a meaningful journey to work route for residents of the Borough based on existing census data. The exception is the A26 at Poundgate where the model forecasts that the Tunbridge Wells Local Plan will be responsible for adding approximately 700 AADT to the total flows by 2038. Note that this traffic growth can be expected to occur incrementally over the plan period, matching the housing delivery trajectory.

3.2 Air quality calculations

3.2.1 Natural England advised that the impact assessment should only include those areas which are currently heathland rather than speculate about parts of the SAC that constitute other habitats (particularly woodland) and may or may not be put down to heathland at an unspecified point in the future[17]. In any event, the ability to create heathland adjacent to the A26 is likely to be influenced much more by other factors such as management, soil pH, soil phosphate levels, drainage and the removal of tree trunks and root systems[18]. Therefore, this assessment focusses on effects on the nearest areas of heathland.

Ammonia

3.2.2 Ammonia concentrations in atmosphere are discussed in this section. Ammonia as a source of nitrogen is discussed in the following section on nitrogen deposition.

3.2.3 There are two critical levels for ammonia in atmosphere, which represent the differing sensitivities of lower plants (lichens and mosses) and higher plants (all other vegetation) to the gas. The difference is because higher plants have a protective cuticle which makes them less vulnerable to the gas than lower plants. A judgment must be made over which is more appropriate in a given location. The lower critical level (1 μm^{-3}) is only appropriate to use in an HRA where the affected area within the modelled transect has a high lichen/bryophyte interest that is relevant to the integrity of the SAC habitat. Otherwise the higher critical level (3 μm^{-3}) is more appropriate. If concentrations are forecast to be below the critical level within the relevant part of the SAC, then there is good reason to conclude no adverse effect will arise.

3.2.4 Heathlands can support a diverse terricolous lichen flora provided the sward is sufficiently open for colonisation. All heathland SACs therefore automatically have the lower critical level assigned to them on the UK Air Pollution Information System (www.apis.ac.uk) and APIS makes it clear that this is due to an *a priori* assumption of lichen/bryophyte interest somewhere in the site. However, APIS assigns critical levels to SACs fairly generically rather than basing the decision on location specific data. In practice there are many areas of heathland that do not support a diverse lichen flora, since management is very significant in influencing lichen diversity and abundance and closed dense swards are much less likely to support a terricolous lichen community than more open swards. In such cases the higher critical level of 3 μm^{-3} is a more appropriate reference threshold.

3.2.5 Some parts of Ashdown Forest SAC do support a diverse terricolous heathland lichen assemblage. However, Wealden District Council has produced habitat maps using Earth Observation (satellite imagery and airborne systems) and commissioned site vegetation surveys[19]. None of these data indicate the presence of a significant assemblage of terricolous

[17] Semi-natural woodland is an interest feature of Ashdown Forest SSSI, so it is very unlikely that clear-felling of such habitats would ever take place in order to replace them with heathland

[18] The process of creating, and then resurfacing/maintaining a significant road and buried roadside services (where these are present) or drainage, often results in changes to the underlying geology and hydrological function of the soils at the roadside, including from the importation of atypical fill material during historic road construction. These habitats can be further affected by surface water runoff all year round (depending on local topography) and salt spray from winter gritting. In addition, it is often desirable to retain a belt of permanent forestry adjacent to roads in order to serve as a buffer feature to the heathland and (for the SPA) the disturbance-sensitive bird populations that lie behind it. The area adjacent to the road is the area most affected by nitrogen deposition due to local traffic.

[19] Two interim ecological survey reports have been released so far, the most recent dated May 2016. These are available at http://www.wealden.gov.uk/Wealden/Residents/Planning_and_Building_Control/Planning_Policy/Evidence_Base/Planning_Evidence_Base_Habitat_Regulations_Assessment.aspx

heathland lichens adjacent to any of the modelled roads[20] and such an assemblage would not be expected in these areas given the tall dense swards (including a high proportion of gorse, bracken, scrub and trees). This has been verified by site inspections undertaken by AECOM. Even in heathland that is not scrub and bracken encroached, diverse lichen assemblages will generally only occur where the sward is managed to keep it open to control dwarf shrub (i.e. heather) cover. As such, the higher critical level is considered more appropriate for the relevant roadside locations at Ashdown Forest SAC.

3.2.6 Bearing that in mind, the modelling undertaken for the Tunbridge Wells Local Plan indicates that the 3 μm^{-3} critical level for these specific roadside locations is not exceeded and is not forecast to be exceeded (Appendix A).

3.2.7 Nonetheless, for completeness, Table 3 below summarises the ammonia concentration results for both links relevant to Tunbridge Wells (A26 and A275) with reference to whether the lower critical level (1 μm^{-3}) is forecast to be exceeded at the nearest area of heathland based on AECOM modelling.

Table 3. Summary of ammonia results for the nearest areas of heathland to each modelled link, with reference to the 1 μm^{-3} critical level for ammonia

Link/Transect	Nearest area of heathland	Summary of results by reference to the 1 μm^{-3} critical level
Transect 38: A26 at Poundgate	Approximately 40m from the road, although most is more distant. Intervening habitat is woodland.	2038 ammonia concentrations are forecast exceed the 1 μm^{-3} threshold at this distance, being 1.16 μm^{-3}
Transect 37W: A275 at Wych Cross	Extensive areas approximately 5m from the road. Area within 15m of the road unlikely to support terricolous lichens as vegetation is tall, dense and gorse encroached, providing a closed sward.	2038 ammonia concentrations are forecast to exceed the 1 μm^{-3} threshold at this distance, being 1.14 μm^{-3}
Transect 37E: A275 at Wych Cross	Extensive areas approximately 5m from the road. Area within 15m of the road unlikely to support terricolous lichens as vegetation is tall, dense and gorse encroached, providing a closed sward.	2038 ammonia concentrations are forecast to exceed the 1 μm^{-3} threshold at this distance, being 1.24 μm^{-3}

3.2.8 It can be seen that using a reference critical level of 1 μm^{-3} the ability of the nearest areas of heathland to support lichens probably would be affected. However, Appendix A indicates that this would be equally true if no development or traffic growth took place at all to 2038, the habitat in this area is a dense closed sward unsuitable for lichens and the contribution of Tunbridge Wells Local Plan to any increase in ammonia at the closest area of heathland is close to zero (0.01 μm^{-3} at most). Moreover, a modest future reduction in ammonia from agricultural sources would reduce the ammonia levels across the SAC to an acceptable level and Natural England and partners already intend to introduce a Shared Nitrogen Action Plan for the site to address such issues. It can be seen from Appendix A that even at distances relatively remote from the road (200m away) ammonia concentrations are approximately 0.9 μm^{-3}, indicating that approximately 80% of ammonia at the site is background rather than road contribution. This matches source attribution data for the SAC on the UK Air Pollution Information System, which attributes 80% of ammonia within the SAC to livestock and fertiliser use in the surrounding area and 3% to road traffic.

Oxides of Nitrogen

3.2.9 Appendix A shows the annual mean NOx concentrations for the Baseline, Do Nothing scenario and Do Something Scenario. It also shows the 'Projected Baseline'. This is the modelled NOx concentrations in the hypothetical scenario of no traffic growth to 2038 but allowing for improvements in vehicle emissions for the existing traffic and an associated reduction in background nitrogen deposition. It is presented such that the additional NOx emissions due to traffic growth can be visually separated from the reduction in NOx concentrations due to the improving baseline.

[20] Paragraph 3.3.2 of the 2015 interim botanical survey report for Ashdown Forest states that '*Varying amounts of bryophytes and lichens were recorded, with Cladonia present in some areas but not particularly prevalent along transects'.*

3.2.10 Based on background mapping, adjusted for the effect of the road, the air quality calculations provided in Appendix A show that the NOx concentrations are modelled to be well below the 30 µgm^{-3} Critical Level for vegetation at the nearest areas of heathland (as per Table 3) in all scenarios, even allowing for traffic growth.

3.2.11 Moreover, by 2038, NOx concentrations on all modelled links are forecast to experience a net reduction due to changes in vehicle emissions, notwithstanding the projected increase in traffic on the roads (and notwithstanding the fact that the model has frozen improvements in emission factors at 2030), including that attributable to the Tunbridge Wells Local Plan. For example, at the roadside of the A275 the reduction (improvement) is 13.62 µgm^{-3}.

Nitrogen deposition

3.2.12 Since the most ecologically significant role of NOx at the concentrations forecast at the nearest areas of heathland (i.e. below the critical level) is as a source of nitrogen the next step is to consider what effect this may have on nitrogen deposition rates, and this also factors in the role of ammonia as a source of nitrogen.[21] Calculating nitrogen deposition rates rather than relying purely on scrutiny of NOx concentrations has the advantage of being habitat specific (the critical level for NOx is entirely generic; in reality different habitats have varying tolerance to nitrogen)

3.2.13 As with NOx, Appendix A shows the annual mean nitrogen deposition rates for the Baseline, Do Nothing scenario and Do Something Scenario. It also shows the 'Projected Baseline'. This is the modelled nitrogen deposition rates in the hypothetical scenario of no traffic growth to 2038 but allowing for improvements in vehicle emissions for the existing traffic and an associated reduction in background nitrogen deposition. It is presented such that the additional nitrogen deposition due to traffic growth can be visually separated from the reduction in nitrogen deposition due to the improving baseline. When assessing the likely effects of the planned growth in Tunbridge Wells Borough by 2038, it is necessary to consider: i) the additional nitrogen deposition caused by growth in the region (DS - Proj BL); ii) the contribution of Tunbridge Wells growth to the additional nitrogen; and iii) the overall change in annual mean nitrogen deposition rates by 2033, taking into account improvements in vehicle emissions standards as applied to both existing and future traffic (DS - BL).

3.2.14 Although much of Ashdown Forest SAC (including the borders of many roads) is covered with woodland and the habitat is a feature of the SSSI, woodland is not a notified feature of the internationally important wildlife sites. Ashdown Forest SAC is designated for its heathland and it is this habitat on which the birds of Ashdown Forest SPA depend[22]. In order to undertake the nitrogen deposition modelling it is necessary to select an appropriate deposition velocity and background deposition rate. Since heathland is the SAC habitat appropriate deposition velocities for this habitat were used in the modelling since deposition to other habitats (e.g. woodland) is not relevant to the assessment. In late 2018 the CJEU ruled in case C-461/17, dubbed the Holohan case, that it was necessary to consider other habitats besides those for which the site is actually designated:' … *provided that those implications* [for those habitats] *are liable to affect the conservation objectives of the* [European] *site'* (para. 39 and elsewhere). The vegetative characteristics of the permanent woodland are <u>not</u> linked to the ability of the SAC or SPA to achieve their conservation objectives. Therefore, the Holohan case <u>does</u> not require the woodland to be considered in the modelling.

3.2.15 Critical loads are always presented as a range, which for heathland is 10 kgN/ha/yr to 20 kgN/ha/yr[23]. The lowest part of the nitrogen Critical Load range has been used in this assessment as that is the most precautionary stance to take. The baseline for nitrogen deposition to heathland along A26 and A275 is above the Critical Load and has been modelled to be c.17-25 kgN/ha/yr at the closest points to the road, reducing to c.13-15 kgN/ha/yr by 200m from the road. The results relating to the nearest areas of heathland are summarised in Table 4 below.

[21] Acid deposition rates for all transects on all modelled links are expected to improve over the plan period and the contribution of the Tunbridge Wells Local Plan to any retardation of that improvement is effectively zero, in that any contribution is too small to show in the model (i.e. it would affect the third decimal place or beyond, which are never reported in modelling). Acid deposition is therefore not discussed further in this document.

[22] Neither nightjar or woodlark has highly specialised prey requirements, eating a wide range of insects; as such the evidence indicates that both species forage in a wide range of habitats including heathland, plantation, deciduous woodland, rough pasture, arable land and grassland margins; wherever they can obtain a supply of insects (and seeds in the case of woodlark) of sufficient size. For this reason, impact assessments for nightjar and woodlark focus on their nesting habitat, for which they do have very precise requirements.

[23] APIS advises to use the high end of the range with high precipitation and the low end of the range with low precipitation and to use the low end of the range for systems with a low water table, and the high end of the range for systems with a high water table.

Table 4. Total additional nitrogen deposition due to growth 'in combination' at closest area of heathland

Link/Transect	Nearest existing area of heathland	Summary of results 'in combination'
Transect 38: A26 at Poundgate	Small patch approximately 40m from the road, although most is more distant.	0.35 kgN/ha/yr at 40m from the road
Transect 37W: A275 at Wych Cross	Extensive areas approximately 5m from the road.	0.33 kgN/ha/yr at 5m from the road
Transect 37E: A275 at Wych Cross	Extensive areas approximately 5m from the road.	0.42 kgN/ha/yr at 5m from the road

3.2.16 At the closest areas of heathland to the A275 the worst-case additional deposition due to extra traffic is forecast to be c. 0.4 kgN/ha/yr. The contribution of Tunbridge Wells Local Plan to nitrogen deposition at the roadside of the A275 would be a nugatory 0.04 kgN/ha/yr[24], falling to effectively zero by 10m from the road[25]. On the road to which Tunbridge Wells Local Plan will contribute the greatest traffic (the A26) the worst case 'in combination' nitrogen dose at the closest patch of heathland is 0.35 kgN/ha/yr with Tunbridge Wells contributing a similarly nugatory 0.07 kgN/ha/yr.

3.2.17 Moreover, the DS-BL column in Appendix A shows that the deposition from additional traffic (irrespective of source) is forecast to be offset at the nearest areas of heathland by a much larger reduction in background deposition expected over the same timescale. As a result, a net *reduction* in deposition of c. 1.2 kgN/ha/yr is actually forecast at the closest area of heathland notwithstanding traffic growth[26].

<u>*Ecological significance*</u>

3.2.18 The modelling demonstrates that there will be a net decreasing trend in nitrogen deposition rates to heathland within the SAC along the modelled links. Accordingly, the Local Plans will not have significant in-combination effects on the SAC by way of contributing to any net increase in nitrogen deposition.

3.2.19 However, it is also necessary to consider whether the Local Plans could have a significant effect on the SAC as a result of materially retarding (i.e. slowing) the improvement of nitrogen deposition rates, as the modelling in Appendix A identifies that the forecast improvement in deposition rates to heathland would be approximately 20% lower due to expected traffic growth than in the hypothetical situation of no further traffic growth (compare column DS, which is the forecast 2038 deposition rates including traffic growth, with column 'Proj BL', which is the forecast 2038 deposition rates if there were no traffic growth).

3.2.20 Drawing a conclusion on this matter requires ecological interpretation to determine whether a given retardation of improvement in nitrogen deposition is likely to result in an ecological impact that is sufficiently large in size or great in extent to materially interfere with the ability of the site to achieve its conservation objectives. This involves consideration of the size of the dose as a percentage of the critical load, the extent and location of the affected area, the function of the affected area in enabling the site to meet its conservation objectives, whether the restore objective for the SAC would be compromised and whether other factors are of greater significance than nitrogen deposition in enabling the site to achieve its conservation objectives.

3.2.21 A key factor in drawing conclusions over whether the dose due to traffic growth will affect the ability of the site to meet its conservation objectives and compromise the restore objective is the relative extent of the affected area. The area forecast to exceed 1% of the critical load 'in combination' (i.e. the total area which is subject to an 'in combination' dose greater than imperceptible) totals 3.1ha (0.6ha of heathland along the A26 and 2.5ha of heathland along the A275) amounting to just 0.2% of all heathland in the SAC[27]. Furthermore, even the worst-case

[24] 21% of the modelled difference between Do Something and Do Nothing for this link in Appendix A
[25] Traffic on every road will make a very small contribution to the 'background' air pollution across a large geographic area, as well as its much greater contribution to changes in roadside air quality. However, these emissions can disperse hundreds of kilometres from the source. As such, the incremental contribution that all vehicles make to background NOx and nitrogen deposition is properly considered at the national and international scale and is being addressed through national and international initiatives such as improved emissions technology, the government's Clean Air Strategy etc.
[26] If the actual current roadside deposition rates are substantially higher than that included in the AECOM model, the percentage reduction in nitrogen deposition rate by 2033 would be the same but the actual reduction in deposition rate would be much greater.
[27] According to the Natura 2000 data sheet there are 1,611 ha of heathland in the SAC.

dose forecast to heathland (0.4 kgN/ha/yr) is small[28] and will affect an extremely small proportion of the SAC (c.0.9ha of heathland or 0.06% of the heathland in the SAC). In other words, 99.8% of heathland in the SAC will be entirely unaffected and the remainder will only be subject to a small 'in combination' nitrogen dose. Moreover, the contribution of Tunbridge Wells Local Plan to even that small dose is nugatory (7 milligrams, or approximately 1/700th of a teaspoon, per square metre, per year).

3.2.22 In addition, the very small area of SAC heathland subject to the small 'in combination' dose is not forecast to experience a deterioration in nitrogen deposition but a modest slowing in the rate of air quality improvement (and potential for vegetation recovery) which is likely to have a commensurately small botanical effect. This can be illustrated by reviewing dose-response data.

3.2.23 Deposition of nitrogen can cause a variety of responses in heathland: transition from heather to grass dominance, decline in lichens (such as *Cladionia* species), changes in plant biochemistry and increased sensitivity to stress[29]. The physical, measurable and observable manifestations of these responses are generally in terms of reduction in species richness[30], reduction in cover (or increase in grass cover) and resulting changes in broad habitat structure. These responses are not independent: for example, reduction in species richness can cause, and in turn be exacerbated by, changes in habitat structure. Note that 'reduction in species richness' means that fewer species are recorded in a randomly placed 2m x 2m quadrat. Therefore, it does not mean species are 'lost' from the affected area; it simply means that at least one species occurs at a reduced frequency[31].

3.2.24 Since there is a forecast to be a significant improvement in nitrogen deposition rates in the Do Something scenario, a relevant question is whether there is likely to be a meaningful difference in the potential for vegetation recovery within the affected 0.06% to 0.2% of the SAC between the Projected Baseline and the Do Something scenario. In real terms, would one expect a meaningful ecological difference in potential for vegetation recovery between an improvement in the rate of nitrogen deposition of 1.2 kgN/ha/yr at 5m from the A275 when all traffic growth is included, or one of 1.6 kgN/ha/yr when no traffic growth is included.

3.2.25 Reference to Appendix 5 of Caporn et al (2016) suggests that at background deposition rates of c. 15kgN/ha/yr (the closest deposition rate in the report to that forecast at the closest areas of heathland in this modelling by 2038) the forecast net reduction in nitrogen deposition at the most affected areas of heathland (roughly 2 kgN/ha/yr) could potentially result in an increase in species richness (whether grass species richness, moss species richness or total species richness) of up to c. 3-4% of the maximum in heathland, although it can only be described as the *potential* for recovery since there will be a considerable lag in vegetation responses to reductions in nitrogen deposition. Using a total maximum species richness for heathland of 37 species[32] this suggests that approximately 1-2 more species could eventually be found in the sward on average. Such a reduction in deposition rates could also ultimately result in a reduction in grass (graminoid) cover of c.1%[33] **if** other factors such as management and drainage are suitable.

3.2.26 Appendix 5 of Caporn et al (2016) also suggests that at the same background deposition rate the worst-case additional nitrogen deposition to heathland as a result of 'in combination' traffic growth (c. 0.4 kgN/ha/yr at 5m from the A275 or 40m from the A26) could, if it constituted a net increase in deposition rate, result in a small (c.0.1%) increase in grass (graminoid) cover and a reduction in species richness (whether grasses, mosses or total species richness) at the roadside equivalent to c.0.6% of the maximum (c.0.2 species i.e. if you dropped a random

[28] A 'small' change in atmospheric pollution is generally considered to be a change equivalent to less than 5% of the critical load (i.e. 0.5 kgN/ha/yr for heathland). The maximum dose at the closest area of heathland is 0.4 kgN/ha/yr. This is just above the lowest dose examined in Caporn et al (2016)

[29] Caporn, S., Field, C., Payne, R., Dise, N., Britton, A., Emmett, B., Jones, L., Phoenix, G., S Power, S., Sheppard, L. & Stevens, C. 2016. Assessing the effects of small increments of atmospheric nitrogen deposition (above the critical load) on semi-natural habitats of conservation importance. Natural England Commissioned Reports, Number 210. Table 1 page 2

[30] This is a good indicator of the effect of nitrogen deposition on vegetation as it arises at low background deposition rates, is easily detectable and occurs across different habitats. The main exception appears to be calcareous grassland where there is no correlation between nitrogen deposition and species richness; for that habitat, rather than there being a reduction in the average number of species per quadrat the reduced frequency of less competitive species appears to be offset by the increased frequency of more competitive species.

[31] Caporn et al (2016), page 39

[32] 37 species is the maximum species richness in the lowland heathland sample reported in Caporn et al (2016) and is the reference species richness for lowland heathland used throughout that report.

[33] Appendix 5, Caporn et al (2016)

quadrat there is an approximately 20% probability you would record one less species)[34] The change away from the roadside would be much less..

3.2.27 In terms of changes in coarse habitat structure it is considered that the small forecast additional nitrogen deposition (equivalent to a maximum c. 2% of the deposition rate otherwise forecast in these locations by 2033) would not stimulate growth to such an extent that a material change in management burden occurred, and the structure of the sward is dictated primarily by management.

3.2.28 Bearing in mind that a net reduction in nitrogen deposition rates is actually being forecast, the most that might be expected by 2033 due to traffic growth on roads through the SAC is that one *might* record a reduction in percentage grass cover immediately adjacent to the A275 of 0.9%, as opposed to a potential 1% reduction in the hypothetical case of no traffic growth, and the frequency of occurrence of at least 1 species might be slightly lower in that area than it would be with no growth. Note that these are not intended to be precise predictions but illustrations of the relatively subtle difference in potential for vegetation recovery between two nitrogen doses that are only slightly different; whether any difference would actually be observed in practice would depend heavily on other factors, because management has and differences in drainage have a great influence on parameters such as percentage grass cover and species richness.

3.2.29 In summary:

1. Air quality within 200m of the roadside in 2038 is forecast to be significantly better than in 2017 notwithstanding the precautionary assumptions made about both growth and improvements in vehicle emissions factors;
2. NOx concentrations at heathland within 200m of the A26 and A275 are expected to be below the critical level by 2038;
3. Nitrogen deposition rates and ammonia concentrations will continue to exceed the critical load or level due to existing sources but the potential for vegetation recovery in more than 99% of heathland in the SAC will be unaffected by local traffic growth;
4. The remainder is a narrow roadside belt that may experience a subtle difference with all planned housing and employment growth, consisting primarily of a slight difference in percentage grass cover and species richness, but even here the reduction in nitrogen deposition, and potential for vegetation recovery, will still be approximately 80% of that which would be expected without housing and employment growth;
5. the contribution of Tunbridge Wells Local Plan to the 'in combination' deposition for those nearest areas of heathland is nugatory, being a little above zero. This is relevant since in European Court of Justice Case C-258/11 Advocate-General Sharpston stated at paragraph 48 of her Opinion that: '*the requirement for an effect to be 'significant' exists in order to lay down a de minimis threshold. Plans and projects that have no appreciable effect on the site can therefore be excluded. If all plans and projects capable of having any effect whatsoever on the site were to be caught by Article 6(3), activities on or near the site would risk being impossible by reason of legislative overkill';* and
6. Natural England have confirmed that nitrogen deposition from traffic is not preventing the site from achieving its conservation objectives, but rather the principal issue is lack of management. For example, a review of the Natural England condition assessment on a unit by unit basis clearly indicates that historic (and in many cases current) inadequate management is the reason why only 20% of Ashdown Forest SAC is currently in a favourable condition.

3.2.30 For all these reasons it is considered that the ability of the SAC and SPA to achieve its conservation objectives would not be significantly compromised by Local Plan growth either alone or in combination.

[34] Caporn el al (2016) indicates that not all species respond equally to nitrogen deposition (some are stimulated, others negatively affected). For example, Table 22 of NECR2010 shows that at background rates of 15 kgN/ha/yr one would expect a dose of 1 kgN/ha/yr (three times what is forecast in the AECOM model) to reduce the frequency of occurrence (percentage cover, or probability of presence) of five representative lowland heathland lower plant species (*Hylocomium splendens, Hylocomium splendens, Cladonia portentosa, Cladonia portentosa, Brachythecium rutabulum*) by between 0.2% and 0.5%. However, they also state on page 71 that '*The relatively small datasets mean that caution should be applied when drawing conclusions on site integrity based on the presence or absence of individual species and that this information* [should] *be used in conjunction with changes in species richness and composition'*.

4 Conclusion

4.1.1 There is no basis to conclude an adverse effect on integrity of Ashdown Forest SAC or SPA, and thus the ability of the site to achieve its conservation objectives, from growth in Tunbridge Wells Borough over that period in combination with other plans. Since no adverse effect on integrity is forecast, no mitigation as such would be required.

4.1.2 It should be noted that the assessment undertaken to inform this conclusion was precautionary. For example:

- AECOM has taken a cautious approach to allowing for improvements in background nitrogen deposition over the plan period.
- Rather than simply model the rates of growth set out in adopted or submitted Core Strategies and Local Plans, the AECOM model increased the housing delivery rates for those authorities immediately surrounding Ashdown Forest SAC (Wealden District, Mid-Sussex District and Tandridge District) to allow for additional growth in line with the most-recently expressed Objectively Assessed Need as of June 2017. In some cases (e.g. Mid-Sussex) this substantially increased the amount of housing allowed for over the period to 2033. In practice, therefore, growth around Ashdown Forest SAC may have been over-estimated. For example, the recent Government consultation on Objectively Assessed Need (OAN) proposes a significantly lower OAN for Wealden District than was allowed for in the AECOM model.

4.1.3 It is therefore concluded that no adverse effect upon the integrity of Ashdown Forest SAC is expected to result from development provided by the Tunbridge Wells Local Plan, even in combination with other plans and projects. This is due to a combination of a) an expected net improvement in air quality over the Local Plan period, b) the fact that, whether or not that improvement occurs to the extent forecast, the contribution of the Tunbridge Wells Local Plan to changes in roadside air quality is demonstrably ecologically nugatory due to the very small magnitude and c) the precautionary nature of the modelling.

4.1.4 This conclusion is not intended to suggest that no active attempt should be made to reduce background NOx concentrations and nitrogen deposition around Ashdown Forest as a matter of general good stewardship if that is what the authorities agree, and the authorities already have a forum for collaborative involvement in this issue via the working group that has recently been convened by South Downs National Park Authority.

Appendix A. Detailed Modelling Results

Ammonia Concentrations (red text denotes the closest area of heathland to the road)

	Annual Mean NH_3 (ug/m^3)				Difference		
Distance from road	2017 Baseline	2038 baseline	2038 Do Nothing	2038 Do Something	Change in pollution between 2017 and 2038	Dose due to traffic growth 'in combination'	Dose due to Tunbridge Wells Local Plan alone
A26 at Poundgate							
0	2.35	2.73	3.10	3.19	0.84	0.46	0.09
5	1.64	1.83	2.02	2.07	0.43	0.24	0.05
10	1.40	1.53	1.66	1.69	0.29	0.16	0.03
15	1.28	1.37	1.48	1.50	0.22	0.13	0.02
20	1.20	1.28	1.36	1.38	0.18	0.10	0.02
30	1.11	1.16	1.22	1.24	0.13	0.08	0.02
40	1.05	1.10	1.15	1.16	0.11	0.06	0.01
50	1.02	1.06	1.10	1.11	0.09	0.05	0.01
60	1.00	1.03	1.06	1.07	0.07	0.04	0.01
70	0.98	1.00	1.03	1.04	0.06	0.04	0.01
80	0.96	0.99	1.01	1.02	0.06	0.03	0.01
90	0.95	0.97	0.99	1.00	0.05	0.03	0.01
100	0.94	0.96	0.98	0.99	0.05	0.03	0.01
125	0.92	0.94	0.96	0.96	0.04	0.02	0.00
150	0.91	0.92	0.94	0.94	0.03	0.02	0.00
175	0.90	0.91	0.92	0.93	0.03	0.02	0.01
200	0.90	0.91	0.91	0.92	0.02	0.01	0.01
A275 (west side of road)							
0	1.26	1.36	1.46	1.47	0.21	0.11	0.01
5	1.04	1.09	1.14	1.14	0.10	0.05	0.00
10	0.98	1.01	1.04	1.05	0.07	0.04	0.01
15	0.94	0.97	0.99	1.00	0.06	0.03	0.01
20	0.92	0.94	0.96	0.97	0.05	0.03	0.01
30	0.90	0.92	0.93	0.93	0.03	0.01	0.00
40	0.89	0.90	0.91	0.91	0.02	0.01	0.00
50	0.88	0.89	0.90	0.90	0.02	0.01	0.00
60	0.88	0.88	0.89	0.89	0.01	0.01	0.00
70	0.87	0.88	0.89	0.89	0.02	0.01	0.00
80	0.87	0.87	0.88	0.88	0.01	0.01	0.00
90	0.87	0.87	0.88	0.88	0.01	0.01	0.00
100	0.86	0.87	0.87	0.87	0.01	0.00	0.00
125	0.86	0.86	0.87	0.87	0.01	0.01	0.00
150	0.86	0.86	0.87	0.87	0.01	0.01	0.00
175	0.86	0.86	0.86	0.86	0.00	0.00	0.00
200	0.85	0.86	0.86	0.86	0.01	0.00	0.00

	Annual Mean NH_3 (ug/m^3)				Difference		
Distance from road	**2017 Baseline**	**2038 baseline**	**2038 Do Nothing**	**2038 Do Something**	**Change in pollution between 2017 and 2038**	**Dose due to traffic growth 'in combination'**	**Dose due to Tunbridge Wells Local Plan alone**
A275 (East side of road)							
0	1.34	1.47	1.59	1.60	0.26	0.13	0.01
5	1.11	1.17	1.24	1.24	0.13	0.07	0.00
10	1.03	1.07	1.12	1.12	0.09	0.05	0.00
15	0.98	1.02	1.05	1.06	0.08	0.04	0.01
20	0.96	0.99	1.01	1.02	0.06	0.03	0.01
30	0.93	0.95	0.97	0.97	0.04	0.02	0.00
40	0.91	0.93	0.94	0.94	0.03	0.01	0.00
50	0.90	0.91	0.93	0.93	0.03	0.02	0.00
60	0.89	0.90	0.91	0.92	0.03	0.02	0.01
70	0.88	0.89	0.91	0.91	0.03	0.02	0.00
80	0.88	0.89	0.90	0.90	0.02	0.01	0.00
90	0.88	0.88	0.89	0.89	0.01	0.01	0.00
100	0.87	0.88	0.89	0.89	0.02	0.01	0.00
125	0.87	0.87	0.88	0.88	0.01	0.01	0.00
150	0.86	0.87	0.88	0.88	0.02	0.01	0.00
175	0.86	0.87	0.87	0.87	0.01	0.00	0.00
200	0.86	0.86	0.87	0.87	0.01	0.01	0.00

NOx and Nitrogen Deposition (red text denotes the closest area of heathland to the road)

	Total Annual Mean NOx (ug/m^3)				Total Annual Mean N Dep (kg N/ha/yr)				Difference in Nitrogen dose		
	2017 Baseline	2038 Baseline	2038 Do Nothing	2038 Do Something	2018 Baseline	2038 Baseline	2038 Do Nothing	2038 Do Something	Change in pollution between 2017 and 2038	Dose due to traffic growth 'in combination'	Dose due to Tunbridge Wells Local Plan
A26 at Poundgate											
0	63.62	22.22	25.27	26.12	24.90	22.86	25.00	25.55	0.65	2.69	0.55
5	38.24	14.82	16.40	16.84	19.53	17.64	18.76	19.05	-0.48	1.41	0.29
10	29.71	12.36	13.45	13.76	17.68	15.90	16.68	16.88	-0.80	0.98	0.20
15	25.31	11.10	11.94	12.18	16.71	15.01	15.61	15.77	-0.94	0.76	0.16
20	22.54	10.30	10.99	11.18	16.10	14.45	14.94	15.06	-1.04	0.61	0.12
30	19.26	9.37	9.87	10.01	15.38	13.79	14.14	14.23	-1.15	0.44	0.09
40	17.40	8.84	9.23	9.34	14.97	13.41	13.69	13.76	-1.21	0.35	0.07
50	16.16	8.49	8.81	8.90	14.69	13.17	13.40	13.46	-1.23	0.29	0.06
60	15.29	8.24	8.51	8.59	14.50	12.99	13.19	13.23	-1.27	0.24	0.04
70	14.64	8.05	8.29	8.36	14.35	12.86	13.03	13.07	-1.28	0.21	0.04
80	14.13	7.91	8.12	8.17	14.24	12.76	12.91	12.94	-1.30	0.18	0.03
90	13.72	7.79	7.98	8.03	14.14	12.67	12.81	12.84	-1.30	0.17	0.03
100	13.39	7.70	7.86	7.91	14.08	12.60	12.73	12.76	-1.32	0.16	0.03
125	12.77	7.52	7.65	7.69	13.94	12.48	12.58	12.60	-1.34	0.12	0.02
150	12.35	7.40	7.51	7.54	13.84	12.40	12.47	12.49	-1.35	0.09	0.02
175	12.03	7.31	7.40	7.42	13.77	12.33	12.40	12.41	-1.36	0.08	0.01
200	11.80	7.24	7.32	7.34	13.71	12.29	12.33	12.36	-1.35	0.07	0.03
A275 (west of road)											
0	26.59	12.00	12.88	12.97	17.92	16.24	16.85	16.91	-1.01	0.67	0.06
5	18.80	9.68	10.11	10.15	16.21	14.65	14.95	14.98	-1.23	0.33	0.03
10	16.48	9.00	9.29	9.32	15.69	14.19	14.38	14.41	-1.28	0.22	0.03
15	15.31	8.66	8.88	8.90	15.43	13.96	14.10	14.11	-1.32	0.15	0.01
20	14.60	8.45	8.63	8.64	15.28	13.81	13.93	13.94	-1.34	0.13	0.01
30	13.78	8.21	8.34	8.35	15.09	13.64	13.73	13.74	-1.35	0.10	0.01
40	13.33	8.08	8.18	8.19	14.99	13.55	13.62	13.63	-1.36	0.08	0.01
50	13.04	7.99	8.08	8.08	14.92	13.49	13.55	13.56	-1.36	0.07	0.01
60	12.84	7.93	8.01	8.01	14.88	13.45	13.50	13.50	-1.38	0.05	0.00
70	12.69	7.89	7.95	7.96	14.85	13.43	13.47	13.47	-1.38	0.04	0.00
80	12.58	7.86	7.91	7.92	14.82	13.40	13.44	13.45	-1.37	0.05	0.01
90	12.49	7.83	7.88	7.89	14.80	13.38	13.41	13.43	-1.37	0.05	0.02
100	12.42	7.81	7.86	7.86	14.79	13.37	13.40	13.40	-1.39	0.03	0.00
125	12.28	7.77	7.81	7.81	14.76	13.34	13.37	13.37	-1.39	0.03	0.00
150	12.19	7.74	7.78	7.78	14.74	13.33	13.35	13.35	-1.39	0.02	0.00
175	12.13	7.73	7.76	7.76	14.72	13.31	13.34	13.34	-1.38	0.03	0.00
200	12.08	7.71	7.74	7.74	14.71	13.30	13.32	13.32	-1.39	0.02	0.00

	Total Annual Mean NOx (ug/m³)				Total Annual Mean N Dep (kg N/ha/yr)				Difference in Nitrogen dose		
	2017 Baseline	2038 Baseline	2038 Do Nothing	2038 Do Something	2018 Baseline	2038 Baseline	2038 Do Nothing	2038 Do Something	Change in pollution between 2017 and 2038	Dose due to traffic growth 'in combination'	Dose due to Tunbridge Wells Local Plan
A275 (east of road)											
0	29.58	12.90	13.96	14.07	18.58	16.87	17.59	17.67	-0.91	0.80	0.08
5	21.16	10.39	10.95	11.01	16.73	15.14	15.53	15.57	-1.16	0.43	0.04
10	18.24	9.53	9.92	9.96	16.08	14.55	14.82	14.84	-1.24	0.29	0.02
15	16.72	9.08	9.38	9.41	15.75	14.24	14.45	14.47	-1.28	0.23	0.02
20	15.78	8.80	9.05	9.07	15.54	14.05	14.22	14.24	-1.30	0.19	0.02
30	14.68	8.48	8.66	8.68	15.29	13.83	13.96	13.97	-1.32	0.14	0.01
40	14.06	8.29	8.44	8.45	15.15	13.70	13.80	13.81	-1.34	0.11	0.01
50	13.65	8.17	8.29	8.31	15.06	13.62	13.70	13.71	-1.35	0.09	0.01
60	13.37	8.09	8.19	8.20	15.00	13.56	13.63	13.64	-1.36	0.08	0.01
70	13.16	8.03	8.12	8.13	14.95	13.52	13.58	13.58	-1.37	0.06	0.00
80	13.00	7.98	8.07	8.07	14.92	13.48	13.55	13.55	-1.37	0.07	0.00
90	12.88	7.95	8.02	8.03	14.89	13.46	13.52	13.52	-1.37	0.06	0.00
100	12.77	7.92	7.98	7.99	14.86	13.44	13.49	13.49	-1.37	0.05	0.00
125	12.59	7.86	7.92	7.92	14.83	13.40	13.44	13.45	-1.38	0.05	0.01
150	12.46	7.82	7.87	7.88	14.80	13.38	13.41	13.41	-1.39	0.03	0.00
175	12.36	7.79	7.84	7.84	14.77	13.36	13.39	13.39	-1.38	0.03	0.00
200	12.29	7.77	7.81	7.82	14.76	13.35	13.37	13.37	-1.39	0.02	0.00

Appendix B. Air Quality Modelling Methodology

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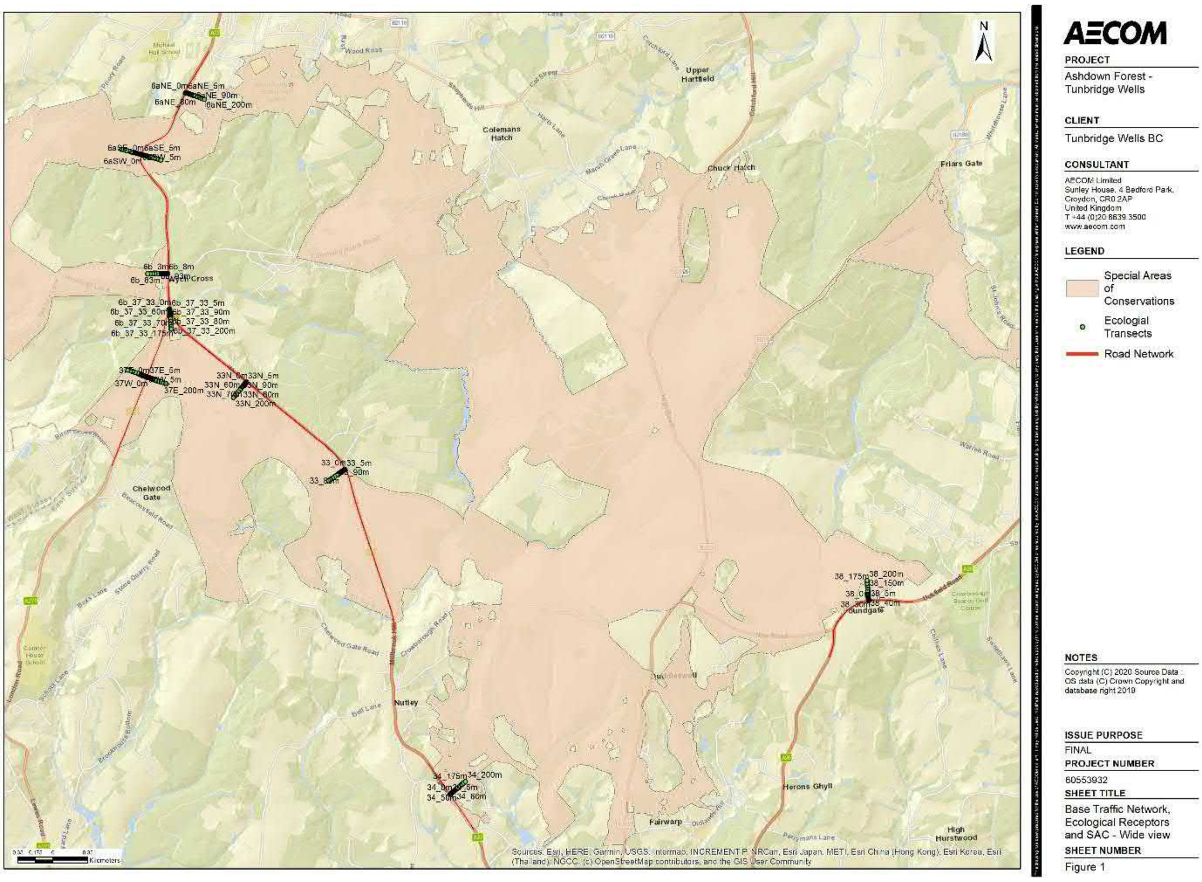
Appendix B – Air Quality Modelling Methodology

Overview

Tunbridge Wells Borough Council have prepared a Local Plan setting out proposed developments up to 2038. This project assesses the impact on air quality of the Local Plan on internationally designated ecological sites that require a Habitats Regulation Assessment (HRA).

Ashdown Forest is located in Wealden district. This project considers the impact of changes in traffic flow on concentrations of nitrogen oxides (NOx), ammonia (NH_3) and nitrogen deposition at the closest ecological receptors, within Ashdown Forest Special Area of Conservation (SAC). Figure 1 shows the traffic network, ecological receptors and SAC considered in this project.

Figure 1 Base Traffic Network, Ecological Receptors and SAC



Methodology

Traffic Data

The road network includes multiple links along the A275 and A26 which run through the Ashdown Forest SAC. Traffic data in the form of 24-hour AADT (Annual Average Daily Traffic) based on 2017 data and forecast to 2038 are shown in Table 1. Baseline traffic data were obtained from Manual Count data for the A26 and through TEMPRO growth (version 7.2b) of 2014 data for the A275.

The Baseline and Future Baseline scenarios (both without Local Plan) used 2017 traffic data. The future year without Local Plan (2038 Do-Something) traffic flows were calculated by applying a growth factor to the 2017 traffic to 2038 traffic flows for the A275 and A26 roads resulting in increases of 908 and 2,451 AADT respectively. The Local Plan is predicted to increase the daily average flows by a further 98 and 691 AADT for A275 and A26 respectively in 2038 compared with the situation without the Local Plan (but with expected traffic growth). No increase on the A22 arises from the Local Plan.

Table 1 Traffic Data

Scenario	Road Link	AADT	HDV %	Average Daily Mean Speed (kph)
Base 2017 and Future Base (2038)	A275 Wych Cross A26 Poundgate	4,542 12,264	2.3% 3.4%	64 80
2038 Do Nothing	A275 Wych Cross A26 Poundgate	5,449 14,715	2.3% 3.4%	64 80
2038 Do Something	A275 Wych Cross A26 Poundgate	5,548 15,406	2.3% 3.2%	64 80

Receptors

Ecological receptors have been taken from the various parts of the SAC, which abuts the road, every 10 metres, up to 200m from the road. The ecological receptors relevant to this project are included in Appendix A within Table A 1, and their locations presented in Figure 1.

Model Setup

Road traffic emissions of NOx were derived using Defra's current Emission Factor Toolkit (EFT v10.1) and associated tools[1]. Road traffic emissions of NH_3 were derived using Air Quality Consultants' Calculator for Road Emissions of Ammonia (CREAM) V1A)[2].

Detailed dispersion modelling was undertaken using ADMS-Roads v5.0 to model concentrations of NOx and NH_3 using the parameters in Table 2 for the following scenarios:

1. 2017 Baseline – 2017 AADT, emission factors and background concentrations;
2. 2038 Future Baseline – 2017 AADT, 2030 emission factors and background concentrations (the latest projected year available from Defra);
3. 2038 Do Nothing – 2038 AADT without Local Plan, 2030 emission factors and background concentrations;
4. 2038 Do Something – 2038 AADT with Local Plan in place, 2030 emission factors and background concentrations.

Table 2 General ADMS-Roads Model Conditions

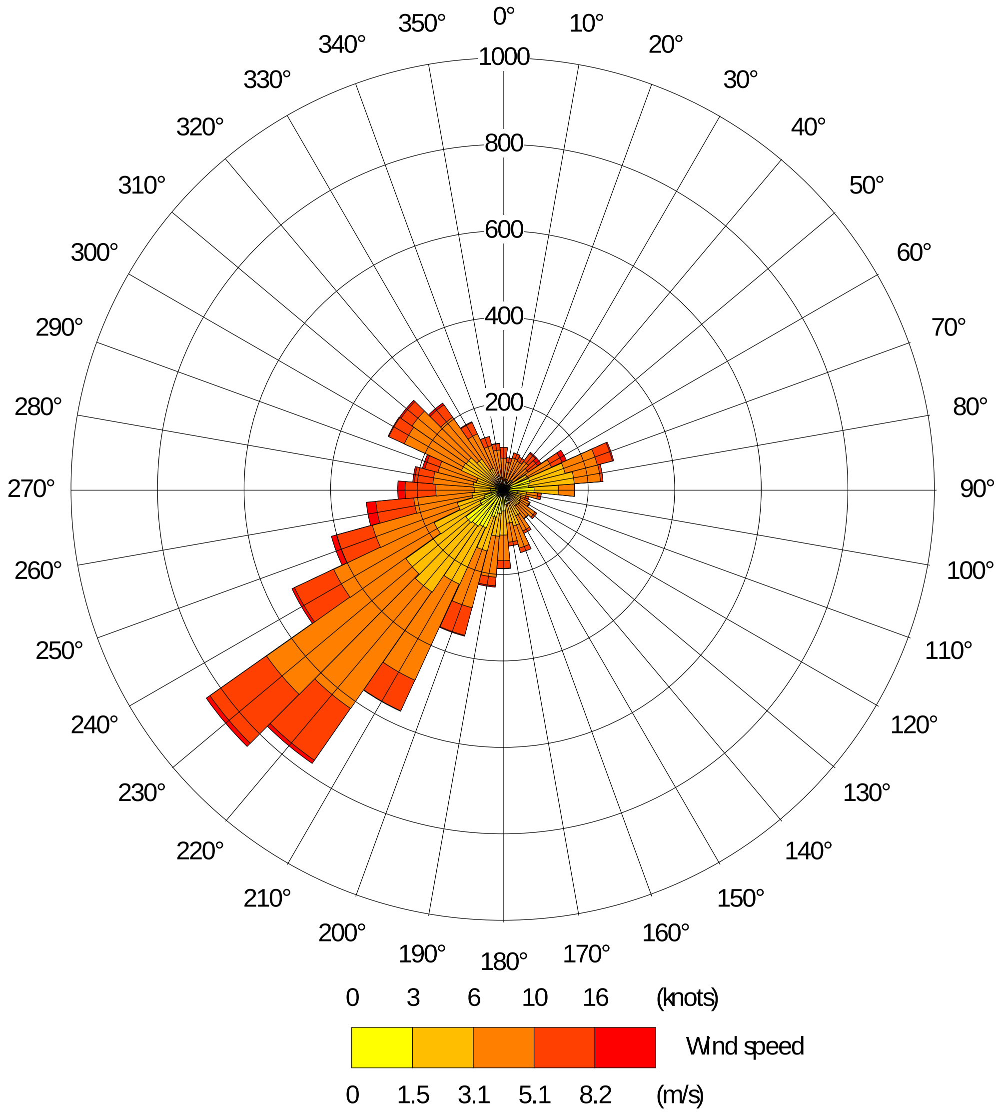
Variables	ADMS-Roads Model Input
Surface roughness at source	0.5m
Surface roughness at Metrological Site	0.2m
Minimum Monin-Obukhov length for stable conditions	30m
Receptor location	x, y coordinates determined by GIS, z = 0m for ecological receptors.
Emissions	NO_x – Defra's EFT v10.1. NH_3 – CREAM V1A
Meteorological data	1 year (2017) hourly sequential data from Gatwick Airport meteorological station.
Receptors	Ecological
Model output	Long-term (annual) mean NO_x and NH_3 concentrations.

Meteorological Data

One year (2017) of hourly sequential observation data from Gatwick Airport meteorological station has been used in this assessment to correspond with the baseline year. The station is located approximately 15km north-west of the SAC and experiences meteorological conditions that are representative of those experienced within the air quality study area. Figure 2 shows that the dominant direction of wind is from the south-west, as is typical for the UK. The wind speed ranges from 0-18 knots (0 - ~9.3 m/s).

[1] https://laqm.defra.gov.uk/
[2] https://www.aqconsultants.co.uk/resources/ammonia-emissions-from-roads-for-assessing-impacts

Figure 2 Wind Rose of Gatwick Met Data 2017



Background Data

Background data for NO_2 and NOx concentrations for 2018 and 2030 have been sourced from Defra's 2018-based background maps for receptors within the nearest 1km by 1km grid squares (Table 3). The NO_2 and NOx concentrations for 2017 were back projected from 2018 using continuous background monitors within 50km of the site. The data shows that the mapped background concentrations are predicted to decrease between 2017 and 2030.

Table 3 Defra Mapped Background Pollutant Concentrations (μg/m³)

Grid Square (X, Y)	Annual Mean Concentrations			
	2017 NO_2	2017 NOx	2030 NO_2	2030 NOx
548500,128500	8.1	10.5	5.4	6.9
541500,131500	8.9	11.6	6.0	7.6
541500,132500	9.1	11.9	6.1	7.7
541500,133500	9.1	12.0	6.1	7.8
542500,133500	9.0	11.8	6.0	7.7

Ecological Data

The annual mean critical levels of NOx and NH_3, concentrations above which adverse effects on ecosystems may occur based on present knowledge are summarised in Table 4.

Table 4 Annual Mean Critical Levels (NOx and NH_3)

Pollutant	Critical Level
Oxides of nitrogen (NOx)	30 µg/m^3
Ammonia (NH_3)	3 µg/m^3 1 µg/m^3 for lichens and bryophytes

The Air Pollution Information System[3] (APIS) provides 'a searchable database and information on pollutants and their impacts on habitats and species'. The parameters for *Dwarf Shrub Heath* were taken from APIS and are presented in Table 5.

A 1.4 kgN/ha/yr improvement in the APIS nitrogen deposition rates has been assumed from the APIS 2016-2018 values to the future year.

Table 5 Air Pollution Information System (APIS) Data of the Ecological Receptors.

Receptor	Av. N Dep Rate kgN/ha/yr	Critical Load Av. N Dep Rate kgN/ha/yr	Total Av. Acid Dep Rate keq/ha/yr	Nitrogen Av. Acid Dep Rate keq/ha/yr	Critical Load Nitrogen Av. Acid Dep Rate keq/ha/yr	Ammonia µg/m^3	Habitat	APIS Data Year
38 (Transect)	13.42	10-20	1.107	0.959	0.714 - 2.444	0.86	Dwarf Shrub Heath	2016 - 2018
37W (Transect)	14.601	10-20	1.211	1.043	0.714 - 2.444	0.84	Dwarf Shrub Heath	2016 - 2018
37E (Transect)	14.601	10-20	1.211	1.043	0.714 - 2.444	0.84	Dwarf Shrub Heath	2016 - 2018
34 (Transect)	14.149	10-20	1.164	1.011	0.714 - 2.444	0.99	Dwarf Shrub Heath	2016 - 2018
33 (Transect)	14.601	10-20	1.211	1.043	0.714 - 2.444	0.84	Dwarf Shrub Heath	2016 - 2018
6b_37_33 (Transect)	14.601	10-20	1.211	1.043	0.714 - 2.444	0.84	Dwarf Shrub Heath	2016 - 2018
6b_3 (Transect)	14.601	10-20	1.211	1.043	0.714 - 2.444	0.84	Dwarf Shrub Heath	2016 - 2018
6aSW (Transect)	14.601	10-20	1.211	1.043	0.714 - 2.444	0.84	Dwarf Shrub Heath	2016 - 2018
6aSE (Transect)	14.601	10-20	1.211	1.043	0.714 - 2.444	0.84	Dwarf Shrub Heath	2016 - 2018
6aNE (Transect)	14.601	10-20	1.211	1.043	0.714 - 2.444	0.84	Dwarf Shrub Heath	2016 - 2018
33N (Transect)	14.601	10-20	1.211	1.043	0.714 - 2.444	0.84	Dwarf Shrub Heath	2016 - 2018

[3] http://www.apis.ac.uk/

Verification

Local air quality monitoring was carried out along the modelled network in the vicinity of Ashdown Forest during 2017. The monitoring data are used make a comparison between modelled and measured concentrations to enable the model results to be adjusted to bring the modelled concentrations in-line with measurements. 17 sites were used for verification that measured NO_2 concentration, this produced a verification factor of 2.40 for NOx. A verification factor of 1.0 for NH_3 hasbeen applied based on previous verification and validation of the CREAM tool. Note the CREAM tool was created based on the 2017 data obtained therefore the verification factor used for NH_3 is deemed appropriate.

Deposition velocities

Deposition of nitrogen from road traffic derived NH_3 and NO_2 to heathland are estimated using the AQTAG deposition velocities that are cited in the 2020 IAQM guidance[4], as shown in Table 6Table 6.

Table 6 Air Pollution Information System (APIS) Data of the Ecological Receptors.

Pollutant	Habitat	Nitrogen deposition conversion rates	Deposition velocity
NO_2	Heathland	1 µg/m^3 NO_2= 0.14 kgN/ha/yr	0.0015 m/s
NH_3	Heathland	1 µg/m^3 NH_3 = 5.19 kgN/ha/yr	0.020 m/s

Limitations

The verification factor obtained for NO_2 has a RMSE of NO_2 and NOx of 5.4 and 10.9 respectively and therefore results should be viewed with caution.

[4] https://iaqm.co.uk/text/guidance/air-quality-impacts-on-nature-sites-2020.pdf

Appendix A

Table A 1 Receptor locations, height and distance from road

ID	X	Y	Height (m)	Distance from Road (m)	ID	X	Y	Height (m)	Distance from Road (m)
38_0m	548982	128871	0	0	6b_37_33_70m	541979	131726	0	70
38_5m	548982	128875	0	5	6b_37_33_80m	541980	131716	0	80
38_10m	548981	128880	0	10	6b_37_33_90m	541981	131706	0	90
38_15m	548981	128885	0	15	6b_37_33_100m	541982	131696	0	100
38_20m	548981	128890	0	20	6b_37_33_125m	541984	131671	0	125
38_30m	548980	128900	0	30	6b_37_33_150m	541986	131646	0	150
38_40m	548979	128910	0	40	6b_37_33_175m	541988	131621	0	175
38_50m	548978	128920	0	50	6b_37_33_200m	541990	131596	0	200
38_60m	548977	128930	0	60	6b_3m	541952	132151	0	3
38_70m	548976	128940	0	70	6b_8m	541947	132151	0	8
38_80m	548975	128950	0	80	6b_13m	541942	132151	0	13
38_90m	548975	128960	0	90	6b_18m	541937	132151	0	18
38_100m	548974	128970	0	100	6b_23m	541932	132151	0	23
38_125m	548971	128995	0	125	6b_33m	541922	132151	0	33
38_150m	548969	129020	0	150	6b_43m	541912	132151	0	43
38_175m	548967	129045	0	175	6b_53m	541902	132151	0	53
38_200m	548965	129070	0	200	6b_63m	541892	132151	0	63
37W_0m	541743	131117	0	0	6b_73m	541882	132151	0	73
37W_5m	541738	131119	0	5	6b_83m	541872	132151	0	83
37W_10m	541734	131120	0	10	6b_93m	541862	132151	0	93
37W_15m	541729	131122	0	15	6b_103m	541852	132151	0	103
37W_20m	541724	131124	0	20	6b_128m	541827	132151	0	128
37W_30m	541715	131127	0	30	6b_153m	541802	132151	0	153
37W_40m	541705	131131	0	40	6b_178m	541777	132151	0	178
37W_50m	541696	131134	0	50	6b_203m	541752	132151	0	203
37W_60m	541687	131137	0	60	6aSW_0m	541684	133345	0	0
37W_70m	541677	131141	0	70	6aSW_5m	541680	133346	0	5
37W_80m	541668	131144	0	80	6aSW_10m	541675	133347	0	10
37W_90m	541658	131148	0	90	6aSW_15m	541670	133349	0	15
37W_100m	541649	131151	0	100	6aSW_20m	541665	133350	0	20
37W_125m	541626	131160	0	125	6aSW_30m	541655	133352	0	30
37W_150m	541602	131168	0	150	6aSW_40m	541646	133355	0	40
37W_175m	541579	131177	0	175	6aSW_50m	541636	133358	0	50

ID	X	Y	Height (m)	Distance from Road (m)	ID	X	Y	Height (m)	Distance from Road (m)
37W_200m	541555	131185	0	200	6aSW_60m	541626	133360	0	60
37E_0m	541749	131115	0	0	6aSW_70m	541617	133363	0	70
37E_5m	541754	131113	0	5	6aSW_80m	541607	133365	0	80
37E_10m	541759	131111	0	10	6aSW_90m	541598	133368	0	90
37E_15m	541764	131110	0	15	6aSW_100m	541588	133371	0	100
37E_20m	541768	131108	0	20	6aSW_125m	541564	133377	0	125
37E_30m	541778	131105	0	30	6aSW_150m	541540	133383	0	150
37E_40m	541787	131101	0	40	6aSW_175m	541515	133390	0	175
37E_50m	541796	131098	0	50	6aSW_200m	541491	133396	0	200
37E_60m	541806	131094	0	60	6aSE_0m	541692	133343	0	0
37E_70m	541815	131091	0	70	6aSE_5m	541696	133342	0	5
37E_80m	541825	131087	0	80	6aSE_10m	541701	133341	0	10
37E_90m	541834	131084	0	90	6aSE_15m	541706	133339	0	15
37E_100m	541843	131081	0	100	6aSE_20m	541711	133338	0	20
37E_125m	541867	131072	0	125	6aSE_30m	541720	133335	0	30
37E_150m	541890	131064	0	150	6aSE_40m	541730	133333	0	40
37E_175m	541914	131055	0	175	6aSE_50m	541740	133330	0	50
37E_200m	541937	131046	0	200	6aSE_60m	541749	133328	0	60
34_0m	544785	126930	0	0	6aSE_70m	541759	133325	0	70
34_5m	544789	126933	0	5	6aSE_80m	541769	133322	0	80
34_10m	544793	126937	0	10	6aSE_90m	541778	133320	0	90
34_15m	544797	126940	0	15	6aSE_100m	541788	133317	0	100
34_20m	544800	126943	0	20	6aSE_125m	541812	133311	0	125
34_30m	544808	126949	0	30	6aSE_150m	541836	133304	0	150
34_40m	544816	126956	0	40	6aSE_175m	541861	133298	0	175
34_50m	544823	126962	0	50	6aSE_200m	541885	133291	0	200
34_60m	544831	126969	0	60	6aNE_0m	542134	133965	0	0
34_70m	544839	126975	0	70	6aNE_5m	542139	133964	0	5
34_80m	544846	126982	0	80	6aNE_10m	542144	133962	0	10
34_90m	544854	126988	0	90	6aNE_15m	542148	133960	0	15
34_100m	544862	126994	0	100	6aNE_20m	542153	133959	0	20
34_125m	544881	127011	0	125	6aNE_30m	542162	133955	0	30
34_150m	544900	127027	0	150	6aNE_40m	542172	133952	0	40
34_175m	544919	127043	0	175	6aNE_50m	542181	133948	0	50
34_200m	544938	127059	0	200	6aNE_60m	542191	133945	0	60
33_0m	543730	130183	0	0	6aNE_70m	542200	133941	0	70
33_5m	543726	130180	0	5	6aNE_80m	542209	133938	0	80
33_10m	543721	130177	0	10	6aNE_90m	542219	133935	0	90
33_15m	543717	130175	0	15	6aNE_100m	542228	133931	0	100

ID	X	Y	Height (m)	Distance from Road (m)	ID	X	Y	Height (m)	Distance from Road (m)
33_20m	543713	130172	0	20	6aNE_125m	542252	133923	0	125
33_30m	543705	130166	0	30	6aNE_150m	542275	133914	0	150
33_40m	543697	130160	0	40	6aNE_175m	542299	133906	0	175
33_50m	543689	130155	0	50	6aNE_200m	542322	133897	0	200
33_60m	543680	130149	0	60	33N_0m	542741	131062	0	0
33_70m	543672	130143	0	70	33N_5m	542738	131058	0	5
33_80m	543664	130137	0	80	33N_10m	542735	131055	0	10
33_90m	543656	130132	0	90	33N_15m	542732	131051	0	15
33_100m	543648	130126	0	100	33N_20m	542728	131047	0	20
33_125m	543627	130112	0	125	33N_30m	542722	131039	0	30
33_150m	543607	130097	0	150	33N_40m	542716	131032	0	40
33_175m	543586	130083	0	175	33N_50m	542709	131024	0	50
33_200m	543566	130069	0	200	33N_60m	542703	131016	0	60
6b_37_33_0m	541973	131796	0	0	33N_70m	542696	131009	0	70
6b_37_33_5m	541973	131791	0	5	33N_80m	542690	131001	0	80
6b_37_33_10m	541974	131786	0	10	33N_90m	542683	130993	0	90
6b_37_33_15m	541974	131781	0	15	33N_100m	542677	130986	0	100
6b_37_33_20m	541975	131776	0	20	33N_125m	542661	130966	0	125
6b_37_33_30m	541975	131766	0	30	33N_150m	542645	130947	0	150
6b_37_33_40m	541976	131756	0	40	33N_175m	542629	130928	0	175
6b_37_33_50m	541977	131746	0	50	33N_200m	542613	130909	0	200
6b_37_33_60m	541978	131736	0	60					

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