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Reigate Development Management Plan: Mole Gap to Reigate Escarpment SAC Air Quality Impact Assessment

Traffic-Related Effects on Mole Gap to Reigate Escarpment SAC

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Contents

1 Introduction

1.1.1 Mole Gap to Reigate Escarpment SAC is approximately 8 miles long and covers 892 ha in area, located in Surrey. It is the only area of stable box scrub in the UK and is featured on the steep chalk slopes where the Mole River has cut into the North Downs Escarpment, creating Mole Gap. The SAC is also supports a wide range of calcareous grassland types on steep slopes and exhibits a wide range of structural conditions ranging from short turf through to scrub margins and is particularly important for rare vascular plants including orchids. Yew woodlands have also been formed within the SAC by invasion of chalk grassland and from development of beech woodland following destruction of the beech over-storey. European dry heaths and beech woodlands are also present within the SAC. Protected species also include great crested newt (*Triturus cristatus*) and Bechstein's bat (*Myotis bechsteinii*).

1.1.2 Mole Gap to Reigate Escarpment SAC is designated for the following:

- Annex I habitats that are a primary reason for selection of this site:
    - Natural box scrub
    - Dry grasslands and scrublands on chalk or limestone (important orchid sites)
    - Yew dominated woodland
- Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site:
    - European dry heaths
    - Beech forests on neutral to rich soils
- Annex II species present as a qualifying feature, but not a primary reason for selection:
    - Great crested newt
    - Bechstein's bat

1.1.3 The conservation objectives of the SAC are to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;

- The extent and distribution of qualifying natural habitats and habitats of qualifying species
- The structure and function (including typical species) of qualifying natural habitats
- The structure and function of the habitats of qualifying species
- The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely
- The populations of qualifying species, and,
- The distribution of qualifying species within the site

1.1.4 The principal risks to site integrity according to the Natural England Site Improvement Plan[1] are as follows:

- Disease – pressure/threat to natural box scrub.
- Inappropriate scrub control – pressure to dry grasslands and scrublands on chalk or limestone (important orchid sites)
- Change in land management – threat to dry grasslands and scrublands on chalk or limestone (important orchid sites)
- Public access/disturbance – threat to dry grasslands and scrublands on chalk or limestone (important orchid sites), great crested newts and Bechstein's bat.
- Air pollution: risk of atmospheric nitrogen deposition – threat to European dry heaths, natural box scrub, dry grasslands and scrublands on chalk or limestone (important orchid

[1] http://publications.naturalengland.org.uk/publication/5966636066537472 [Accessed 22nd March 2018]

sites), beech forests on neutral to rich soils, yew-dominated woodlands and Bechstein's bat.

1.1.5 AECOM was commissioned jointly by Tandridge District Council, Mole Valley District Council and Reigate & Banstead Borough Council to analyse the risks posed to the European site through the last of these pathways, air quality, as a result of proposed growth in the three authorities to 2033, including growth 'in combination' with surrounding authorities.

1.1.6 This specific report covers the aspects of the modelling and interpretation relevant to Reigate & Banstead.

2 Methodology

2.1.1 Vehicle exhaust emissions generally only have a local effect within approximately 200m of the centreline of the road. 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.

2.1.2 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. In extreme cases NOx can be directly toxic to vegetation but its main importance is as a source of nitrogen, which is then deposited on adjacent habitats. 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.

2.1.3 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 ($kgNha^{-1}yr^{-1}$).

2.1.4 A third pollutant included in this assessment is ammonia emissions from traffic. In ecological terms ammonia differs from NOx in that it is not only a source of nitrogen but can also be directly toxic to vegetation in relatively 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, and consistency with modelling being undertaken for Tandridge District Council for Ashdown Forest SAC, they have been included in AECOM's modelling, both in terms of atmospheric concentrations and as a source of nitrogen.

2.1.5 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 A series of road links within 200m of Mole Gap to Reigate Escarpment Special Area of Conservation (SAC) were identified for investigation. These links were chosen as they are all representative points on the busiest roads through the SAC and are also the roads likely to experience the greatest increase in flows over the period to 2033. As such, these are the roads where an air quality effect due to additional traffic growth is most likely to be observed.

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, as provided either by Surrey County Council, Highways England (regarding the M25) or, for more minor roads, specifically collected by AECOM for this project. Since the most recent traffic count data are for 2017, that year has been used as the base year for this modelling.

2.2.4 Since the emerging plans are backdated several years, this means that housing and employment development that has been delivered and occupied prior to 2017 is allowed for in the measured baseline flows. However, this is also true for all other local authorities, so there is no disparity in treatment of local authorities in the modelling. Development in Reigate & Banstead, Tandridge and Mole Valley that has been consented but not actually completed/occupied does not appear in the baseline flows and is instead added to the modelled future (2033) Do Something scenario as this development would not have been contributing traffic to the road network at the time traffic counts were undertaken.

2.2.5 The Do Nothing scenario is the term used in this report to describe the future flows on the same roads by 2033, without consideration of the role of the Reigate & Banstead Plan, Tandridge Local Plan and Mole Valley Local Plan. This therefore presents the expected contribution of other plans and projects to flows by 2033, outside these three authorities. An assessment year of 2033 has been selected for the future scenario as this is the year at which Local Plan traffic will be at its greatest. The scenario is calculated by extrapolating the observed traffic data. The Do Nothing scenario adds all traffic growth from 2017 to 2033 that will result in additional journeys on the modelled road links.

2.2.6 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 between 2017 and 2033 because:

1. Since most commence in 2006 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 over the period 2017 to 2033 because most adopted plans for the boroughs/districts immediately around the SAC finish prior to 2033. This means that there will be several years of growth which is not covered by most adopted plans.

2.2.7 Expected development in these authorities over the period 2017 to 2033 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[2]) regarding 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 2033 and beyond, using growth assumptions that are regularly updated and distributed to the level of Middle-Layer Super Output Area and of being an industry standard database tool across England meaning that modelling exercises that use TEMPRO will have a high degree of consistency.

2.2.8 The other authorities immediately surrounding Mole Gap to Reigate Escarpment SAC are those in which development is most likely to influence annual average daily traffic flows through the SAC.

2.2.9 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. Tandridge District Council, Mole Valley District Council and Reigate & Banstead Borough Council therefore commissioned AECOM to create a bespoke model for their authorities.

2.2.10 The bespoke modelling exercise adds traffic in the aforementioned three local authority plans into the existing Do Nothing modelling to create the Do Something scenario. The 2033 Do Something scenario reported in this document includes bespoke modelling for Tandridge District Council, Mole Valley District Council and Reigate & Banstead Borough Council, although the relative contribution of Reigate & Banstead Local Plan to that Do Something forecast is identifiable.

2.2.11 The Do Something scenario reflects the combined role of Tandridge District Council, Mole Valley District Council and Reigate & Banstead Borough Council by 2033, in addition to growth in other authorities and permitted but currently uncompleted planning applications. Detailed modelling of Local Plan/Neighbourhood Plan growth locations undertaken by the AECOM transport planning

[2] 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.

team was added to the adjusted TEMPRO growth for all other authorities. To build the Local Plan model, housing and employment sites in Tandridge District Council, Mole Valley District Council and Reigate & Banstead Borough Council were geographically assigned to 'distribution groups' across these authorities 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.

2.2.12 The 'in combination' growth scenario is therefore the Do Something flows, as these include existing traffic, all future journeys arising from within Tandridge District Council, Mole Valley District Council and Reigate & Banstead Borough Council due to the Local Plans (from AECOM's model), and future traffic arising from all other authorities (from TEMPRO, adjusted for expected higher growth rates in some authorities; the plans/growth rates used for these authorities are included in Appendix D). The difference between the Do Something scenario and the Do Nothing scenario illustrates the role of the Tandridge District Council, Mole Valley District Council and Reigate & Banstead Borough Council in changing future flows compared to what would be expected without the Local Plan proposals.

2.2.13 At the request of Tandridge District Council, six Do Something scenarios were modelled. Tandridge District Council is still developing its Local Plan. The Council asked AECOM to consider six different options for delivery of growth in the District, the difference between the six being the differing locations for a proposed Garden Village. The scenarios AECOM were asked to consider are as follows.

Scenario	Description
2A	Blindley Heath Garden Village Location
2B	South Godstone Garden Village Location
2C	Redhill Aerodrome Garden Village Location
2D	Blindley Heath and South Godstone Garden Village Location
2E	Blindley Heath and Redhill Aerodrome Garden Village Location
2F	South Godstone and Redhill Aerodrome Garden Village Location

2.2.14 The only difference between these scenarios is the distribution of growth in Tandridge District. For this reason, this Reigate & Banstead air quality impact assessment report only presents the results of Do Something Scenario 2F. This scenario was chosen as it is fairly representative of the highest flow scenarios on the most significant roads for Reigate & Banstead District (particularly the A217 which is the most affected road) and any difference between scenarios is attributable to Tandridge not Reigate & Banstead. The three links of relevance to Reigate & Banstead that lie within 200m of the SAC are:

- M25 between junction 8 and 9;
- A217 Reigate Hill south of the M25 junction; and
- B2032 Pebble Hill Road.

2.2.15 The traffic modelling indicated that none of the other modelled links were expected to experience any increase in flows due to growth in Reigate & Banstead. They are therefore not discussed in this report.

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 based on the assessment methodology presented in Annex F of the Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 1 (HA207/07)[3] for the assessment of impacts on sensitive designated ecosystems due to highways works[4]. Background data for NOx and NO_2 were sourced from the Department of

[3] Design Manual for Roads and Bridges, HA207/07, Highways Agency

[4] DMRB advocates a nitrogen deposition velocity of 0.1 cms^{-1} for non-woodland vegetation and that velocity is therefore used in AECOMs modelling.

Environment, Food and Rural Affairs (Defra) background maps[5]. Background data for ammonia was sourced from the UK Air Pollution Information System (APIS) website.

2.3.2 The DMRB does not provide a method for forecasting ammonia emissions from traffic. A method has therefore been devised for this modelling in order to be consistent with the modelling being undertaken for Tandridge District Council at Ashdown Forest. The methodology for this is presented in detail in Appendix C.

2.3.3 The background air quality data for the relevant kilometre grid square is obtained from the UK Air Pollution Information System; ADMS-Roads is then used to model the traffic emissions for the baseline scenario, drawing upon the 2017 measured traffic counts, vehicle speeds and percentage heavy duty vehicles. Because air quality models like ADMS-Roads are known to underestimate emissions very close to the road in certain environments it is necessary to apply a verification factor to make a correction. This either comes from specific recent measurement data for the relevant roads, or (where that is unavailable or cannot be obtained within the project timescales: a minimum of 3-6 months of data are required) a professional judgment is made as to a suitable factor based on experience of other similar environments. Traditionally, for rural areas, the factor is generally 1.5 but in Ashdown Forest the monitoring data suggested that a factor of 3 was more appropriate for that area. In this modelling therefore AECOM applied the higher factor both for consistency with the Ashdown Forest work and to be precautionary. It is important to note however that a factor of 3 is higher than would normally be expected in a rural area.

2.3.4 Given that the assessment year (2033) 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[6] as well as that of central government[7]. Background nitrogen deposition rates were sourced from the Air Pollution Information System (APIS) website[8]. 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[9]. There is also an improving trend for nitrogen deposition, although the rate of improvement has been much lower than for NOx[10]. The current DMRB guidance for ecological assessment suggests reducing nitrogen deposition rates by 2% each year between the base year and assessment year. However, due to some uncertainty as to the rate with which projected future vehicle emission rates and background pollution concentrations are improving, the precautionary assumption has been made in this assessment that not all improvements projected by DMRB (for nitrogen deposition) or Defra (for NOx concentrations) will occur. With regards to background ammonia concentrations; as there is greater uncertainty associated with rates of improvement over time, background concentrations have been kept the same through all assessment years.

2.3.5 Therefore, the air quality calculations assume that conditions in 2023 (an approximate midpoint between the base year and the year of assessment) are representative of conditions in 2033 (the year of assessment). The effect on the 2033 data is equivalent to assuming a 0.75% per annum improvement in background NOx concentrations and nitrogen deposition rates between 2017 and 2033. The approach of not assuming all projected improvements occur (known as Gap Analysis) is accepted within the professional air quality community and accounts for known recent improvements in vehicle technologies (new standard Euro 6/VI vehicles), whilst excluding the more distant and therefore more uncertain projections on the evolution of the vehicle fleet. No discussion is made in this analysis of the UK Government's recent decision to ban the sale of new petrol and diesel vehicles from 2040 since it would not affect the time period under consideration, but that announcement illustrates the general long-term direction of travel for

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[5] Air Quality Archive Background Maps. Available from: http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html

[6] http://www.iaqm.co.uk/text/position_statements/vehicle_NOx_emission_factors.pdf

[7] 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

[8] Air Pollution Information System (APIS) www.apis.ac.uk

[9] Emissions of nitrogen oxides fell by 69% between 1970 and 2015. Source: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/579200/Emissions_airpollutants_statisticalrelease_2016_final.pdf [accessed 08/06/17]

[10] 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.

roadside air quality in the UK and underlines that allowing for improvements in both vehicle emissions factors and background rates of deposition over long timescales is both appropriate and realistic.

2.3.6 Annual mean concentrations of NOx were calculated at varied intervals back from each road link up to a maximum of 200m, with the closest distance being the closest point of the designated site to the road. Predictions were made using the latest version of ADMS-Roads using emission rates derived from the Defra Emission Factor Toolkit which utilises traffic data in the form of 24-hour Annual Average Daily Traffic (AADT), %HDV and average speed. The tables in Appendix A present the calculated changes in NOx concentration, nitrogen deposition and acid deposition 'in combination' (i.e. the difference between Do Something and the 2017 Base case) and the role played by Local Plan development compared to that which would occur in any case over the plan period (i.e. the difference between Do Something and Do Nothing).

2.3.7 In ecologically interpreting the air quality data habitat data has been used taken from MAGIC (www.magic.gov.uk), verified with aerial photography and by reference (where appropriate) to SSSI citations (such as for the lichen locations) or any published reports (notably a report produced by RPS for Stansted Airport which is relevant to the M25).

2.3.8 In addition to conventional housing and employment development, there is a proposal for a new Energy from Waste facility at Lambs Business Park, South Godstone, in Tandridge District. This is included in the draft Surrey Waste Local Plan. The proposed facility is located 9.9km from Mole Gap to Reigate Escarpment SAC and is thus on the outer edge of the 10km zone beyond which the Environment Agency would normally not require any consideration of NOx, ammonia or nitrogen deposition effects on European sites on the basis that at such distances the change in concentrations or deposition rates due to the stack emissions of all but the largest facilities will be negligible. The scheme is still under development and therefore its parameters have not been confirmed and no modelling has yet been undertaken. However, it is noted that paragraph 8.9.32 of the Waste Local Plan (version consulted upon between late 2017 and February 2018) states that *'Applications for Energy from Waste or similar technologies should demonstrate the facility will not have an adverse air quality effect on internationally designated sites within a 10km radius*'. As such, this issue will be addressed in detail once a full scheme is developed and, if necessary to protect the integrity of the SAC, mitigation will be a legal requirement in order to obtain an Environment Agency permit to operate. As such, that proposed facility is not discussed in this HRA other than to note that the procedural mechanisms exist to ensure that it would not result in an adverse effect either alone or in combination with the growth modelled in this HRA.

3 Results

3.1 Traffic modelling

3.1.1 The flows forecast by 2033, and how these differ between Do Nothing (without the Reigate & Banstead, Mole Valley and Tandridge Local Plans but including growth in other authorities) and Do Something (*including* the Mole Valley, Reigate & Banstead and Tandridge Local Plans) are presented overleaf.

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

A	B	C	D	E	F
Link Description	**2017 Base AADT**	**2033 DN AADT (traffic growth excluding Reigate & Banstead, Mole Valley and Tandridge Local Plans but including growth in other authorities)**	**2033 DS AADT (traffic growth including Reigate & Banstead Local Plan, Mole Valley Local Plan and Scenario 2F of Tandridge Local Plan in addition to growth in other authorities)**	**Difference between 2017 Base and DS (i.e. traffic growth from all sources 'in combination' from 2017 to 2033)**	**Difference between DS and DN (i.e. relative contribution of growth in Reigate & Banstead, Tandridge and Mole Valley collectively)**
A217 Reigate Hill	22,261	26,217	31,836	9,575	5,619
M25 Junction 8 to 9	166,214	195,759	208,256	42,042	12,497
B2032 Pebble Hill	14,053	16,550	18,223	4,170	1,673

Table 2. Breakdown of Table 1 to show the relative contributions of Reigate & Banstead Local Plan to the change in flows between 2017 and 2033, expressed as AADT and as percentage contribution to the difference between DS and DN

Link ID	Reigate and Banstead Local Plan (AADT)
A217 Reigate Hill	2,723 (48%)
M25 Junction 8 to 9	4,707 (38%)
B2032 Pebble Hill	214 (13%)

Growth attributable to Reigate & Banstead, Tandridge and Mole Valley were all added to create the Do Something scenario. As such, the growth between 2017 and 2033 attributable to Reigate & Banstead alone is not directly visible by comparing Do Nothing and Do Something. Table 2 shows the growth attributable specifically to Reigate & Banstead both as AADT and as a percentage as the difference between Do Something and Do Nothing. The percentages in Table 2 can be applied to the difference between DS and DN in Appendix 1 to determine the relative contribution of the Reigate & Banstead Local Plan to ammonia, NOx, nitrogen deposition and acid deposition.

3.1.2 All links are forecast to experience an increase in traffic flows between 2017 and 2033 when all expected traffic growth sources (including the Reigate & Banstead Local Plan, Mole Valley Local Plan and Scenario 2F of Tandridge Local Plan) are taken into account (Column E of Table 1). Note that this traffic growth can be expected to occur incrementally over the plan period, matching the housing delivery trajectory. The contribution of the Reigate & Banstead Local Plan to traffic growth on the B2032 is small, probably reflecting the less significant nature of this road regarding journey to work routes for residents of Reigate & Banstead.

3.2 Air quality calculations

3.2.1 The SAC is located 70m from the M25 at its closest (most of the SAC is 100m or more from the M25). Within the SAC boundary the closest SSSI Management Unit to the M25 is Unit 23. The principal habitat in this unit is lowland calcareous grassland. In December 2017 the consultancy RPS undertook an HRA screening exercise for the Gatwick Runway 2 project that examined the potential for effects on this part of the SAC[11]. That report cited an ecological survey of Mole Gap to Reigate Escarpment within 200m of the M25 that was undertaken in June 2017[12]. In summary, the key finding of this survey work, amended in accordance with comments provided by Natural England, was that: '*based on the survey work carried out by RPS, this report concludes that the grassland within 200m of the M25 is currently of a condition unlikely to support SAC quality orchidaceous rich grasslands. Therefore, there is no potential effect for increase in traffic on the M25, as a result of LGW-2R, to have a significant effect with respect to the Annex 1 priority habitat important orchid sites'.* The same report also cited Natural England as confirming that neither natural box scrub nor yew-dominated woodland occur within Unit 23 (that located within 200m of the M25). There is also no heathland within the relevant part of the SAC. This was used as a basis to screen out air quality impacts of traffic growth on the M25 on the international interest features of the SAC.

3.2.2 Moreover, even with the forecast 'in combination' traffic growth to 2033 there is modelled to be a net *reduction* in nitrogen deposition of c. 1.8kgN/ha/yr at the closest point of the SAC to the M25 due to improvements in vehicle emission factors and reduction in background NOx concentrations and nitrogen deposition rates. As such, it is considered that traffic growth on the M25 will not result in a likely significant effect on the SAC due to the absence of SAC quality interest features within 200m of the M25 and the fact that the affected area will experience a net improvement in air quality to 2033.

3.2.3 The M25 is therefore not discussed further in this report which concentrates on the A217 Reigate Hill and the B2032 Pebble Hill.

Ammonia

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

3.2.5 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 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 even 'in combination' then no adverse effect will arise.

3.2.6 The habitats within 200m of the A217 and B2032 are primarily woodland but also (along the B2032) calcareous grassland. The SAC woodlands of Mole Gap to Reigate Escarpment are either yew woodland or beech forest. No critical level is suggested on APIS for beech woodland since the lichen and bryophyte interest of such habitat varies greatly. The higher critical level of 3 μm^{-3} is provided for yew woodland on the basis that these woodlands rarely have significant lichen flora. APIS associates calcareous grassland with a critical level for ammonia of 1 μm^{-3} because that threshold is automatically assigned to all habitats which can contain rare and/or

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[11] RPS (December 2017). Appendix 5. Gatwick Runway 2 – Mole Gap to Reigate Escarpment SAC & Ashdown Forest SPA/SAC Revised Habitat Regulations Assessment Report Stage 1 (Screening). https://www.gatwickairport.com/globalassets/publicationfiles/business_and_community/all_public_publications/second_runway/revised-draft-nps/appendix-5--report1-mole-gap-reigate-escarpment-sac-ashdown-forest-spasac-habitat-regs-stage-1-screen.pdf

[12] Mole Gap to Reigate Escarpment – Site Survey by RPS (June 8th 2017)

diverse bryophytes and lichens, depending on circumstances and location. However, experience indicates that an interesting terricolous lichen flora will generally only develop in calcareous grasslands where the grassland sward (the SAC feature) has itself been damaged, exposing bare ground for lichen colonisation. The calcareous grasslands of the underlying SSSI are noted for their higher plants (particularly orchids) but not for their terricolous lichen interest, with the exception of '*Areas of open turf at Burford Bridge Ridge and Juniper Top* [which] *support a rich lichen flora with many noteworthy species including Toninia caeruleonigricans and Verrucaria mutabilis*'[13]. Both of these locations are remote from the A217 and B2032. Even when present lichens, while of interest in themselves, are rarely integral to the conservation status of the calcareous grassland sward for the reasons already cited. For this analysis therefore the critical level of 3 μm^{-3} is used as a reference threshold for the parts of the SAC within 200m of the A217 and B2032.

3.2.7 The modelling indicates that the 3 μm^{-3} critical level at the modelled transects along the A217 is not exceeded and is not forecast to be exceeded. Along the B2032 the critical level is exceeded, but only within 5m of roadside. Beyond this distance ammonia concentrations are modelled to be below the critical level and to remain so by 2033 even allowing for 'in combination' traffic growth. Therefore, using this critical level, no direct toxicity effects of ammonia are expected on the habitats of the SAC.

Oxides of Nitrogen

3.2.8 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 2033 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. When assessing the likely effects of the planned growth in Reigate & Bantead Borough by 2033, it is useful to consider: i) the additional NOx emissions caused by growth in the region (DS - Proj BL); ii) the contribution of Reigate & Banstead growth to the additional emissions; and iii) the overall change in annual mean NOx concentrations by 2033, taking into account improvements in vehicle emissions standards as applied to both existing and future traffic (DS - BL).

3.2.9 Based on background mapping, adjusted for the effect of the road, the air quality calculations provided in Appendix A show that the baseline NOx concentrations are modelled to be above the 30 μgm^{-3} general Critical Level for vegetation at the roadside along all transects.

Likely significant effects

3.2.10 The additional NOx emissions to the closest part of the SAC along the B2032 due to traffic growth 'in combination' (column 'DS-ProjBL' in Appendix A) would be approximately 17 μgm^{-3} (57% of the critical level) by 2033, although it would drop away quickly, falling nearly 50% by 5m from the road and falling further to 3.85 μgm^{-3} (10% of the critical level) by 25m from the road. The worst-case contribution of Reigate & Banstead Local Plan to NOx (i.e. at the closest point to the road) would be 0.86 μgm^{-3} (3% of the critical level)[14].

3.2.11 The additional NOx emissions due to traffic growth 'in combination' to any part of the SAC along the A217 (column 'DS-ProjBL' in Appendix A) would be approximately 23.86 μgm^{-3} (80% of the critical level) by 2033, although it would also drop away quickly, falling nearly 50% by 5m from the road and falling further to 3.80 μgm^{-3} at 40m from the roadside. The worst-case contribution of Reigate & Banstead Local Plan to NOx is 6.42 μgm^{-3} (21% of the critical level)[15].

3.2.12 Using the metric '1% of the critical level' for determining whether likely significant effects can be dismissed 'in combination', these data illustrate that likely significant effects cannot be dismissed out of hand based purely on the proportional change in NOx concentrations due to growth. However, considering the change in NOx concentrations due to growth is only the first step in analysis and does not mean that an adverse effect on integrity will necessarily arise. Further analysis is needed to draw a conclusion on that matter, firstly to put the additional emissions within the context of an improving baseline and secondly to translate NOx concentrations into nitrogen deposition rates.

[13] SSSI citation
[14] 13% of the modelled difference between Do Something and Do Nothing in Appendix A
[15] 48% of the modelled difference between Do Something and Do Nothing in Appendix A

Appropriate Assessment

3.2.13 In practice, improvements in NOx emission factors would apply to the existing traffic flows as well as to the additional flows and the contribution of existing traffic to total volumes on the road network (and thus total NOx concentrations) is much larger than that of additional traffic. When a cautious allowance is made for improved emission factors applied to *all* traffic (existing and future), NOx is expected to remain above the critical level, but is forecast to experience a *net reduction* of c. 26 μgm^{-3} at the closest point of the SAC to the B2032 (as opposed to a net increase of 17 μgm^{-3}), compared to the baseline. The improvements in vehicle emission factors expected to 2033 are thus forecast to more than offset the increase in NOx from an increase in the volume of vehicle movements, although the improvement is considerably less than would be the case in the hypothetical scenario of no traffic growth. The same pattern is forecast at the roadside of the A272, where a net reduction of approximately 23 μgm^{-3} is forecast at the closest point to the road.

3.2.14 In summary, by 2033, NOx concentrations on both the B2032 and A217 are forecast to experience a large net reduction due to changes in vehicle emissions, notwithstanding the projected increase in traffic on both roads, including that attributable to the Reigate & Banstead Local Plan.

Nitrogen deposition

Appropriate Assessment

3.2.15 Since the ecologically significant role of NOx 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[16]. Calculating nitrogen deposition rates rather than relying purely on scrutiny of NOx concentrations has the advantage of being habitat specific and more directly relatable to effects on the ground. The critical level for NOx is entirely generic; in reality different habitats have varying tolerance to nitrogen.

3.2.16 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 2033 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 Reigate and Banstead by 2033, it is useful to consider: i) the additional nitrogen deposition caused by growth in the region (DS - Proj BL); ii) the contribution of Reigate & Banstead 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).

3.2.17 Critical loads are always presented as a range. The lowest part of the nitrogen Critical Load range has been used in this assessment. The lowest nitrogen critical load for woodland is 10kgN/ha/yr[17]. The lowest nitrogen critical load for calcareous grassland is 15kgN/ha/yr. The baseline for nitrogen deposition at both modelled links is above the Critical Load and has been modelled to be c.22-24 kgN/ha/yr at the closest points to the roads, declining to 16-17 kgN/ha/yr (still above the critical load for both woodland and calcareous grassland) by 200m from the road. The results are summarised in Table 4 below and presented in full in Appendix A.

3.2.18 Note that exceedance of the critical load does not necessarily mean that an adverse effect will arise from additional nitrogen, or that an adverse effect is already occurring, since a range of other factors influence whether vegetation will actually respond to incremental increase in nitrogen at a given location. Exceedance of the critical load can therefore only be taken to mean that the potential for an effect exists.

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[16] The difference in acid deposition rates between the scenario allowing for all traffic growth to 2033, and that assuming no traffic growth to 2033, is negligible for all modelled links. Acid deposition is therefore not discussed further in this document.

[17] APIS provides two woodland critical load ranges in the Site Relevant Critical Load tab for Mole Gap to Reigate Escarpment SAC: a broadleaved woodland range of 10-20 kgN/ha/yr and a coniferous woodland range of 5-15 kgN/ha/yr. However, the range for coniferous woodland is derived from research into northern pine and spruce forests and the lowest part of the load range (5 kgN/ha/yr) is driven by the lichen and bryophyte interest of those forests which are quite different from lichen poor yew woodland present at this SAC. A lower critical load of 10kgN/ha/yr is considered most appropriate for this SAC.

Table 4. Changes in nitrogen deposition at the roadside

Link/Transect	Habitat (associated SSSI Management Unit)	Nitrogen deposition due to all additional traffic 'in combination'	Contribution of Reigate & Banstead Local Plan to this nitrogen deposition	Summary of net change in deposition rate to 2033 taking account of both additional traffic and a forecast improving baseline
A217 Reigate Hill	Woodland (Management Unit 27)	2.42 kgN/ha/yr at the roadside, declining to c. 1kgN/ha/yr by 80m from the road	0.82 kgN/ha/yr at the roadside, declining to 0.44 kgN/ha/yr by 160m from the road	**Net reduction in deposition** of 1.95 kgN/ha/yr compared to baseline, even allowing for projected traffic growth
B2032 Pebble Hill	Calcareous grassland (Management Unit 36) Woodland (Management Unit 35)	2.19 kgN/ha/yr at the roadside dropping below 1kgN/ha/yr by 15m from the roadside and dropping further to 0.5 kgN/ha/yr by 115m from the roadside	0.14 kgN/ha/yr at the roadside, declining to a negligible 0.08 kgN/ha/yr by 10m from the roadside	**Net reduction in deposition** of 1.51 kgN/ha/yr compared to baseline, even allowing for projected traffic growth

3.2.19 At the closest areas of woodland to the A217 the worst-case forecast additional deposition due to total traffic growth is 2.42 kgN/ha/yr at the roadside, declining with distance such that it reduces 50% by 40m from the road and drops below 1kgN/ha/yr at 80m from the road. The contribution of Reigate & Banstead Local Plan to this nitrogen deposition would be 0.82 kgN/ha/yr[18] at the roadside of the A217, falling to 0.44 kgN/ha/yr by 160m from the road. This is a medium scale contribution using DMRB definitions[19]. At the closest areas of calcareous grassland and woodland to the B2032 (Pebble Hill) the worst-case additional deposition due to extra traffic is forecast to be c. 2.19 kgN/ha/yr at the roadside, declining steeply with distance, such that it reduces c. 50% by 10m from the roadside. The contribution of Reigate & Banstead Local Plan to nitrogen deposition at the roadside of the B2032 would be small (0.14 kgN/ha/yr or 1% of the critical load)[20], falling to a negligible 0.08 kgN/ha/yr at 10m from the road.

3.2.20 Most importantly, however, the deposition from additional traffic (irrespective of source) is forecast to be offset by a much larger reduction in background deposition over the same timescale due to improved vehicle emission factors. As a result a net *reduction* in deposition of 1.5 - 2 kgN/ha/yr (depending on link) is actually forecast at the roadside notwithstanding traffic growth.

3.3 Ecological significance

3.3.1 The modelling demonstrates that there will be a net decrease in nitrogen deposition to SAC habitats along the modelled links, notwithstanding the precautionary assumptions made in the modelling concerning improvements in NO_2 emission factors. **Accordingly, growth to 2033 will not have a significant in-combination adverse effect on the integrity of the SAC by way of contributing to any net increase in nitrogen deposition.** Therefore, the Local Plans will not prevent the SAC achieving its conservation objectives, even where those objectives involve seeking a net improvement in the conservation status of the SAC.

3.3.2 It is, however, worth considering whether the Local Plans could meaningfully retard the forecast improvement in nitrogen deposition rates that would otherwise arise in the absence of growth, and, if so, whether steps should be taken to reduce the emissions further as good stewardship. It must be stressed that this is a somewhat hypothetical comparison since, with an increasing population and increasing car ownership rates, it is extremely unlikely that there would be no increase in traffic flows between 2017 and 2033 just because of the absence of any Local Plans. However, it is precautionary to consider whether steps should be taken to reduce any retardation of improvement attributable to planned growth and thus increase the robustness of the conclusion of no adverse effects 'in combination'. This depends on the scale of retardation expected and whether it is likely to be ecologically meaningful. Paragraph 3.2.18 and the

[18] 48% of the modelled difference between Do Something and Do Nothing for this link in Appendix A
[19] These define a small change as 1-5% of the critical load, a medium change as 5-10% of the critical load and a large change as being above 10% of the critical load
[20] 14% of the modelled difference between Do Something and Do Nothing for this link in Appendix A

modelling in Appendix A identify that the forecast improvement in deposition rates would be materially less on both links (c. 2 kgN/ha/yr less at the roadside) due to all expected traffic growth cumulatively, than it would be in the hypothetical situation of no traffic growth at all. On the A217 the difference is forecast to still exceed 1 kgN/ha/yr at 70m from the roadside.

3.3.3 Critical Loads have been in use for a number of years and have been 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'*. However, more recent studies[21] comparing deposition rate with reduction in species richness and other parameters indicate that the response of some habitats to long-term nitrogen deposition is curved for most parameters[22]. Moreover, those studies also indicate that the effect on species richness of adding a given amount of nitrogen in many habitats is not simple, linear and additive as is often assumed (i.e. 'x' amount of further nitrogen equates to 'x' amount of vegetation effect irrespective of current nitrogen dose) but is heavily influenced by the existing nitrogen deposition rate and other factors. It has thus become clear that the response of vegetation to nitrogen deposition is more nuanced that the 'black and white' critical load concept suggests.

3.3.4 Unfortunately, it is not possible to examine nitrogen dose-response data for woodland in any detail as insufficient research has been undertaken into quantifying doses and responses for this habitat at varying background deposition rates. Elevated nitrogen deposition in general has certainly driven strong biogeochemical responses in woodlands with many authors documenting reductions in soil carbon-nitrogen ratio, acidification and increased nitrate leaching[23] and understory plants can be negatively affected by nitrogen inputs. However, the impact of nitrogen deposition on vegetation composition of woodlands is poorly understood partly due to the strong confounding influence that tree canopy structure places on ground flora species richness, cover and other parameters that might illustrate the influence of nitrogen deposition. The canopy does this through interception of light, rainfall and pollution and the effect of woodland management upon this structure also has a big influence on groundflora. It is therefore very difficult to determine whether a given amount of additional nitrogen will in practice result in a detectable effect on vegetation at a given point in a specific woodland. However, some idea can be gained from examining dose-response relationships in other habitats. A range of other habitats have been studied and doses of between 1.1 kgN/ha/yr and 2 kgN/ha/yr have been correlated in heathland, acid grassland and sand dunes with a reduction of species richness[24] of '1 species' at background deposition rates of c. 15-20 kgN/ha/yr. This is comparable to the scale of 'in combination' retardation forecast within c. 75m of the A217 and c. 10m of the B2032 at the same forecast background deposition rates. Note that 'reduction in species richness' only means that fewer species are recorded in a randomly placed quadrat. It does not mean species are 'lost' from the affected area; it simply means that at least one species occurs at a reduced frequency[25] and is therefore a relatively subtle metric.

3.3.5 Therefore, while a net improvement in nitrogen deposition is forecast along the A217, it is conceivable that any associated vegetation recovery might be somewhat more limited within 75m of the A217 and 10m of the B2032 than it would in a situation without any forecast traffic growth. However, even the worst-case outcome is relatively subtle (i.e. recovery in species richness being 1 species less than might otherwise be the case), the most affected location would be a band along the roadside with the rest of the SAC entirely unaffected and there is a distinct possibility that confounding factors (particularly related to canopy cover) could well prevent any vegetation effect from actually arising or being detectable As such, **it is considered that the 'in combination' retardation of improvement would not overturn the overall conclusion of no adverse effect on integrity due to the net reduction in nitrogen deposition by 2033.** However, the scale of the forecast retardation is such that it **is** considered advisable that steps are introduced to minimise the additional nitrogen deposition due to traffic growth on the A217 and B2032 and to monitor air quality and vegetation as a matter of good stewardship.

[21] Compiled and analysed in 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.
[22] Ibid. paragraph 5 page ii
[23] Ibid. Section 7.3, page 65
[24] 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 (more desirable) species appears to be masked by an increase in the frequency of more competitive (less desirable) species.
[25] Ibid page 39

3.3.6 Each local authority would only fairly be responsible for its own contribution to any steps so it is also important to consider the specific role played by growth in Reigate & Banstead on each link. On the B2032 the contribution of growth in Reigate & Banstead is sufficiently small (c. 1% of the critical load for nitrogen deposition at the roadside, falling to a negligible level by 10m from the roadside) that it will not play any meaningful role retarding the improvement. In other words, even with housing and employment growth in Reigate & Banstead Borough the forecast improvement in nitrogen deposition rate on the B2032 is barely any different than it would be with no traffic growth at all (an improvement of 3.6 kgN/ha/yr compared to one of 3.7 kgN/ha/yr with no traffic growth). In contrast, growth in Reigate & Banstead is forecast to be responsible for approximately 50% of expected traffic growth on the A217 to 2033 and while this is still not sufficient to result in a net deterioration in nitrogen deposition, it does translate into a retardation of improvement of 0.8 kgN/ha/yr at the closest point of the A217.

3.3.7 Firstly, the local authority should introduce a strong sustainable transport policy. In consultation on Core Strategies and Local Plans elsewhere in Surrey, local authorities four broad types of mitigation measure have been identified:

- Behavioural measures and modal shift - reducing the amount of traffic overall;
- Traffic management - modifying traffic behaviour to control where emissions are generated;
- Emissions reduction at source - reducing the emissions level per vehicle; and
- Roadside barriers - reducing the impact on the public of emissions.

3.3.8 Measures have already been developed for the Reigate & Banstead Local Plan to cover the first two of these categories (the third and fourth being outside the remit of local planning policy). Through the planning system the Council can secure a range of sustainable travel options and choices to reduce the impact and consequence of the significant travel movements that take place within and across the borough. This will include working with partners such as Surrey County Council (as the Highway Authority) and the Highways Agency, to promote travel options which, amongst other things, recognise the importance of – but reduce dependency on – the car, and promote alternative transport choices. In addition, the planning system can also promote more sustainable communities by minimising the need for people to travel to essential services, for example, by:

a. directing development to accessible areas conveniently located near to the services and facilities needed to support communities
b. coordinating the provision of services and facilities as part of new development, and ensuring they are adaptable to change in the local population
c. promoting better travel choices for existing and new development
d. by helping improve the vitality and viability of local shopping centres and parades

3.3.9 Policy CS17 (Travel options and accessibility) of the adopted Reigate & Banstead Core Strategy provides the policy basis for these interventions. The policy is reproduced overleaf.

Policy CS17 : Travel options and accessibility
The Council will work with Surrey County Council, the Highways Agency, rail and bus operators, neighbouring local authorities and developers to: 1. Manage demand and reduce the need to travel, by: a. Allocating land for development and directing development to accessible locations in the borough b. Securing provision of - or easy access to - services, facilities and public transport as part of new development. 2. Improve the efficiency of the transport network, by: a. Enhancing public interchange facilities in Redhill and Horley town centres and promoting Redhill/ Reigate as a transport hub b. Delivering improvements to the road network to meet all street users' needs, enhance accessibility along key corridors and accommodate the forecast increase in journeys. 3. Facilitate sustainable transport choices, by: a. Improving travel options through enhanced provision for bus, rail, walking, cycling and bridleways b. Promoting walking and cycling as the preferred travel option for shorter journeys c. Promoting non-car travel d. Requiring the provision of travel plans and transport assessments for proposals which are likely to generate significant amounts of movement e. Seeking to minimise parking provision in the most sustainable locations, and secure adequate parking provision relative to patterns of car ownership elsewhere.
This policy will be implemented through: • DMP policies, including in relation to sustainable transport routes and travel plans • Design and Parking SPD, including parking standards and guidance on parking provision • Green Infrastructure Strategy, including walking and cycling routes • Surrey County Council's Local Transport Plan • partnership working with the Highways Authority, transport infrastructure providers and neighbouring authorities • developer contributions through Section 106 payments and/or Community Infrastructure Levy • consideration and determination of planning applications and appeals. Indicators used to monitor this policy will include: • the location of new development in relation to public transport services • the delivery of travels plans as applicable • the delivery of travel and transport projects in line with the Infrastructure Delivery Plan.
Evidence base: • Surrey Local Transport Plan (3). • Transport Assessment. • Redhill Transport Modelling • Infrastructure Delivery Plan.

3.3.10 This is partly reflected and expanded upon in Policy TAP1 (Access, parking and servicing) of the Reigate & Banstead Development Management Plan, although this policy is largely concerned with the responsibilities that will be placed upon individual planning applications. The policy is reproduced overleaf.

Policy TAP1 - Access, parking and servicing

1) All types of development, across the borough, will be required to:
   a) Provide safe and convenient access for all road users, in a way which would not:
      i. unnecessarily impede the free flow of traffic on the public highway, or compromise pedestrians or any other transport mode, including public transport and cycling.
      ii. materially exacerbate traffic congestion on the existing highway network.
      iii. increase the risk of accidents or endanger the safety of road users including pedestrians, cyclists, and other vulnerable road users.
      iv. All of the above should include consideration of cumulative impacts of development in the locality.
   b) Incorporate a highway design and layout that:
      i. complies with currently adopted highway standards and guidance (including roads which will not be adopted by the Highways Authority, unless evidence can be provided to clearly demonstrate a scheme would be safe, accessible and in accordance with other policies).
      ii. provides adequate access in particular with regard to circulation, manoeuvring, turning space, visibility splays and provision for loading/unloading for an appropriate range of vehicles.
      iii. Allows for access by service vehicles (including refuse vehicles) and emergency vehicles at all times without restriction, including adequate width to ensure there is no obstruction from parked vehicles. On existing road layouts, new development must not materially worsen the existing access for service and emergency vehicles and look to improve it where possible.
      iv. achieves a permeable highway layout, connecting with the existing highway network safely and includes safe access for pedestrians and cyclists.
      v. Provides sufficient visibility and lighting for the safe and convenient use of the roads, cycle tracks, paths and parking places.
   c) Include car parking and cycle storage for residential and non-residential development in accordance with adopted local standards (see Annex 4). Development should not result in unacceptable levels of on-street parking demand in existing or new streets.
   d) Demonstrate that if the development would result in the loss of existing car parking spaces that there is no need for these car parking spaces.
   e) Incorporate pedestrian and cycle routes within and through the site, linking to the wider sustainable transport network where possible, especially in and to the borough's town centres.
   f) Provide electric vehicle charging points.
   g) Remove any dropped kerbs and crossovers made redundant by the development and reinstate the footway/verge.
2) Planning applications will be looked upon favourably where they do not have unacceptable transport impacts (including cumulative impacts) or where they provide improvements that would make them acceptable.

Policy TAP1 - Access, parking and servicing (contd.)

3) For all developments which are likely to generate significant amounts of movement, a Transport Assessment or a Transport Statement will be required.
4) Provision of the following should be considered and are encouraged in new development:
   a) Shared use of private parking provision for public parking when not in use
   b) Initiatives to increase travel by more sustainable options and help reduce the impact and frequency of travel by individual private car journeys (such as car pools/car clubs) to and from the development.

3.3.11 The implications of these policies cannot be directly reflected in the air quality modelling as their benefits are difficult to quantify, but their effectiveness can be indirectly assessed through monitoring at regular intervals over the plan period, including air quality monitoring. NO_2 monitoring of the SAC within 200m of the A217 can also be used to both ground-truth the modelled results presented in this report. The air quality monitoring would be accompanied by vegetation monitoring of transects within the SAC perpendicular to the A217 which would aim to establish the current botanical condition and whether there was any identifiable qualitative effect over the plan period that could be linked to any change in NOx concentrations over the same transects. This would enable the forecast positive net trend to be confirmed but also determine whether existing sustainable transport initiatives were proving effective and provide a trigger for introducing additional measures. Note that the monitoring would not be scrutinising harm to the SAC, as that would be too late to prevent an adverse effect; rather it would be monitoring for evidence of a negative trend before any harm manifested and enable the introduction of further measures to reverse such a trend.

3.4 Recommendation

3.4.1 The Council should therefore work with other local authorities (particularly Mole Valley District Council and Tandridge District Council in the first instance), land managers, and strategic highway authorities to develop a framework by which forecast improvements in roadside air quality along the A217 Reigate Hill can be monitored, both in order to confirm that forecast improvements are occurring as predicted and to facilitate introduction of supplementary measures[26] beyond those that will already be implemented by Core Strategy policy CS17 and Development Management policy TAP1, if required. This is in line with the approach to the same issue being undertaken by other Surrey authorities in their Core Strategies and Local Plans with regard to Thames Basin Heaths SPA.

[26] These could include adjustment of speed limits, measures to reduce congestion if relevant, adjustments to site management, developing a scheme with land managers to address other nitrogen sources (such as agriculture), introducing specific initiatives such as improved bus services between key destinations to further reduce private car use, encouraging additional electric vehicle charging points in key locations, introducing a low emission zone, re-routing of certain traffic such as HGVs, or (as a worst-case outcome) adjusting the planned housing and/or employment levels during five-yearly core strategy reviews.

4 Conclusion

4.1.1 The modelling demonstrates that there will be a net decrease in nitrogen deposition to SAC habitats along the modelled links, notwithstanding the precautionary assumptions made in the modelling concerning improvements in NO_2 emission factors. Accordingly, growth to 2033 will not have a significant in-combination adverse effect on the integrity of the SAC by way of contributing to any net increase in nitrogen deposition. Therefore, the Local Plans will not prevent the SAC achieving its conservation objectives, even where those objectives involve seeking a net improvement in the conservation status of the SAC.

4.1.2 Moreover, the forecast scale of 'in combination' retardation of improvement would not overturn the overall conclusion of no adverse effect on integrity due to the net reduction in nitrogen deposition by 2033. However, the scale of the forecast retardation is such that it **is** considered advisable that steps are introduced to minimise the additional nitrogen deposition due to traffic growth on the A217 and B2032 and to monitor air quality and vegetation.

4.1.3 Therefore, Council should therefore work with other local authorities (particularly Mole Valley District Council and Tandridge District Council in the first instance), land managers, and strategic highway authorities to develop a framework by which forecast improvements in roadside air quality along the A217 Reigate Hill can be monitored, both in order to confirm that forecast improvements are occurring as predicted and to facilitate introduction of supplementary measures[27] beyond those that will already be implemented by Core Strategy policy CS17 and Development Management policy TAP1, if required. This is in line with the approach to the same issue being undertaken by other Surrey authorities in their Core Strategies and Local Plans with regard to Thames Basin Heaths SPA.

4.1.4 It should be borne in mind that the assessment undertaken to inform this conclusion is precautionary. For example:

- The Design Manual for Roads and Bridges and Defra guidance recommend making a 2% reduction per annum in background emissions/deposition rates throughout the period from base year to assessment year in order to allow for improvements such as the introduction of Euro6 standard vehicles. AECOM took a considerably more cautious approach in this modelling which could therefore prove to underestimate improvements in NOx and nitrogen deposition.
- This modelling takes no account of the Government's 2017 announcement to ban the sale of new petrol and diesel cars by 2040, or the possibility that this date may be brought forward. In practice this policy may result in replacement of aspects of the vehicle fleet by non-diesel or petrol vehicles at a date materially earlier than 2040 and this would have a significant effect on reducing NOx and ammonia emissions from traffic.
- To account for dispersion model bias, the predicted road contribution output from the model was adjusted by a factor of **3** for both NH_3 and NO_2 to produce the results reported in Appendix A, with consequential effects on the nitrogen and acid deposition rates. The basis for this factor is from recent professional experience having verified models for other studies undertaken on behalf of Tandridge District Council in East Sussex. However, for this site it represents an intentionally conservative adjustment factor in lieu of site-specific NO_2 or NH_3 monitoring data with which to verify the model. It could therefore prove to be an overestimate of emissions, particularly for NO_2 (and thus nitrogen deposition).
- This conclusion assumes that the woodland adjacent to the A217 and B2032 does in fact constitute SAC quality yew woodland and/or beech forest. At time of writing this has not been verified on the ground. The Management Unit within 200m of the A217 Reigate Hill is Unit 25. The principal habitat in this management unit is 'broadleaved mixed and yew

[27] Which could include adjustment of speed limits, adjustments to site management, developing a scheme to address other nitrogen sources (such as agriculture), introducing specific initiatives such as improved bus services, encouraging additional electric vehicle charging points in key locations, introducing a low emission zone or re-routing of certain traffic such as HGVs, or (as a worst-case outcome) adjusting the planned housing and/or employment levels during five-yearly core strategy reviews.

woodland'. The SSSI condition assessment describes the composition of this woodland further: '*Yew, Ash and Beech dominated woodland with Oak and Birch with Hazel, Hawthorn, Dog rose, Privet and Holly understory. Ground flora is Bramble, Ivy, Dogs mercury, Wild strawberry, Early dog-violet and chalk grassland species in the open glades and adjacent to tracks. Some Horse Chestnut, laurel and Sycamore adjacent to houses. Areas of secondary woodland probably resulting from the 1987 Storm are being colonised with Sycamore and Buddlea although there are signs that this has/is being controlled. Has good and varied structure and plenty of standing and fallen deadwood, reasonable regeneration of key species but some attention needs to be paid to undesirables colonising the clearings and glades'*[28]. Yew, ash and beech dominated woodland would constitute the SAC qualifying habitats. However, this description (dating from the last Condition Standards Monitoring survey) applies to the Management Unit as a whole, which is 20ha in area and stretches up to 1km from the A217. Although woodland habitat is certainly present adjacent to the A217, there is no information available from desk study as to whether that woodland constitutes SAC qualifying yew woodland or beech forest.

4.1.5 Given the extremely precautionary nature of the modelling it is considered that it would be inappropriate for the Councils to undertake any more active interventions (e.g. changing speed limits etc.), particularly since the modelling is forecasting a net improvement in NOx and nitrogen deposition. However, a commitment to initiating monitoring of air quality on the affected links (particularly the A217) is advisable for 3 reasons:

- The first 3-6 months of monitoring may enable forecasts to be revised downwards if it confirms a lower verification factor is appropriate;
- If undertaken for long enough (e.g. for 6 months every 5 years) then it may confirm that the allowance currently made in the model for improvements in NO_2 emission factors is actually over-cautious, which would also enable forecasts to be revised downwards; and
- If on the other hand it actually shows that NO_2 concentrations are not declining as forecast (which is not expected as there is already a reducing trend for NOx and oxidised nitrogen deposition at this European site according to APIS), it can then allow further measures to be triggered if necessary. The decision over these could be tied to each 5-year review of the Local Plan. Note that the monitoring would not be monitoring for damage to the SAC but for air quality trends not matching forecasts.

[28] https://designatedsites.naturalengland.org.uk/UnitDetail.aspx?UnitId=1008870

Appendix A. Detailed Modelling Results

Ammonia Concentrations

B2032 Pebble Hill Road

	Annual Mean NH_3 (ug/m^3)						
Distance From Road (m)	**BL Baseline**	**Proj BL Proj Baseline**	**DM (Base 2033)**	**DS (Scn1 2033)**	**Change (DS-DM)**	**(DS-ProjBL)**	**(DS-BL)**
0.00	3.42	3.35	3.71	3.95	0.24	0.60	0.53
5.00	2.46	2.42	2.62	2.74	0.13	0.32	0.28
10.00	2.18	2.15	2.30	2.39	0.10	0.25	0.21
15.00	2.00	1.98	2.10	2.17	0.08	0.20	0.17
20.00	1.89	1.86	1.96	2.02	0.06	0.16	0.14
25.00	1.83	1.81	1.90	1.95	0.06	0.14	0.12
30.00	1.77	1.76	1.84	1.89	0.05	0.13	0.11
35.00	1.73	1.71	1.79	1.83	0.04	0.12	0.10
40.00	1.70	1.69	1.76	1.80	0.04	0.11	0.09
45.00	1.68	1.67	1.73	1.77	0.04	0.10	0.09
50.00	1.66	1.65	1.71	1.74	0.04	0.10	0.08
55.00	1.65	1.63	1.69	1.72	0.03	0.09	0.08
60.00	1.63	1.62	1.67	1.71	0.03	0.09	0.08
65.00	1.62	1.61	1.66	1.69	0.03	0.09	0.07
70.00	1.61	1.60	1.65	1.68	0.03	0.08	0.07
75.00	1.60	1.59	1.64	1.67	0.03	0.08	0.07
80.00	1.59	1.58	1.63	1.66	0.03	0.08	0.07
85.00	1.59	1.58	1.62	1.65	0.03	0.08	0.06
90.00	1.58	1.57	1.62	1.64	0.03	0.07	0.06
95.00	1.58	1.56	1.61	1.64	0.03	0.07	0.06
100.00	1.57	1.56	1.61	1.63	0.03	0.07	0.06
105.00	1.57	1.55	1.60	1.63	0.03	0.07	0.06
110.00	1.56	1.55	1.60	1.62	0.02	0.07	0.06
115.00	1.56	1.55	1.59	1.62	0.02	0.07	0.06
120.00	1.56	1.55	1.59	1.61	0.02	0.07	0.06
125.00	1.55	1.54	1.59	1.61	0.02	0.07	0.06
130.00	1.55	1.54	1.58	1.61	0.02	0.07	0.06
135.00	1.55	1.54	1.58	1.60	0.02	0.07	0.05
140.00	1.55	1.54	1.58	1.60	0.02	0.06	0.05
145.00	1.54	1.53	1.58	1.60	0.02	0.06	0.05
150.00	1.54	1.53	1.57	1.60	0.02	0.06	0.05
155.00	1.54	1.53	1.57	1.59	0.02	0.06	0.05
160.00	1.54	1.53	1.57	1.59	0.02	0.06	0.05
165.00	1.54	1.53	1.57	1.59	0.02	0.06	0.05
170.00	1.54	1.53	1.57	1.59	0.02	0.06	0.05
175.00	1.54	1.52	1.56	1.59	0.02	0.06	0.05
180.00	1.53	1.52	1.56	1.58	0.02	0.06	0.05

185.00	1.53	1.52	1.56	1.58	0.02	0.06	0.05
190.00	1.53	1.52	1.56	1.58	0.02	0.06	0.05
195.00	1.53	1.52	1.56	1.58	0.02	0.06	0.05
200.00	1.53	1.52	1.56	1.58	0.02	0.06	0.05

A217 Reigate Hill (Transect 1)

	Annual Mean NH_3 (ug/m^3)						
Distance	**BL**	**Proj BL**	**DM**	**DS**		**Change**	
From Road (m)	**Baseline**	**Proj Baseline**	**(Base 2033)**	**(Scn1 2033)**	**(DS-DM)**	**(DS-ProjBL)**	**(DS-BL)**
0.20	2.37	2.36	2.49	2.66	0.17	0.31	0.29
5.20	2.06	2.04	2.13	2.22	0.09	0.18	0.16
10.20	1.96	1.95	2.02	2.09	0.07	0.14	0.13
15.20	1.90	1.89	1.95	2.01	0.06	0.11	0.10
20.20	1.87	1.86	1.91	1.96	0.05	0.10	0.09
25.20	1.85	1.84	1.88	1.93	0.04	0.09	0.08
30.20	1.83	1.82	1.86	1.90	0.04	0.08	0.07
25.20	1.81	1.81	1.85	1.88	0.04	0.08	0.07
40.20	1.81	1.80	1.84	1.87	0.03	0.07	0.06
45.20	1.80	1.79	1.83	1.86	0.03	0.07	0.06
50.20	1.79	1.78	1.82	1.85	0.03	0.07	0.06
55.20	1.79	1.78	1.81	1.84	0.03	0.06	0.06
60.20	1.78	1.77	1.81	1.83	0.03	0.06	0.05
65.20	1.78	1.77	1.80	1.83	0.03	0.06	0.05
70.20	1.77	1.77	1.80	1.83	0.03	0.06	0.05
75.20	1.77	1.76	1.80	1.82	0.02	0.06	0.05
80.20	1.77	1.76	1.79	1.82	0.02	0.06	0.05
85.20	1.77	1.76	1.79	1.82	0.02	0.06	0.05
90.20	1.77	1.76	1.79	1.81	0.02	0.05	0.05
95.20	1.76	1.76	1.79	1.81	0.02	0.05	0.05
100.20	1.76	1.76	1.79	1.81	0.02	0.05	0.05
105.20	1.76	1.75	1.79	1.81	0.02	0.05	0.05
110.20	1.76	1.75	1.78	1.81	0.02	0.05	0.04
115.20	1.76	1.75	1.78	1.80	0.02	0.05	0.04
120.20	1.76	1.75	1.78	1.80	0.02	0.05	0.04
125.20	1.76	1.75	1.78	1.80	0.02	0.05	0.04
130.20	1.76	1.75	1.78	1.80	0.02	0.05	0.04
135.20	1.76	1.75	1.78	1.80	0.02	0.05	0.04
140.20	1.76	1.75	1.78	1.80	0.02	0.05	0.04
145.20	1.76	1.75	1.78	1.80	0.02	0.05	0.04
150.20	1.76	1.75	1.78	1.80	0.02	0.05	0.04
155.20	1.76	1.75	1.78	1.80	0.02	0.05	0.04
160.20	1.76	1.75	1.78	1.80	0.02	0.05	0.04
165.20	1.76	1.75	1.78	1.80	0.02	0.05	0.04
170.20	1.76	1.75	1.78	1.80	0.02	0.05	0.04
175.20	1.76	1.75	1.78	1.80	0.02	0.05	0.04
180.20	1.76	1.75	1.78	1.80	0.02	0.05	0.04
185.20	1.76	1.75	1.78	1.80	0.02	0.05	0.04
190.20	1.76	1.75	1.78	1.80	0.02	0.05	0.04
195.20	1.76	1.75	1.78	1.80	0.02	0.05	0.04
200.20	1.76	1.75	1.79	1.80	0.02	0.05	0.04

A217 Reigate Hill (Transect 2)

Distance From Road (m)	BL Baseline	Proj BL Proj Baseline	DM (Base 2033)	DS (Scn1 2033)	Change (DS-DM)	Change (DS-ProjBL)	Change (DS-BL)
	Annual Mean NH_3 (ug/m^3)						
4.60	2.14	2.13	2.22	2.34	0.11	0.21	0.20
9.60	2.03	2.02	2.09	2.18	0.09	0.16	0.15
14.60	1.95	1.94	2.00	2.07	0.07	0.13	0.12
19.60	1.90	1.89	1.94	2.00	0.06	0.11	0.10
24.60	1.86	1.86	1.90	1.95	0.05	0.10	0.09
29.60	1.85	1.84	1.88	1.93	0.04	0.09	0.08
34.60	1.83	1.82	1.86	1.90	0.04	0.08	0.07
39.60	1.81	1.80	1.84	1.88	0.04	0.08	0.07
44.60	1.80	1.79	1.83	1.86	0.03	0.07	0.06
49.60	1.79	1.78	1.82	1.85	0.03	0.07	0.06
54.60	1.78	1.78	1.81	1.84	0.03	0.06	0.06
59.60	1.78	1.77	1.80	1.83	0.03	0.06	0.05
64.60	1.77	1.76	1.80	1.82	0.03	0.06	0.05
69.60	1.77	1.76	1.79	1.82	0.02	0.06	0.05
74.60	1.76	1.76	1.79	1.81	0.02	0.06	0.05
79.60	1.76	1.75	1.78	1.81	0.02	0.05	0.05
84.60	1.76	1.75	1.78	1.80	0.02	0.05	0.05
89.60	1.76	1.75	1.78	1.80	0.02	0.05	0.04
94.60	1.75	1.75	1.78	1.80	0.02	0.05	0.04
99.60	1.75	1.75	1.77	1.80	0.02	0.05	0.04
104.60	1.75	1.74	1.77	1.79	0.02	0.05	0.04
109.60	1.75	1.74	1.77	1.79	0.02	0.05	0.04
114.60	1.75	1.74	1.77	1.79	0.02	0.05	0.04
119.60	1.75	1.74	1.77	1.79	0.02	0.05	0.04
124.60	1.75	1.74	1.77	1.79	0.02	0.05	0.04
129.60	1.75	1.74	1.77	1.79	0.02	0.05	0.04
134.60	1.75	1.74	1.77	1.79	0.02	0.05	0.04
139.60	1.75	1.74	1.77	1.79	0.02	0.05	0.04
144.60	1.75	1.74	1.77	1.79	0.02	0.05	0.04
149.60	1.75	1.74	1.77	1.79	0.02	0.05	0.04
154.60	1.75	1.74	1.77	1.79	0.02	0.05	0.04
159.60	1.75	1.74	1.77	1.79	0.02	0.05	0.04
164.60	1.75	1.74	1.77	1.79	0.02	0.05	0.04
169.60	1.75	1.74	1.77	1.79	0.02	0.05	0.04
174.60	1.75	1.74	1.77	1.79	0.02	0.05	0.04
179.60	1.75	1.74	1.77	1.79	0.02	0.05	0.04
184.60	1.75	1.74	1.77	1.79	0.02	0.05	0.04
189.60	1.75	1.74	1.77	1.79	0.02	0.05	0.04
194.60	1.75	1.74	1.77	1.79	0.02	0.05	0.04
199.60	1.75	1.74	1.77	1.79	0.02	0.05	0.04

NOx, Nitrogen Deposition and Acid Deposition

B2032 Pebble Hill Road

Distance From Road (m)	Annual Mean NOx (ug/m^3)							Annual Mean Total N Dep (kg N/ha/yr)							Annual Mean Total N Acid Dep (keq/ha/yr)						
	BL	Proj BL	DM	DS	Change			BL	Proj BL	DM	DS	Change			BL	Proj BL	DM	DS	Change		
	Baseline	Proj Baseline	(Base 2033)	(Scn1 2033)	(DS-DM)	(DS-ProjBL)	(DS-BL)	Baseline	Proj Baseline	(Base 2033)	(Scn1 2033)	(DS-DM)	(DS-ProjBL)	(DS-BL)	Baseline	Proj Baseline	(Base 2033)	(Scn1 2033)	(DS-DM)	(DS-ProjBL)	(DS-BL)
0.00	112.45	69.87	80.35	86.99	6.63	17.11	-25.47	23.89	20.18	21.35	22.38	1.03	2.19	-1.51	2.88	2.92	2.85	2.93	0.09	0.01	0.06
5.00	66.43	42.05	47.65	51.15	3.50	9.10	-15.28	20.10	17.04	17.70	18.40	0.70	1.36	-1.69	2.63	2.66	2.60	2.66	0.06	0.00	0.03
10.00	53.17	34.01	38.20	40.81	2.60	6.80	-12.36	18.94	16.10	16.61	17.21	0.60	1.11	-1.73	2.55	2.57	2.52	2.57	0.05	0.00	0.02
15.00	44.67	28.87	32.16	34.19	2.03	5.32	-10.48	18.18	15.50	15.90	16.44	0.53	0.94	-1.74	2.50	2.52	2.48	2.52	0.04	0.00	0.02
20.00	39.06	25.48	28.18	29.82	1.64	4.34	-9.24	17.67	15.09	15.43	15.92	0.49	0.83	-1.75	2.47	2.48	2.45	2.48	0.04	0.00	0.01
25.00	36.24	23.78	26.17	27.62	1.45	3.85	-8.61	17.41	14.89	15.19	15.66	0.47	0.77	-1.75	2.45	2.47	2.43	2.47	0.04	0.00	0.01
30.00	33.79	22.30	24.43	25.72	1.28	3.42	-8.07	17.18	14.71	14.99	15.43	0.45	0.72	-1.75	2.44	2.45	2.42	2.45	0.04	0.00	0.01
35.00	31.74	21.06	22.98	24.12	1.14	3.06	-7.62	17.00	14.56	14.81	15.24	0.43	0.68	-1.75	2.43	2.44	2.40	2.44	0.03	0.00	0.01
40.00	30.34	20.22	21.99	23.04	1.05	2.82	-7.31	16.87	14.46	14.69	15.11	0.42	0.65	-1.75	2.42	2.43	2.40	2.43	0.03	0.00	0.01
45.00	29.38	19.64	21.30	22.29	0.98	2.65	-7.09	16.77	14.39	14.61	15.02	0.41	0.63	-1.75	2.41	2.42	2.39	2.42	0.03	0.00	0.01
50.00	28.33	19.00	20.56	21.47	0.91	2.46	-6.86	16.68	14.31	14.52	14.92	0.40	0.61	-1.75	2.41	2.41	2.38	2.42	0.03	0.00	0.01
55.00	27.55	18.54	20.01	20.87	0.86	2.33	-6.69	16.60	14.26	14.46	14.85	0.39	0.59	-1.75	2.40	2.41	2.38	2.41	0.03	0.00	0.01
60.00	26.92	18.16	19.56	20.37	0.81	2.22	-6.55	16.54	14.21	14.40	14.79	0.39	0.58	-1.75	2.40	2.41	2.38	2.41	0.03	0.00	0.01
65.00	26.36	17.82	19.16	19.94	0.77	2.12	-6.42	16.49	14.17	14.35	14.74	0.38	0.57	-1.75	2.40	2.40	2.37	2.40	0.03	0.00	0.01
70.00	25.87	17.53	18.82	19.56	0.74	2.03	-6.31	16.45	14.14	14.31	14.69	0.38	0.56	-1.75	2.39	2.40	2.37	2.40	0.03	0.00	0.01
75.00	25.46	17.28	18.53	19.24	0.71	1.96	-6.22	16.41	14.11	14.28	14.66	0.38	0.55	-1.75	2.39	2.40	2.37	2.40	0.03	0.00	0.01
80.00	25.09	17.05	18.26	18.95	0.69	1.89	-6.14	16.37	14.08	14.25	14.62	0.37	0.54	-1.75	2.39	2.39	2.37	2.39	0.03	0.00	0.01
85.00	24.76	16.86	18.03	18.69	0.66	1.84	-6.07	16.34	14.06	14.22	14.59	0.37	0.53	-1.75	2.39	2.39	2.36	2.39	0.03	0.00	0.01
90.00	24.43	16.66	17.80	18.44	0.64	1.78	-5.99	16.31	14.03	14.19	14.56	0.37	0.53	-1.75	2.38	2.39	2.36	2.39	0.03	0.00	0.01
95.00	24.21	16.53	17.64	18.26	0.62	1.74	-5.94	16.29	14.02	14.17	14.54	0.37	0.52	-1.75	2.38	2.39	2.36	2.39	0.03	0.00	0.01
100.00	23.97	16.38	17.47	18.08	0.61	1.70	-5.89	16.27	14.00	14.15	14.52	0.36	0.52	-1.75	2.38	2.39	2.36	2.39	0.03	0.00	0.01
105.00	23.73	16.24	17.30	17.89	0.59	1.65	-5.84	16.25	13.98	14.13	14.49	0.36	0.51	-1.75	2.38	2.38	2.36	2.39	0.03	0.00	0.01
110.00	23.56	16.14	17.18	17.76	0.58	1.62	-5.80	16.23	13.97	14.12	14.48	0.36	0.51	-1.75	2.38	2.38	2.36	2.38	0.03	0.00	0.01
115.00	23.37	16.02	17.04	17.61	0.57	1.59	-5.76	16.21	13.96	14.10	14.46	0.36	0.50	-1.75	2.38	2.38	2.36	2.38	0.03	0.00	0.01
120.00	23.21	15.92	16.93	17.48	0.55	1.56	-5.73	16.20	13.95	14.09	14.45	0.36	0.50	-1.75	2.38	2.38	2.36	2.38	0.03	0.00	0.01
125.00	23.08	15.85	16.84	17.39	0.55	1.54	-5.70	16.19	13.94	14.08	14.43	0.36	0.50	-1.75	2.38	2.38	2.35	2.38	0.03	0.00	0.01
130.00	22.93	15.76	16.73	17.27	0.53	1.51	-5.67	16.17	13.93	14.06	14.42	0.36	0.49	-1.75	2.38	2.38	2.35	2.38	0.03	0.00	0.01
135.00	22.81	15.68	16.64	17.17	0.53	1.49	-5.64	16.16	13.92	14.05	14.41	0.35	0.49	-1.75	2.37	2.38	2.35	2.38	0.03	0.00	0.01
140.00	22.69	15.61	16.56	17.08	0.52	1.47	-5.61	16.15	13.91	14.04	14.40	0.35	0.49	-1.75	2.37	2.38	2.35	2.38	0.03	0.00	0.01
145.00	22.59	15.55	16.49	17.00	0.51	1.45	-5.59	16.14	13.90	14.04	14.39	0.35	0.49	-1.75	2.37	2.38	2.35	2.38	0.03	0.00	0.01
150.00	22.50	15.49	16.42	16.92	0.50	1.43	-5.57	16.13	13.90	14.03	14.38	0.35	0.48	-1.75	2.37	2.38	2.35	2.38	0.03	0.00	0.01
155.00	22.41	15.44	16.36	16.85	0.50	1.42	-5.55	16.12	13.89	14.02	14.37	0.35	0.48	-1.75	2.37	2.38	2.35	2.38	0.03	0.00	0.01
160.00	22.33	15.39	16.30	16.79	0.49	1.40	-5.54	16.12	13.88	14.02	14.36	0.35	0.48	-1.75	2.37	2.38	2.35	2.38	0.03	0.00	0.01
165.00	22.25	15.34	16.25	16.73	0.48	1.39	-5.52	16.11	13.88	14.01	14.36	0.35	0.48	-1.75	2.37	2.37	2.35	2.38	0.03	0.00	0.01
170.00	22.17	15.30	16.19	16.67	0.48	1.37	-5.50	16.10	13.87	14.00	14.35	0.35	0.48	-1.75	2.37	2.37	2.35	2.38	0.03	0.00	0.01
175.00	22.12	15.26	16.15	16.62	0.47	1.36	-5.49	16.10	13.87	14.00	14.35	0.35	0.48	-1.75	2.37	2.37	2.35	2.38	0.03	0.00	0.01
180.00	22.05	15.22	16.10	16.57	0.47	1.35	-5.48	16.09	13.87	13.99	14.34	0.35	0.48	-1.75	2.37	2.37	2.35	2.38	0.03	0.00	0.01
185.00	21.99	15.18	16.06	16.52	0.46	1.34	-5.47	16.09	13.86	13.99	14.34	0.35	0.47	-1.75	2.37	2.37	2.35	2.38	0.03	0.00	0.01
190.00	21.93	15.15	16.02	16.48	0.46	1.33	-5.46	16.08	13.86	13.98	14.33	0.35	0.47	-1.75	2.37	2.37	2.35	2.37	0.03	0.00	0.01
195.00	21.89	15.13	15.99	16.45	0.46	1.32	-5.45	16.08	13.85	13.98	14.33	0.35	0.47	-1.75	2.37	2.37	2.35	2.37	0.03	0.00	0.01
200.00	21.84	15.09	15.95	16.41	0.45	1.31	-5.44	16.07	13.85	13.98	14.32	0.35	0.47	-1.75	2.37	2.37	2.35	2.37	0.03	0.00	0.01

A217 Reigate Hill (Transect 1)

Distance From Road (m)	Annual Mean NOx (ug/m^3)							Annual Mean Total N Dep (kg N/ha/yr)							Annual Mean Total N Acid Dep (keq/ha/yr)						
	BL	Proj BL	DM	DS	Change			BL	Proj BL	DM	DS	Change			BL	Proj BL	DM	DS	Change		
	Baseline	Proj Baseline	(Base 2033)	(Scn1 2033)	(DS-DM)	(DS-ProjBL)	(DS-BL)	Baseline	Proj Baseline	(Base 2033)	(Scn1 2033)	(DS-DM)	(DS-ProjBL)	(DS-BL)	Baseline	Proj Baseline	(Base 2033)	(Scn1 2033)	(DS-DM)	(DS-ProjBL)	(DS-BL)
0.20	120.76	73.47	83.96	97.34	13.38	23.86	-23.42	22.47	18.10	18.81	20.52	1.71	2.42	-1.95	2.97	2.98	2.86	2.97	0.12	0.00	0.00
5.20	74.39	46.15	51.91	59.15	7.23	13.00	-15.25	20.01	16.23	16.67	18.03	1.36	1.80	-1.97	2.81	2.80	2.72	2.81	0.09	0.01	0.00
10.20	60.89	38.27	42.64	48.06	5.42	9.80	-12.83	19.23	15.67	16.02	17.26	1.25	1.59	-1.97	2.76	2.75	2.67	2.76	0.09	0.01	0.00
15.20	51.93	33.05	36.51	40.72	4.21	7.67	-11.21	18.70	15.29	15.57	16.74	1.17	1.45	-1.96	2.73	2.71	2.65	2.73	0.08	0.02	0.00
20.20	46.47	29.88	32.77	36.24	3.47	6.36	-10.23	18.36	15.05	15.30	16.41	1.11	1.36	-1.95	2.71	2.68	2.63	2.71	0.08	0.02	0.00
25.20	43.56	28.19	30.78	33.86	3.08	5.67	-9.70	18.18	14.93	15.15	16.24	1.09	1.31	-1.94	2.69	2.67	2.62	2.69	0.08	0.02	0.00
30.20	40.69	26.53	28.82	31.51	2.69	4.98	-9.18	18.00	14.80	15.01	16.07	1.06	1.26	-1.93	2.68	2.66	2.61	2.68	0.07	0.02	0.00
25.20	38.55	25.28	27.36	29.75	2.40	4.47	-8.79	17.87	14.71	14.90	15.94	1.04	1.23	-1.93	2.67	2.65	2.60	2.68	0.07	0.03	0.00
40.20	37.14	24.47	26.40	28.60	2.20	4.13	-8.54	17.78	14.65	14.83	15.85	1.02	1.20	-1.93	2.67	2.64	2.60	2.67	0.07	0.03	0.00
45.20	35.76	23.67	25.46	27.47	2.01	3.80	-8.29	17.69	14.59	14.76	15.77	1.01	1.18	-1.92	2.66	2.64	2.59	2.66	0.07	0.03	0.00
50.20	34.82	23.12	24.81	26.69	1.88	3.57	-8.12	17.63	14.55	14.71	15.71	1.00	1.16	-1.92	2.66	2.63	2.59	2.66	0.07	0.03	0.00
55.20	31.91	21.17	22.77	24.53	1.76	3.36	-7.38	17.58	14.52	14.67	15.66	0.99	1.15	-1.92	2.65	2.62	2.58	2.65	0.07	0.03	0.00
60.20	31.10	20.70	22.21	23.86	1.65	3.16	-7.24	17.53	14.48	14.63	15.61	0.98	1.13	-1.92	2.65	2.62	2.58	2.65	0.07	0.03	0.00
65.20	30.52	20.37	21.82	23.38	1.57	3.02	-7.13	17.49	14.46	14.60	15.58	0.98	1.12	-1.91	2.64	2.61	2.58	2.64	0.07	0.03	0.00
70.20	29.91	20.01	21.40	22.88	1.48	2.87	-7.03	17.45	14.43	14.57	15.54	0.97	1.11	-1.91	2.64	2.61	2.57	2.64	0.07	0.03	0.00
75.20	29.39	19.71	21.05	22.45	1.41	2.74	-6.93	17.42	14.41	14.55	15.51	0.96	1.10	-1.91	2.64	2.61	2.57	2.64	0.07	0.03	0.00
80.20	29.00	19.49	20.78	22.13	1.35	2.65	-6.87	17.40	14.39	14.53	15.49	0.96	1.09	-1.91	2.64	2.61	2.57	2.64	0.07	0.03	0.00
85.20	28.62	19.27	20.52	21.82	1.30	2.55	-6.80	17.37	14.38	14.51	15.47	0.96	1.09	-1.91	2.64	2.60	2.57	2.64	0.07	0.03	0.00
90.20	28.25	19.06	20.27	21.52	1.25	2.46	-6.74	17.35	14.36	14.49	15.44	0.95	1.08	-1.91	2.63	2.60	2.57	2.64	0.07	0.03	0.00
95.20	27.98	18.90	20.08	21.29	1.20	2.39	-6.69	17.33	14.35	14.48	15.43	0.95	1.08	-1.91	2.63	2.60	2.57	2.64	0.07	0.03	0.00
100.20	27.68	18.72	19.88	21.04	1.16	2.32	-6.64	17.32	14.34	14.46	15.41	0.95	1.07	-1.90	2.63	2.60	2.57	2.63	0.07	0.03	0.00
105.20	27.41	18.57	19.69	20.82	1.12	2.25	-6.59	17.30	14.33	14.45	15.40	0.94	1.07	-1.90	2.63	2.60	2.57	2.63	0.07	0.03	0.00
110.20	27.20	18.45	19.55	20.65	1.09	2.20	-6.56	17.29	14.32	14.44	15.38	0.94	1.06	-1.90	2.63	2.60	2.57	2.63	0.07	0.03	0.00
115.20	27.00	18.33	19.42	20.48	1.06	2.15	-6.52	17.28	14.31	14.43	15.37	0.94	1.06	-1.90	2.63	2.60	2.56	2.63	0.07	0.03	0.00
120.20	26.80	18.21	19.28	20.31	1.03	2.10	-6.49	17.26	14.31	14.42	15.36	0.94	1.06	-1.90	2.63	2.60	2.56	2.63	0.07	0.03	0.00
125.20	26.64	18.12	19.17	20.17	1.01	2.05	-6.47	17.25	14.30	14.42	15.35	0.94	1.05	-1.90	2.63	2.60	2.56	2.63	0.07	0.03	0.00
130.20	26.47	18.02	19.05	20.03	0.98	2.01	-6.44	17.25	14.29	14.41	15.34	0.93	1.05	-1.90	2.63	2.60	2.56	2.63	0.07	0.03	0.00
135.20	26.33	17.94	18.96	19.92	0.96	1.98	-6.42	17.24	14.29	14.41	15.34	0.93	1.05	-1.90	2.63	2.60	2.56	2.63	0.07	0.03	0.00
140.20	26.19	17.85	18.85	19.79	0.94	1.94	-6.39	17.23	14.28	14.40	15.33	0.93	1.05	-1.90	2.63	2.59	2.56	2.63	0.07	0.03	0.00
145.20	26.05	17.77	18.76	19.68	0.91	1.90	-6.37	17.22	14.28	14.39	15.32	0.93	1.04	-1.90	2.63	2.59	2.56	2.63	0.07	0.04	0.00
150.20	25.96	17.72	18.70	19.60	0.90	1.88	-6.36	17.22	14.28	14.39	15.32	0.93	1.04	-1.90	2.63	2.59	2.56	2.63	0.07	0.04	0.00
155.20	25.84	17.65	18.61	19.50	0.88	1.85	-6.34	17.21	14.27	14.39	15.31	0.93	1.04	-1.90	2.63	2.59	2.56	2.63	0.07	0.04	0.00
160.20	25.73	17.59	18.54	19.40	0.86	1.82	-6.33	17.21	14.27	14.38	15.31	0.92	1.04	-1.90	2.63	2.59	2.56	2.63	0.07	0.04	0.00
165.20	25.61	17.52	18.46	19.30	0.84	1.78	-6.31	17.20	14.27	14.38	15.30	0.92	1.04	-1.90	2.63	2.59	2.56	2.63	0.07	0.04	0.00
170.20	25.42	17.40	18.32	19.13	0.81	1.73	-6.29	17.19	14.26	14.37	15.29	0.92	1.03	-1.90	2.62	2.59	2.56	2.63	0.07	0.04	0.00
175.20	25.50	17.45	18.38	19.20	0.82	1.75	-6.30	17.19	14.26	14.38	15.30	0.92	1.03	-1.90	2.62	2.59	2.56	2.63	0.07	0.04	0.00
180.20	25.25	17.30	18.21	18.99	0.78	1.68	-6.27	17.18	14.26	14.37	15.29	0.92	1.03	-1.90	2.62	2.59	2.56	2.63	0.07	0.04	0.00
185.20	25.33	17.35	18.26	19.05	0.79	1.70	-6.28	17.19	14.26	14.37	15.29	0.92	1.03	-1.90	2.62	2.59	2.56	2.63	0.07	0.04	0.00
190.20	25.11	17.22	18.11	18.86	0.75	1.64	-6.25	17.18	14.26	14.37	15.28	0.92	1.03	-1.90	2.62	2.59	2.56	2.63	0.07	0.04	0.00
195.20	25.16	17.25	18.14	18.90	0.76	1.66	-6.26	17.18	14.26	14.37	15.28	0.92	1.03	-1.90	2.62	2.59	2.56	2.63	0.07	0.04	0.00
200.20	25.05	17.18	18.06	18.80	0.74	1.62	-6.25	17.18	14.25	14.37	15.28	0.92	1.03	-1.90	2.62	2.59	2.56	2.63	0.07	0.04	0.00

A217 Reigate Hill (Transect 2)

Distance From Road (m)	Annual Mean NOx (ug/m^3)							Annual Mean Total N Dep (kg N/ha/yr)							Annual Mean Total N Acid Dep (keq/ha/yr)						
	BL	Proj BL	DM	DS	Change			BL	Proj BL	DM	DS	Change			BL	Proj BL	DM	DS	Change		
	Baseline	Proj Baseline	(Base 2033)	(Scn1 2033)	(DS-DM)	(DS-ProjBL)	(DS-BL)	Baseline	Proj Baseline	(Base 2033)	(Scn1 2033)	(DS-DM)	(DS-ProjBL)	(DS-BL)	Baseline	Proj Baseline	(Base 2033)	(Scn1 2033)	(DS-DM)	(DS-ProjBL)	(DS-BL)
4.60	86.28	53.48	60.48	69.30	8.83	15.83	-16.97	20.70	16.76	17.28	18.73	1.46	1.97	-1.97	2.85	2.85	2.76	2.85	0.10	0.01	0.00
9.60	69.85	43.79	49.11	55.77	6.65	11.98	-14.08	19.78	16.08	16.49	17.81	1.32	1.73	-1.97	2.79	2.78	2.70	2.79	0.09	0.01	0.00
14.60	57.86	36.74	40.84	45.90	5.06	9.16	-11.96	19.09	15.57	15.90	17.12	1.22	1.55	-1.96	2.75	2.73	2.67	2.75	0.08	0.02	0.00
19.60	50.87	32.63	36.02	40.15	4.12	7.52	-10.72	18.67	15.27	15.55	16.71	1.16	1.44	-1.95	2.72	2.70	2.64	2.72	0.08	0.02	0.00
24.60	45.80	29.66	32.53	35.97	3.45	6.32	-9.82	18.35	15.05	15.30	16.41	1.11	1.36	-1.95	2.70	2.68	2.63	2.70	0.08	0.02	0.00
29.60	42.91	27.96	30.54	33.60	3.06	5.63	-9.31	18.18	14.93	15.15	16.24	1.08	1.31	-1.94	2.69	2.67	2.62	2.69	0.08	0.02	0.00
34.60	39.96	26.24	28.51	31.17	2.66	4.93	-8.79	17.99	14.80	15.00	16.06	1.06	1.26	-1.93	2.68	2.66	2.61	2.68	0.07	0.03	0.00
39.60	37.82	24.99	27.04	29.41	2.37	4.42	-8.40	17.86	14.70	14.89	15.93	1.03	1.22	-1.93	2.67	2.65	2.60	2.67	0.07	0.03	0.00
44.60	35.97	23.91	25.77	27.89	2.12	3.99	-8.08	17.74	14.62	14.80	15.81	1.02	1.19	-1.92	2.66	2.64	2.59	2.67	0.07	0.03	0.00
49.60	34.57	23.09	24.81	26.74	1.93	3.65	-7.83	17.65	14.56	14.73	15.73	1.00	1.17	-1.92	2.66	2.63	2.59	2.66	0.07	0.03	0.00
54.60	33.52	22.47	24.09	25.87	1.79	3.40	-7.64	17.58	14.52	14.67	15.67	0.99	1.15	-1.92	2.66	2.63	2.59	2.66	0.07	0.03	0.00
59.60	32.43	21.84	23.34	24.98	1.64	3.14	-7.45	17.51	14.47	14.62	15.60	0.98	1.13	-1.92	2.65	2.62	2.58	2.65	0.07	0.03	0.00
64.60	31.59	21.35	22.77	24.29	1.53	2.94	-7.30	17.46	14.43	14.58	15.55	0.97	1.11	-1.91	2.65	2.62	2.58	2.65	0.07	0.03	0.00
69.60	30.80	20.89	22.22	23.64	1.42	2.75	-7.16	17.41	14.40	14.54	15.50	0.96	1.10	-1.91	2.64	2.61	2.58	2.65	0.07	0.03	0.00
74.60	30.29	20.59	21.87	23.22	1.35	2.63	-7.07	17.38	14.38	14.51	15.47	0.96	1.09	-1.91	2.64	2.61	2.58	2.64	0.07	0.03	0.00
79.60	29.68	20.23	21.45	22.71	1.26	2.48	-6.97	17.34	14.35	14.48	15.43	0.95	1.08	-1.91	2.64	2.61	2.57	2.64	0.07	0.03	0.00
84.60	29.19	19.95	21.12	22.31	1.19	2.36	-6.88	17.31	14.33	14.46	15.40	0.95	1.07	-1.91	2.64	2.61	2.57	2.64	0.07	0.03	0.00
89.60	28.72	19.68	20.80	21.92	1.13	2.25	-6.80	17.28	14.31	14.43	15.38	0.94	1.06	-1.90	2.64	2.61	2.57	2.64	0.07	0.03	0.00
94.60	28.41	19.50	20.58	21.67	1.08	2.17	-6.75	17.26	14.30	14.42	15.36	0.94	1.06	-1.90	2.63	2.60	2.57	2.64	0.07	0.03	0.00
99.60	28.04	19.28	20.33	21.35	1.03	2.08	-6.68	17.24	14.28	14.40	15.34	0.94	1.05	-1.90	2.63	2.60	2.57	2.64	0.07	0.03	0.00
104.60	27.74	19.10	20.12	21.11	0.99	2.00	-6.63	17.22	14.27	14.39	15.32	0.93	1.05	-1.90	2.63	2.60	2.57	2.63	0.07	0.03	0.00
109.60	27.44	18.93	19.91	20.86	0.94	1.93	-6.58	17.20	14.26	14.37	15.30	0.93	1.04	-1.90	2.63	2.60	2.57	2.63	0.07	0.03	0.00
114.60	27.24	18.81	19.78	20.69	0.91	1.88	-6.55	17.19	14.25	14.36	15.29	0.93	1.04	-1.90	2.63	2.60	2.57	2.63	0.07	0.03	0.00
119.60	26.99	18.67	19.61	20.49	0.88	1.82	-6.50	17.17	14.24	14.35	15.28	0.92	1.03	-1.90	2.63	2.60	2.57	2.63	0.07	0.03	0.00
124.60	26.80	18.56	19.48	20.32	0.85	1.77	-6.47	17.16	14.24	14.34	15.27	0.92	1.03	-1.90	2.63	2.60	2.57	2.63	0.07	0.03	0.00
129.60	26.60	18.44	19.34	20.16	0.82	1.71	-6.44	17.15	14.23	14.33	15.25	0.92	1.03	-1.90	2.63	2.60	2.56	2.63	0.07	0.03	0.00
134.60	26.44	18.35	19.23	20.03	0.79	1.68	-6.42	17.14	14.22	14.33	15.25	0.92	1.02	-1.90	2.63	2.60	2.56	2.63	0.07	0.03	0.00
139.60	26.30	18.27	19.13	19.90	0.77	1.64	-6.39	17.13	14.22	14.32	15.24	0.92	1.02	-1.90	2.63	2.59	2.56	2.63	0.07	0.03	0.00
144.60	26.15	18.18	19.03	19.78	0.75	1.60	-6.37	17.13	14.21	14.32	15.23	0.92	1.02	-1.89	2.63	2.59	2.56	2.63	0.07	0.04	0.00
149.60	26.03	18.11	18.95	19.68	0.73	1.57	-6.35	17.12	14.21	14.31	15.23	0.91	1.02	-1.90	2.63	2.59	2.56	2.63	0.07	0.04	0.00
154.60	25.93	18.05	18.88	19.59	0.71	1.54	-6.34	17.11	14.21	14.31	15.22	0.91	1.01	-1.89	2.63	2.59	2.56	2.63	0.07	0.04	0.00
159.60	25.83	17.99	18.81	19.51	0.69	1.51	-6.32	17.11	14.20	14.30	15.22	0.91	1.01	-1.89	2.63	2.59	2.56	2.63	0.07	0.04	0.00
164.60	25.73	17.93	18.74	19.42	0.68	1.48	-6.31	17.10	14.20	14.30	15.21	0.91	1.01	-1.89	2.63	2.59	2.56	2.63	0.07	0.04	0.00
169.60	25.65	17.89	18.69	19.35	0.66	1.46	-6.30	17.10	14.20	14.30	15.21	0.91	1.01	-1.89	2.63	2.59	2.56	2.63	0.07	0.04	0.00
174.60	25.57	17.84	18.63	19.28	0.65	1.44	-6.29	17.10	14.20	14.30	15.21	0.91	1.01	-1.89	2.62	2.59	2.56	2.63	0.07	0.04	0.00
179.60	25.52	17.81	18.59	19.23	0.64	1.42	-6.28	17.10	14.20	14.30	15.20	0.91	1.01	-1.89	2.62	2.59	2.56	2.63	0.07	0.04	0.00
184.60	25.45	17.77	18.55	19.17	0.63	1.40	-6.28	17.09	14.19	14.29	15.20	0.91	1.01	-1.89	2.62	2.59	2.56	2.63	0.07	0.04	0.00
189.60	25.40	17.74	18.51	19.13	0.61	1.39	-6.27	17.09	14.19	14.29	15.20	0.91	1.01	-1.89	2.62	2.59	2.56	2.63	0.07	0.04	0.00
194.60	25.34	17.71	18.47	19.08	0.60	1.37	-6.27	17.09	14.19	14.29	15.20	0.91	1.01	-1.89	2.62	2.59	2.56	2.63	0.07	0.04	0.00
199.60	25.31	17.69	18.45	19.05	0.60	1.36	-6.26	17.09	14.19	14.29	15.20	0.90	1.00	-1.89	2.62	2.59	2.56	2.63	0.07	0.04	0.00

Appendix B. Extract from Caporn et al (2010)

Table 21 of Caporn et al (2010): Summary of relationships between long-term nitrogen deposition and species richness by habitat expressed as the amount of incremental N deposition (in kg N ha^{-1} yr^{-1}) associated with a reduction in species richness of one species along the survey gradient sites. Modelled relationship only applied over N deposition range in which survey sites occurred; where no sites were surveyed at a given N deposition level '-' is shown.

Survey/ Habitat/	Max. species richness	Habitat/ species critical load kg N ha^{-1} yr^{-1}	Increase in N deposition (in kg N ha^{-1} yr^{-1}) required to reduce measured species richness by 1 at different background long-term N deposition levels					
			5 kg N	10 kg N	15 kg N	20 kg N	25 kg N	30 kg N
Upland heath (TU 2009)								
Total species richness	42 spp.	10-20	0.4 kg	0.8 kg	1.3 kg	1.7 kg	2.0 kg	2.4 kg
Upland heath (MRS)*								
Total species richness	16 spp.	10-20	1.7 kg	2.0 kg	2.5 kg	3.3 kg	5.0 kg	20.0 kg
Lowland heath (TU 2009)								
Total species richness	37 spp.	10-20	0.4 kg	0.8 kg	1.3 kg	1.7 kg	2.0 kg	2.4 kg
Bog (TU 2009)								
Total species richness	32 spp.	5-10	3.3 kg					
Sand dunes (TU 2009, all sites)								
Total species richness	77 spp.	8-15	0.1 kg	0.5 kg	1.1 kg	2.0 kg	-	-
Sand dunes TU 2009 (pH ≥6.5)								
Total species richness	77 spp.	8-15	0.3 kg	0.6 kg	0.9 kg	1.3 kg	-	-
Sand dunes TU 2009 + 2002 (Fixed dune grasslands)								
Total species richness	77 spp.	8-15	0.3 kg	0.6 kg	0.9 kg	1.3 kg	-	-
Acid grasslands (BEGIN)								
Total species richness	42 spp.	10-15	1.7 kg	1.7 kg	2.0 kg	2.0 kg	2.5 kg	2.5 kg

*in the upland heath MRS survey quadrat size was 0.5 x 0.5 m. This produced different results than the other surveys which used 2 x 2 m quadrats.

Appendix C.Modelling ammonia emissions from traffic

Data Sources

The ammonia modelling used 2015 road transport emission factors from the National Atmospheric Emissions Inventory website (NAEI, latest available data[29]). This document provides fleet-weighted, average ammonia emission factors in grams per kilometre (g/km) for different road types and vehicle types. The NAEI road transport emission factors include average speed throughout the UK and the speeds used to derive these g/km emission rates may be different to the speeds used in the air quality model, however this is a known limitation of the ammonia modelling.

Specifically, hot exhaust emission factors from the 2015 NAEI road transport emission factor dataset were used, together with data from the latest version of Defra's Emission Factor Toolkit; the vehicle fleet for 2015 was applied to the model for the specific road type for each road (e.g. rural, urban or motorway). The light duty/heavy duty vehicle split in the traffic data provided for the assessment and was maintained.

Background concentrations for ammonia were taken from the Air Pollution Information System (APIS) website[30]. These modelled data are available on a 5x5 km grid as a 3-year mean for 2014-16.

Verification

Data from previous modelling and monitoring of ammonia in a similar environment, combined with professional judgement, have been used to inform the verification factor. The analysed data highlighted that roadside monitored concentrations of ammonia (up to 2.5m from the road source) were much higher than those sited further back. In addition, the model underestimated ammonia concentrations by a greater margin at the roadside monitoring locations. Monitored concentrations beyond 20m from the road were found to be similar to background concentrations.

Overall, monitored ammonia was almost three times the modelled concentrations, prior to adjustment. As such, a factor of 3.0 has been applied to the modelled NH_3 concentrations. It should be noted that this provides a conservative approach – as the analysis includes roadside sites and locations further from the road, the factor is likely to overestimate the road contribution at sites beyond 20m from the road source.

Assessment

Modelling has been carried out to predict concentrations of ammonia and the influence of ammonia on nitrogen deposition rates using the methodology outlined above with the following assumptions for the assessment year:

- 2033 with and without the local plan traffic flows;
- 2023 traffic fleet mix (in keeping with NOx predictions);
- 2015 ammonia emission rates (as projected rates are not available from the NAEI); and
- Modelled background concentrations were taken for the appropriate APIS 5x5 km grid square.

The contribution of ammonia to total nitrogen deposition was calculated using a deposition rate for ammonia of 0.02 m/s, taken from the CERC ADMS-Roads User Guide.

[29] NAEI road transport emission factors: http://naei.beis.gov.uk/data/ef-transport
[30] APIS website: http://www.apis.ac.uk/

Appendix D.Growth allowances for other plans and projects included in the 'in combination' modelling

Application of the Ashdown Forest principle

Figures highlighted yellow were those used in the modelling. A general principle in the agreement of housing numbers as follows:

- If a LP is less than 5 years old use the adopted figure
- If an emerging LP is nearing pre-submission and the LPA is confident then use the emerging figure
- If the adopted LP is over 5 years old and an emerging plan has not progressed use the OAN/standard methodology (once confirmed by CLG) unless otherwise evidenced.

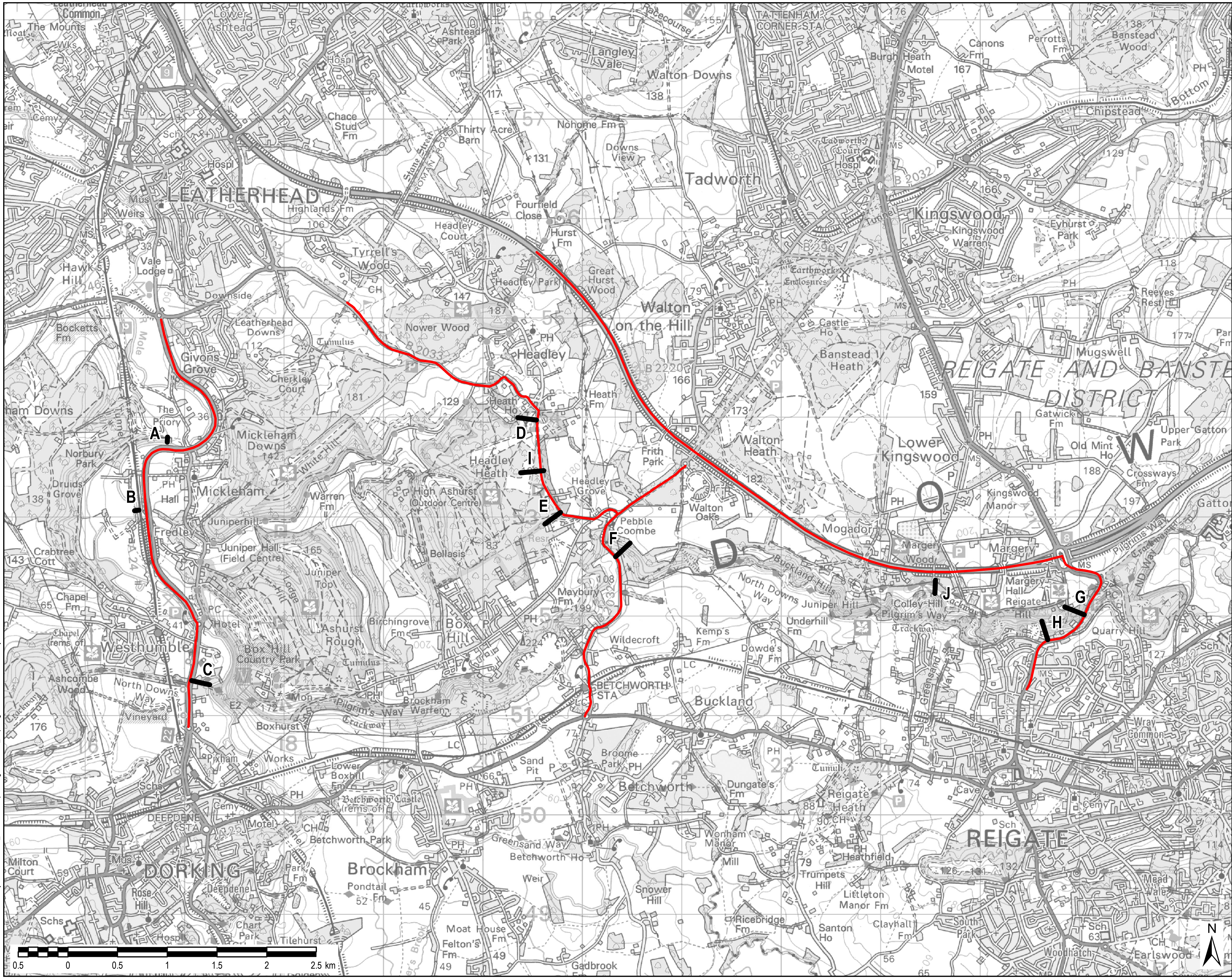
Authority Name	Adopted Local Plan housing number and Date	OAN	DCLG new methodology	Numbers used for own emerging Local Plan and stage Reached
Elmbridge BC	Core Strategy (Adopted 2011) The Core Strategy plans for approximately 3,375 net additional dwellings (225 net dwellings annual average) within the Borough between 2011 and 2026.	**9,480 (2015-2035)** **474 p/a.** **(Source: SHMA 2016)**	612	New Local Plan underwent Strategic Options Consultation that ended in February 2017
Epsom and Ewell BC	Core Strategy (Adopted 2007) Provides for 181 homes per annum or 3,620 dwellings between 2006 and 2026;	**8,352 (2015-2035)** **418 p/a** **(Source: SHMA June 2016)**	579	Just finished I&O consultation in Nov 2017
Guildford BC		693 p/a to 2033 (Source; 2015 SHMA)	789	**Submission Local Plan (Reg 22) December 2017** **At least 12,426 (2015-34)** **Staggered as follows:**

Authority Name	Adopted Local Plan housing number and Date	OAN	DCLG new methodology	Numbers used for own emerging Local Plan and stage Reached
Horsham	**Horsham District Planning Framework – November 2015** **At least 16,000 homes within the period 2011-2031, at an average of 800 p/a** **Confirmed on 13/12/17 by** **Mark Daly** Planning Officer **Telephone:** 01403 215106			Horsham District Council is now in the evidence gathering stage of the Local Plan Review. A new Site Allocations Document, which will replace the existing Site Specific Allocations of Land document, will be part of this review. This new document will include development proposals for new homes, employment land, community facilities, open space and other uses. We envisage this Local Plan review will be ready for initial Regulation 18 consultation in Spring 2018 - See more at: https://www.horsham.gov.uk/planningpolicy/planning-policy/site-specific-allocations-of-land#sthash.pPYEX9xj.dpuf
LB Croydon	**The London Plan 2016** **The Plan establishes a minimum 10 year housing target 2015-2025 across all London Boroughs of 423,887. This includes the following:** **Croydon: 14,348** **Equates to 1,435pa**			Croydon Local Plan: Strategic Policies - Partial Review (Main Modifications) Auguts 2017 32,880 (2011 to2036) 1315 pa https://www.croydon.gov.uk/sites/default/files/articles/downloads/Track%20changes%20to%20Croydon%20Local%20Plan%20-%20Strategic%20Policies%20-%20Partial%20Review%20showing%20Main%20Modifications.pdf see page 32 **Draft London Plan** **Consultation 1 December 2017 – 2 March 2018**

Authority Name	Adopted Local Plan housing number and Date	OAN	DCLG new methodology	Numbers used for own emerging Local Plan and stage Reached
				Croydon 2019/20 – 2028/29 = 29,490 **Per annum=2,949** https://www.london.gov.uk/what-we-do/planning/london-plan/new-london-plan/draft-new-london-plan/chapter-4-housing/policy-h1-increasing-housing-supply
LB Kingston	The London Plan 2016 The Plan establishes a minimum 10 year housing target 2015-2025 across all London Boroughs of 423,887. This includes the following: Kingston-upon-Thames: 6,434 Equates to 643 pa https://www.london.gov.uk/what-we-do/planning/london-plan/current-london-plan/london-plan-2016-pdf	14,348 (2015-2035) 717 p/a (Source: SHMA June 2016)	New Local Plan 2019 to 2041 at very early stages	New Kingston Local Plan not yet at Submission stage. Appear to still be at 'Call for Sites' stage although LDS suggests should be further forward. **Draft London Plan** **Consultation 1 December 2017 – 2 March 2018** **kINGSTON 2019/20 – 2028/29 = 13,640** **Per annum=1,364** https://www.london.gov.uk/what-we-do/planning/london-plan/new-london-plan/draft-new-london-plan/chapter-4-housing/policy-h1-increasing-housing-supply
LB Sutton	The London Plan 2016 The Plan establishes a minimum 10 year housing target 2015-2025 across all London Boroughs of 423,887. This includes the following: Sutton: 3,626 363p/a			**Sutton Draft Local Plan 2016-2031** **6,405 (2016-2031)** **427 p/a** **Submitted April 2017 and now been through Examination** Note: Sutton specifically request we use this figure, stating that the housing number has not been a point of contention, but they are objecting to latest GLP figure below. Draft London Plan Consultation 1 December 2017 – 2 March 2018 Sutton 2019/20 – 2028/29 = 9,390 Per annum=939 https://www.london.gov.uk/what-we-do/planning/london-plan/new-london-plan/draft-new-london-plan/chapter-4-

Authority Name	Adopted Local Plan housing number and Date	OAN	DCLG new methodology	Numbers used for own emerging Local Plan and stage Reached
				housing/policy-h1-increasing-housing-supply
Mid Sussex				**As per Ashdown Forest work** **The emerging Mid Sussex District Plan 2014-2031 sets a minimum housing provision figure of 16,390 homes.** **For the purposes of calculating the five-year housing land supply a 'stepped trajectory' will be applied through the calculation of a 5-year rolling average. The annual provision in this stepped trajectory is 876 dwellings per annum for years 2014/15 until 2023/24 and thereafter, from 1st April 2024, 1,090 dwellings per annum until 2030/31, subject to future HRA on further allocated sites, to meet unmet needs of neighbouring authorities**.
Mole Valley	Core Strategy 2009 (2006-2026)	**7,814 (2015-2035)** **391 p/a** **(Source: SHMA June 2016)**	441	**Local Plan, 'Future Mole Valley' – early stages. Initial consultation closed September 2017.**
Reigate & Banstead	**Core Strategy (2012-2027) adopted in 2014.** **The Core Strategy identified 6,900 homes to be delivered (460 homes per year).**			Nov 2017 Reg 19 Developmet Management Plan going to Full Council ready for submission.
Tandridge	125 dpa 2008 CS	**470**	645	TBC
Waverley		519 p/a to 2033 (Source; 2015 SHMA)	538	**The Waverley Borough Pre- Submission Local Plan Part 1: Strategic Policies and Sites makes provision for at least 9,861 net additional homes** **in the period from 2013 to 2032**

Authority Name	Adopted Local Plan housing number and Date	OAN	DCLG new methodology	Numbers used for own emerging Local Plan and stage Reached
				(equivalent to at least 519 dwellings a year). Local Plan Part 1: Strategic Policies and Sites up to 2032. (examination currently underway) The new Local Plan looks forward 15 years and sets out the strategy to develop at least 9,861 new homes in the period from 2013 to 2032 (519pa)
Woking	Core Strategy October 2012. 4964 dwellings between 2010 an 2027. 292 p/a	**517 p/a to 2033** **(Source; 2015 SHMA)**	409	DM policies And Site allocations DPD being prepared.
Crawley BC	**Crawley 2030: Crawley Borough Local Plan 2015 - 2030 (adopted December 2015)** **Identifies minimum of 5,100 new homes between 2015 – 2030.** **Equates to at least 340 p/a but phased according to trajectory on page 165 of plan here** http://www.crawley.gov.uk/pw/web/PUB271853	10,125 (2015 to 2030) 675 dwellings per annum x 15years (Objective Assessment of Crawley's Housing and Economic Needs (Chilmark Consulting, 2015) multiplied over the 15 year Plan period)		Local Plan Review at Early engagement: January 2018 – April 2018;



File Name: I:\5004 - Information Systems\60562201_AQIA Mole Gap to Reigate SAC\02_Maps\Figure 1 - Modelled Air Quality Transects.mxd

THIS DRAWING IS TO BE USED ONLY FOR THE PURPOSE OF ISSUE THAT IT WAS ISSUED FOR AND IS SUBJECT TO AMENDMENT

LEGEND

- Modelled Road Link
- Receptor

Receptors

A = A24 North of Mickleham
B = A24 West of Mickleham
C = A24 at Westhumble
D = B2033 (North)
E = B2033 (South)
F = B2032 (Pebble Hill)
G = A217 (North)
H = A217 (South)
I = B2033 (Central)
J = M25

Purpose of Issue: FINAL

Client: MOLE VALLEY DISTRICT COUNCIL, REIGATE & BANSTEAD BOROUGH COUNCIL AND TANDRIDGE DISTRICT COUNCIL

Project Title: AIR QUALITY IMPACT ASSESSMENT OF MOLE GAP TO REIGATE ESCARPMENT SAC

Drawing Title: MODELLED AIR QUALITY TRANSECTS

Drawn	Checked	Approved	Date
TD	DH	JR	03/05/2018

AECOM Internal Project No.	Scale @ A3
60562201	1:35,000

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Drawing Number: FIGURE 1

Rev

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