EB211A

Epping Forest District Local Plan

2021 Habitat Regulations Assessment

Epping Forest District Council

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Quality information

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3	21/01/19	Updates for recreation and air quality	JR	James Riley	Technical Director
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1. Introduction

Background to the Project

1.1 AECOM was appointed by Epping Forest District Council to assist the Council in undertaking a Habitat Regulations Assessment of its Local Plan (hereafter referred to as the 'Plan' or 'Local Plan'), which sets out the Council's proposed strategy to meet the economic and housing needs in the District up to 2033. The Plan identifies sites for housing (including traveller accommodation) and employment. It also sets out development management policies and infrastructure requirements. The objective of this assessment is to identify any aspects of the Plan that would cause an adverse effect on the integrity of internationally important sites (Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and, as a matter of Government policy, Ramsar sites), either in isolation or in combination with other plans and projects, and to advise on appropriate policy mechanisms for delivering mitigation where such effects were identified.

1.2 An assessment of housing need across the East Herts and West Essex Housing Market Area (HMA) was undertaken, which was then used as the basis for developing the Local Plan. The HMA covers Epping Forest District Council, Harlow Council, East Herts District Council and Uttlesford District Council. The HMA developed a series of different Options for quanta and distribution of housing in each of the Authority boundaries, focussed on growth within the wider Harlow area.

1.3 Following the completion of the Examination hearings for the Epping Forest District Local Plan extensive further work has been undertaken regarding recreational pressure and air quality at Epping Forest. This includes a second visitor survey and comprehensive air quality modelling using number-plate recognition technology to create a locally specific vehicle fleet rather than the generalised vehicle fleet used in previous modelling. In addition, this HRA takes into account the sites which have been proposed for removal from the Local Plan or where their capacity has been amended in response to the Inspector's Advice Note dated 2 August 2019 (ED98) or where sites previously proposed for allocation have already been partially or wholly developed following the grant of planning permission. As such, this report updates the HRA work that was undertaken in 2018 and early 2019 for the Local Plan Submission Version 2017 (LPSV). Since the amendments to create this report are extensive (with regard to comprehensively updating the air quality work for Epping Forest SAC) this June 2021 HRA entirely replaces the January 2019 HRA.

Legislation

1.4 The need for Appropriate Assessment is set out within the Conservation of Habitats and Species Regulations 2017 (as amended)[1]. The Regulations apply the precautionary principle to internationally important sites. Plans and projects can only be permitted having ascertained that there will be no adverse effect on the integrity of the site(s) in question. Plans and projects with predicted adverse impacts on internationally important sites may still be permitted if there are no alternatives to them and there are Imperative Reasons of Overriding Public Interest (IROPI) as to why they should go ahead. In such cases, compensation would be necessary to ensure the overall integrity of the site network.

1.5 In order to ascertain whether or not site integrity will be affected, an Appropriate Assessment should be undertaken of the plan or project in question:

Box 1: The legislative basis for Appropriate Assessment

Conservation of Habitats and Species Regulations 2017 (as amended)

The Regulations state that:

"*A competent authority, before deciding to … give any consent for a plan or project which is likely to have a significant effect on a European site … shall make an appropriate assessment of the implications for the site in view of that sites conservation objectives… The authority shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the European site*".

1.6 Over time the phrase 'Habitats Regulations Assessment' (HRA) has come into wide currency to describe the overall process from screening through to Imperative Reasons of Overriding Public Interest (IROPI). This has arisen in order to distinguish the process from the individual stage described in the law as an 'appropriate assessment'. Throughout this report we use the term Habitat Regulations Assessment for the overall process and restrict the use of Appropriate Assessment to the specific stage of that name.

Scope of the Project

1.7 There is no pre-defined guidance that dictates the physical scope of a HRA of a Plan document. Therefore, in considering the physical scope of the assessment, we were guided primarily by the identified impact pathways rather than by arbitrary 'zones'. Current guidance suggests that the following internationally important sites be included in the scope of assessment:

- All sites within the Epping Forest District boundary; and
- Other sites shown to be linked to development within the District boundary through a known 'pathway' (discussed below).

1.8 Briefly defined, pathways of impact are routes by which a change in activity provided within a Local Plan document can lead to an effect upon an internationally designated site. Guidance from the former Department of Communities and Local Government states that the HRA should be '*proportionate to the geographical scope of the [plan policy*]' and that '*an AA need not be done in any more detail, or using more resources, than is useful for its purpos*e' (CLG, 2006, p.6). More recently, the Court of Appeal [2] ruled that providing the Council (as competent authority) was duly satisfied that proposed mitigation could be '*achieved in practice'* such that the proposed development would have no adverse effect, then this would suffice. This ruling has since been applied to a planning permission (rather than a Core Strategy document)[3]. In this case the High Court ruled that for 'a multistage process, so long as there is sufficient information at any particular stage to enable the authority to be satisfied that the proposed mitigation can be achieved in practice it is not necessary for all matters concerning mitigation to be fully resolved before a decision maker is able to conclude that a development will satisfy the requirements of the Habitats Regulations'.

1.9 There are three internationally important sites that lie partly within Epping Forest District:

- Epping Forest SAC;
- Lee Valley SPA; and
- Lee Valley Ramsar site.

1.10 Outside the District, the following site also requires consideration because there is potential for impacts stemming from the Local Plan to create significant effects even though the site lies outside the authority boundary:

- Wormley-Hoddesdonpark Woods SAC located 2.2km west of the District.

1.11 The reasons for designation of these sites, together with current trends in habitat quality and pressures on the sites, are set out at Appendix A. All the Internationally important sites are shown on Appendix B1.

1.12 In order to fully inform the HRA process, a number of recent studies have been consulted to determine likely significant effects that could arise from the Plan. These include:

- Final Water Resources Management Plan, 2020-2080. Affinity Water. April 2020
- Future development proposed (and, where available, HRAs) for Harlow, East Hertfordshire District, Chelmsford, Brentwood, Havering, Redbridge, Waltham Forest, Enfield and Broxbourne District, and Uttlesford District.
- Recreational activity, tourism and Internationally important site recreational catchment data has been used where this exists for individual Internationally important sites although, apart from Epping Forest SAC, this is limited. In such circumstances where data does not exist then this HRA has used appropriate proxy information from other internationally important sites designated for similar features and in similar settings;

[1] Various amendments to the Regulations were published in late 2018 but these do not change the HRA process for Local Plans or the legal tests which must be met
[2] No Adastral New Town Ltd (NANT) v Suffolk Coastal District Council Court of Appeal, 17th February 2015
[3] High Court case of R (Devon Wildlife Trust) v Teignbridge District Council, 28 July 2015

- Visitor survey work undertaken for Epping Forest SAC to inform this HRA;
- Traffic and air quality modelling undertaken for Epping Forest SAC to inform this HRA;
- The UK Air Pollution Information System (www.apis.ac.uk); and
- Multi Agency Geographic Information for the Countryside (MAGIC) and its links to SSSI citations and the JNCC website (www.magic.gov.uk)

This Report

1.13 Chapter 2 of this report explains the process by which the HRA has been carried out. Chapter 3 explores the relevant pathways of impact. Chapter 4 contains an initial analysis of likely significant effects. Chapters 5 to 8 then provide appropriate assessment of each impact pathway. Each chapter begins with a consideration of the interest features and ecological condition of the site(s) and of the environmental processes essential to maintain their integrity. An assessment of the Plan in respect of each internationally important site is then carried out mitigation strategies are proposed where necessary[4]. The key findings are summarised in Chapter 9: which provides overall conclusions.

[4] Legal precedent confirms that it is perfectly acceptable to reference mitigation measures at the screening stage of HRA, if that is the stage at which they can be identified.

2. Methodology

Introduction

2.1 The HRA has been carried out in the continuing absence of formal central Government guidance regarding assessment of plans, although general EC guidance on HRA does exist[5] and the UK government published high level guidance on HRA in summer 2019[6]. The former Department of Communities and Local Government (DCLG) released a consultation paper on the Appropriate Assessment of Plans in 2006[7]. As yet, no further formal guidance has emerged. However, RSPB has produced guidance on HRA[8] and the Habitats Regulations Assessment Handbook is widely used[9].

2.2 Figure 1 below outlines the stages of HRA up to the conclusion of whether adverse effects on the integrity of a European site will arise alone or in combination with other plans and projects. The stages are essentially iterative, being revisited as necessary in response to more detailed information, recommendations and any relevant changes to the plan until no adverse effects on integrity remain.

Evidence Gathering – collecting information on relevant internationally important sites, their conservation objectives and characteristics and other plans or projects.

↓

HRA Task 1: Likely significant effects ('screening') –identifying whether a plan is 'likely to have a significant effect' on a internationally important site

↓

HRA Task 2: Ascertaining the effect on site integrity – assessing the effects of the plan on the conservation objectives of any internationally important sites 'screened in' during HRA Task 1, taking account of any existing mitigation

↓

HRA Task 3: Avoidance and Mitigation – where adverse effects are identified at HRA Task 2, the plan should be altered until adverse effects are cancelled out fully. The Appropriate Assessment is then updated and finalised.

Figure 1: Four Stage Approach to Habitats Regulations Assessment

[5] European Commission (2001): Assessment of plans and projects significantly affecting Natura 2000 Sites: Methodological Guidance on the Provisions of Article 6(3) and 6(4) of the Habitats Directive.
[6] https://www.gov.uk/guidance/appropriate-assessment
[7] CLG (2006) Planning for the Protection of European Sites, Consultation Paper
[8] Dodd A.M., Cleary B.E., Dawkins J.S., Byron H.J., Palframan L.J. and Williams G.M. (2007). *The Appropriate Assessment of Spatial Plans in England: a guide to why, when and how to do it.* The RSPB, Sandy.
[9] https://www.dtapublications.co.uk/

HRA Task 1: Likely Significant Effects (LSE)

2.3 Following evidence gathering, the first stage of any Habitat Regulations Assessment and the purpose of this assessment is a Likely Significant Effect (LSE) test - essentially a risk assessment to decide whether the full subsequent stage known as Appropriate Assessment is required. The essential question is:

"*Is the Plan, either alone or in combination with other relevant projects and plans, likely to result in a significant effect upon internationally important sites?"*

2.4 The objective is to 'screen out' those plans and projects that can, without any detailed appraisal, be said to be unlikely to result in significant adverse effects upon internationally important sites, usually because there is no mechanism for an adverse interaction with internationally important sites.

2.5 A decision by the Court of Justice of the European Union[10] in spring 2018 concluded that measures intended to avoid or reduce the harmful effects of a proposed project or plan on a internationally important site should not be taken into account by competent authorities at the Likely Significant Effects or 'screening' stage of HRA. The UK is no longer part of the European Union but rulings of the European Court of Justice still apply to the UK.

HRA Task 2: Appropriate Assessment (AA)

2.6 Where it is determined that a conclusion of 'no likely significant effect' cannot be drawn, the analysis has proceeded to the next stage of HRA known as Appropriate Assessment. Case law has clarified that 'appropriate assessment' is <u>not</u> a technical term. In other words, there are no particular technical analyses, or level of technical analysis, that are classified by law as belonging to appropriate assessment rather than determination of likely significant effects. However, an Appropriate Assessment must refer to the best available scientific information and contain complete precise and definitive findings and conclusions to ensure that there is no reasonable scientific doubt (as to the absence of adverse effects to site integrity).

2.7 The level of detail in land use plans concerning developments that will be permitted under the plans is rarely sufficient to allow the fullest quantification of potential adverse effects. It is therefore necessary to be cognisant of the fact that HRAs for plans can be tiered, with assessments being undertaken with increasing specificity at lower tiers. This is in line with DCLG guidance and court rulings that the level of detail of the assessment, whilst meeting the relevant requirements of the Habitats Regulations, should be '*appropriate'* to the level of plan or project that it addresses. This 'tiering' of assessment is summarised in Figure 2.

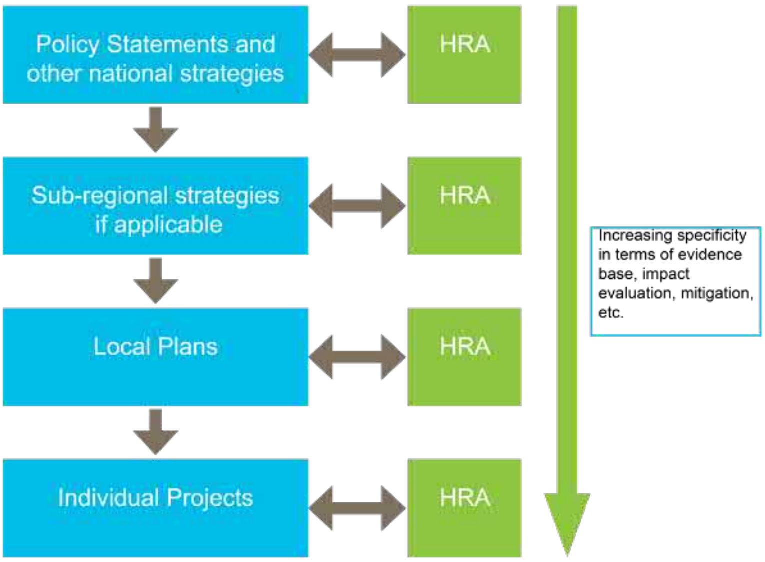


Figure 2: Tiering in HRA of land use plans

2.8 On these occasions the advice of Advocate-General Kokott[11] to the European Court of Justice is worth considering. She commented that: *"It would …hardly be proper to require a greater level of detail in preceding plans* [rather than planning applications] *or the abolition of multi-stage planning and approval procedures so that the assessment of*

[10] People Over Wind and Sweetman v Coillte Teoranta (C-323/17)
[11] Opinion of Advocate-General Kokott, 9th June 2005, Case C-6/04. Commission of the European Communities v United Kingdom of Great Britain and Northern Ireland, paragraph 49. http://curia.europa.eu/juris/document/document.jsf?docid=58359&doclang=EN

implications can be concentrated on one point in the procedure. Rather, adverse effects on areas of conservation must be assessed at every relevant stage of the procedure ***to the extent possible on the basis of the precision of the plan*****.** ***This assessment is to be updated with increasing specificity in subsequent stages of the procedure****"* [emphasis added].

2.9 A more recent 2018 European Court of Justice case[12] confirmed that an appropriate assessment must consider the interest features of internationally important sites even where those features may be found outside the strict boundaries of those sites and must also consider other habitat types or species, which are present on the site, but for which that site has not been listed **if** they are necessary to the conservation of the habitat types and species listed for the protected area. The former matter is traditionally captured in Appropriate Assessment in England (and in this HRA) through consideration of the concept of 'functionally linked land' but that has not been identified in this HRA process as being a relevant issue. The latter is captured where, for example, habitats within a European that are not themselves designated are nonetheless considered in impact assessment because of the functional role in enabling the site to meet its conservation objectives (i.e. the bird interest of the Lee Valley SPA is protected by preserving not only the birds themselves but the vegetation on which they feed, through protection of water quality in the SPA).

Task 3: Avoidance & Mitigation

2.10 Where necessary, measures will be recommended for incorporation into the Plan in order to avoid or mitigate adverse effects on internationally important sites. There is considerable precedent concerning the level of detail that a Local Plan document needs to contain regarding mitigation for recreational impacts on internationally important sites. The implication of this precedent is that it is not necessary for all measures that will be deployed to be fully developed prior to adoption of the Plan, but the Plan must provide an adequate policy framework within which these measures can be delivered. The Plan must provide clear and precise policy wording to ensure that any mitigation relied upon is delivered for development to be regarded as being in accordance with the Plan.

2.11 When discussing 'mitigation' for a Local Plan document, one is concerned primarily with the policy framework to secure the delivery of such mitigation rather than the details of the mitigation measures themselves since the Local Plan document is a high-level policy document.

Principal Other Plans and Projects That May Act 'In Combination'

2.12 In practice in combination assessment is of greatest relevance when the plan would otherwise be screened out because its individual contribution is inconsequential. For the purposes of this assessment, we have determined that, due to the nature of the identified impacts, the key other plans and projects relate to the additional housing and commercial/industrial development proposed for other relevant Essex and Hertfordshire authorities over the lifetime of the District Plan, particularly East Herts, Harlow and Uttlesford. These have therefore been taken into consideration.

[12] Holohan et al vs. An Bord Pleanála (C-461/17)

Table 1: Housing levels to be delivered across Epping Forest District and surrounding authorities, provided for context.

<table>
<tr><th>Local Authority</th><th>Total housing provided</th></tr>
<tr><td>Uttlesford</td><td rowspan="3">These three authorities with Epping Forest District worked together as part of a HMA. Where impacts in combination such as air quality impacts are considered, these assessments will be based in the level of development provided within the Local Plans.</td></tr>
<tr><td>East Hertfordshire</td></tr>
<tr><td>Harlow</td></tr>
<tr><td>Broxbourne</td><td>7,718 (2018-2033)[13]</td></tr>
<tr><td>Chelmsford</td><td>18,515 (to 2036)[14]</td></tr>
<tr><td>Brentwood</td><td>7,752 (to 2033) [15]</td></tr>
<tr><td>Havering</td><td>17,551 (2016 - 2031) [16]</td></tr>
<tr><td>Redbridge</td><td>17,237 (2015-2030)[17]</td></tr>
<tr><td>Waltham Forest</td><td>27,000 (2020 - 2035)[18]</td></tr>
<tr><td>Enfield</td><td>13,480 (to 2030)[19]</td></tr>
</table>

2.13 The Minerals and Waste Development Plans for Hertfordshire, Essex, London and Cambridgeshire are also of some relevance, since these may contribute to increased vehicle movements on the road network within Epping (and thereby contribute to air quality impacts). The, Essex, Hertfordshire and Cambridgeshire Local Transport Plans to 2031 will also be important in terms of encouraging sustainable transport. However, the major contributor to any in combination effect is likely to be that of housing and commercial development within the surrounding districts as set out in Local Plans and these have therefore been the main focus of cumulative 'in combination' effects with regard to this HRA.

2.14 In relation to recreational activity, the following documents have been consulted for their plans and projects that may affect internationally important sites in combination with development in Epping Forest District: Lee Valley Regional Park Authority Site Management Plan and Epping Forest Management Plan and visitor surveys.

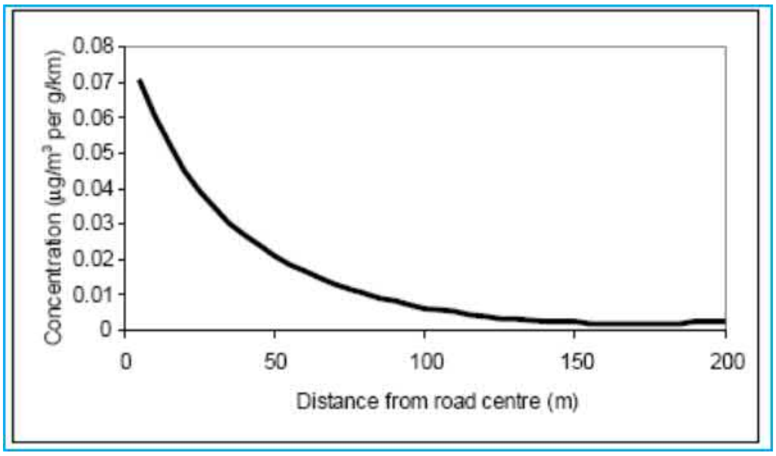
Air Quality Impact Assessment

2.15 To support this HRA, traffic modelling and an air quality impact assessment was undertaken in 2020. The methodology is reported separately in Appendix D.

2.16 As a general rule, vehicle exhaust emissions are considered to only have a local effect within a narrow band along the roadside; typically, within 200m of the centreline of the road. Beyond 200m emissions should generally have dispersed sufficiently that atmospheric concentrations are essentially background levels. The rate of decline is steeply curved rather than linear. In other words, concentrations will decline rapidly as one begins to move away from the roadside, slackening to a more gradual decline over the rest of the distance up to 200m. For this project transect modelling has been undertaken and isopleth (contour) mapping has also been produced.

[13] https://ex.broxbourne.gov.uk/sites/default/files/Documents/Planning_Policy/EXAM%2034A%20-%20Consolidated%20Schedule%20of%20Main%20Modifications.pdf [accessed 06/04/2020]
[14] https://www.chelmsford.gov.uk/_resources/assets/inline/full/0/3951296.pdf [accessed 06/04/2020]
[15] http://www.brentwood.gov.uk/pdf/31012019170028000000.pdf [accessed 06/04/2020]
[16] http://havering.objective.co.uk/file/4645335 [accessed 31/10/2017]
[17] https://www.redbridge.gov.uk/media/4934/10-redbridgelocal-plan_070318_web-1.pdf [accessed 06/04/20]
[18] https://www.walthamforest.gov.uk/sites/default/files/Final%20Draft%20Local%20Plan_July2019_Web%20optimised_Part1.pdf [accessed 06/04/20]
[19] https://new.enfield.gov.uk/services/planning/planning-policy/local-plan/planning-policy-information-enfield-core-strategy.pdf [accessed 31/10/2017]. A new Local Plan is in development but a total quantum of housing has yet to be determined

Figure 3: Traffic contribution to concentrations of pollutants at different distances from a road (Source: DfT)



2.17 There are two measures of particular relevance regarding air quality impacts from vehicle exhausts (although a third, ammonia concentrations, is also being modelled for Epping Forest SAC). The first is the concentration of oxides of nitrogen (known as NOx) in the atmosphere. The main importance is as a source of nitrogen, which is then deposited on adjacent habitats (including directly onto the plants themselves) either directly (known as dry deposition) or washed out in rainfall (known as wet deposition). The deposited nitrogen can then have a range of effects, primarily growth stimulation or inhibition[20], but also biochemical and physiological effects such as changes to chlorophyll content. The UK Air Pollution Information System (APIS) website[21] notes that it is likely that the strongest effect of emissions of nitrogen oxides on vegetation is through their contribution to nitrogen deposition[22]. The guideline atmospheric concentration of NOx advocated by Government for the protection of vegetation is 30 micrograms per cubic metre (μgm^{-3}), known as the Critical Level.

2.18 The second important metric is a direct determination of the rate of the resulting nitrogen deposition. Calculating nitrogen deposition rates rather than relying purely on scrutiny of NOx concentrations has the advantage of being habitat specific (the critical level for NOx is entirely generic; in reality different habitats have varying tolerance to nitrogen) and, for many habitats, of being directly relatable to measurable effects on the ground through scrutiny of published dose-response relationships that do not exist for NOx. Unlike NOx, the nitrogen deposition rate below which current evidence suggests that harmful effects should not arise is different for each habitat. The rate (known as the Critical Load) is provided on the UK Air Pollution Information System website (www.apis.ac.uk) and is expressed as a quantity (kilograms) of nitrogen over a given area (hectare) per year ($kgNha^{-1}yr^{-1}$). More recently, there has also been research compiled[23] which investigates nitrogen dose-response relationships in a range of habitats.

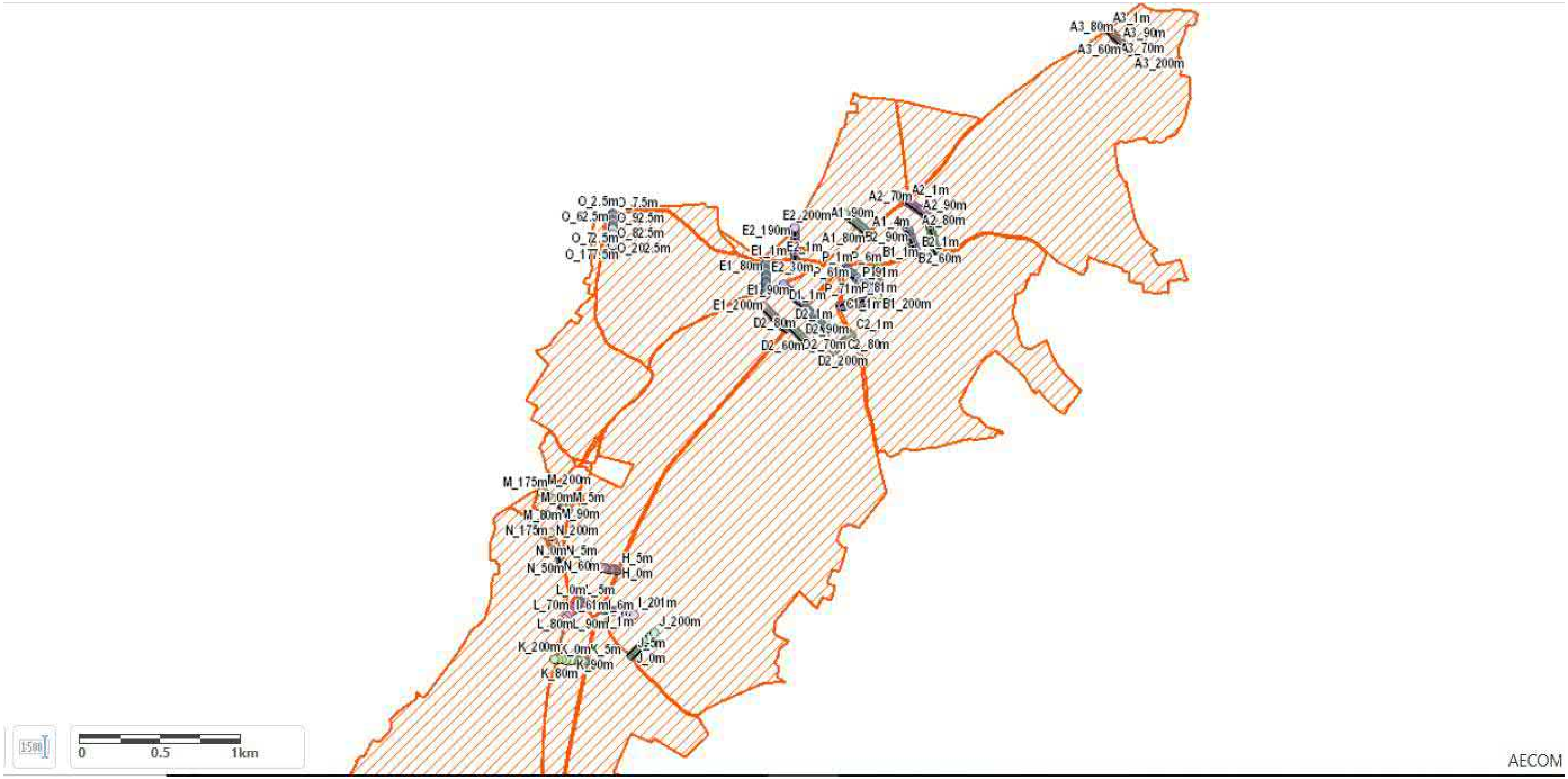
2.19 Using the generated traffic scenarios, and information on average vehicle speeds and percentage heavy duty vehicles (both of which influence the emissions profile), air quality specialists calculated expected NOx concentrations, ammonia concentrations and nitrogen deposition rates for the modelled links. For some road sections (particularly around Wake Arms Roundabout which lies within the Epping Forest SAC) multiple transects were modelled in order to capture the effects of queuing traffic. The modelled links are depicted in Figure 4 overleaf.

2.20 In addition to modelling transects at key locations, isopleth (pollution contour) maps were produced illustrating the different pollution concentrations covering particular areas of the SAC. The modelling methodology described in Appendix D utilised the Emission Factor Toolkit v 9.0 for calculating NOx emissions. Since the modelling was completed an updated version of the Toolkit (v 10.1) has been produced. The modelling was therefore rerun to determine what impact the new version of the EFT would have on the NOx modelling results and thus on nitrogen deposition rates. In summary, the background NOx concentrations and the NOx doses due to growth would be slightly lower than the original modelling (EFT v9.0), the verification factor is slightly higher (1.91 rather than 1.86) but the future NOx concentrations (and thus nitrogen deposition rates) would also be lower than in the original modelling. There is no change in the vehicle fleet mix as AECOM used the London fleet to inform the projection of the ANPR

[20] The addition of nitrogen is a form of fertilization, which can have a negative effect on habitats over time by encouraging more competitive plant species that can force out the less competitive species that are more characteristic of such habitats.
[21] http://www.apis.ac.uk/overview/pollutants/overview_NOx.htm
[22] APIS identifies that direct effects of gaseous nitrogen oxides can also be important, but that negative effects of NO_2 in atmosphere (as distinct from its role in nitrogen deposition) are most likely to arise in the presence of equivalent concentrations of sulphur dioxide (SO_2)..
[23] 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.

vehicle fleet, and this remains unchanged from EFT v9.0 to EFT v10.1 (only the fleet outside of London has been updated for EFT v10.1). Since the new EFT (v10.1) results in lower NOx concentrations and slightly lower doses (and thus lower nitrogen deposition rates) than the original modelling, the original modelling has been reported in this HRA as being more precautionary.

Figure 4: Modelled air quality transect locations at Epping Forest SAC



2.21 The general long-term trend for NOx concentrations in the UK has been one of improvement (particularly since 1990) despite an increase in vehicles on the roads[24]. This trend can also be observed locally to Epping Forest.

2.22 The APIS website shows NOx trend data for the 1km grid square within which Epping Forest SAC is situated. The data are presented as mid-year 3-year averages to 2016 and show that average NOx concentrations across the grid square fell from 37 μgm^{-3} in 2003 (2002-2004 average) to 29 μgm^{-3} in 2016 (2015-2017 average).

2.23 The authors expect that the improving trend shown in the most recent data can be expected to continue, and indeed steepen, as drivers continue to replace older cars with newer vehicles and as further improvements in vehicle NO_x emissions technology are introduced, progressing towards the government's target of ending the sale of all new petrol and diesel cars and vans by 2030. For example, the latest and most stringent (Euro6/VI) emissions standard only became mandatory in 2014 (for heavy duty vehicles) and 2015 (for cars). In contrast, far more drivers can be expected to be using Euro6 compliant vehicles by the end of the Local Plan period (2033) since vehicles that are not compliant with Euro6 ceased manufacture in 2015. Defra's UK vehicle fleet projections show that in 2030, 99% of petrol and diesel cars are expected to be Euro 6 compliant[25].

2.24 The authors expect this continued reduction in background NOx concentrations to be reflected in a fall in background total nitrogen deposition by 2033, particularly as by the same year the measures outlined in the government's 2019 Clean Air Strategy can also be expected to have had a significant effect, including the agricultural ammonia reduction initiatives set out in Chapter 7 of the Clean Air Strategy. This is supported by the Nitrogen Futures work recently published by the JNCC[26]. That project investigated whether a net improvement in nitrogen deposition (including expected development over the same period) was expected to occur to 2030 at a national scale, under a range of scenarios. The report concluded that *'The scenario modelling predicts a substantial decrease in risk of impacts on sensitive vegetation by 2030, under the most likely future baseline* [a scenario called '2030 NAPCP+DA (NECR NOx)'[27]]. *This is estimated to achieve the UK Government's CAS target for England, defined as a 17% decrease in total reactive N deposition onto protected priority sensitive habitats, with a predicted 18.9% decrease* [for England] *from a 2016 base year'*. The report predicted a fall in nitrogen deposition by 2030 under every modelled scenario. **Nonetheless, for the purposes of the air quality modelling reported in this HRA no allowance has been made for any improvement in background nitrogen deposition rates.** This means that the future predicted nitrogen deposition rates are likely to be overestimated with the greatest overestimation in 2033.

2.25 For the original 2016 modelling, a series of road links within 200m of Lee Valley SPA/ Ramsar site were also identified for further investigation. However, in their consultation response on the 2016 Regulation 18 draft of the Local Plan HRA Natural England confirmed that they were satisfied that the area of the Lee Valley SPA being analysed (Rye Meads) was not susceptible to atmospheric pollution from road traffic. That site is therefore not discussed further with regard to air quality.

[24] Emissions of nitrogen oxides fell by 72% between 1970 and 2017. Source: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/778483/Emissions_of_air_pollutants_1990_2017.pdf [accessed 30/08/19]
[25] Defra's Emission Factor Toolkit (EFT) v8.0.1 available at https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html
[26] https://hub.jncc.gov.uk/assets/04f4896c-7391-47c3-ba02-8278925a99c5
[27] The research team considered this the most likely scenario to occur by 2030 as it would achieve the legally mandated National Air Pollution Control Programme (NECR) targets. It includes policies that had already been adopted or implemented, plus additional measures which are currently in development. These additional measures are represented by the UK's National Air Pollution Control Programme (NAPCP).

3. Pathways of Impact

Introduction

3.1 In carrying out an HRA it is important to determine the various ways in which land use plans can impact on internationally designated sites by following the pathways along which development can be connected with internationally designated sites, in some cases many kilometres distant. Briefly defined, pathways are routes by which a change in activity associated with a development can lead to an effect upon an internationally designated site. Following screening of the Plan, the following impact pathways are considered within this document.

3.2 Impact pathways for consideration are:

- Disturbance from recreational activities including urbanisation
- Atmospheric pollution
- Water abstraction
- Water quality

Disturbance from Recreational Activities Including Urbanisation

3.3 Recreational use of an internationally designated site has potential to:

- Cause damage through mechanical/ abrasive damage and nutrient enrichment;
- Cause disturbance to sensitive species, particularly ground-nesting birds and wintering wildfowl; and
- Prevent appropriate management or exacerbate existing management difficulties.

3.4 Different types of internationally designated sites are subject to different types of recreational pressures and have different vulnerabilities. Studies across a range of species have shown that the effects from recreation can be complex.

Mechanical/abrasive damage and nutrient enrichment

3.5 Most types of land based internationally designated site can be affected by trampling, which in turn causes soil compaction and erosion. Walkers with dogs contribute to pressure on sites through nutrient enrichment via dog fouling and also have potential to cause greater disturbance to fauna as dogs are less likely to keep to marked footpaths and move more erratically. Motorcycle scrambling and off-road vehicle use can cause serious erosion, as well as disturbance to sensitive species.

3.6 There have been several papers published that empirically demonstrate that damage to vegetation in woodlands and other habitats can be caused by vehicles, walkers, horses and cyclists:

- Wilson & Seney (1994)[28] examined the degree of track erosion caused by hikers, motorcycles, horses and cyclists from 108 plots along tracks in the Gallatin National Forest, Montana. Although the results proved difficult to interpret, it was concluded that horses and hikers disturbed more sediment on wet tracks, and therefore caused more erosion, than motorcycles and bicycles.
- Cole et al (1995a, b)[29] conducted experimental off-track trampling in 18 closed forest, dwarf scrub and meadow and grassland communities (each tramped between 0 – 500 times) over five mountain regions in the US. Vegetation cover was assessed two weeks and one year after trampling, and an inverse relationship with trampling intensity was discovered, although this relationship was weaker after one year than two weeks indicating some recovery of the vegetation. Differences in plant morphological characteristics were found to explain more variation in response between different vegetation types than soil and topographic factors. Low-growing, mat-forming grasses regained their cover best after two weeks and were considered most

[28] Wilson, J.P. & J.P. Seney. 1994. Erosional impact of hikers, horses, motorcycles and off road bicycles on mountain trails in Montana. *Mountain Research and Development* 14:77-88

[29] Cole, D.N. 1995a. Experimental trampling of vegetation. I. Relationship between trampling intensity and vegetation response. *Journal of Applied Ecology* 32: 203-214

Cole, D.N. 1995b. Experimental trampling of vegetation. II. Predictors of resistance and resilience. *Journal of Applied Ecology* 32: 215-224 resistant to trampling, while tall forbs (non-woody vascular plants other than grasses, sedges, rushes and ferns) were considered least resistant. Cover of hemicryptophytes and geophytes (plants with buds below the soil surface) was heavily reduced after two weeks, but had recovered well after one year and as such these were considered most resilient to trampling. Chamaephytes (plants with buds above the soil surface) were least resilient to trampling. It was concluded that these would be the least tolerant of a regular cycle of disturbance.

- Cole (1995c)[30] conducted a follow-up study (in 4 vegetation types) in which shoe type (trainers or walking boots) and trampler weight were varied. Although immediate damage was greater with walking boots, there was no significant difference after one year. Heavier tramplers caused a greater reduction in vegetation height than lighter tramplers, but there was no difference in effect on cover.
- Cole & Spildie (1998)[31] experimentally compared the effects of off-track trampling by hiker and horse (at two intensities – 25 and 150 passes) in two woodland vegetation types (one with an erect forb understorey and one with a low shrub understorey). Horse traffic was found to cause the largest reduction in vegetation cover. The forb-dominated vegetation suffered greatest disturbance, but recovered rapidly. Higher trampling intensities caused more disturbance.

3.7 The total volume of dog faeces deposited on sites can be surprisingly large. For example, at Burnham Beeches National Nature Reserve over one year, Barnard[32] estimated the total amounts of urine and faeces from dogs as 30,000 litres and 60 tonnes respectively. The specific impact on Epping Forest SAC has not been quantified from local studies; however, the fact that habitats for which the SAC is designated appear to be subject already to excessive nitrogen deposition, suggests that any additional source of nutrient enrichment (including uncollected dog faeces) will make a cumulative contribution to overall enrichment. Any such contribution must then be considered within the context of other recreational sources of impact on sites.

Disturbance

3.8 Concern regarding the effects of disturbance on birds stems from the fact that they are expending energy unnecessarily and the time they spend responding to disturbance is time that is not spent feeding[33]. Disturbance therefore risks increasing energetic output while reducing energetic input, which can adversely affect the 'condition' and ultimately the survival of the birds. In addition, displacement of birds from one feeding site to others can increase the pressure on the resources available within the remaining sites, as they have to sustain a greater number of birds[34].

3.9 The potential for disturbance may be less in winter than in summer, in that there are often a smaller number of recreational users. In addition, the consequences of disturbance at a population level may be reduced because birds are not breeding. However, winter activity can still cause disturbance, especially as birds are particularly vulnerable at this time of year due to food shortages, such that disturbance which results in abandonment of suitable feeding areas can have severe consequences. Several empirical studies have, through correlative analysis, demonstrated that out-of-season (October-March) recreational activity can result in quantifiable disturbance:

- Underhill et al[35] counted waterfowl and all disturbance events on 54 water bodies within the South West London Water bodies Special Protection Area and clearly correlated disturbance with a decrease in bird numbers at weekends in smaller sites and with the movement of birds within larger sites from disturbed to less disturbed areas.
- Evans & Warrington[36] found that on Sundays total water bird numbers (including shoveler and gadwall) were 19% higher on Stocker's Lake LNR in Hertfordshire, and attributed this to displacement of birds resulting from greater recreational activity on surrounding water bodies at weekends relative to week days.

[30] Cole, D.N. (1995c) Recreational trampling experiments: effects of trampler weight and shoe type. Research Note INT-RN-425. U.S. Forest Service, Intermountain Research Station, Utah
[31] Cole, D.N., Spildie, D.R. (1998) Hiker, horse and llama trampling effects on native vegetation in Montana, USA. *Journal of Environmental Management* 53: 61-71
[32] Barnard, A. (2003) Getting the Facts - Dog Walking and Visitor Number Surveys at Burnham Beeches and their Implications for the Management Process. *Countryside Recreation*, 11, 16 - 19
[33] Riddington, R. *et al*. 1996. The impact of disturbance on the behaviour and energy budgets of Brent geese. *Bird Study* 43:269-279
[34] Gill, J.A., Sutherland, W.J. & Norris, K. 1998. The consequences of human disturbance for estuarine birds. *RSPB Conservation Review* 12: 67-72
[35] Underhill, M.C. *et al.* 1993. Use of Waterbodies in South West London by Waterfowl. An Investigation of the Factors Affecting Distribution, Abundance and Community Structure. Report to Thames Water Utilities Ltd. and English Nature. Wetlands Advisory Service, Slimbridge
[36] Evans, D.M. & Warrington, S. 1997. The effects of recreational disturbance on wintering waterbirds on a mature gravel pit lake near London. International Journal of Environmental Studies 53: 167-182

- Tuite et al[37] used a large (379 site), long-term (10-year) dataset (September – March species counts) to correlate seasonal changes in wildfowl abundance with the presence of various recreational activities. They found that on inland water bodies shoveler was one of the most sensitive species to disturbance. The greatest impact on winter wildfowl numbers was associated with sailing/windsurfing and rowing.
- Pease et al[38] investigated the responses of seven species of dabbling ducks to a range of potential causes of disturbance, ranging from pedestrians to vehicle movements. They determined that walking and biking created greater disturbance than vehicles and that gadwall were among the most sensitive of the species studied.
- A three-year study of wetland birds at the Stour and Orwell SPA, Ravenscroft[39] found that walkers, boats and dogs were the most regular source of disturbance. Despite this, the greatest responses came from relatively infrequent events, such as gun shots and aircraft noise Birds seemed to habituate to frequent 'benign' events such as those involving vehicles, sailing and horses, but there was evidence that apparent habituation to more disruptive events related to reduced bird numbers – i.e. birds were avoiding the most frequently disturbed areas. Disturbance was greatest at high tide on the Orwell, but birds on the Stour showed greatest sensitivity.

3.10 A number of studies have shown that birds are affected more by dogs and people with dogs than by people alone, with birds flushing more readily, more frequently, at greater distances and for longer. In addition, dogs, rather than people, tend to be the cause of many management difficulties, notably by worrying grazing animals, and can cause eutrophication near paths. Nutrient-poor habitats such as heathland are particularly sensitive to the fertilising effect of inputs of phosphates, nitrogen and potassium from dog faeces[40] .

3.11 Underhill-Day[41] summarises the results of visitor studies that have collected data on the use of semi-natural habitat by dogs. In surveys where 100 observations or more were reported, the mean percentage of visitors who were accompanied by dogs was 54.0%.

3.12 However the outcomes of many of these studies need to be treated with care. For instance, the effect of disturbance is not necessarily correlated with the impact of disturbance, i.e. the most easily disturbed species are not necessarily those that will suffer the greatest effect. It has been shown that, in some cases, the most easily disturbed birds simply move to other feeding sites with ample resources, whilst others may remain (possibly due to an absence of alternative sites) and thus suffer greater impacts on their population[42]. A literature review undertaken for the RSPB[43] also urges caution when extrapolating the results of one disturbance study because responses differ between species and the response of one species may differ according to local environmental conditions. These facts have to be taken into account when attempting to predict the impacts of future recreational pressure on internationally designated sites.

3.13 Disturbing activities are on a continuum. The most disturbing activities are likely to be those that involve irregular, infrequent, unpredictable loud noise events, movement or vibration of long duration (such as those often associated with construction activities). Birds are least likely to be disturbed by activities that involve regular, frequent, predictable, quiet patterns of sound or movement or minimal vibration. The further any activity is from the birds, the less likely it is to result in disturbance.

3.14 The factors that influence a species response to a disturbance are numerous, but the three key factors are species sensitivity, proximity of disturbance sources and timing/duration of the potentially disturbing activity.

3.15 It should be emphasised that recreational use is not inevitably a problem. Many internationally designated sites are also nature reserves managed for conservation and public appreciation of nature. The Lee Valley Regional Park that

[37] Tuite, C.H., Hanson, P.R. & Owen, M. 1984. Some ecological factors affecting winter wildfowl distribution on inland waters in England and Wales and the influence of water-based recreation. *Journal of Applied Ecology* 21: 41-62
[38] Pease, M.L., Rose, R.K. & Butler, M.J. 2005. Effects of human disturbances on the behavior of wintering ducks. *Wildlife Society Bulletin* 33 (1): 103-112.
[39] Ravenscroft, N. (2005) Pilot study into disturbance of waders and wildfowl on the Stour-Orwell SPA: analysis of 2004/05 data. Era report 44, Report to Suffolk Coast & Heaths Unit.
[40] Shaw, P.J.A., K. Lankey and S.A. Hollingham (1995) – Impacts of trampling and dog fouling on vegetation and soil conditions on Headley Heath. *The London Naturalist*, **74**, 77-82.
[41] Underhill-Day, J.C. (2005). A literature review of urban effects on lowland heaths and their wildlife. Natural England Research Report 623.
[42] Gill et al. (2001) - Why behavioural responses may not reflect the population consequences of human disturbance. *Biological Conservation,* **97**, 265-268
[43] Woodfield & Langston (2004) - Literature review on the impact on bird population of disturbance due to human access on foot. *RSPB research report* No. 9.

encompasses the SPA and Ramsar sites is such an example. At these sites, access is encouraged and resources are available to ensure that recreational use is managed appropriately.

3.16 The Epping Forest SAC and Lee Valley SPA and Ramsar site lie within the District boundary, whilst Wormley-Hoddesdonpark Woods SAC is located 2.2km from the District boundary. As such they are potentially vulnerable to the effects of recreational pressure and/ or disturbances from construction activities resulting from development within Epping Forest District.

3.17 It is therefore necessary to undertake an initial screening exercise to determine whether the development proposals within the Submission Version Local Plan could lead to a likely significant effects, either alone or 'in combination' with other plans and projects, through recreational pressure, on these internationally designated sites.

Urbanisation

3.18 This impact is closely related to recreational pressure, in that they both result from increased populations within close proximity to sensitive sites. The two impact pathways (recreation and urbanisation) are therefore discussed together in this report. The list of urbanisation impacts can be extensive, but the most significant for the internationally important sites considered in this report (particularly Epping Forest SAC) is risk of increased fly-tipping. The principal adverse ecological effect of tipping is the introduction of invasive non-native species with garden waste. Non-native species can in some situations, lead to negative interactions with habitats or species for which internationally designated sites may be designated. Garden waste results in the introduction of invasive non-native species precisely because it is the 'troublesome and over-exuberant' garden plants that are typically thrown out[44]. Non-native species may also be introduced deliberately or may be bird-sown from local gardens. Invasive species can also be spread from seeds attached to clothes and footwear, thus underlining the inter-relatedness between some urbanisation impact pathways and recreational activity. The heathland parts of the SAC are particularly vulnerable to arson or accidental fires. Wildfires can result in the rapid loss of large areas of important habitat, to the detriment of priority species. The Epping Forest Conservators report that in the summer of 2020 a number of fires, including two large examples, one of which was located in the Loughton area.

3.19 Urbanisation effects are linked with recreational pressure effects and would potentially therefore arise from across the core recreational catchment of the SAC.

Atmospheric Pollution

3.20 The main pollutants of concern for internationally important sites are oxides of nitrogen (NOx), ammonia (NH_3) and sulphur dioxide (SO_2). Ammonia can have a directly toxic effect upon vegetation and research suggests that this may also be true for NOx at very high concentrations. More significantly, greater NOx or ammonia concentrations within the atmosphere will lead to greater rates of nitrogen deposition to vegetation and soils. An increase in the deposition of nitrogen from the atmosphere is generally regarded to lead to an increase in soil fertility, which can have a serious deleterious effect on the quality of semi-natural, nitrogen-limited terrestrial habitats.

[44] Gilbert, O. & Bevan, D. 1997. The effect of urbanisation on ancient woodlands. British Wildlife 8: 213-218.

Table 2: Main sources and effects of air pollutants on habitats and species

Pollutant	Source	Effects on habitats and species
Acid deposition	SO_2, NOx and ammonia all contribute to acid deposition.	Can affect habitats and species through both wet (acid rain) and dry deposition. Some sites will be more at risk than others depending on soil type, bed rock geology, weathering rate and buffering capacity.
Ammonia (NH_3)	Ammonia is released following decomposition and volatilisation of animal wastes. It is a naturally occurring trace gas, but levels have increased considerably with expansion in numbers of agricultural livestock. Ammonia reacts with acid pollutants such as the products of SO_2 and NO_X emissions to produce fine ammonium (NH_4+) - containing aerosol which may be transferred much longer distances (can therefore be a significant trans-boundary issue.)	Direct toxicity possible even in low concentrations primarily due to the alkalinity of the gas. Other adverse effects are as a result of nitrogen deposition leading to eutrophication. As emissions mostly occur at ground level in the rural environment and NH_3 is rapidly deposited, some of the most acute problems of NH_3 deposition are for small relict nature reserves located in intensive agricultural landscapes.
Nitrogen oxides (NO_x)	Nitrogen oxides are mostly produced in combustion processes. About one quarter of the UK's emissions are from power stations, one-half from motor vehicles, and the rest from other industrial and domestic combustion processes.	Deposition of nitrogen compounds (nitrates (NO_3), nitrogen dioxide (NO_2) and nitric acid (HNO_3)) can lead to both soil and freshwater acidification. In addition, NO_x can cause eutrophication of soils and water. This alters the species composition of plant communities and can eliminate sensitive species.
Nitrogen (N) deposition	The pollutants that contribute to nitrogen deposition derive mainly from NO_X and NH_3 emissions. These pollutants cause acidification (see also acid deposition) as well as eutrophication.	Species-rich plant communities with relatively high proportions of slow-growing perennial species and bryophytes are most at risk from N eutrophication, due to its promotion of competitive and invasive species which can respond readily to elevated levels of N. N deposition can also increase the risk of damage from abiotic factors, e.g. drought and frost.
Ozone (O_3)	A secondary pollutant generated by photochemical reactions from NO_x and volatile organic compounds (VOCs). These are mainly released by the combustion of fossil fuels. The increase in combustion of fossil fuels in the UK has led to a large increase in background ozone concentration, leading to an increased number of days when levels across the region are above 40ppb. Reducing ozone pollution is believed to require action at international level to reduce levels of the precursors that form ozone.	Concentrations of O_3 above 40 ppb can be toxic to humans and wildlife, and can affect buildings. Increased ozone concentrations may lead to a reduction in growth of agricultural crops, decreased forest production and altered species composition in semi-natural plant communities.
Sulphur Dioxide (SO_2)	Main sources of SO_2 emissions are electricity generation, industry and domestic fuel combustion. May also arise from shipping and increased atmospheric concentrations in busy ports. Total SO_2 emissions have decreased substantially in the UK since the 1980s and are now within the air quality criteria set to protect human health and vegetation across England.	Wet and dry deposition of SO_2 acidifies soils and freshwater, and alters the species composition of plant and associated animal communities. The significance of impacts depends on levels of deposition and the buffering capacity of soils.

3.21 Sulphur dioxide emissions are overwhelmingly influenced by the output of power stations and industrial processes that require the combustion of coal and oil. Ammonia emissions are dominated by agriculture, with some chemical processes also making notable contributions, as do certain vehicles since NOx reduction technology often involves the trade-off of increased ammonia emissions. NOx emissions are dominated by the output of vehicle exhausts (more than half of all emissions). Within a 'typical' housing development, by far the largest contribution to NOx (92%) will be made by the associated road traffic. Other sources, although relevant, are of minor importance (8%) in comparison[45]. Emissions of NOx could therefore be reasonably expected to increase as a result of greater vehicle use as an indirect effect of the plan, where vehicles are directly powered by fossil fuels.

3.22 The Conservation Objectives for Epping Forest SAC include objectives to maintain or restore the structure and function (including typical species) of qualifying natural habitats, and the supporting processes on which qualifying natural habitats and the habitats of qualifying species rely. In order to achieve that objective the supplementary advice with specific regard to ammonia for both heathland and woodland is to '*…restore concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (*www.apis.ac.uk*)*'.

Table 3: Attributes and targets within the Epping Forest Supplementary Advice document which directly refer to air pollution

Qualifying feature	Attributes		Targets
Northern Atlantic wet heaths with *Erica tetralix* and European dry heaths	Supporting processes (on which the feature relies)	Air quality.	**Restore** as necessary, the concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System. *(The explanatory notes refer to NOx, NH3, nitrogen deposition and sulphur dioxide).*
Supporting processes (on which the feature relies)	Soils, substrate and nutrient cycling.		**Restore** the properties of the underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal: bacterial ratio, to within typical values for the habitat. *(The explanatory notes state that the restore objective reflects the exposure to acidification, nutrient enrichment and pollution due to proximity to roads)*.
Atlantic acidophilous beech forests	Structure and function (including its typical species)	Soils, substrate and nutrient cycling.	**Maintain** the properties of the underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal: bacterial ratio, to within typical values for the habitat. *(The explanatory notes state that the threats to soil quality include nutrient enrichment from elevated atmospheric nitrogen)*.
Structure and function (including its typical species)	Key structural, influential and/or distinctive species.		**Maintain** the abundance of the species listed below to enable each of them to be a viable component of the feature. *(species listed include several which are known to be especially sensitive to air pollution impacts, in particular epiphytic bryophytes and lichens)*
Supporting processes (on which the feature relies)	Air quality.		**Restore** as necessary, the concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this woodland feature of the site on the Air Pollution Information System. *(The explanatory notes refer to NOx, NH3, nitrogen deposition and sulphur dioxide).*
Stag beetle	Supporting processes (on which the feature relies)	Air quality.	**Restore** as necessary, the concentrations and deposition of air pollutants to at or below the site-

[45] Proportions calculated based upon data presented in Dore CJ et al. 2005. UK Emissions of Air Pollutants 1970 – 2003. UK National Atmospheric Emissions Inventory. http://www.airquality.co.uk/archive/index.php

Qualifying feature	Attributes		Targets
			relevant Critical Load or Level values given for this woodland feature of the site on the Air Pollution Information System. *(The explanatory notes refer to NOx, NH3, nitrogen deposition and sulphur dioxide).*

Water Abstraction

3.23 The East of England is generally an area of high water stress. It is particularly vulnerable to future climate change. It is already the driest region in the country and the predicted changes could affect the amount and distribution of rainfall, and the demand for water from all sectors. The average natural summer flows of rivers could drastically reduce; the period where groundwater resources are replenished could be shorter; and resources could become much more vulnerable. By 2050, climate change could reduce water resources by 10 -15% on an annual average basis, and reduce summer river flows by 50 -80%. Drought and floods may become more frequent in the future. The reliability of existing reservoirs, groundwater extractions and river intakes will change. The delivery of housing and economic development throughout the region could therefore result in adverse effects on many internationally designated sites in the region including those listed in preceding sections.

3.24 Epping Forest District lies within the Affinity Water supply area, specifically their Central region, WRZ 5. Approximately 60% of the Central region's water supply comes from groundwater sources (chalk and gravel aquifers) and 40% comes from surface water sources and imports from neighbouring water companies (Thames Water, Anglian Water and Cambridge Water). Water is also exported to South East Water and Cambridge Water[46].

Water Quality

3.25 The quality of the water that feeds internationally important sites is an important determinant of the nature of their habitats and the species they support. Poor water quality can have a range of environmental impacts:

3.26 At high levels, toxic chemicals and metals can result in immediate death of aquatic life, and can have detrimental effects even at lower levels, including increased vulnerability to disease and changes in wildlife behaviour.

- Eutrophication, the enrichment of plant nutrients in water, increases plant growth and consequently results in oxygen depletion. Algal blooms, which commonly result from eutrophication, increase turbidity and decrease light penetration. The decomposition of organic wastes that often accompanies eutrophication deoxygenates water further, augmenting the oxygen depleting effects of eutrophication. In the marine environment, nitrogen is the limiting plant nutrient and so eutrophication is associated with discharges containing available nitrogen.
- Some pesticides, industrial chemicals, and components of sewage effluent are suspected to interfere with the functioning of the endocrine system, possibly having negative effects on the reproduction and development of aquatic life.

3.27 Sewage and some industrial effluent discharges contribute to increased nutrients in the internationally important sites and in particular to phosphate levels in watercourses.

3.28 The Plan provides for development within the following settlements that are served by the following Wastewater Treatment Works (WwTW):

Table 4: Wastewater Treatment Works with Catchments Serving Settlements Identified to Provide New Development in the Local Plan.

WwTW Catchment	Settlements to Provide Residential Development and Approximate Quantum	HRA implications
Rye Meads	Roydon – 48 dwellings, Lower Sheering - 14 dwellings Sites around Harlow - 3,900 dwellings	Discharges into watercourses such as the Tollhouse Stream (ultimately entering the River Lee)
Deephams	Waltham Abbey – 836 dwellings Nazeing – 118 dwellings	Discharges into the Salmon Brook, a tributary of the River Lee, but is not connected to the Lee Valley SPA/Ramsar site

[46] Affinity Water (2020) Final Water Resource Management Plan, 2020-2080.

	Buckhurst Hill – 87 new dwellings	
Theydon Bois	Theydon Bois – 57 dwellings	Discharges into the River Roding which discharges into the River Thames near Barking, 16.2 km from the discharge point (in a straight line)
Fiddlers Hamlet	Epping – 709 dwellings (it is not known how much new development will be located within this catchment)	Discharges into Brookhouse Brook, and then the River Roding which discharges into the River Thames near Barking, 18.9 km from the discharge point (in a straight line)
Thornwood	Epping – 709 dwellings (it is not known how much new development will be located within this catchment) North Weald Bassett – 1050 dwellings Coopersale – 6 dwellings Thornwood – 172 dwellings	Discharges into a ditch, then to Cripsey Brook, and then the River Roding which discharges into the River Thames near Barking, 23.5 km from the discharge point (in a straight line)
Stanford Rivers	Ongar - 590 dwellings High Ongar – 10 dwellings	Discharges into the River Roding which discharges into the River Thames near Barking, 20.5 km from the discharge point (in a straight line)
Moreton	Fyfield - 14 dwellings	Discharges into a drain and then the River Roding which discharges into the River Thames near Barking, 26.3 km from the discharge point (in a straight line)
Abbess Roding	Sheering - ~ 74 dwellings	Discharges into a drain and then the River Roding which discharges into the River Thames near Barking, 30.7 km from the discharge point (in a straight line)
Beckton	Loughton – 455 dwellings Chigwell - 206 dwellings Stapleford Abbotts – 33 dwellings	Discharges into the River Thames close to the site near Barking

3.29 Of the WwTWs serving Epping Forest District, Rye Meads WwTW is the only one that is to receive an increase in housing numbers has potential to link to an internationally designated site (identified in orange in Table 4). This will be discussed later in this document.

4. Likely Significant Effects

Likely Significant Effects of Plan Policies

4.1 Table 5 presents an initial assessment of likely significant effects for plan policies, from the point of view of HRA. Where policies have been coloured green in the 'Likely Significant Effects' column, this indicates that the policy does not contain potential impact pathways linking to European designated sites and has been screened out from further consideration. Where policies have been coloured orange in the 'Likely Significant Effects' column, this indicates that the policy provides for potential impact pathways linking to European designated sites and has been screened in for appropriate assessment in this report. Where policies contain both negative and positive implications for Internationally important sites, the negative implications have resulted in the policy being taken forward to appropriate assessment.

Table 5: Screening Assessment of Main Modifications Local Plan Policies

<table>
<tr><th>Policy number/ name</th><th>Policy detail</th><th>Likely Significant Effects</th></tr>
<tr><td colspan="3">Chapter 2: Strategic Policies</td></tr>
<tr><td>Policy SP1: Spatial Development Strategy 2011-2033</td><td>This policy sets out the quantum of development needs that will be provided across the District over the period 2011- 2033 being a minimum of 11,400 new homes. It also identifies the approach taken to the allocation of sites including:

through the creation of Garden Communities around Harlow;
using a sequential flood risk assessment where land in Flood Zone 2 and 3 will only be allocated where need cannot be met in Flood Zone 1;
locating sites on previously developed land within settlements;
Sites located on greenfield land within settlements where the proposals will maintain adequate open space provision within the settlement;
allocating previously developed land within the Green Belt;
the approach taken to the allocating of Greenfield/Green Belt land
the approach taken to the allocation of agricultural land
enabling small scale sites in rural communities to come forward where there is a demonstrable local need which supports the social and economic well-being of that community.

The new homes are be distributed as follows:
<table>
<tr><th>Settlement</th><th>Allocated Housing</th></tr>
<tr><td>Sites around Harlow</td><td>~3900</td></tr>
<tr><td>Epping</td><td>~709</td></tr>
<tr><td>Loughton</td><td>~455</td></tr>
<tr><td>Waltham Abbey</td><td>~836</td></tr>
<tr><td>Ongar</td><td>~590</td></tr>
<tr><td>Buckhurst Hill</td><td>~87</td></tr>
<tr><td>North Weald Bassett</td><td>~1050</td></tr>
<tr><td>Chigwell</td><td>~206</td></tr>
<tr><td>Theydon Bois</td><td>~57</td></tr>
<tr><td>Roydon</td><td>~48</td></tr>
</table>
</td><td>Likely Significant Effects
This policy identifies a quantum of new homes (set as a minimum), pitches and yards for Travellers and Travelling Showpeople, and employment land to be provided during the Plan period, including for the Garden Communities around Harlow.

This policy does contain the positive provision of the requirement for development proposals to demonstrate they accord with infrastructure requirements.

Dependent on the location of the types of development provided within this policy.

Potential impact pathways are present:

Recreational Pressure and urbanisation
Atmospheric Pollution
Water Abstraction
Water Quality.

</td></tr>
</table>

Policy number/ name	Policy detail	Likely Significant Effects
	Nazeing ~118 Thornwood ~172 Coopersale, Fyfield, High Ongar, Sheering, Lower Sheering, Stapleford Abbots ~161 Rural East ~11 The policy then goes on to identify how the new homes will be delivered. The policy sets out that a minimum of 64 pitches and 1 yard will be provided through the allocation of sites to accommodate the needs of Travellers and travelling showpeople as identified in Policy SP4 and Chapter 5. The policy sets out that employment needs will be met by: • retaining and enhancing existing employment sites and premises; • allocating 23 hectares of new employment land; and • promoting new small-scale employment opportunities within mix-use developments, including at the Garden Communities. In addition, the policy sets out that the Council will: • promote and support town centre development and regeneration; • encourage town centres to complement other larger sub-regional and regional comparison retail destinations outside of the District; • support growth in the food production and glasshouse industry; • support growth in the tourism industry and visitor economy; • seek to provide suitable training and skills development for local residents, to provide them with the skills needed to access future employment opportunities both within and outside the District; • seek to increase workforce participation and encouraging older workers to continue to work; and • attract new businesses, encourage start-ups, and help growing businesses.	
Policy SP2 Place Shaping	This policy sets out the place-shaping principles that Strategic Masterplans and development proposals must reflect and demonstrate commensurate to the scale of development proposed. The policy includes principles which are of particular relevance in relation to this Assessment in relation to:	No Likely Significant Effects This is a development management policy. It does not identify any location, quantum or type of development.

Policy number/ name	Policy detail	Likely Significant Effects
	• providing for the long term stewardship of assets; • providing high quality and imaginatively designed homes with gardens or access to usable and accessible amenity space • ensuring generous, well connected and biodiverse rich green space provision; • extending, enhancing and reinforcing strategic green infrastructure and public open space; • ensuring that development enhances the natural environment; • conserving and positively enhancing key landscapes, habitats and biodiversity; • providing for sustainable movement and access to local and strategic destinations (including rail, bus and pedestrians/cycling); • positively responding to sustainable water management; and • incorporating Active Design principles and supporting healthy living through their design by providing opportunities for physical activity and sport, access to quality open spaces, and employment opportunities. It also sets out a guide to densities for different locations to ensure the best and most efficient use of land.	A positive policy that provides for green infrastructure which has potential to divert recreational pressure away from internationally designated sites, encourages sustainable transport which has potential to improve air quality, and to positively respond to sustainable water management which has potential to reduce water abstraction and improve water quality. There are no impact pathways present.
Policy SP3 Development & Delivery of Garden Communities in the Harlow and Gilston Garden Town	This policy identifies the three Garden Communities planned in the Harlow and Gilston Garden Town within Epping Forest District as follows: (i) Latton Priory; (ii) Water Lane Area; and (iii) East of Harlow It sets out the approach to their development being that they should be holistically and comprehensively planned and are of sufficient scale to incorporate a range of homes, employment, education and community facilities, green space and other uses to enable residents to meet the majority of their day-to-day needs underpinned by the delivery of a comprehensive package of infrastructure. It identifies the principles that the design, development and phased delivery of each Garden Community must accord with. The following are of particular relevance to this Assessment:	**Likely Significant Effects** Whilst this policy provides the positive provision of sustainable transport corridors (which by definition would not result in a likely significant effect), provision of infrastructure and sustainable and long-term governance of green space assets prior to outline planning, and encourages alternative transport methods (walking cycling and public transport), that have potential to reduce atmospheric pollution contributions), this policy also provides for a quantum and broad locations of residential development. **Potential impact pathways are present:** • **Recreational Pressure** • **Atmospheric Pollution** • **Water Abstraction** • **Water Quality.**

Policy number/ name	Policy detail	Likely Significant Effects
	• That the public sector will work pro-actively and collaboratively with the private sector to design, and bring forward the Garden Communities to secure a high-quality of place-making; ensure the timely delivery of both the on-site and off-site infrastructure; and provide and fund a mechanism for future stewardship, management, maintenance and renewal of community infrastructure and assets; • Agreeing appropriate and sustainable long term governance and stewardship arrangements for community assets including green space; • Developing a Strategic Masterplan for each Garden Community setting out the key development design and delivery principles and guide development proposals. • Promote and implement the highest quality of planning, design and management of the built and public realm so that the Garden Communities are characterised as distinctive places that capitalise on local assets and establish environments that promote health, happiness and well-being. In addition, proposals have regard to the original guiding principles established by Sir Frederick Gibberd's masterplan for Harlow, including the Green Wedge network; • Ensure that on-site and off-site infrastructure is provided in a timely manner, subject to viability considerations, ahead of or in tandem with the development it supports to mitigate any impacts of the new Garden Communities, meet the needs of residents and establish sustainable travel patterns; • Provide and promote appropriate opportunities for small-scale employment generating uses; • Ensure the provision of integrated and sustainable transport systems that put walking, cycling and public transit networks and connections at the heart of growth in the area, to create a step change in modal shift through providing for and encouraging more sustainable travel patterns; • Contribute to the delivery of the Sustainable Transport Corridors and the establishment of an integrated, accessible and safe transport system which maximises the use of the sustainable transport modes of walking, cycling and the use of public and community transport in order to improve air quality and reduce emissions and promote healthy lifestyles. • Create sociable, vibrant, healthy and walkable neighbourhoods with equality of access for all to local employment opportunities, a range of community services and facilities including health, education, retail, culture, community meeting spaces, multi-functional open space, the Green Wedge Network, sports and leisure facilities and to high quality digital infrastructure; • Develop specific Garden Town Community parking approaches and standards recognising that car-ownership will need to be accommodated without impacting on the 'quality of place, and sustainable transport objectives' whilst making the best use of land;	

<table>
<tr><th>Policy number/ name</th><th>Policy detail</th><th>Likely Significant Effects</th></tr>
<tr><td></td><td>

Create distinctive environments which relate to the surrounding area, the natural and historic landscapes and systems, provide a multi-functional green-grid which creates significant networks of new green infrastructure and which provides a high degree of connectivity to existing corridors and networks and enhance biodiversity; and
Integrate a sustainable approach to design and construction that secures net gains in local biodiversity and the highest standards of energy efficiency and innovation in technology.

</td><td></td></tr>
<tr><td>Policy SP4 Garden Town Strategic Allocations</td><td>
This policy identifies the quantum of development to be provided in each of the Garden Communities as follows:
<table>
<tr><th>Allocation Reference</th><th>Location</th><th>Development to be delivered</th></tr>
<tr><td>SP4.1</td><td>Latton Priory</td><td>A minimum of 1,050 homes
and 1ha of employment land and 5 traveller pitches</td></tr>
<tr><td>SP4.2</td><td>Water Lane Area</td><td>A minimum of 2,100 homes and 5 traveller pitches</td></tr>
<tr><td>SP4.3</td><td>East of Harlow</td><td>A minimum of 750 homes and potential relocation of Princess Alexandra Hospital, and 5 traveller pitches</td></tr>
</table>

The Garden Communities are also expected to make provision for appropriate small-scale employment, retail and community uses and must be planned and delivered as high quality, integrated, sustainable and distinctive developments supported by necessary infrastructure, services and facilities. Development proposals for the Garden Town Communities must reflect and demonstrate that the Place Shaping and Garden Town principles set out in policies SP2 and SP3 have been adhered to.

Matters of relevance in the development of Latton Priory in relation to this Assessment include:

The provision of strategic natural green space of a sufficient size and quality (as detailed in the relevant Mitigation Strategy for the Epping Forest Special Area of Conservation) to support biodiversity and to avoid placing pressure on existing sites of international and national importance;
A sympathetic design which preserves and enhances the adjacent ancient woodland
a local centre

</td><td>
Likely Significant Effects
The closest of these sites is 5.5km from Epping Forest SAC (SP4.1), 6.3km from Wormley-Hoddesdonpark Woods SAC (SP4.2), and 2.9 km from Lee Valley SPA and Ramsar site (SP4.2).
Full screening of the Site Allocations can be found in Table 6, Table 7 and
Table 8.
Potential impact pathways present include:

Recreational Pressure
Atmospheric Pollution
Water Abstraction
Water Quality.

Locations are illustrated on Appendix B2.
</td></tr>
</table>

Policy number/ name	Policy detail	Likely Significant Effects
	• A new primary school with early years and childcare provision on an education site of at least 2.1 hectares; • At least 10ha of land to accommodate a secondary school in addition to any necessary contributions; • Early years facilities; • The provision of appropriate community and health facilities; • The provision of highway and transport improvements including to the north-south sustainable transport corridor, works to Southern Way and Second Avenue corridor, and upgrades to Junction 7 of the M11; • The provision of utility infrastructure including water, waste water, solid waste, gas, electricity and telecommunications • bus services and direct pedestrian and cycle links between housing and the facilities that serve them. Matters of relevance in the development of the Water Lane Area in relation to this Assessment include: • the provision of strategic natural green space of a sufficient size and quality (as detailed in the relevant Mitigation Strategy for the Epping Forest Special Area of Conservation) to support biodiversity and to avoid placing pressure on existing sites of international and national importance; • a local centre; • A new primary school with early years and childcare provision on an education site of at least 2.1 hectares;; • Contributions towards new secondary school provision within the Garden Town; • Early years facilities; • The provision of appropriate community and health facilities; • The provision of utility infrastructure including water, waste water, solid waste, gas, electricity and telecommunications; and • Bus services and direct pedestrian and cycle links between housing and the facilities that serve them. Matters of relevance in the development of the East of Harlow site in relation to this Assessment include: • The provision of strategic ‘green and blue infrastructure’ comprising natural / semi natural open space, walking and cycling routes, flood mitigation and wildlife space; • A local centre; • The provision of appropriate community and health facilities including approximately 14 hectares of land for a health and well-being hospital campus;	

Policy number/ name	Policy detail	Likely Significant Effects
	• A new primary school with early years and childcare provision on an education site of at least 2.1 hectares;; • At least 10ha of land to accommodate a new secondary school in addition to any necessary contributions; • Early years facilities; • The provision of appropriate community and health facilities; • Highway and transport improvements including linkages into off-road cycle and walking networks; • Suitable highway improvements to be agreed with the highway authority; • The provision of utility infrastructure including water, waste water, solid waste, gas, electricity and telecommunications; • Bus services and direct pedestrian and cycle links between housing and the facilities that serve them; and • Integration with the proposed National Cycle Route 1.	
Policy SP5 Green Belt and Local Green Space	This policy identifies the extent of Green Belt and local greenspace within the District and the level of protection that will be afforded to such designations. It identifies that the key characteristics of the Green Belt is its openness and permanence. They key characteristics of Local greenspace are their beauty, wildlife value, historic significance and/or recreational value. However, it is not necessary for each of these characteristics to be present to be designated or retained as local greenspace.	No Likely Significant Effects. This is a development management policy that provides for the protection of the Green Belt and Local Green Space. There are no impact pathways present.
Policy SP6 The Natural Environment, Landscape Character and Green and Blue Infrastructure	This policy sets out the strategic approach by which the Council will protect the natural environment, enhance its quality and extend access to it. It identifies that the Council aims to create a comprehensive network of green and blue corridors and places, appropriate to the specific rural or urban setting. In so doing, biodiversity will be enriched through habitat connection, improvement and protection at all scales, including priority habitats. Access will be extended and the recreational opportunities of the countryside and urban open spaces will be maximized. The policy includes matters of relevance in relation to this Assessment in relation including that: • the Council will conserve and enhance the character and appearance of the countryside; • A multifunctional countryside will be supported, which is productive, rich in biodiversity at all scales, with a well-connected green infrastructure network that is accessible for quiet enjoyment, recreation and exercise • The green and blue infrastructure assets of the towns, villages and rural communities will be protected and the quality of existing greenspace in towns and smaller settlements will be improved.	No Likely Significant Effects. This is a positive policy as it provides for the retention and extension of green infrastructure which has potential to divert recreational pressure away from internationally designated sites. There are no impact pathways present.

Policy number/ name	Policy detail	Likely Significant Effects
	• Development will be designed to protect existing green and blue infrastructure assets, enhance networks, secure better provision where deficiencies have been identified and deliver new green and blue assets to link to local or wider green and blue infrastructure networks; and • Quality greenspace appropriate to the scale of the development will be sought. The District's green and blue infrastructure network (including priority habitats) will also be preserved, restored, extended, maintained and enhanced, and priority species protected as appropriate, through the application of other policies in the Plan including: • the location of development (Policy SP1 and Chapter 5) • protecting habitat and improving biodiversity (Policy DM1) • the protection of the Epping Forest SAC and Lee Valley SPA (DM2) • the approach to addressing Landscape Character, Ancient Landscapes and Geodiversity considerations (Policy DM3); • the maintenance, protection and enhancement of green and blue infrastructure assets in the District (DM5) • designated and undesignated open spaces (Policy DM6) • sustainable urban drainage systems (Policy DM16) • protection of the Epping Forest SAC from the adverse effects of air pollution (DM2 and DM22) • supporting sustainable transport choices (Policy T1) All appropriate development proposals are expected to contribute towards the delivery of green and blue assets which develop and enhance a network of multi-functional green and blue infrastructure. Contributions will be proportionate to the scale of the proposed development and the rural or urban context. Development which improves the District's existing green and blue infrastructure and where possible, enhances and protects networks will be supported. Additional provision will be required where deficiencies have been identified through the Infrastructure Delivery Plans Schedules, Green Infrastructure and other appropriate evidence base documents. Where on site provision is not feasible financial contributions will be sought.	
Chapter 3: Housing, Economic and Transport Policies		
Policy H1 Housing mix and accommodation types	This policy sets out the Council's expectations in terms matters including of the range of house types and sizes of new homes that should be provided, as well as requiring the provision of affordable housing, facilitating community led housing schemes, ensuring the accessibility and adaptability of new homes, the criteria for supporting the provision of specialist accommodation, self-build/custom build housing, sites upon which caravans can be stationed, or locations for mooring houseboats,	No Likely Significant Effects. This is a policy relating to the mix and type of housing to be provided. This policy does not identify any location or quantum of development. There are no impact pathways present.

<table>
<tr><th>Policy number/ name</th><th>Policy detail</th><th>Likely Significant Effects</th></tr>
<tr><td>Policy H2 Affordable housing</td><td>This policy sets out the approach that the Council will take in relation to the provision of affordable housing. In particular it identifies the size of development proposals above which affordable housing will be required, the approach to the management of the affordable housing, how the mix of units will be determined, and the evidence required to justify any reduction in the level of affordable housing proposed and the approach that the Council will take in assessing such evidence.</td><td>No Likely Significant Effects.
This is a policy relating to the provision of affordable housing. This policy does not identify any location or quantum of development.
There are no impact pathways present.</td></tr>
<tr><td>Policy H3 Rural exceptions</td><td>This policy sets out the circumstances whereby small-scale affordable housing may be granted in locations where planning permission would not normally be granted and the approach to be taken in relation to their occupation.</td><td>No Likely Significant Effects.
It is noted that this policy provides for new housing beyond that previously identified, however this is small scale housing in exceptional circumstances. This policy does not provide for any location or quantum (other than small scale) for development.
As such there are no impact pathways present.</td></tr>
<tr><td>Policy H4 Traveller site development</td><td>This policy provides a criteria based approach to the determination of planning applications for Traveller plots and/or pitches on sites other than those allocated in the Local Plan.</td><td>No Likely Significant Effects.
Whilst this policy relates to provision of new Traveller sites, it does not itself identify any quantum or location (this is provide in policies SP 2 and SP 3). In addition, it ensures that no adverse impact upon the natural environment will occur. As such there are No Likely Significant Effects.</td></tr>
<tr><td>Policy E1 Employment sites</td><td>This policy sets out the approach that the Council will take to support long-term economic growth in the District. Existing employment sites and premises will be retained and enhanced and proposals for the redevelopment, renewal, intensification, or extension of B Use Class or Sui generis uses of an employment character existing employment sites and premises for their authorised use will be encouraged. Complementary and supporting uses may be considered acceptable where they do not change the site's employment character and function. A number of new employment sites are also proposed for allocation as follows:.
<table>
<tr><th>Allocation reference</th><th>Site Name</th><th>Primary use</th><th>Indicative Development Area</th></tr>
<tr><td>LOU.E2A</td><td>Land adjacent to Langston Road Industrial Estate</td><td>B2</td><td>1 ha</td></tr>
<tr><td>NWB.E4A</td><td>North Weald Airfield</td><td>B1/B2/B8</td><td>10 ha</td></tr>
<tr><td>RUR.E19A</td><td>Land adjacent to Dorrington Farm</td><td>B1a/B1b</td><td>1 ha</td></tr>
</table></td><td>Likely Significant Effects
The closest new employment site is located 1km from Epping Forest SAC (SR-1034-Z: WAL.E9), 6.3km from Wormley-Hoddesdonpark Woods SAC (SP 5.2), and 1 km from Lee Valley SPA and Ramsar site (SR-0375-N: WAL.E7).
Full screening of the Site Allocations can be found in Table 6, Table 7 and
Table 8.
Potential impact pathways present include:
• Atmospheric Pollution
• Water Abstraction
• Water Quality.
Locations are illustrated on Appendix B2.</td></tr>
</table>

<table>
<tr><th>Policy number/ name</th><th>Policy detail</th><th>Likely Significant Effects</th></tr>
<tr><td></td><td><table><tr><td>WAL.E6A</td><td>Land adjacent to Galley Hill Road Industrial Estate</td><td>B2/B8</td><td>1 ha</td></tr><tr><td>WAL.E8</td><td>Land North of A121</td><td>B1c/B2/B8</td><td>10 ha</td></tr><tr><td>Total</td><td></td><td></td><td>23ha</td></tr></table>(note – figures have been rounded)

The policy also supports and encourages the development of flexible local employment space.</td><td></td></tr>
<tr><td>Policy E2 Centre Hierarchy/Retail Policy</td><td>This policy sets out the hierarchy of Town and District Centres to be applied across the District as follows:
Town Centres:
• Epping
• Loughton High Road
District Centres:
• Waltham Abbey
• Loughton Broadway
• Ongar
• Buckhurst Hill
The policy sets out that proposals within defined Town and District Centres for retail, leisure, entertainment, offices, arts and culture, tourism and other main town centre uses, will be supported where they will maintain and enhance the vitality and viability of the centres. It sets out the approach the Council will take in relation to proposals in Primary and Secondary retail frontages, and the scale and type of development that will be appropriate dependent on the position of the relevant centre in the hierarchy. It seeks to protect the change of use of shops in certain locations outside of the Town and District centres and sets out the approach the Council will take to Out of Centre development including its accessibility or potential accessibility by a range of transport options, including public transport, cycle and foot.</td><td>No Likely Significant Effects.
This is a policy relates to Centre Hierarchy and Retail.
This policy does not identify any type or location of development.
There are no impact pathways present.</td></tr>
<tr><td>Policy E3 Food production and glasshouses</td><td>This policy sets out that proposals for new or replacement glasshouses, any ancillary packhouse development, any ancillary low carbon energy generation facilities and Combined Heat and Power (CHP) facilities will be permitted subject to a number of criteria. Of relevance to this Assessment are that:
• adequate surface water and foul drainage capacity exists or can be provided as part of the development.</td><td>No Likely Significant Effects.</td></tr>
</table>

Policy number/ name	Policy detail	Likely Significant Effects
	• adequate quality and quantity of provision of water is available or can be provided on-site, for all domestic and non-domestic purposes; The policy also requires that any energy generation facilities do not impact on the integrity of the Epping Forest Special Area of Conservation in accordance with the requirements of Policies DM2 and DM20.	This is a policy relating to food production and glasshouses. This policy does not identify and location or quantum of development. It does provide the requirement for adequate water resources. It should be noted that food production uses lots of water. At this stage it is not possible to assess the impacts of any new food production and glasshouse development. Any increase in water abstraction for commercial reasons would be required to gain an abstraction license from the Environment Agency for the specific development. The quantum of new residential development provided by this policy is likely to be small. As no location is identified, there are no impact pathways present.
Policy E4 The visitor economy	This policy sets out that opportunities for the sustainable development of the visitor economy will be supported where they are of a scale, type and appearance appropriate to the locality and provide local economic benefits. This includes: • support for the development of high quality visitor accommodation including where linked to outdoor sport and activity hubs in the Lee Valley Regional Park. • encouraging sustainable tourism in rural areas including better linkages between the towns and rural surroundings; and opportunities for the enjoyment of the Lee Valley Regional Park and Epping Forest. It sets out that any proposal will need to ensure where appropriate, that these sites are protected in accordance with the Habitat Regulations • supporting and encouraging the improvement of sustainable and active transport opportunities for visitors in order to minimise increases in traffic and the affects it will have on the highway network and air quality;	No Likely Significant Effects. This policy has potential to increase visitor numbers to internationally designated sites and to lead to impact pathways such as increased water abstraction and atmospheric pollution, and reduction in water quality. However, by definition sustainable development, sustainable tourism and sustainable transport would not result in likely significant effects upon internationally designated sites. Further, this policy does not identify any location, type or scale of development. There are no impact pathways present.
Policy T1 Sustainable Transport Choices	This policy sets out the approach that the Council will take to promote a safe, efficient and convenient transport system. Of particular relevance to this Assessment is that the Council will: • promote transport choice, through improvements to public transport services and supporting infrastructure, and providing coherent and direct cycling and walking networks to provide a genuine alternative to the car and facilitate a modal shift; and • provide opportunities to improve access to the two town and four district centres and rail stations by all modes of transport and ensure good integration between transport modes;	No Likely Significant Effects By definition sustainable transport would not result in likely significant effects upon internationally designated sites. Further, this policy does not identify any location, type or scale of development, or any scale or location of any transport schemes. It contains positive text to encourage modal shift away towards cycling, walking and use of public transport and electric cars which all have potential to reduce atmospheric pollution. There are no impact pathways present.

Policy number/ name	Policy detail	Likely Significant Effects
	It sets out that development should minimise the need to travel, promote opportunities for sustainable transport modes, improve accessibility to services and support the transition to a low carbon future. Development proposals that generate significant amounts of movement will normally be required to provide a Travel Plan and those developments which generate a significant number of heavy goods vehicle movements will be required to submit a Routing Management Plan. Reduced car parking, including car free, development in sustainable locations will be supported and in order to accommodate the use of low emission vehicles to support improvements in air quality within the District all new parking spaces provided as part of a development must provide direct access to an electric vehicle charging point.	
Policy T2 Safeguarding of routes and facilities	This policy seeks to protect any land required for proposed transport schemes and local facilities.	No Likely Significant Effects. This is a policy relating to safeguarding land for future schemes. There are no impact pathways present.
Chapter 4: Development Management Policies		
Policy DM1 Habitat Protection and Improving Biodiversity	This policy sets out that all development should, where possible, seek to deliver net biodiversity gain in addition to protecting existing habitat and species. Development proposals should seek to integrate biodiversity through their design and layout and provide connections between physical and functional networks. Development proposals must seek to avoid harm to, protect and enhance natural habitats, areas and corridors for biodiversity. Development will not be permitted where significant impacts upon areas of international designation (including sites designated as Special Areas of Conservation or Special Protection Areas and Ramsar sites) or national designation (including Sites of Special Scientific Interest) cannot be avoided, mitigated or as a last resort compensated. Developments that are likely to have an adverse impact, either alone or in combination, on internationally designated sites must satisfy the requirements of the Habitats Regulations, determining site specific impacts and avoiding or mitigating against impacts where identified. The creation of new corridors for biodiversity will be supported in appropriate locations. The provision of buffers to protect sensitive habitats including those of wetlands and ponds will be required where necessary. In exceptional circumstances where the negative impacts of development on natural habitat and biodiversity are unavoidable, the negative impacts must be proportionately addressed in accordance with the hierarchy of: (i) mitigation; (ii) compensation in the form of habitat; and finally (iii) offsetting within the locality.	No Likely Significant Effects. This is a development management policy relating to the protection of habitats and improving biodiversity. It includes text that explicitly identifies the need to '*not negatively impact upon areas of international or national designation*.' There are no impact pathways present.

Policy number/ name	Policy detail	Likely Significant Effects
	The loss, deterioration or fragmentation of irreplaceable habitats, such as Veteran trees and Ancient Woodland, will not be permitted unless the need for, and benefits of, the development in that location can be demonstrated to clearly outweigh the loss. Ecological impacts of a proposed development will need to be quantified by using the Biodiversity Impact Assessment Calculator (BIAC) where appropriate and development proposals must demonstrate a net gain in ecological units.	
Policy DM2 Epping Forest SAC and the Lee Valley SPA	This policy sets out that the Council will expect all relevant development proposals to assist in the conservation and enhancement of the biodiversity, character, appearance and landscape setting of the Epping Forest Special Area of Conservation (SAC) and the Lee Valley Special Protection Area (SPA), and ensure no adverse effect on integrity arises. It includes specific reference to the strategic approach that the Council has taken through the development and adoption of: • an Air Pollution Mitigation Strategy, • an Approach to managing recreational pressure on the Epping Forest SAC (SAMM Strategy); and • a Green Infrastructure Strategy which includes SANG requirements and strategic infrastructure projects to protect Epping Forest SAC. It then provides details of the requirements in relation to individual development proposals to secure the implementation of these strategies in order to ensure that there will be no harm to the integrity of the protected sites.	No Likely Significant Effects This is a positive policy. The supporting text to this policy sets out in detail the approach that the Council will take to managing the effects of development on the Epping Forest SAC in particular including through the adoption of Mitigation Strategies to address Visitor Pressure and Air Pollution issues. The policy itself provides for the explicit protection of Epping Forest SAC and the Lee Valley SPA and Ramsar site. There are no impact pathways present.
Policy DM3 Landscape Character, Ancient Landscapes and Geodiversity	This policy sets out how the Council will assess applications for development in relation to landscape character, the nature and physical appearance of ancient landscapes and geological sites of importance.	No Likely Significant Effects. This is a development management policy relating to landscape character and ancient landscapes. There are no impact pathways present.
DM4 Green Belt	This policy sets out the five purposes of the Green Belt, the approach to the determination of applications for development in the green belt in relation to very special circumstances and the consideration of openness. It also identifies development that is not considered to be, or has the potential to not be considered to be, inappropriate development in the Green Belt or may be considered.	No Likely Significant Effects. This is a development management policy relating to development in the Green Belt. There are no impact pathways present.

Policy number/ name	Policy detail	Likely Significant Effects
Policy DM5 Green and Blue Infrastructure	This policy requires development proposals to demonstrate that they have been designed to retain and enhance the Districts Green and Blue Infrastructure. In addition proposals for Green and Blue Infrastructure need to be appropriate and adequate, taking into account the nature and scale of the development, its setting, context and intended use. In the Garden Communities a full concept plan of proposed green and blue infrastructure that incorporates existing features on the site and its links to the wider landscape and townscape will be required for submission with the application along with any requirements set out in the Strategic Masterplans. It also makes clear that provides for enhanced connectivity and integration to existing Green Infrastructure should not increase increased visitor pressure on the Epping Forest SAC.	No Likely Significant Effects This is a positive policy with regards to biodiversity.
Policy DM6 Designated and undesignated open spaces	This policy sets out that appropriate development proposals will be required to provide open space, or links to open space and nationally adopted space standards will be used as a starting point for provision. Development on open spaces will only be permitted if it does not result in a net loss of usable public open space or reasonable access to alternative open space within a settlement. It makes reference that new or enhanced links would not be appropriate of it increases visitor pressure on the Epping Forest SAC.	No Likely Significant Effects This is a positive policy with regards to biodiversity.
Policy DM7 Heritage Assets	This policy sets out the Council's approach to preserving and enhancing the historic environment of the District. This includes both designated and non-designated heritage assets and their settings.	No Likely Significant Effects. A development management policy relating to heritage assets including Registered Parks and Gardens. These spaces can act to divert recreational pressure away from internationally designated sites. There are no impact pathways present.
Policy DM8 Heritage at Risk	This policy sets out the Council's approach for bringing forward proposals for the conservation and enhancement of Heritage Assets at Risk or under threat within the District to secure their future and seek a viable use.	No Likely Significant Effects A development management policy relating to Heritage at Risk. There are no impact pathways present.
Policy DM9 High quality design	This policy sets out the Council's requirement that all new development must achieve a high quality of design and contribute to the distinctive character and amenity of the local area. The Council will require all development proposals to be design-led, use sustainable design and construction principles that consider adaptation and mitigation approaches to address climate change and minimise vulnerability to climate change impacts and which will not exacerbate vulnerability in other areas. It also includes the Council's required approach to achieving high quality design within the Strategic Masterplan Areas, design standards, landscaping, the Public Realm, Connectivity and Permeability (development proposals must maximise connectivity within, and through, the development and to the surrounding areas including the provision of high quality and safe pedestrian and cycle routes) and privacy and amenity (including needing to address issues of vibration, noise, fumes, odour, light pollution, air quality and microclimatic conditions).	No Likely Significant Effects. This is a development management policy relating to design. It is a positive policy as it includes text relating to sustainable design, which by definition would not have an impact upon designated sites. There are no impact pathways present.

Policy number/ name	Policy detail	Likely Significant Effects
Policy DM10 Housing design and quality	This policy sets out the Council's requirements that development should meet or exceed the minimum internal space standards set out in the latest National Drescribed Space Standards and open space standards as adopted or endorsed by the Council. Where appropriate development proposals should seek to include enhanced provision of green infrastructure, including the quantity and quality of landscaped areas, tree provision and the provision of additional open space.	No Likely Significant Effects. This is a positive policy as it encourages the inclusion of amenity/ garden space, green infrastructure and open space. These have potential to divert recreational pressure away from internationally designated sites. There are no impact pathways present.
Policy DM11 Waste recycling facilities on new development	This policy sets out that all development which generates waste will be required to make on site provision for general waste, the separation of recyclable materials and organic material for composting. In addition on-site provision must ensure adequate dedicated internal and external storage space to manage the volume of waste arising from the site.	No Likely Significant Effects. This is a development management policy relating to waste recycling storage facilities on new development sites. This is a positive policy as it is likely to reduce any occurrences of fly tipping within an internationally designated site as a result of new development. There are no impact pathways present.
Policy DM12 Subterranean, basement development and lightwells	This policy sets out the approach the Council will take when considering proposals for subterranean developments, basements, or extensions to existing basements. This includes the consideration of local geological conditions. In determining proposals for basements and other underground development the Council will require an assessment of the scheme's impact on drainage, flooding, groundwater conditions and structural stability in the form of a Basement Impact Assessment and where appropriate a Basement Construction Management Statement.	No Likely Significant Effects. This is a development management policy relating to subterranean, basement development and lightwells. This policy ensures that new development should have regard to local geological conditions, thus ensuring that new development will not impact upon subterranean hydrological systems. There are no impact pathways present.
Policy DM13 Advertisements	This policy sets out the approach the Council will take when considering applications for advertisement consent.	No Likely Significant Effects. This is a development management policy relating to advertisements. There are no impact pathways present.
Policy DM14 Shopfronts and on street dining	This policy sets out the approach the Council will take when considering applications for the replacement of shopfronts, provision of security shutters and canopies, and for on-street and forecourt dining areas.	No Likely Significant Effects. This is a development management policy relating to shopfronts and on street dining. There are no impact pathways present.

Policy number/ name	Policy detail	Likely Significant Effects
Policy DM15 Managing and reducing flood risk	This policy sets out the approach that the Council will take in relation to managing and reducing flood risk. The Council will require all development proposals to demonstrate that they avoid and reduce the risk of all forms of flooding to future occupants and do not increase the risk of flooding elsewhere. Local Plan allocations are directed towards Flood Zone 1 or to areas with the lowest probability of flooding. Any proposals for new development (except water compatible uses) within Flood Zone 2 and 3a will be required to provide sufficient evidence for the Council to assess whether the requirements of the Sequential Test and Exception Test, have been satisfied. However, the Sequential Test does not need to be applied to sites which have been allocated in this Local Plan and where the proposed development is in accordance with this Plan. The Policy Identifies when a development proposal will be required to be supported by a site specific Flood Risk Assessment (FRA) which should take account of all potential sources of flooding and climate change allowances and the matters that should be addressed within it. All proposals for new development will be required to manage and reduce surface water run-off, manage water and waste water discharges, ensure safe access and egress for future users of the development and an emergency evacuation plan where appropriate include measures to assist existing communities at risk of flooding where feasible. All proposals for development within a Critical Drainage Area or a Flood Risk Assessment Zone will be required to provide a site specific flood risk assessment.	No Likely Significant Effects This is a positive development management policy relating to management and reduction of flood risk. It provides for the requirement for new development to manage and reduce surface run-off and waste water discharges. There are no impact pathways present.
Policy DM16 Sustainable Drainage Systems	This policy sets out that all proposals for new development must seek to manage surface water as close to its source as possible in line with the drainage hierarchy set out in the policy. The Council will require Sustainable Drainage Systems (SuDS) to be incorporated into new development by way of site layout and design and sets out the requirements for reducing surface water flows in major and non-major developments on greenfield and brownfield sites. The policy also sets out the requirements for SuDS including that they are designed to maximise biodiversity and local amenity benefits and where appropriate, ensure that they provide for clean and safe water at the surface and improve water quality.	No Likely Significant Effects. By definition, sustainable drainage systems would not result in likely significant effects upon internationally designated sites. This is a positive policy as it aims to improve water quality and reduce runoff. There are no impact pathways present.
Policy DM17 Protecting and enhancing watercourses and flood defenses	This policy sets out the distances that new development must be set back from main rivers and ordinary watercourses in order to provide a naturalised and undeveloped buffer zone. It also sets out when exceptions to the policy may apply. Buffer zones should be designed for the benefit of biodiversity and should be undisturbed by lighting. It also identifies when environmental enhancements should be investigated and secured. In addition proposals must not adversely affect the natural functioning of main rivers and ordinary watercourses, including through culverting and development on or adjacent to a watercourse must not result in the deterioration of the water quality of that watercourse or impact on the stability of the banks of a watercourse or river.	No Likely Significant Effects. This is a positive policy that ensures that development does not lead to deterioration to the quality or stability of a watercourse and refers to the WFD and TRBMP. There are no impact pathways present.

Policy number/ name	Policy detail	Likely Significant Effects
Policy DM18 On site management of waste water and water supply	This sets out the approach the Council will take to ensure that there is adequate surface water, foul drainage and treatment capacity to serve a proposed development, demonstrate that it does not impact on existing development and ensure the separation of surface and foul water systems. The Council will expect new development to connect to mains foul drainage and will restrict the use of non-mains drainage for foul water disposal, particularly in Groundwater Source Protection Zones. In addition, all proposals for new development will be required to ensure that there is adequate water supply infrastructure capacity both on and off site to serve the development with sufficient quality and quantity, flow rate and pressure of water, without impacting on existing users. It also requires the installation and management of measures for the efficient use of mains water and where possible with direct connection to the mains public water supply.	No Likely Significant Effects. This is a positive development management policy as it ensures that the public sewerage network has sufficient capacity to serve existing and new development, and that provision of new infrastructure is in place prior to occupation, thus preventing a reduction in water quality. There are no impact pathways present.
Policy DM19 Sustainable water use	This policy sets out the requirement to incorporate water saving measures and equipment in all new development and the water efficiency standards to be met.	No Likely Significant Effects. This is a positive development management policy that provides for enhanced water use efficiency, thus reducing the need for water abstraction. There are no impact pathways present.
Policy DM20 Low carbon and renewable energy	This policy encourages the incorporation of low carbon and renewable energy measures in new and existing development. Low carbon and renewable energy technologies will be permitted provided that they do not have any adverse impact on the integrity of any European sites, wildlife sites, protected species or habitats or the openness of the Green Belt. A positive assessment has to be provided as part of any application demonstrating how any impacts on the environment and heritage assets, including cumulative landscape, noise, visual, air quality and emissions, and traffic generation impacts can be avoided or mitigated through careful consideration of location, scale and design. The use of combined heat and power (CHP), and/or combined cooling, heat and power (CCHP) and district heating will be encouraged in new developments. Bio-mass based CHP proposals are required to demonstrate that they would not have an adverse effect on the integrity of the Epping Forest SAC, any designated Air Quality Management Area (AQMA), or result in the need for an AQMA to be designated. Strategic Masterplans will be required to demonstrate how the potential to incorporate infrastructure for district heating can be provided.	No Likely Significant Effects. This is a development management policy relating to low carbon and renewable energy. No type, location or extent of development is identified. In addition, this policy provides explicit protection for European sites. There are no impact pathways present.

Policy number/ name	Policy detail	Likely Significant Effects
Policy DM21 Local environmental impacts, pollution and land contamination	This policy sets out that the Council will require that the residual local environmental impacts of all development proposals after mitigation do not lead to unacceptable impacts on the health, safety, wellbeing and amenity of existing and new users or occupiers of a development site, or the surrounding land. These potential impacts can include, but are not limited to, air and water (surface and groundwater) pollution, dust, noise, vibration, light pollution, odours, and fumes as well as land contamination. The Council will resist development which, amongst other things, leads to unacceptable local environmental impacts, including, but not limited to, air pollution, noise and vibration, light pollution, odours, dust and land and water contamination. It requires that activities likely to generate pollution are located away from sensitive uses and receptors where possible, practical and economically feasible. Development proposals must mitigate and reduce to a minimum any adverse local environmental impacts and activities that may have wider cumulative effects.	No Likely Significant Effects. This is a positive development management policy relating to environmental impact, pollution and land contamination. It is a positive policy as it provides for preventing detrimental impacts as a result of environmental conditions resulting from new development such as air quality, and provides for the reuse and recycling of building materials and the use of local products, thus reducing atmospheric pollutants further, and the use of water resources during the manufacturing process. There are no impact pathways present.
DM22 Air Quality	This policy sets out that the Council will seek to ensure that the District is protected from the impacts of air pollution. Potential air pollution risks will need to be properly considered and adequate mitigation included in the design of new development to ensure that neither future, nor existing residents, workers, visitors, nor environmental receptors are adversely affected. As well as managing the impacts of air pollution on human health it also specifically addresses the need to demonstrate that development will have no adverse effect on the integrity of the Epping Forest SAC as a result of the development and the strategic approach that the Council has taken through the adoption of an Air Pollution Mitigation Strategy, as well as the need for applicants to contribute to that strategy.	No Likely Significant Effects. This is a positive development management policy that ensures that changes in air quality as a result of new development will not adversely impact upon Epping Forest SAC alone or in combination.
Chapter 5: Places		
Policy P1 Epping	Proposals for development on allocated sites should accord with the site specific requirements in Part Two of the Plan. Residential sites proposed for allocation and the quantum of development to be delivered are as follows: • EPP.R1 Land South of Epping, West and EPP.R2 Land South of Epping, East – approximately 450 homes and appropriate uses. • EPP.R4 Land at St Johns Road – approximately 34 homes and appropriate uses. • EPP.R5 Epping Sports Centre – approximately 42 homes • EPP.R6 Cottis Lane Car park – approximately 47 homes • EPP.R7 Bakers Lane Car Park – approximately 31 homes • EPP.R8 Land and part of Civic Offices – approximately 44 homes • EPP.R9 Land at Bower Vale – approximately 50 homes • EPP.R11 Epping Library – approximately 11 homes	**Likely Significant Effects** This policy provides for residential and employment site allocations between 400m and 1.8km from Epping Forest SAC. **Potential linking impact pathways include:** • **Recreational Pressure and urbanisation** • **Atmospheric Pollution** • **Water Abstraction** • **Water Quality.** However, this policy also provides positive provision for financial contributions towards access management and monitoring of visitors to Epping Forest SAC and the phasing of development in line with provision of water treatment facilities.

Policy number/ name	Policy detail	Likely Significant Effects
	The following existing sites are designated for employment uses: • EPP.E1 Land at Eppingdene • EPP.E2 Land at Coopersale Hall • EPP.E3 Falconry Court • EPP.E4 Bower Hill Industrial Estate The policy sets out that all development proposals must demonstrate how opportunities to access jobs, services, education and leisure facilities by means other than the car have been addressed, both within Epping and to the Harlow and Gilston Garden Town. This includes the need to make provision for, improve, enhance and promote use of existing cycling and walking networks and access to passenger transport services. • It also identifies a range of infrastructure requirements that must be delivered at a rate and scale to meet the needs that arise from the proposed development. Specifically, development proposals in Epping will be expected to deliver and / or contribute proportionately towards a number of infrastructure items as required, including: education provision, including early years, primary school and secondary school places; • provision of health facilities; • provision of walking and cycling facilities and linkages both within the site and to key destinations; • enhancements to public transport provision or other initiatives which reduce the need to travel by car; • upgrade and improvement of utility infrastructure including but not limited to water, waste water and telecommunications; and • improvements to existing, and provision of new, green and blue infrastructure assets including open space in accordance with the Councils adopted Green Infrastructure Strategy. The policy identifies that development of sites within Epping have the potential to produce air pollution that could impact upon air quality in the District, including Epping Forest. All proposals are required to accord with the requirements of Policy DM2 and Policy DM22 and the Council's adopted Air Pollution Mitigation Strategy. Developments within Epping which would result in a net increase in dwellings have the potential to result in recreational pressure on the Epping Forest SAC. All such developments will need to demonstrate that they are in accordance with Policy DM 2. This includes, where necessary, the provision of financial contributions towards mitigation and monitoring measures.	It acknowledges that these site allocations have potential to affect Epping Forest SAC from increased atmospheric pollution. It makes clear that all development proposals will need to demonstrate that they are in accordance with Policy DM2 and Policy DM22 and the Council's adopted Air Pollution Mitigation Strategy. This includes, where necessary, the provision of financial contributions for the purposes of implementing air pollution mitigation initiatives and undertaking air quality monitoring and any necessary future air quality assessments., Full screening of the Site Allocations can be found in Table 6, Table 7 and Table 8. Locations are illustrated on Appendix B2.

Policy number/ name	Policy detail	Likely Significant Effects
	Development proposals in relation to sites EPP.R1 and EPP.R2 must be in general conformity with a Strategic Masterplan for the South Epping Area which has been formally endorsed by the Council prior to the determination of planning applications. In addition to the requirements set out above, the Strategic Masterplan should make provision for a range of site specific infrastructure including but not limited to: • appropriate community and health facilities, employment and retail use; • a new primary school; • provision or enhancement of walking and cycling facilities, Public Rights of Way and linkages both within the site, over the railway line, the footbridge over the M25, and to key destinations including Epping London Underground Station and the Town Centre; • incorporation of an appropriate buffer to protect the amenity of future residents with regards to noise and air quality from the M25 and an appropriate buffer from the High Voltage Transmission Cables and land impacted by the BPA Oil Pipeline constraints; • the integration, retention and improvements to the existing watercourse; • adequate levels of high quality public open space, including the retention or replacement of Brook Road Informal Recreation Ground; and • the provision of Suitable Alternative Natural Greenspace The Strategic Masterplan must incorporate measures to promote and encourage the use of sustainable modes of transport and provide viable alternatives to single occupancy private car use. The proposed measures should be underpinned by feasibility evidence that comprehensively demonstrates the delivery of modal shift by way of sustainable travel measures. Any application for planning permission made subsequent to the endorsed Strategic Masterplan should be accompanied by an assessment of potential air quality impacts demonstrating compliance with J. above, Policy DM2 and Policy DM22 and the Council's adopted Air Pollution Mitigation Strategy. Such an assessment must take into account the results of monitoring in 2024/25 which is to be undertaken in accordance with the Council's adopted Air Pollution Mitigation Strategy. Accordingly no application for permission should be determined prior to such monitoring results being available.	
Policy P2 Loughton	Proposals for development on allocated sites should accord with the site specific policy requirements set out in in Part Two of the Plan Residential sites proposed for allocation and the quantum of development to be delivered are as follows: • LOU.R3 Land at Vere Road – Approximately 9 homes	**Likely Significant Effects.** This policy provides for residential and employment site allocations between less than 300m and 2.1km from Epping Forest SAC. **Potential linking impact pathways include:**

Policy number/ name	Policy detail	Likely Significant Effects
	• LOU.R4 Borders Lane playing fields – Approximately 217 homes and appropriate uses • LOU.R6 Royal Oak public house – Approximately 10 homes • LOU.R7 Loughton Library – Approximately 20 homes • LOU.R9 Land at former Epping Forest College – Approximately 111 homes • LOU.R10 Land at Station Road – Approximately 12 homes • LOU.R11 Land west of Roding Road – Approximately 9 homes • LOU.R12 Land at 63 Wellfields – Approximately 10 homes • LOU.R13 Land at 70 Wellfields – Approximately 6 homes • LOU.R14 Land at Alderton Hill – Approximately 19 homes • LOU.R15 Land at Traps Hill – Approximately 6 homes • LOU.R16 St Thomas More RC Church – Approximately 18 homes • LOU.R18 Land at High Beech Road – Approximately 8 homes The following existing sites are designated for employment uses: • LOU.E1 – Oakwood Hill Industrial Estate • LOU.E2B –Langston Road Industrial Estate • LOU.E3 – Buckingham Court The following site is designated for employment uses with a further allocated expansion for B Use Class employment uses: • LOU.E2A – Land adjacent to Langston Road Industrial Estate Development in Loughton will be expected to deliver and/or contribute proportionately towards infrastructure items as required including: • education provision including early years, primary school and secondary school places; • appropriate provision of health facilities; • upgrade and improvement of utility infrastructure including water, waste water, solid waste, gas, electricity and telecommunications • improvements to existing, and provision of new, green and blue infrastructure assets including open space in accordance with the Councils adopted Green Infrastructure Strategy • provision of walking and cycling facilities, and linkages both within the site and to key destinations; • enhancements to public transport provision or other initiatives which reduce the need to travel by car;	• **Recreational pressure and urbanisation** • **Atmospheric pollution** • **Water Abstraction** • **Water Quality.** However, this policy also provides positive provision for financial contributions towards access management and monitoring of visitors to Epping Forest SAC and the phasing of development in line with provision of water treatment facilities. It acknowledges that these site allocations have potential to affect Epping Forest SAC from increase atmospheric pollution. It makes clear that all development proposals will need to demonstrate that they are in accordance with Policy DM2 and Policy DM22 and the Council's adopted Air Pollution Mitigation Strategy. This includes, where necessary, the provision of financial contributions for the purposes of implementing air pollution mitigation initiatives and undertaking air quality monitoring and any necessary future air quality assessments., Full screening of the Site Allocations can be found in Table 6, Table 7 and Table 8. Locations are illustrated on Appendix B2.

Policy number/ name	Policy detail	Likely Significant Effects
	The policy identifies that development of sites within Loughton have the potential to produce air pollution that could impact upon air quality in the District, including Epping Forest. All proposals are required to accord with the requirements of Policy DM2 and Policy DM22 and the Council's adopted Air Pollution Mitigation Strategy. Developments within Loughton which would result in a net increase in dwellings have the potential to result in recreational pressure on the Epping Forest SAC. All such developments will need to demonstrate that they are in accordance with Policy DM 2. This includes, where necessary, the provision of financial contributions towards mitigation and monitoring measures.	
Policy P3 Waltham Abbey	Proposals for development on allocated sites should accord with the site specific policy requirements set out in Part Two of the Plan. Residential sites proposed for allocation and the quantum of development to be delivered are as follows: • WAL.R1 Land west of Galley Hill Road,WAL.R2 Lea Valley Nursery, Crooked Mile and WAL.R3 Land adjoining Parklands – Approximately 740 home and appropriate uses • WAL.R4 Fire Station, Sewardstone Road – Approximately 16 homes • WAL.R5 Waltham Abbey Community Centre, Saxon Way – Approximately 53 homes and re-provision of a community centre • WAL.R6 Waltham Abbey Swimming Pool, Roundhills – Approximately 27 homes The following existing sites are designated for employment uses: • WAL.E1 – Howard Business Park • WAL.E2 – Land at Breeches Farm • WAL.E3 – Land at Woodgreen Road • WAL.E4 – Cartersfield Road/Brooker Road Industrial Estate • WAL.E5 – Meridian Business Park and Distribution Centre • WAL.E6B – Galley Hill Road Industrial Estate The following sites are allocated for B Use Class employment uses: • WAL.E6A – Land adjacent to Galley Hill Road Industrial Estate (B2/B8 Use Classes) • WAL.E8 – Land north of the A121 (B1c/B2/B8 Use Class)	**Likely Significant Effects** This policy provides for residential, traveller and employment site allocations between less than 1.9km and 3.2km from Epping Forest SAC and between 1.1km and 2.6km from Lee Valley SPA and Ramsar site. **Potential linking impact pathways include:** • **Recreational pressure and urbanisation** • **Atmospheric pollution** • **Water Abstraction** • **Water Quality.** This policy provides for pedestrian links to the Lee Valley Regional Park. **Whilst this policy does not identify any locations of the pedestrian links, care should be taken to ensure that these increased links do not increase recreational pressure upon the designated sites.** It is noted that, this policy provides positive provision for financial contributions towards access management and monitoring of visitors to Epping Forest SAC and the phasing of development in line with provision of water treatment facilities. It acknowledges that these site allocations have potential to affect Epping Forest SAC from increase atmospheric pollution. It makes clear that all development proposals will need to demonstrate that they are in accordance with Policy DM2 and

Policy number/ name	Policy detail	Likely Significant Effects
	The following site is allocated for traveller accommodation: • WAL.T1 - Lea Valley Nursery, Crooked Mile – up to 5 pitches Development in Waltham Abbey will be expected to deliver and/or contribute proportionately towards infrastructure items as required including: • education provision including early years, primary school and secondary school places; • appropriate provision of health facilities; • improved pedestrian/cycle links provision of walking and cycling facilities, providing linkages both within the site and to key destinations, including to the Lee Valley Regional Park; • enhancements to public transport provision or other initiatives which reduce the need to travel by car; • appropriate provision of surface water drainage measures; • potential upgrades to existing water infrastructure upgrade and improvement of utility infrastructure including water, waste water, solid waste, gas, electricity and telecommunications; • improvements to existing, and provision of new, green and blue infrastructure assets including open space in accordance with the Councils adopted Green Infrastructure Strategy. The policy identifies that development of sites within Waltham Abbey have the potential to produce air pollution that could impact upon air quality in the District, including Epping Forest. All proposals are required to accord with the requirements of Policy DM2 and Policy DM22 and the Council's adopted Air Pollution Mitigation Strategy. Developments within Waltham Abbey which would result in a net increase in dwellings have the potential to result in recreational pressure on the Epping Forest SAC. All such developments will need to demonstrate that they are in accordance with Policy DM 2. This includes, where necessary, the provision of financial contributions towards mitigation and monitoring measures. Waltham Abbey North Masterplan Development proposals in relation to sites WAL.R1, WAL.R2, WAL.R3 and WAL.T1 must be in general conformity with a Strategic Masterplan. In addition to the requirements set out above the Strategic Masterplan should make provision for: • effective integration with the Town Centre, supporting regeneration; • a new local centre to include a community facility and retail use;	Policy DM22 and the Council's adopted Air Pollution Mitigation Strategy. This includes, where necessary, the provision of financial contributions for the purposes of implementing air pollution mitigation initiatives and undertaking air quality monitoring and any necessary future air quality assessments. The policy also identifies the need to improve walking and cycling links to the Lee Valley Regional Park. Full screening of the Site Allocations can be found in Table 6, Table 7 and Table 8. Locations are illustrated on Appendix B2.

Policy number/ name	Policy detail	Likely Significant Effects
	• new road links to the existing highway network and an internal road layout to support a bus corridor; • measures to promote and encourage the use of sustainable modes of transport and provide viable alternatives to single occupancy private car use including car clubs/car sharing or pooling arrangements, visitor parking and blue badge holders; • the integration, retention and improvements to the existing watercourses and public rights of way; • new pedestrian and cycle links through the site to the Lee Valley Regional Park, the existing allotments to the north, and towards Waltham Abbey District Centre; • improvements to existing open space in the locality, together with enhancements within the Lee Valley Regional Park and on-site open space, including a proportion of natural greenspace, and • ensure that vulnerability to Surface Water flooding as well as the potential consequences for surrounding sites is suitably mitigated through appropriate surface water drainage.	
Policy P4 Ongar	Proposals for development on allocated sites should accord with the site specific policy requirements set out in Part Two of the Plan. Residential sites proposed for allocation and the quantum of development to be delivered are as follows: • ONG.R1 Land west of Ongar – Approximately 99 homes • ONG.R2 Land at Bowes Field – Approximately 135 homes • ONG.R3 Land at Fyfield Road– Approximately 27 homes • ONG.R4 Land north of Chelmsford Road – Approximately 163 homes • ONG.R5 Land at Greensted Road – Approximately 107 homes • ONG.R6 Land between Stamford Rivers Road and Brentwood Road – Approximately 33 homes • ONG.R7 Land south of Hunters Chase and west of Brentwood Road – Approximately 17 homes • ONG.R8 The Stag Pub – Approximately nine homes The following existing site is designated for employment use: • ONG.E1 – Essex Technology and Innovation Centre There are no new employment site allocations in Ongar.	**Likely Significant Effects** This policy provides for residential and employment site allocations more than 9km from Epping Forest SAC and more than 10km from Lee Valley SPA and Ramsar site. **Potential linking impact pathways include:** • **Atmospheric pollution** • **Water Abstraction** • **Water Quality.** It is noted that, this policy provides positive provision for green infrastructure and the phasing of development in line with provision of water treatment facilities. It makes clear that all development proposals will need to demonstrate that they are in accordance with Policy DM2 and Policy DM22 and the Council's adopted Air Pollution Mitigation Strategy. This includes, where necessary, the provision of financial contributions for the purposes of implementing air pollution mitigation initiatives and undertaking air quality monitoring and any necessary future air quality assessments., Full screening of the Site Allocations can be found in Table 6, Table 7 and

<table>
<tr><th>Policy number/ name</th><th>Policy detail</th><th>Likely Significant Effects</th></tr>
<tr><td></td><td>Development in Ongar will be expected to deliver and/or contribute proportionately towards infrastructure items as required including:
education provision including early years, primary school and secondary school places;
provision of health facilities;
improved pedestrian/cycle links provision of walking and cycling facilities and linkages both within the site and to key destinations;
enhancements to public transport provision or other initiatives which reduce the need to travel by car;
potential upgrades to existing waste water infrastructure upgrade and improvement of utility infrastructure including water, waste water, solid waste, gas, electricity and telecommunication where necessary
improvements to existing, and provision of new, green and blue infrastructure assets including open space in accordance with the Councils adopted Green Infrastructure Strategy.
The policy identifies that development of sites within Ongar have the potential to produce air pollution that could impact upon air quality in the District, including Epping Forest. All proposals are required to accord with the requirements of Policy DM2 and Policy DM22 and the Council’s adopted Air Pollution Mitigation Strategy.

West Ongar Concept Framework
In order to ensure that a comprehensive and cohesive approach is taken to the planning and delivery of certain sites and associated infrastructure, development proposals in relation to sites ONG.R1 and ONG.R2 will be required to be in general conformity accordance with a Concept Framework Plan, as defined in Policy SP2, which has been formally endorsed by the Council prior to the determination of any planning application.</td><td>Table 8. Locations are illustrated on Appendix B2.</td></tr>
<tr><td>Policy P5
Buckhurst Hill</td><td>Proposals for development on allocated sites should accord with the site specific policy requirements set out in Part Two of the Plan.

Residential sites proposed for allocation and the quantum of development to be delivered are as follows:
BUCK.R1 Land at Powell Road – Approximately 31 homes
BUCK.R2 Queens Road car park – Approximately 41 homes
BUCK.R3 Stores at Lower Queens Road – Approximately 15 new homes and re-provision of 24 homes and retail floorspace.</td><td>Likely Significant Effects.
This policy provides for three residential site allocations all less than 400m from Epping Forest SAC.
Potential linking impact pathways include:
Recreational pressure and urbanisation
Atmospheric pollution
Water Abstraction
Water Quality</td></tr>
</table>

Policy number/ name	Policy detail	Likely Significant Effects
	There are no existing or allocated employment sites in Buckhurst Hill identified in the Plan. Development in Buckhurst Hill will be expected to deliver and/or contribute proportionately towards infrastructure items as required including: • appropriate education provision including early years, primary school and secondary school places • appropriate provision of health facilities • improvements to existing, and provision of new, green and blue infrastructure assets including open space in accordance with the Councils adopted Green Infrastructure Strategy. • provision of walking and cycling facilities, and linkages both within the site and to key destinations; • enhancements to public transport provision or other initiatives which reduce the need to travel by car The policy identifies that development of sites within Buckhurst Hill have the potential to produce air pollution that could impact upon air quality in the District, including Epping Forest. All proposals are required to accord with the requirements of Policy DM2 and Policy DM22 and the Council's adopted Air Pollution Mitigation Strategy. Developments within Buckhurst Hill which would result in a net increase in dwellings have the potential to result in recreational pressure on the Epping Forest SAC. All such developments will need to demonstrate that they are in accordance with Policy DM 2. This includes, where necessary, the provision of financial contributions towards mitigation and monitoring measures.	It is noted that, this policy provides positive provision for financial contributions to the access management and monitoring of visitors to the Forest in accordance with Policy DM2. It makes clear that all development proposals will need to demonstrate that they are in accordance with Policy DM2 and Policy DM22 and the Council's adopted Air Pollution Mitigation Strategy. This includes, where necessary, the provision of financial contributions for the purposes of implementing air pollution mitigation initiatives and undertaking air quality monitoring and any necessary future air quality assessments. Additionally, this policy refers to the phasing of development in line with provision of water treatment facilities. Full screening of the Site Allocations can be found in Table 6, Table 7 and Table 8. Locations are illustrated on Appendix B2.
P6 North Weald Bassett	Proposals for development on allocated sites should accord with the site specific policy requirements set out in Part Two of the Plan. Residential sites proposed for allocation and the quantum of development to be delivered are as follows: • NWB.R1 Land West of Tylers Green,NWB.R2 Land at Tylers Farm, NWB.R3 Land south of Vicarage Lane, NWB.R4 Land at Chase Farm, NWB.R5 Land at The Acorns, Chase Farm – Approximately 1050 homes. The following existing sites are designated for employment uses: • NWB.E1 – New House Farm, Vicarage Lane • NWB.E2 – Tylers Green Industrial Area • NWB.E3 – Weald Hall Farm and Commercial Centre	**Likely Significant Effects** This policy provides for residential, traveler and employment site allocations within 6.2km of Epping Forest SAC (specifically site NWB.R3) but more than 10km from Lee Valley SPA and Ramsar site. **Potential linking impact pathways include:**

Policy number/ name	Policy detail	Likely Significant Effects
	• NWB.E4B – Bassett Business Park and Merlin Way Industrial Estate The following site is designated for employment uses with a further allocated expansion for B Use Class employment uses: • NWB.E4A – North Weald Airfield The following site is allocated for Traveller Accommodation: • NWB.T1 Land west of Tylers Green – up to 5 pitches Development in North Weald Bassett will be expected to deliver and/or contribute proportionately towards infrastructure items as required including: • Appropriate education provision including early years, primary school and secondary school places • Appropriate provision of health facilities; • upgrade and improvement of utility infrastructure including water, waste water, solid waste, gas, electricity and telecommunication where necessary" • improvements to existing, and provision of new, green and blue infrastructure assets including open space in accordance with the Councils adopted Green Infrastructure Strategy. • the provision of walking and cycling facilities, providing linkages both within the site and to key attractor destinations; • enhancements to public transport provision or other initiatives which reduce the need to travel by car. All development proposals must demonstrate how they will respond to the need to make provision for, and improve and promote use of ~~existing,~~ cycling and walking networks and access to passenger transport services. The Strategic Masterplans for North Weald Bassett and North Weald Airfield must incorporate measures to promote and encourage the use of sustainable methods of transportation and provide viable alternatives to private car use. Such measures are to be planned in consultation with Essex County Council (and relevant passenger transport providers) through the production of the Strategic Masterplans. The measures should provide for, and encourage, more sustainable travel patterns by contributing toward integrated walking and cycling, and public transport connectivity to the wider areas, including Epping and Harlow. The proposed measures need to be underpinned by feasibility evidence that demonstrates the delivery of modal shift away from single occupancy private car use by way of sustainable travel measures.	• **Recreational pressure and urbanisation** • **Atmospheric pollution** • **Water Abstraction** • **Water Quality.** It is noted that, this policy provides positive provision for green infrastructure and contribution to the access management and monitoring of visitors to the Forest in accordance with Policy DM 2 and the phasing of development in line with provision of water treatment facilities. It makes clear that all development proposals will need to demonstrate that they are in accordance with Policy DM2 and Policy DM22 and the Council's adopted Air Pollution Mitigation Strategy. This includes, where necessary, the provision of financial contributions for the purposes of implementing air pollution mitigation initiatives and undertaking air quality monitoring and any necessary future air quality assessments., Full screening of the Site Allocations can be found in Table 6, Table 7 and Table 8. Locations are illustrated on Appendix B2.

Policy number/ name	Policy detail	Likely Significant Effects
	The policy identifies that development of sites within North Weald Bassett have the potential to produce air pollution that could impact upon air quality in the District, including Epping Forest. All proposals are required to accord with the requirements of Policy DM2 and Policy DM22 and the Council's adopted Air Pollution Mitigation Strategy. Developments within North Weald Bassett which would result in a net increase in dwellings have the potential to result in recreational pressure on the Epping Forest SAC. All such developments will need to demonstrate that they are in accordance with Policy DM 2. This includes, where necessary, the provision of financial contributions towards mitigation and monitoring measures. North Weald Bassett Masterplan Area • Development proposals in relation to sites NWB.R1, NMB.R2, NWB.R3, NWB.R4 and NWB.R5, NWB.T1 must comply with a Strategic Masterplan for the North Weald Bassett Area which has been formally endorsed by the Council. In addition to the general infrastructure requirements set out above, the Strategic Masterplan must make provision for: • A local centre including, retail, community, and appropriate provision of health facilities; • addressing surface water flooding; • education provision including early years, primary school and secondary school places; • adequate levels of public open space to be provided on the site; • new and improved Public Rights of Way and cycle linkages with the surrounding area; • the continued protection of those trees benefitting from a Tree Preservation Order, and other identified veteran trees. • Suitable Alternative Natural Greenspace between the two Masterplan Areas • new and improved Public Rights of Way and cycle linkages with the surrounding area including East to West connectivity between the two Masterplan Areas • strengthening of the existing field boundary along the Western edge of the Strategic Masterplan Area to form the defensible boundary to the Green Belt North Weald Airfield Masterplan Development proposals at North Weald Airfield must be in general conformity with a Masterplan for the North Weald Airfield. In addition to the general infrastructure requirements set out above, the Strategic Masterplan must make provision for:	

<table>
<tr><th>Policy number/ name</th><th>Policy detail</th><th>Likely Significant Effects</th></tr>
<tr><td></td><td>a Suitable Alternative Natural Greenspace between the two Masterplan Areas; and
new and improved Public Rights of Way and cycle linkages with the surrounding area including East to West connectivity between the two Masterplan Areas.
To support modal shift through providing for, and encouraging, more sustainable travel patterns, development proposals in North Weald Bassett must contribute toward integrated and sustainable transport solutions including walking and cycling, and public transport connectivity to the wider areas, including to Epping and Harlow.</td><td></td></tr>
<tr><td>Policy P7 Chigwell</td><td>Proposals for development on allocated sites should accord with the site specific policy requirements set out in Part Two of the Plan.

Residential sites proposed for allocation and the quantum of development to be delivered are as follows:
CHIG.R4 Land between Froghall Lane and railway line – Approximately specialist 105 homes
CHIG.R5 Land at Chigwell Nurseries – Approximately 65 homes
CHIG.R8 Land at Fencepiece Road – Approximately 6 homes
CHIG.R9 Land at Grange Court – Approximately 8 homes
CHIG.R10 The Maypole – Approximately 11 homes
CHIG.R11 Land at Hainault Road – Approximately 11 homes
There are no existing employment site designations or new employment site allocations in Chigwell.

Development proposals in Chigwell will be expected to deliver and/ or contribute proportionately towards infrastructure items as required, including:
<u>appropriate education provision including early years, primary school and secondary school places;</u>
<u>appropriate provision of health facilities</u>
<u>upgrade and improvement of utility infrastructure including water, waste water, solid waste, gas, electricity and telecommunication where necessary</u>;
improvements to existing, and provision of new, green and blue infrastructure assets including open space in accordance with the Councils adopted Green Infrastructure Strategy;
provision of walking and cycling facilities, and linkages both within the site and to key destinations; and
Enhancements to public transport provision or other initiatives which reduce the need to travel by car;</td><td>Likely Significant Effects
This policy provides for residential site allocations between 1.7km and 6.2km from Epping Forest SAC. Specifically, sites Chig.R3/R5/R7/R8/R9/R11 and a small part of R6 are all within 6.2 km.

Potential linking impact pathways include:
Recreational pressure and urbanisation
Atmospheric pollution
Water Abstraction
Water Quality.
This policy also provides positive provision for financial contributions towards access management and monitoring of visitors to Epping Forest SAC and the phasing of development in line with provision of water treatment facilities
It acknowledges that these site allocations have potential to affect Epping Forest SAC from increase atmospheric pollution. It makes clear that all development proposals will need to demonstrate that they are in accordance with Policy DM2 and Policy DM22 and the Council's adopted Air Pollution Mitigation Strategy. This includes, where necessary, the provision of financial contributions for the purposes of implementing air pollution mitigation initiatives and undertaking air quality monitoring and any necessary future air quality assessments.,

Full screening of the Site Allocations can be found in Table 6, Table 7 and</td></tr>
</table>

Policy number/ name	Policy detail	Likely Significant Effects
	The development of sites which result in a net increase in dwellings on sites within Chigwell have the potential to result in recreational pressure on the Epping Forest SAC. All such developments will need to demonstrate that they are in accordance with Policy DM 2. This includes, where necessary, the provision of financial contributions towards mitigation and monitoring measures. The policy identifies that development of sites within Chigwell have the potential to produce air pollution that could impact upon air quality in the District, including Epping Forest. All proposals are required to accord with the requirements of Policy DM2 and Policy DM22 and the Council's adopted Air Pollution Mitigation Strategy.	Table 8. Locations are illustrated on Appendix B2.
Policy P8 Theydon Bois	Proposals for development on allocated sites should accord with and the site specific policy requirements set out in Part 2 of the Plan. Residential sites proposed for allocation and the quantum of development to be delivered are as follows: • THYB.R1 Land at Forest Drive – Approximately 39 homes • THYB.R2 Theydon Bois London Underground Station car park – Approximately 12 homes • THYB.R3 Land at Coppice Row – Approximately 6 homes There are no existing employment site designations or new employment site allocations in Theydon Bois.. Development in Theydon Bois will be expected to deliver and/or contribute proportionately towards infrastructure items as required, including: • appropriate education provision including early years, primary school and secondary school places; • upgrade and improvement of utility infrastructure including water, waste water, solid waste, gas, electricity and telecommunications • improvements to existing, and provision of new, green and blue infrastructure assets including open space in accordance with the Councils adopted Green Infrastructure Strategy. • provision of walking and cycling facilities, and linkages both within the site and to key destinations; • enhancements to public transport provision or other initiatives which reduce the need to travel by car; and • appropriate provision of health facilities.	**Likely Significant Effects**. This policy provides for residential site allocations between 260m and 0.7km from Epping Forest SAC. **Potential linking impact pathways include:** • **Recreational pressure and urbanisation** • **Atmospheric pollution** • **Water Abstraction** • **Water Quality.** This policy provides positive provision for financial contributions to the access management and monitoring of visitors to the Forest in accordance with Policy DM 2. It makes clear that all development proposals will need to demonstrate that they are in accordance with Policy DM2 and Policy DM22 and the Council's adopted Air Pollution Mitigation Strategy. This includes, where necessary, the provision of financial contributions for the purposes of implementing air pollution mitigation initiatives and undertaking air quality monitoring and any necessary future air quality assessments., It also requires the phasing of development in line with provision of water treatment facilities and open space. Full screening of the Site Allocations can be found in Table 6, Table 7 and Table 8. Locations are illustrated on Appendix B2.

Policy number/ name	Policy detail	Likely Significant Effects
	The policy identifies that development of sites within Theydon Bois have the potential to produce air pollution that could impact upon air quality in the District, including Epping Forest. All proposals are required to accord with the requirements of Policy DM2 and Policy DM22 and the Council's adopted Air Pollution Mitigation Strategy. Developments within Theydon Bois which would result in a net increase in dwellings have the potential to result in recreational pressure on the Epping Forest SAC. All such developments will need to demonstrate that they are in accordance with Policy DM 2. This includes, where necessary, the provision of financial contributions towards mitigation and monitoring measures.	
Policy P9 Roydon	Proposals for development on allocated sites should accord with the site specific policy requirements set out in Part Two of the Plan. Residential sites proposed for allocation and the quantum of development to be delivered are as follows: • ROYD.R1 The Old Coal Yard – Approximately 7 homes • ROYD.R2 Land at Kingsmead School – Approximately 21 homes • ROYD.R4 Land at Parklands Nursery – Approximately 20 homes There are no existing sites proposed for designation or new employment sites proposed for allocation in Roydon. Development in Roydon will be expected to deliver and/or contribute proportionately towards infrastructure items as required including: • improvements to existing, and provision of new, green and blue infrastructure assets including open space in accordance with the Councils adopted Green Infrastructure Strategy. • the provision of walking and cycling facilities, providing linkages both within the site and to key destinations, including to the Lee Valley Regional park; • enhancements to public transport provision or other initiatives which reduce the need to travel by car; and • appropriate education provision including early years, primary school and secondary school places; • appropriate provision of health facilities; The policy identifies that development of sites within Roydon have the potential to produce air pollution that could impact upon air quality in the District, including Epping Forest. All proposals are required to accord with the requirements of Policy DM2 and Policy DM22 and the Council's adopted Air Pollution Mitigation Strategy.	**Likely Significant Effects** This policy provides for residential site allocations between 1.2km and 1.7km from the Lee Valley SPA and Ramsar site. **Potential linking impact pathways include:** • **Recreational pressure and urbanisation** • **Atmospheric pollution** • **Water Abstraction** • **Water Quality.** This policy acknowledges that these site allocations have potential to affect Epping Forest SAC from increase atmospheric pollution. It makes clear that all development proposals will need to demonstrate that they are in accordance with Policy DM2 and Policy DM22 and the Council's adopted Air Pollution Mitigation Strategy. This includes, where necessary, the provision of financial contributions for the purposes of implementing air pollution mitigation initiatives and undertaking air quality monitoring and any necessary future air quality assessments., It also requires the phasing of development in line with provision of water treatment facilities and open space. Full screening of the Site Allocations can be found in Table 6, Table 7 and Table 8. Locations are illustrated on Appendix B2.

<table>
<tr><th>Policy number/ name</th><th>Policy detail</th><th>Likely Significant Effects</th></tr>
<tr><td>Policy P10 Nazeing</td><td>Proposals for development on allocated sites should accord with the site specific policy requirements set out in Part Two of the Plan.

Residential sites proposed for allocation and the quantum of development to be delivered are as follows:
• NAZE.R1 Land at St Leonards Road – Approximately 33 homes
• NAZE.R2 The Fencing Centre, Pecks Hill – Approximately 25 homes
• NAZE.R3 Land to the rear of Pound Close – Approximately 39 homes
• NAZE.R4 Land at St Leonards Farm – Approximately 21 homes

The following existing sites are designated for employment uses:
• NAZE.E1 – The Old Waterworks
• NAZE.E2 – Land west of Sedge Green
• NAZE.E3 – Bridge Works and Glassworks, Nazeing New Road
• NAZE.E4 – Hillgrove Business Park
• NAZE.E5 – Birchwood Industrial Estate
• NAZE.E6 – Millbrook Business Park
• NAZE.E7 – Land at Winston Farm

There are no new employment site allocations in Nazeing

Development in Nazeing will be expected to deliver and/or contribute proportionately towards infrastructure items as required including:
• appropriate education provision including early years, primary school and secondary school places;
• appropriate provision of health facilities
• improvements to existing, and provision of new, green and blue infrastructure assets including open space in accordance with the Councils adopted Green Infrastructure Strategy.
• provision of walking and cycling facilities, and linkages both within the site and to key destinations, including to the Lee Valley Regional Park;
• enhancements to public transport provision or other initiatives which reduce the need to travel by car;
• upgrade and improvement of utility infrastructure including water, waste water, gas, electricity and telecommunication where necessary</td><td>Likely Significant Effects.
This policy provides for residential traveller and employment site allocations between 2.2km and 2.8km from the Lee Valley SPA and Ramsar site and between 3.9km and 4.7km from Wormley Hoddesdonpark Woods SAC.

Potential linking impact pathways include:
• Recreational pressure and urbanisation
• Atmospheric pollution
• Water Abstraction
• Water Quality.

This policy acknowledges that these site allocations have potential to affect Epping Forest SAC from increase atmospheric pollution. It makes clear that all development proposals will need to demonstrate that they are in accordance with Policy DM2 and Policy DM22 and the Council's adopted Air Pollution Mitigation Strategy. This includes, where necessary, the provision of financial contributions for the purposes of implementing air pollution mitigation initiatives and undertaking air quality monitoring and any necessary future air quality assessments.,

It also requires the phasing of development in line with provision of water treatment facilities and open space.

Full screening of the Site Allocations can be found in Table 6, Table 7 and Table 8. Locations are illustrated on Appendix B2.</td></tr>
</table>

Policy number/ name	Policy detail	Likely Significant Effects
	The policy identifies that development of sites within Nazeing have the potential to produce air pollution that could impact upon air quality in the District, including Epping Forest. All proposals are required to accord with the requirements of Policy DM2 and Policy DM22 and the Council's adopted Air Pollution Mitigation Strategy. In order to ensure that a comprehensive and cohesive approach is taken to the planning and delivery of certain sites and associated infrastructure, development proposals in relation to sites NAZE.R1, NAZE.R3 and NAZE.R4 will be required to be in accordance with a Concept Framework, as defined in Policy SP2.	
Policy P11 Thornwood	Proposals for development on allocated sites should accord with the site specific policy requirements set out in Part Two of the Plan. Residential sites proposed for allocation and the quantum of development to be delivered are as follows: • THOR.R1 Land at Tudor House – Approximately 124 homes • THOR.R2 Land West of High Road – Approximately 48 homes The following existing sites are designated for employment uses: • THOR.E1 – Camfaud Concrete Pumps • THOR.E2 – Land at Esgors Farm • THOR.E3 – Woodside Industrial Estate • THOR.E4 – Weald Hall Lane Industrial area There are no new employment sites proposed for allocation. Development in Thornwood will be expected to deliver and/or contribute proportionately towards infrastructure items as required including: • improvements to existing, and provision of new, green and blue infrastructure assets including open space in accordance with the Councils adopted Green Infrastructure Strategy. • appropriate education provision including early years, primary school and secondary school places' • appropriate provision of health facilities. • enhancements to public transport provision or other initiatives which reduce the need to travel by car; • local utilities upgrades; upgrade and improvement of utility infrastructure including water, waste water, gas, electricity and telecommunication where necessary;	**Likely Significant Effects** This policy provides for site allocations within 6.2km from Epping Forest SAC, although more than 9km from Lee Valley SPA and Ramsar site. All the Thornwood sites are within 6.2km of Epping Forest SAC. **Potential linking impact pathways include:** • **Recreational pressure and urbanisation** • **Atmospheric pollution** • **Water Abstraction** • **Water Quality.** This policy acknowledges that these site allocations have potential to affect Epping Forest SAC from increase atmospheric pollution. It makes clear that all development proposals will need to demonstrate that they are in accordance with Policy DM2 and Policy DM22 and the Council's adopted Air Pollution Mitigation Strategy. This includes, where necessary, the provision of financial contributions for the purposes of implementing air pollution mitigation initiatives and undertaking air quality monitoring and any necessary future air quality assessments., It also requires for infrastructure (including open space) to be delivered in line with rate and scale of need. Full screening of the Site Allocations can be found in Table 6, Table 7 and Table 8. Locations are illustrated on Appendix B2.

Policy number/ name	Policy detail	Likely Significant Effects
	The policy identifies that development of sites within Thornwood have the potential to produce air pollution that could impact upon air quality in the District, including Epping Forest. All proposals are required to accord with the requirements of Policy DM2 and Policy DM22 and the Council's adopted Air Pollution Mitigation Strategy. Developments within Thornwood which would result in a net increase in dwellings have the potential to result in recreational pressure on the Epping Forest SAC. All such developments will need to demonstrate that they are in accordance with Policy DM 2. This includes, where necessary, the provision of financial contributions towards mitigation and monitoring measures.	
Policy P12 Coopersale, Fyfield, High Ongar, Lower Sheering, Sheering and Stapleford Abbotts	Proposals for development on allocated sites should accord with the site specific policy requirements set out in Part Two of the Plan. Residential sites proposed for allocation and the quantum of development to be delivered are as follows: • COOP.R1 Land at Parklands - Approximately 6 homes (Coopersale); • FYF.R1 Land at Gypsy Mead - Approximately 14 homes (Fyfield); • HONG.R1 Land at Mill Lane - Approximately 10 homes (High Ongar); • LSHR.R1 Land at Lower Sheering - Approximately 14 homes (Lower Sheering); • SHR.R1 Land at Daubneys Farm- Approximately 10 homes, SHR.R2 Land to the East of the M11 Approximately 62 homes and SHR.R3 Land north of Primley Lane - Approximately 12 homes (Sheering); and • STAP.R1 Land at Oak Hill Road - Approximately 33 homes. The following existing sites are designated for employment uses: • High Ongar – HONG.E1 Nash Hall Industrial Estate • Lower Sheering – LSHR.E1 Land at The Maltings • Stapleford Abbotts – STAP.E1 Land at High Willows There are no new employment site allocations in Coopersale, Fyfield, High Ongar, Lower Sheering, Sheering or Stapleford Abbotts. Development proposals in these settlements will be expected to deliver and / or contribute proportionately towards infrastructure items as required, including: • improvements to existing, and provision of new, green and blue infrastructure assets including open space in accordance with the Councils adopted Green and Blue Infrastructure Strategy. • appropriate education provision including early years, primary school places and secondary school places;	**Likely Significant Effects** This policy provides for site allocations within 3.3km from Epping Forest SAC. **Potential linking impact pathways include:** • **Recreational pressure and urbanisation** • **Atmospheric pollution** • **Water Abstraction** • **Water Quality.** This policy acknowledges that these site allocations have potential to affect Epping Forest SAC from increase atmospheric pollution. It makes clear that all development proposals will need to demonstrate that they are in accordance with Policy DM2 and Policy DM22 and the Council's adopted Air Pollution Mitigation Strategy. This includes, where necessary, the provision of financial contributions for the purposes of implementing air pollution mitigation initiatives and undertaking air quality monitoring and any necessary future air quality assessments., It also requires for infrastructure (including open space) to be delivered in line with rate and scale of need and for residential development in Coopersale to contribution to the access management and monitoring of visitors to the Forest in accordance with Policy DM 2.

Policy number/ name	Policy detail	Likely Significant Effects
	• appropriate provision of health facilities. • upgrade and improvement of utility infrastructure including water, waste water, solid waste, gas, electricity and telecommunication where necessary; and • enhancements to public transport provision or other initiatives which reduce the need to travel by car; The policy identifies that development of sites within Coopersale, Fyfield, High Ongar, Lower Sheering, Sheering and Stapleford Abbots have the potential to produce air pollution that could impact upon air quality in the District, including Epping Forest. All proposals are required to accord with the requirements of Policy DM2 and Policy DM22 and the Council's adopted Air Pollution Mitigation Strategy. Developments within Coopersale which would result in a net increase in dwellings have the potential to result in recreational pressure on the Epping Forest SAC. All such developments will need to demonstrate that they are in accordance with Policy DM 2. This includes, where necessary, the provision of financial contributions towards mitigation and monitoring measures.	Full screening of the Site Allocations can be found in Table 6, Table 7 and Table 8. Locations are illustrated on Appendix B2.
Policy P13 Rural sites in the east of the District	Proposals for development on allocated sites should accord with the site specific policy requirements set out in Part Two of the Plan. The only residential site proposed for allocation and the quantum of development to be delivered is as follows: • RUR.R1 Avenue Home, Latton Common – Approximately 11 homes The following existing sites are designated for employment uses: • RUR.E1 – Brickfield House, Thornwood • RUR.E2 – Land at Kingstons Farm, Matching • RUR.E3 – Matching Airfield South • RUR.E4 – Land at London Road, Stanford Rivers • RUR.E6 – Land at Housham Hall Farm, Matching • RUR.E7 – Land at Searles Farm, Foster Street • RUR.E8 – Fosters Croft, Foster Street • RUR.E9 – Horseshoe Farm, London Road • RUR.E10 – Land at Little Hyde Hall Farm, Sheering • RUR.E11 – Land at Quickbury Farm, Sheering • RUR.E12 – New House Farm, Little Laver Road • RUR.E14 – Matching Airfield North	**Likely Significant Effects** This policy provides for residential, traveler and employment site allocations located more than 8km from the Lee Valley SPA and Ramsar site. **Potential linking impact pathways include:** • **Atmospheric pollution** • **Water Abstraction** • **Water Quality.** This policy acknowledges that these site allocations have potential to affect Epping Forest SAC from increase atmospheric pollution. It makes clear that all development proposals will need to demonstrate that they are in accordance with Policy DM2 and Policy DM22 and the Council's adopted Air Pollution Mitigation Strategy. This includes, where necessary, the provision of financial contributions for the purposes of implementing air pollution mitigation initiatives and undertaking air quality monitoring and any necessary future air quality assessments.,

Policy number/ name	Policy detail	Likely Significant Effects
	• RUR.E15 – Land at Rolls Farm Barns, Hastingwood Road • RUR.E18 – Land at Dunmow Road, Fyfield • RUR.E19B – Land at Dorrington Farm (see Policy SP4 and allocation SP4.1) • RUR.E20 – Land at Stewarts Farm • RUR.E21 – Land at Paslow Hall Farm, King Street, High Ongar • RUR.E22 – Hastingwood Business Centre, Hastingwood • RUR.E23 – Hobbs Cross Business Centre, Theydon Garnon • RUR.E24 – Land at Holts Farm, Threshers Bush The following site is designated for employment uses with a further allocated expansion for B Use Class employment uses: • RUR.E19A – Land adjacent to Dorrington Farm, Rye Hill Road (see Policy SP4 and allocation SP4.1) The following sites are allocated for Traveller Accommodation: • RUR.T4 Land at Valley View, Curtis Mill Lane – up to one pitch • RUR.T6 Lakeview Moreton – this site has been identified as suitable for intensification commensurate with on site amenity that allows for children's play and the appropriate storage for vehicles and machinery. Development <u>proposals</u> on <u>the Eastern rural part of the District</u> will be expected to <u>deliver and/or</u> contribute proportionately towards infrastructure items <u>including</u>: • <u>appropriate education provision including early years, primary school and secondary school places;</u> • <u>appropriate provision of health facilities; and</u> • <u>enhancements to public transport provision or other initiatives which reduce the need to travel by car.</u> The policy identifies that development of sites within the east of the District have the potential to produce air pollution that could impact upon air quality in the District, including Epping Forest. All proposals are required to accord with the requirements of Policy DM2 and Policy DM22 and the Council's adopted Air Pollution Mitigation Strategy.	It also requires for infrastructure (including open space and utilities upgrades) to be delivered in line with rate and scale of need. Full screening of the Site Allocations can be found in Table 6, Table 7 and Table 8. Locations are illustrated on Appendix B2.
Policy P14 Rural sites in the west of the District	Proposals for development on allocated sites should accord with the site specific policy requirements set out in Part Two of the Plan. The following existing sites are designated for employment uses: • RUR.E5 – Land at Hayleys Manor, Epping Upland • RUR.E13 – Warlies Park House, Horseshoe Hill	**Likely Significant Effects** This policy provides for site allocations of which RUR.T3 lies within 6.2km of Epping Forest SAC. **Potential linking impact pathways include:**

Policy number/ name	Policy detail	Likely Significant Effects
	There are no new employment sites proposed for allocation. The following sites are allocated for Traveller Accommodation: • RUR.T1 Land at Sons Nursery, Hamlet Hill – two pitches • RUR.T3 Land at James Mead, Waltham Road – four pitches • RUR.T5 Land at Stoneshot View – five pitches Development proposals on these allocations will be expected to deliver and/or contribute proportionately towards infrastructure items including: • appropriate education provision including early years, primary school and secondary school places; • appropriate provision of health facilities; and • enhancements to public transport provision or other initiatives which reduce the need to travel by car. The policy identifies that development of sites within the west of the District have the potential to produce air pollution that could impact upon air quality in the District, including Epping Forest. All proposals are required to accord with the requirements of Policy DM2 and Policy DM22 and the Council's adopted Air Pollution Mitigation Strategy.	• **Recreational pressure and urbanisation** • **Atmospheric pollution** • **Water Abstraction** • **Water Quality.** This policy provides only for the allocation of existing employment sites and 12 Traveller pitches. It makes clear that all development proposals will need to demonstrate that they are in accordance with Policy DM2 and Policy DM22 and the Council's adopted Air Pollution Mitigation Strategy. This includes, where necessary, the provision of financial contributions for the purposes of implementing air pollution mitigation initiatives and undertaking air quality monitoring and any necessary future air quality assessments. It has 'in combination' potential to affect Epping Forest SAC via increased atmospheric pollution and (with regard to traveller pitches) recreational pressure. Full screening of the Site Allocations can be found in Table 6, Table 7 and Table 8. Locations are illustrated on Appendix B2.
Policy P15 Rural sites in the south of the District	The following existing sites are designated for employment uses: • RUR.E16 – Taylors Farm, Gravel Lane • RUR.E17 – Brookside Garage, Gravel Lane There are no new residential or employment allocations proposed. The policy identifies that development of sites in the Southern part of the District have the potential to produce air pollution that could impact upon air quality in the District, including Epping Forest. All proposals are required to accord with the requirements of Policy DM2 and Policy DM22 and the Council's adopted Air Pollution Mitigation Strategy.	No Likely Significant Effects This policy provides for the allocation of two existing employment sites. As such there no impact pathways present. Full screening of the Site Allocations can be found in Table 6, Table 7 and Table 8. Locations are illustrated on Appendix B2.
Chapter 6: Infrastructure and Delivery.		

Policy number/ name	Policy detail	Likely Significant Effects
Policy D1 Delivery of Infrastructure	This policy sets out that new development must be served and supported by appropriate on and off-site infrastructure and services. Proposals must demonstrate that there is sufficient appropriate infrastructure capacity to support the development or that such capacity will be delivered by the proposed development. Applications must be able to demonstrate that such capacity will prove to be sufficient and sustainable over time both in physical and financial terms. It sets out the approach to securing agreement for any measures required, how infrastructure will be secured, and the evidence and justification required to support an exception to the policy and the approach that the Council will take if an exception is sought. Development proposals within the Garden Communities will be expected to contribute collectively, equitably and proportionally towards delivering the identified infrastructure requirements related to each of the sites.	Likely Significant Effects. This is a development management policy relating to the delivery of infrastructure. This is a positive policy as it required development to demonstrated sufficient appropriate infrastructure capacity to support the development or that such capacity will be delivered by the proposed development. It also includes for appropriate phasing of infrastructure and services. There are no impact pathways present.
Policy D2 Essential Facilities and Services	Development proposals will be permitted only where they provide or improve the essential facilities and services required to serve the scale of the proposed development. Development proposals which would be detrimental to or result in the loss of essential facilities and services that meet community needs and support well-being will only be permitted where it can be clearly demonstrated against a set of defined criteria. Proposals for new facilities will be supported where they meet an identified local need.	No Likely Significant Effects. This is a development management policy relating to essential facilities and services. There are no impact pathways present.
Policy D3 Utilities	Planning permission will be granted for proposals only where it can be demonstrated that there will be sufficient capacity within the utilities infrastructure to meet the needs of the development. Applicants will be expected to consult with utilities providers to ensure this is the case, and may be required to undertake assessments to demonstrate sufficient capacity.	No Likely Significant Effects. This is a positive development management policy relating to provision of utilities. It ensures that any required upgrades are in place prior to occupation/ phasing. There are no impact pathways present.
Policy D4 Community, Leisure and Cultural Facilities	This policy supports development which proposes the retention and maintenance of existing facilities that are valued by the community or which Improves the quality and capacity of such facilities. It sets out the approach to how proposed developments of different sizes will be expected to contribute to the provision of new or improved community, leisure and cultural facilities. It sets out how proposals that would result in the loss of valued facilities currently or last used for the provision of community, leisure and cultural activities will be assessed.	No Likely Significant Effects. This is a development management policy relating to community, leisure and cultural facilities. Loss of leisure facilities has potential to lead to an increase in recreational pressure upon a designated site, as such provides policy to prevent this loss, except in some circumstances as outlined. There are no impact pathways present.
Policy D5 Communications Infrastructure	This policy sets out that the Council will promote enhanced digital connectivity throughout the District by supporting high speed broadband and telecommunication infrastructure. In particular applicants submitting planning applications for major development proposals should demonstrate how high speed broadband infrastructure will be accommodated within the development.	No Likely Significant Effects. This is a development management policy relating to communications infrastructure. It does not identify any location, or type of development. This is a positive policy: the provision of high speed internet and telecommunications has potential to reduce the need to travel, thus reducing atmospheric pollution. There are no impact pathways present.

Policy number/ name	Policy detail	Likely Significant Effects
Policy D6 Neighbourhood Planning	This policy sets out the Council's approach in relation to the preparation and production of Neighbourhood Plans including that it is demonstrated that they are contributing towards the strategic objectives of the Local Plan and that they are in general conformity with its strategic approach and policy. In addition they should clearly set out how they will promote sustainable development at the same level or above that which would be delivered through the Local Plan, and that policies are supported by evidence on local need for new homes, jobs and facilities, for their Plan area.	No Likely Significant Effects. This is a development management policy relating to Neighbourhood Planning and ensures conformity with Local Plan documents. There are no impact pathways present.
Policy D7 Monitoring and Enforcement	This policy sets out that the Council will monitor the implementation of the Local Plan policies and infrastructure provision and report the results on an annual basis and that it will deal with the enforcement of planning controls in accordance with the Council's Local Enforcement Plan.	No Likely Significant Effects. This is a development management policy providing for annual monitoring of implementation of Plan policies and infrastructure. There are no impact pathways present.
Policy D8 Local Plan Review	This policy sets out that the Council will complete a review of the Local Plan policies and publish its conclusions at least every five years. Conclusions from the first review will be published no later than five years from the adoption date of the Plan. It identifies the factors that the Council will have particular regard to when reviewing policies within the Plan and determining whether or not relevant policies require updating. It states that, where appropriate, the Council will commence an earlier review of the Plan to address significant changes in circumstances including if monitoring indicates that the Council, as competent authority, can no longer conclude that the delivery of planned development will not cause adverse impacts on Epping Forest Special Area of Conservation.	No Likely Significant Effects This policy sets out the process for Local Plan review and is therefore incapable of having an adverse effect on European internationally important sites. Indeed, by setting out the parameters for Local Plan Review it will play a part in the plan mitigation strategy for air quality.

4.2 Table 4 identifies that District Plan policies provide potential linking impact pathways to European designated sites. Impact pathways include:

- Recreational pressure and urbanisation
- Atmospheric pollution
- Water Abstraction
- Water Quality.

4.3 These impact pathways are discussed further in relation to Epping Forest SAC, Lee Valley SPA and Ramsar site and Worley-Hoddesdonpark Woods SAC in Chapters 5 to 8.

Likely Significant Effects of Site Allocations

4.4 Table 6 presents an assessment of likely significant effects of Residential Site Allocations within the Local Plan from the point of view of HRA; Table 7 does the same for Travellers Site Allocations and

4.5 Table 8 for Employment Site Allocations. **Note that this table only discriminates between site allocations on the basis of recreational pressure and urbanisation catchments because it is considered that all development in Epping Forest District will result in a likely significant effect through the air quality pathway.**

4.6 In Table 6, Table 7 and Table 8 where Site Allocations have been coloured green in the 'Likely Significant Effects' column, this indicates that the Allocations do not contain potential impact pathways linking to European designated sites and have been screened out from further consideration. Where Site Allocations have been coloured orange in the 'Likely Significant Effects' column, this indicates that the Allocations have potential impact pathways linking to European designated sites and have been screened in for appropriate assessment in this report.

4.7 Table 8 includes existing employment sites designated for employment uses. However, Plan policy does not identify any type or quantum of development at these locations; as such, they are not assessed further.

4.8 For Residential and Traveller Site Allocations, impacts relating to recreational pressure in combination have been screened out for Allocations located more than 6.2 km from Epping Forest SAC, 7 km from Worley-Hoddesdonpark Woods SAC and 6 km from Lee Valley SPA and Ramsar site. The reasoning for these distances is discussed in Chapter 5.

Table 6: Screening Assessment of Residential Site Allocations

Site Ref	Parish	Settlement	Number of dwellings	Distance from Internationally Designated Sites	Pathways of Impact Requiring Investigation
EPF/0719/17 (LOU.R18)	Loughton	Loughton	~8	348m from Epping Forest SAC; more than 6km from Lee Valley SPA/ Ramsar site; more than 13 km from Wormley-Hoddesdonpark Woods SAC.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC
EPP.R1 (West)	Epping	Epping	225[47]	400m from Epping Forest SAC; more than 7km from Lee Valley SPA/ Ramsar site; more than 12 km from Wormley-Hoddesdonpark Woods SAC.	**HRA implications** Due to its close proximity to Epping Forest SAC, in-combination effect of recreational pressure and urbanisation require consideration. Due to the large number of dwellings to be provided this site should consider bespoke greenspace provision
EPP.R2 (East)	Epping	Epping	225[48]	970m from Epping Forest SAC; more than 8km from Lee Valley SPA/ Ramsar site; more than 13 km from Wormley-Hoddesdonpark Woods SAC.	**HRA implications** Due to its close proximity to Epping Forest SAC, in-combination effects of recreational pressure and

[47] The combined capacity for both EPP.R1 and EPP.R2 is 450 dwellings and therefore this is a theoretical split.
[48] The combined capacity for both EPP.R1 and EPP.R2 is 450 dwellings and therefore this is a theoretical split.

Site Ref	Parish	Settlement	Number of dwellings	Distance from Internationally Designated Sites	Pathways of Impact Requiring Investigation
					urbanisation require consideration. Due to the large number of dwellings to be provided this site should consider bespoke greenspace provision
Latton Priory (SP5.1)	North Weald Bassett	Harlow	~1,050	5.8km from Epping Forest SAC; more than 6km from Lee Valley SPA/ Ramsar site; more than 9 km from Wormley-Hoddesdonpark Woods SAC.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC.
Water Lane (SP5.2)	Roydon	Harlow	~2,100	5.8km from Epping Forest SAC; 2.9km from Lee Valley SPA/ Ramsar site; 6.3 km from Wormley-Hoddesdonpark Woods SAC.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC. In-combination effect of recreational pressure upon Lee Valley SPA/ Ramsar site is considered in Chapter 5, along with in-combination recreational pressure impact pathway for Wormley-Hoddesdonpark Woods SAC.
East of Harlow (SP5.3)	Sheering	Harlow	~750	More than 11km from Epping Forest SAC; more than 9km from Lee Valley	No Likely Significant Effects.

Site Ref	Parish	Settlement	Number of dwellings	Distance from Internationally Designated Sites	Pathways of Impact Requiring Investigation
				SPA/ Ramsar site; more than 13 km from Wormley-Hoddesdonpark Woods SAC.	Due to the distances involved, there are no impact pathways present.
SR-0011 (NAZE.R1)	Nazeing	Nazeing	~33	6.3km from Epping Forest SAC; 2.8km from Lee Valley SPA/ Ramsar site; 4.3km from Wormley-Hoddesdonpark Woods SAC.	**Likely Significant Effects** In-combination effect of recreational pressure upon Lee Valley SPA/ Ramsar site is considered in Chapter 5, along with in-combination recreational pressure impact pathway for Wormley-Hoddesdonpark Woods SAC.
SR-0032 (LSHR.R1)	Sheering	Lower Sheering	~14	More than 14km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; more than 10km from Lee Valley SPA/ Ramsar site.	No Likely Significant Effects. Due to the distances involved, there are no impact pathways present.
SR-0033 (SHR.R1)	Sheering	Sheering	~10	More than 14km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; more than 10km from Lee Valley SPA/ Ramsar site.	No Likely Significant Effects. Due to the distances involved, there are no impact pathways present.

Site Ref	Parish	Settlement	Number of dwellings	Distance from Internationally Designated Sites	Pathways of Impact Requiring Investigation
SR-0036 (NWB.R1)	North Weald Bassett	North Weald Bassett	~223	6.7km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; more than 10km from Lee Valley SPA/ Ramsar site.	No Likely Significant Effects. Due to the distances involved, there are no impact pathways present. However, due to the large size of this site, it may have potential to provide bespoke greenspace.
SR-0067i-N (ONG.R1)	Chipping Ongar	Ongar	~99	More than 10km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; more than 10km from Lee Valley SPA/ Ramsar site.	No Likely Significant Effects. Due to the distances involved, there are no impact pathways present.
SR-0070 (THYB.R1)	Theydon Bois	Theydon Bois	~39	0.7km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; more than 10km from Lee Valley SPA/ Ramsar site.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC
SR-0072 (NWB.R2)	North Weald Bassett	North Weald Bassett	~21	6.9km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; more than 10km from Lee Valley SPA/ Ramsar site.	No Likely Significant Effects. Due to the distances involved, there are no impact pathways present.
SR-0073 (SHR.R2)	Sheering	Sheering	~62	More than 13km from Epping Forest SAC; more	No Likely Significant Effects.

Site Ref	Parish	Settlement	Number of dwellings	Distance from Internationally Designated Sites	Pathways of Impact Requiring Investigation
				than 7km from Wormley-Hoddesdonpark Woods SAC; more than 10km from Lee Valley SPA/ Ramsar site.	Due to the distances involved, there are no impact pathways present.
SR-0089A (WAL.R1)	Waltham Abbey	Waltham Abbey	~295	2.7km from Epping Forest SAC; 1.4km from Lee Valley SPA/ Ramsar site; more than 7km from Wormley-Hoddesdonpark Woods SAC.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC and the Lee Valley SPA/ Ramsar site are considered in Chapter 5.
SR-0099 (WAL.R2)	Waltham Abbey	Waltham Abbey	~315	2.7km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; within 1.1km from Lee Valley SPA/ Ramsar site.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC and the Lee Valley SPA and Ramsar site are considered in Chapter 5. Due to the large size of this site, it may have potential to provide bespoke publically accessible green space.
SR-0102 (ONG.R2)	Chipping Ongar	Ongar	~135	More than 10km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods	No Likely Significant Effects.

Site Ref	Parish	Settlement	Number of dwellings	Distance from Internationally Designated Sites	Pathways of Impact Requiring Investigation
				SAC; more than 10km from Lee Valley SPA/ Ramsar site.	Due to the distances involved, there are no impact pathways present.
SR-0104 (WAL.R3)	Waltham Abbey	Waltham Abbey	~130	2.5km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; within 1.5km from Lee Valley SPA/ Ramsar site.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC and the Lee Valley SPA and Ramsar site.
SR-0120 (ONG R3)	Chipping Ongar	Ongar	~27	More than 10km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; more than 10km from Lee Valley SPA/ Ramsar site.	No Likely Significant Effects. Due to the distances involved, there are no impact pathways present.
SR-0149 (THOR.R1)	North Weald Bassett	Thornwood	~124	4.4km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; more than 9.5km from Lee Valley SPA/ Ramsar site.	**Likely Significant Effects.** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC
SR-0150 (NAZE.R2)	Nazeing	Nazeing	~25	More than 7km from Epping Forest SAC; 3.9km from Wormley-Hoddesdonpark Woods SAC; 2.6km from Lee Valley SPA/ Ramsar site.	**Likely Significant Effects** In-combination recreational pressure impact pathway for Wormley-Hoddesdonpark Woods SAC and the Lee

Site Ref	Parish	Settlement	Number of dwellings	Distance from Internationally Designated Sites	Pathways of Impact Requiring Investigation
					Valley SPA and Ramsar site are considered in Chapter 5.
SR-0158A (NWB.R3)	North Weald Bassett	North Weald Bassett	~728	5.9km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; more than 10km from Lee Valley SPA/ Ramsar site.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC Due to the large size of this site, it may have potential to provide ANG.
SR-0169 (ROYD.R1)	Roydon	Roydon	~7	More than 9km from Epping Forest SAC; 5.4km from Wormley-Hoddesdonpark Woods SAC; 1.7km from Lee Valley SPA/ Ramsar site.	**Likely Significant Effects** In-combination recreational pressure impact pathway for Wormley-Hoddesdonpark Woods SAC and the Lee Valley SPA and Ramsar site are considered in Chapter 5.
SR-0176 (BUCK.R1)	Buckhurst Hill	Buckhurst Hill	~31	Within 400m of Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; more than 6km from Lee Valley SPA/ Ramsar site.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC

Site Ref	Parish	Settlement	Number of dwellings	Distance from Internationally Designated Sites	Pathways of Impact Requiring Investigation
SR-0181 (HONG.R1)	High Ongar	High Ongar	~10	More than 11km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; more than 10km from Lee Valley SPA/ Ramsar site.	No Likely Significant Effects. Due to the distances involved, there are no impact pathways present.
SR-0184 (ONG.R4)	Chipping Ongar	Ongar	~163	More than 11km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; more than 10km from Lee Valley SPA/ Ramsar site.	No Likely Significant Effects. Due to the distances involved, there are no impact pathways present.
SR-0185 (ONG.R5)	Chipping Ongar	Ongar	~107	More than 10km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; more than 10km from Lee Valley SPA/ Ramsar site.	No Likely Significant Effects. Due to the distances involved, there are no impact pathways present.
SR-0186 (ONG.R6)	Chipping Ongar	Ongar	~33	More than 10km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; more than 10km from Lee Valley SPA/ Ramsar site.	No Likely Significant Effects. Due to the distances involved, there are no impact pathways present.
SR-0197-N (ROYD.R2)	Roydon	Roydon	~21	More than 9km from Epping Forest SAC; 1.6km from Lee Valley SPA/	**Likely Significant Effects**

Site Ref	Parish	Settlement	Number of dwellings	Distance from Internationally Designated Sites	Pathways of Impact Requiring Investigation
				Ramsar site; 5.2 km from Wormley-Hoddesdonpark Woods SAC.	In-combination recreational pressure impact pathway for Wormley-Hoddesdonpark Woods SAC and for Lee Valley SPA and Ramsar site are considered in Chapter 5.
SR-0219 (WAL.R4)	Waltham Abbey	Waltham Abbey	~16	2.7km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; within 1.4km from Lee Valley SPA/ Ramsar site.	**Likely Significant Effects** In-combination impacts relating to recreational pressure and urbanization upon Epping Forest SAC and the Lee Valley SPA and Ramsar site are considered in Chapter 5.
SR-0225 (BUCK.R2)	Buckhurst Hill	Buckhurst Hill	~41	Less than 100m from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; more than 6km from Lee Valley SPA/ Ramsar site.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC
SR-0228i-N (THYB.R2)	Theydon Bois	Theydon Bois	~12	0.6km from Epping Forest SAC; more than 8km from Lee Valley SPA/ Ramsar site; more than 13 km from Wormley-Hoddesdonpark Woods SAC.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC

Site Ref	Parish	Settlement	Number of dwellings	Distance from Internationally Designated Sites	Pathways of Impact Requiring Investigation
SR-0242-N (STAP.R1)	Stapleford Abbotts	Stapleford Abbotts	~33	More than 8km from Epping Forest SAC; more than 15km from Lee Valley SPA/ Ramsar site; more than 21km from Wormley-Hoddesdonpark Woods SAC.	No Likely Significant Effects. Due to the distances involved, there are no impact pathways present.
SR-0281-N (EPP.R4)	Epping	Epping	~34	1.3km from Epping Forest SAC; more than 8km from Lee Valley SPA/ Ramsar site; more than 13km from Wormley-Hoddesdonpark Woods SAC.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC
SR-0289 (LOU.R3)	Loughton	Loughton	~9	1.9km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; more than 10km from Lee Valley SPA/ Ramsar site.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC
SR-0300c (NAZE.R3)	Nazeing	Nazeing	~39	6.3km from Epping Forest SAC; 2.2km from Lee Valley SPA/ Ramsar site; more than 4.7 km from Wormley-Hoddesdonpark Woods SAC.	**Likely Significant Effects** In-combination impacts relating to recreational pressure upon Lee Valley SPA/ Ramsar site and Wormley-Hoddesdonpark Woods SAC are considered in Chapter 5.
SR-0311 (SHR.R3)	Sheering	Sheering	~12	More than 14km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods	No Likely Significant Effects.

Site Ref	Parish	Settlement	Number of dwellings	Distance from Internationally Designated Sites	Pathways of Impact Requiring Investigation
				SAC; more than 10km from Lee Valley SPA/ Ramsar site.	Due to the distances involved, there are no impact pathways present.
SR-0317-N (CHIG.R4)	Chigwell	Chigwell	~105	3.1km from Epping Forest SAC; more than 9km from Lee Valley SPA/ Ramsar site; more than 17km from Wormley-Hoddesdonpark Woods SAC.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC
SR-0318 (CHIG.R5)	Chigwell	Chigwell	~65	2.6km from Epping Forest SAC; more than 9km from Lee Valley SPA/ Ramsar site; more than 16km from Wormley-Hoddesdonpark Woods SAC.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC
SR-0347 (EPP.R5)	Epping	Epping	~42	1.2km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; more than 7km from Lee Valley SPA/ Ramsar site.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC
SR-0348 (EPP.R6)	Epping	Epping	~47	1.6km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; more than 8km from Lee Valley SPA/ Ramsar site.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC
SR-0349 (EPP.R7)	Epping	Epping	~31	1.6km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark	**Likely Significant Effects** In-combination effect of recreational pressure and

Site Ref	Parish	Settlement	Number of dwellings	Distance from Internationally Designated Sites	Pathways of Impact Requiring Investigation
				Woods SAC; more than 8km from Lee Valley SPA/ Ramsar site.	urbanisation upon Epping Forest SAC
SR-0356 (LOU.R4)	Loughton	Loughton	~217	1.7km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; more than 10km from Lee Valley SPA/ Ramsar site.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC
SR-0390-N (ONG.R.7)	Chipping Ongar	Ongar	~17	More than 9km from Epping Forest SAC; more than 17km from Lee Valley SPA/ Ramsar site; more than 20 km from Wormley-Hoddesdonpark Woods SAC.	No Likely Significant Effects. Due to the distances involved, there are no impact pathways present.
SR-0410 (THOR.R2)	North Weald Bassett	Thornwood	~48	Just over 4km from Epping Forest SAC; more than 9km from Lee Valley SPA/ Ramsar site; more than 12 km from Wormley-Hoddesdonpark Woods SAC.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC
SR-0455 (NWB.R4)	North Weald Bassett	North Weald Bassett	~27	6.3km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; more than 10km from Lee Valley SPA/ Ramsar site.	No Likely Significant Effects. Due to the distances involved, there are no impact pathways present.
SR-0473 (NAZE.R4)	Nazeing	Nazeing	~21	Just within 6.2km of Epping Forest SAC; 4.4km	**Likely Significant Effect**

Site Ref	Parish	Settlement	Number of dwellings	Distance from Internationally Designated Sites	Pathways of Impact Requiring Investigation
				from Wormley-Hoddesdonpark Woods SAC; 2.2-3km from Lee Valley SPA/ Ramsar site.	In-combination recreational pressure impact pathway for Epping Forest SAC, Wormley-Hoddesdonpark Woods SAC and the Lee Valley SPA and Ramsar site are discussed in Chapter 5.
SR-0527 (LOU.R6)	Loughton	Loughton	~10	Within 400m of Epping Forest SAC (less than 100m); more than 7km from Wormley-Hoddesdonpark Woods SAC; more than 10km from Lee Valley SPA/ Ramsar site.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC
SR-0541 (WAL.R5)	Waltham Abbey	Waltham Abbey	~53	2.9km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; 1.1km from Lee Valley SPA/ Ramsar site.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC and the Lee Valley SPA and Ramsar site.
SR-0556 (EPP.R8)	Epping	Epping	~44	1.8km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; more than 7km from Lee Valley SPA/ Ramsar site.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC

Site Ref	Parish	Settlement	Number of dwellings	Distance from Internationally Designated Sites	Pathways of Impact Requiring Investigation
SR-0565-N (LOU.R7)	Loughton	Loughton	~20	300m from Epping Forest SAC; more than 7km from Lee Valley SPA/ Ramsar site; more than 12 km from Wormley-Hoddesdonpark Woods SAC.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC
SR-0587 (EPP.R9)	Epping	Epping	~50	1.3km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; more than 7km from Lee Valley SPA/ Ramsar site.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC
SR-0588 (CHIG.R8)	Chigwell	Chigwell	~6	1.7km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; more than 10km from Lee Valley SPA/ Ramsar site.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC
SR-0813 (BUCK.R3)	Buckhurst Hill	Buckhurst Hill	~15	Within 400m of Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; more than 6km from Lee Valley SPA/ Ramsar site.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC
SR-0835 (LOU.R9)	Loughton	Loughton	~111	1.5km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; more than	**Likely Significant Effects** In-combination effect of recreational pressure and

Site Ref	Parish	Settlement	Number of dwellings	Distance from Internationally Designated Sites	Pathways of Impact Requiring Investigation
				10km from Lee Valley SPA/ Ramsar site.	urbanisation upon Epping Forest SAC
SR-0842 (ONG.R8)	Chipping Ongar	Ongar	~9	More than 10km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; more than 10km from Lee Valley SPA/ Ramsar site.	No Likely Significant Effects. Due to the distances involved, there are no impact pathways present.
SR-0878 (LOU.R10)	Loughton	Loughton	~12	0.7km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; more than 10km from Lee Valley SPA/ Ramsar site.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC
SR-0895 (CHIG.R9)	Chigwell	Chigwell	~8	2.9km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; more than 10km from Lee Valley SPA/ Ramsar site.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC
SR-0898 (CHIG.R10)	Chigwell	Chigwell	~11	2.4km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; more than 10km from Lee Valley SPA/ Ramsar site.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC
SR-0903 (WAL.R6)	Waltham Abbey	Waltham Abbey	~27	2.3km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark	**Likely Significant Effects** In-combination effect of

Site Ref	Parish	Settlement	Number of dwellings	Distance from Internationally Designated Sites	Pathways of Impact Requiring Investigation
				Woods SAC; within 1.9km from Lee Valley SPA/ Ramsar site.	recreational pressure and urbanisation upon Epping Forest SAC and the Lee Valley SPA and Ramsar site are discussed in Chapter 5.
SR-0916 (CHIG.R11)	Chigwell	Chigwell Row	~11	2.8km from Epping Forest SAC; more than 11km from Lee Valley SPA/ Ramsar site; more than 18 km from Wormley-Hoddesdonpark Woods SAC.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC
SR-0935 (FYF.R1)	Fyfield	Fyfield	~14	More than 12km from Epping Forest SAC; more than 17km from Lee Valley SPA/ Ramsar site; more than 20km from Wormley-Hoddesdonpark Woods SAC.	No Likely Significant Effects. Due to the distances involved, there are no impact pathways present.
SR-0937 (RUR.R1)	North Weald Bassett	Rural sites (east)	~11	More than 7km from Epping Forest SAC; more than 8km from Lee Valley SPA/ Ramsar site; more than 11km from Wormley-Hoddesdonpark Woods SAC.	No Likely Significant Effects. Due to the distances involved, there are no impact pathways present.
SR-0974 (LOU.R11)	Loughton	Loughton	~9	0.9km from Epping Forest SAC; more than 7km from Lee Valley SPA/ Ramsar site; more than 13km from Wormley-Hoddesdonpark Woods SAC.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC

Site Ref	Parish	Settlement	Number of dwellings	Distance from Internationally Designated Sites	Pathways of Impact Requiring Investigation
SR-0976 (ROYD.R4)	Roydon	Roydon	~20	More than 9km from Epping Forest SAC; 1.2km from Lee Valley SPA/ Ramsar site; more than 4.8km from Wormley-Hoddesdonpark Woods SAC.	**Likely Significant Effects** In-combination impacts relating to recreational pressure upon Lee Valley SPA/ Ramsar and Wormley-Hoddesdonpark Woods SAC are discussed in Chapter 5.
SR-0984 (LOU.R12)	Loughton	Loughton	~10	0.8km from Epping Forest SAC; more than 7km from Lee Valley SPA/ Ramsar site; more than 13km from Wormley-Hoddesdonpark Woods SAC.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC
SR-0986 (LOU.R13)	Loughton	Loughton	~6	0.9km from Epping Forest SAC; more than 7km from Lee Valley SPA/ Ramsar site; more than 13km from Wormley-Hoddesdonpark Woods SAC.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC
SR-0987 (COOP.R1)	Epping	Coopersale	~6	3.3km from Epping Forest SAC; more than 10km from Lee Valley SPA/ Ramsar site; more than 13km from Wormley-Hoddesdonpark Woods SAC.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC
SR-0991 (NWB.R5)	North Weald Bassett	North Weald Bassett	~51	6.3km from Epping Forest SAC; more than 11km from Lee Valley SPA/ Ramsar site; more than 14km from Wormley-	No Likely Significant Effects. Due to the distances involved, there are no

Site Ref	Parish	Settlement	Number of dwellings	Distance from Internationally Designated Sites	Pathways of Impact Requiring Investigation
				Hoddesdonpark Woods SAC.	impact pathways present.
SR-1020 (THYB.R3)	Theydon Bois	Theydon Bois	~6	260m from Epping Forest SAC; more than 7km from Lee Valley SPA/ Ramsar site; more than 14km from Wormley-Hoddesdonpark Woods SAC.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC
SR-1026 (LOU.R14)	Loughton	Loughton	~19	0.9km from Epping Forest SAC; more than 7km from Lee Valley SPA/ Ramsar site; more than 13km from Wormley-Hoddesdonpark Woods SAC.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC
SR-1027 (LOU.R15)	Loughton	Loughton	~6	0.7km from Epping Forest SAC; more than 7km from Lee Valley SPA/ Ramsar site; more than 13km from Wormley-Hoddesdonpark Woods SAC.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC
SR-1032 (LOU.R16)	Loughton	Loughton	~18	0.9km from Epping Forest SAC; more than 8km from Lee Valley SPA/ Ramsar site; more than 14km from Wormley-Hoddesdonpark Woods SAC.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC
SR-1035 (EPP.R11)	Epping	Epping	~11	1.4km from Epping Forest SAC; more than 8km from Lee Valley SPA/ Ramsar site; more than 11km from Wormley-Hoddesdonpark	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping

Site Ref	Parish	Settlement	Number of dwellings	Distance from Internationally Designated Sites	Pathways of Impact Requiring Investigation
				Woods SAC.	Forest SAC

Table 7: Screening Assessment of Traveller Site Allocations

Site Ref	Parish	Settlement	Number of Pitches	Distance from Internationally Designated Sites	Pathways of Impact Requiring Investigation
T-E_11 (RUR.T2)	Roydon	Rural sites (west)	1	7.3km from Epping Forest SAC; 4.7km from Lee Valley SPA/ Ramsar site; 5.3km from Wormley-Hoddesdonpark Woods SAC.	**HRA implications** In-combination recreational pressure impact pathway for the Lee Valley SPA/ Ramsar and Wormley-Hoddesdonpark Woods SAC.
T-E_12 (RUR.T4)	Stapleford Abbotts	Rural Sites (east)	1	More than 10km from Epping Forest SAC; more than 7 km from Lee Valley SPA/ Ramsar site; more than 20 km from Wormley-Hoddesdonpark Woods SAC.	No Likely Significant Effects. Due to the distances involved, there are no impact pathways present.
T-I_02 (RUR.T3)	Roydon	Rural sites (west)	4	4.9km from Epping Forest SAC; 3.4km from Lee Valley SPA/ Ramsar site; 6.0km from Wormley-Hoddesdonpark Woods SAC.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC. In-combination recreational pressure impact pathway for the Lee Valley SPA/ Ramsar and Wormley-Hoddesdonpark Woods SAC.
GRT_N_07 (WAL.T1)	Waltham Abbey	Waltham Abbey	5	3.2km from Epping Forest SAC; 6.9km from Wormley-Hoddesdonpark Woods SAC; within 1.1km of Lee Valley SPA/ Ramsar site.	**Likely Significant Effects** In-combination effect of recreational pressure and urbanisation upon Epping Forest SAC and the Lee Valley SPA and Ramsar site.
GRT_N_06 (NWB.T1)	North Weald Bassett	North Weald Bassett	5	6.8km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; more than 10km from Lee Valley SPA/ Ramsar site.	No Likely Significant Effects. Due to the distances involved, there are no impact pathways present.

Site Ref	Parish	Settlement	Number of Pitches	Distance from Internationally Designated Sites	Pathways of Impact Requiring Investigation
GRT_I-09 (RUR.T6)	Moreton, Bobbingworth and the Lavers	Moreton	1 yard	More than 10km from Epping Forest SAC; more than 7km from Wormley-Hoddesdonpark Woods SAC; more than 10km from Lee Valley SPA/ Ramsar site.	No Likely Significant Effects. Due to the distances involved, there are no impact pathways present.
GRT-1_08 (RUR.T1)	Roydon	Rural sites (west)	2	More than 7km from Epping Forest SAC; 5.2km from Wormley-Hoddesdonpark Woods SAC; within 4.7km from Lee Valley SPA/ Ramsar site.	**Likely Significant Effects** In-combination recreational pressure impact pathway for Wormley-Hoddesdonpark Woods SAC and the Lee Valley SPA and Ramsar site.
EPF/1105/17 (RUR.T5)	Nazeing	Rural Sites (west)	5	More than 7km from Epping Forest SAC; 2.9km from Wormley-Hoddesdonpark Woods SAC; 2.5 from Lee Valley SPA/ Ramsar site.	**Likely Significant Effects** In-combination recreational pressure impact pathway for Wormley-Hoddesdonpark Woods SAC and the Lee Valley SPA and Ramsar site.

4.9 The screening undertaken in Table 6 of Residential and Table 7 of Traveller Site Allocations identify sites that are located within 6.2 km of Epping Forest SAC, 7 km of Worley-Hoddesdonpark Woods SAC and 6 km of Lee Valley SPA and Ramsar site. These are discussed in Chapter 5.

Table 8: Screening Assessment of Employment Site Allocations

Site Ref	Parish	Settlement	Area (ha) and Type of Employment	Distance from Internationally Designated Sites	Pathways of Impact Requiring Investigation
EMP-0002b (LOU.E2A)	Loughton	Loughton	1ha of B2 (General industrial) uses.	1.9km from Epping Forest SAC; more than 8km from Lee Valley SPA/ Ramsar site; more than 14km from Wormley-Hoddesdonpark Woods SAC.	No Likely Significant Effects No impacts beyond in-combination effects: atmospheric pollution, water quality, and water abstraction
SR-0006-N (RUR.E19A)	North Weald Bassett	Harlow	1ha of B1a/B1b Use Class (Offices and research and development)	More than 5km from Epping Forest SAC; more than 6km from Lee Valley SPA/ Ramsar site; more than 9km from Wormley-Hoddesdonpark Woods SAC.	No Likely Significant Effects No impacts beyond in-combination effects: atmospheric pollution, water quality, and water abstraction
SR-0940 (NWB.E4A)	North Weald Bassett	North Weald Bassett	10ha of B1 (Business) / B2 (General industrial)/ B8 (Storage or distribution) uses.	More than 4km from Epping Forest SAC; more than 11km from Lee Valley SPA/ Ramsar site; more than 13km from Wormley-Hoddesdonpark Woods SAC.	No Likely Significant Effects No impacts beyond in-combination effects: atmospheric pollution, water quality, and water abstraction
EMP-0021 (WAL.E6A)	Waltham Abbey	Waltham Abbey	1ha of B2 (General industrial)/ B8 (Storage or distribution) uses.	2.6km from Epping Forest SAC; 1.4km from Lee Valley SPA/ Ramsar site; more than 7km from Wormley-Hoddesdonpark Woods SAC.	No Likely Significant Effects No impacts beyond in-combination effects: atmospheric pollution, water quality, and water abstraction
SR-0945 (WAL.E8)	Waltham Abbey	Waltham Abbey	10ha of B1c (Business) / B2 (General industrial)/ B8 (Storage or distribution) uses.	1.8km from Epping Forest SAC; 2.7km from Lee Valley SPA/ Ramsar site; more than 8km from Wormley-Hoddesdonpark Woods SAC.	No Likely Significant Effects No impacts beyond in-combination effects: atmospheric pollution, water quality, and water abstraction
E-095 (EPP.E1)	Epping	Epping	Existing site designated for employment uses	N/A	N/A
ELR-0091	Epping	Epping	Existing site	N/A	N/A

Site Ref	Parish	Settlement	Area (ha) and Type of Employment	Distance from Internationally Designated Sites	Pathways of Impact Requiring Investigation
(EPP.E2)			designated for employment uses		
EMP-0011 (EPP.E3)	Epping	Epping	Existing site designated for employment uses	N/A	N/A
EMP0013 (EPP.E4)	Epping	Epping	Existing site designated for employment uses	N/A	N/A
EMP-0002a (LOU.E1)	Loughton	Loughton	Existing site designated for employment uses	N/A	N/A
EMP-0002b (LOU.E2B)	Loughton	Loughton	Existing site designated for employment uses	N/A	N/A
EMP-0003 LOU.E3	Loughton	Loughton	Existing site designated for employment uses	N/A	N/A
E-066 (WAL.E1)	Waltham Abbey	Waltham Abbey	Existing site designated for employment uses	N/A	N/A
E-113 (WAL.E2)	Waltham Abbey	Waltham Abbey	Existing site designated for employment uses	N/A	N/A
ELR-0088 (WAL.E4)	Waltham Abbey	Waltham Abbey	Existing site designated for employment uses	N/A	N/A
EMP-0005 (WAL.E5)	Waltham Abbey	Waltham Abbey	Existing site designated for employment uses	N/A	N/A

Site Ref	Parish	Settlement	Area (ha) and Type of Employment	Distance from Internationally Designated Sites	Pathways of Impact Requiring Investigation
EMP-0021 (WAL.E6B)	Waltham Abbey	Waltham Abbey	Existing site designated for employment uses	N/A	N/A
E-058 (ONG.E1)	Ongar	Ongar	Existing site designated for employment uses	N/A	N/A
ELR-0097 (NWB.E1)	North Weald Bassett	North Weald Bassett	Existing site designated for employment uses	N/A	N/A
EMP-0019 (NWB.E2)	North Weald Bassett	North Weald Bassett	Existing site designated for employment uses	N/A	N/A
SR-0415 (NWB.E3)	North Weald Bassett	North Weald Bassett	Existing site designated for employment uses	N/A	N/A
SR-0940 (NWB.E4B)	North Weald Bassett	North Weald Bassett	Existing site designated for employment uses	N/A	N/A
E-112 (NAZE.E1)	Nazeing	Lower Nazeing	Existing site designated for employment uses	N/A	N/A
ELR-0099 (NAZE.E2)	Nazeing	Lower Nazeing	Existing site designated for employment uses	N/A	N/A
EMP-0007 (NAZE.E3)	Nazeing	Lower Nazeing	Existing site designated for employment uses	N/A	N/A
EMP-0009 (NAZE.E4)	Nazeing	Lower Nazeing	Existing site designated for employment uses	N/A	N/A
SR-0151 (NAZE.E5)	Nazeing	Nazeing	Existing site designated for	N/A	N/A

Site Ref	Parish	Settlement	Area (ha) and Type of Employment	Distance from Internationally Designated Sites	Pathways of Impact Requiring Investigation
			employment uses		
SR-0863-N (NAZE.E6)	Nazeing	Nazeing	Existing site designated for employment uses	N/A	N/A
SR-0965 (NAZE.E7)	Nazeing	Nazeing	Existing site designated for employment uses	N/A	N/A
E-092 (THOR.E1)	North Weald Bassett	Thornwood	Existing site designated for employment uses	N/A	N/A
ELR-0092 (THOR.E2)	North Weald Bassett	Thornwood	Existing site designated for employment uses	N/A	N/A
ELR 0093 (THOR.E3)	North Weald Bassett	Thornwood	Existing site designated for employment uses	N/A	N/A
EMP 0014 (THOR.E4)	North Weald Bassett	Thornwood	Existing site designated for employment uses	N/A	N/A
SR-0394 (HONG. E1)	High Ongar	High Ongar	Existing site designated for employment uses	N/A	N/A
SR-0017 (LSHR.E1)	Sheering	Lower Sheering	Existing site designated for employment uses	N/A	N/A
ELR-0074 (STAP.E1)	Stapleford Abbotts	Stapleford Abbotts	Existing site designated for employment uses	N/A	N/A
E-049 (RUR.E1)	North Weald Bassett	Thornwood	Existing site designated for employment uses	N/A	N/A
E068 (RUR.E2)	Matching	Matching	Existing site designated for	N/A	N/A

Site Ref	Parish	Settlement	Area (ha) and Type of Employment	Distance from Internationally Designated Sites	Pathways of Impact Requiring Investigation
			employment uses		
E-070 (RUR.E3)	Abbess Beauchamp and Berners Roding	Abbess Roding	Existing site designated for employment uses	N/A	N/A
E-078 (RUR.E4)	Stanford Rivers	Stanford Rivers	Existing site designated for employment uses	N/A	N/A
E-097 (RUR.E6)	Matching	Matching	Existing site designated for employment uses	N/A	N/A
E-101 (RUR.E7)	North Weald Bassett	Harlow	Existing site designated for employment uses	N/A	N/A
E-104 (RUR.E8)	North Weald Bassett	Harlow	Existing site designated for employment uses	N/A	N/A
E-105 (RUR.E9)	North Weald Bassett	Harlow	Existing site designated for employment uses	N/A	N/A
E-106 (RUR.E10)	Sheering	Lower Sheering	Existing site designated for employment uses	N/A	N/A
E-107 (RUR.E11)	Sheering	Lower Sheering	Existing site designated for employment uses	N/A	N/A
E-109 (RUR.E12)	Moreton, Bobbingworth and the Lavers	Moreton	Existing site designated for employment uses	N/A	N/A
E-119 (RUR.E14)	Abbess Beauchamp and Berners	Abbess Roding	Existing site designated for employment uses	N/A	N/A

Site Ref	Parish	Settlement	Area (ha) and Type of Employment	Distance from Internationally Designated Sites	Pathways of Impact Requiring Investigation
	Roding				
ELR-0095 (RUR.E15)	Moreton, Bobbingworth and the Lavers	Magdalen Laver	Existing site designated for employment uses	N/A	N/A
EMP-0020 (RUR.E18)	Fyfield	Fyfield	Existing site designated for employment uses	N/A	N/A
SR-0006-N (RUR.E19B)	North Weald Bassett	Harlow	Existing site designated for employment uses	N/A	N/A
SR-0211 (RUR.E20)	Stanford Rivers	Stanford Rivers	Existing site designated for employment uses	N/A	N/A
ELR-0094 (RUR.E22)	North Weald Bassett	Hastingwood	Existing site designated for employment uses	N/A	N/A
E-065 (RUR.E23)	Theydon Garnon	Theydon Garnon	Existing site designated for employment uses	N/A	N/A
E-098 (RUR.E24)	Moreton, Bobbingworth and the Lavers	Threshers Bush	Existing site designated for employment uses	N/A	N/A
E-096 (RUR.E5)	Epping Upland	Epping Upland	Existing site designated for employment uses	N/A	N/A
E-115 (RUR.E13)	Waltham Abbey	Waltham Abbey	Existing site designated for employment uses	N/A	N/A
ELR-0104A (RUR.E16)	Chigwell	Chigwell	Existing site designated for employment uses	N/A	N/A

Site Ref	Parish	Settlement	Area (ha) and Type of Employment	Distance from Internationally Designated Sites	Pathways of Impact Requiring Investigation
ELR-0104B (RUR.E17)	Chigwell	Chigwell	Existing site designated for employment uses	N/A	N/A

4.10 Screening of the Employment Site Allocations undertaken in Table 7 does not identify any potential impact pathways linking to European designated sites beyond in combination affects relating to changes in air quality as a result of increase traffic movement resulting from development provided by the Plan.

Air Quality Modelling Results: Likely Significant Effects

4.11 Epping Forest SAC is known to be adversely affected by relatively poor local air quality alongside the roads that traverse the SAC, and this has been demonstrated to have negatively affected the epiphytic lichen communities of the woodland. The nature of the road network around the modelled part of Epping Forest SAC is such that journeys between a number of key settlements around the Forest by car, van or bus effectively necessitate traversing the SAC. Moreover, queues are known to build around most arms of Wake Arms Roundabout, primarily during the AM and PM peak, which increases emissions compared to the same volume and composition of free-flowing traffic.

4.12 Full air quality modelling was reported in the 2019 HRA of the Local Plan Submission Version 2017. The conclusion of that exercise was that the change in pollutant concentrations attributable to all growth in combination exceeded 1% of the critical level along multiple modelled transects. As such, it was not possible to conclude no likely significant effect. This is in line with the screening methodology in published internal Natural England guidance on air quality assessment for HRA[49]. Appropriate Assessment was therefore considered necessary.

4.13 Since the 1% of the critical level threshold was exceeded for both NOx and ammonia at the majority of receptors due to growth ‘in combination’, appropriate assessment was deemed necessary.

Which authorities play the greatest part in the ‘in combination’ effect?

4.14 The relative responsibility for the additional NOx, ammonia and nitrogen deposition was ascertained in 2019 by comparing the difference between the 2033 Baseline and the various 2033 growth scenarios modelled in 2019. It was established that growth in Epping Forest District between 2014 and 2033 is by far the greatest source of additional ammonia and NOx emissions on the modelled road sections and all other plans and projects make a negligible contribution to the ‘in combination’ effect. This is most probably because the average daily traffic flow on all the modelled sections of road is dominated by people who either live or work in Epping Forest District, particularly the settlements that surround the SAC, including Epping itself.

[49] NE Internal Guidance – Approach to Advising Competent Authorities on Road Traffic Emissions and HRAs V1.4 Final - June 2018

5. Appropriate Assessment: Recreational Pressure and Urbanisation

5.1 The following policies and site allocations were deemed to pose a risk of likely significant effects upon the Lee Valley SPA and Ramsar site, Wormley-Hoddesdonpark Woods SAC and Epping Forest SAC internationally designated sites as a result of increased recreational pressure including urbanisation affects. These are therefore discussed further in this Chapter:

Policies

- Policy SP 1: Spatial Development Strategy 2011-2033;
- Policy SP 3 Development & Delivery of Garden Communities in the Harlow and Gilston Garden Town; and
- Policy SP 4 Garden Town Communities.

Site Allocations

5.2 In general, residential site allocations will not result in an impact alone upon internationally designated sites. Any loss of publicly accessible green spaces[50] could result in an increase in recreational pressure upon internationally designated sites. However, there are no sites proposed for allocation which would result in the loss of such publicly accessible green space. Distances from internationally designated sites and the quantum of development to be delivered are identified in Table 6.

5.3 The following policies within the Plan provide a positive contribution that could result in a reduction in recreational pressure and urbanisation:

- Policy DM 2 (Epping Forest SAC and the Lee Valley SPA) is a positive policy as it expects all relevant development to '*assist in the conservation and enhancement of the biodiversity*' of Epping Forest SAC and Lee Valley SPA and also requires development to contribute to the delivery of the recreation and air pollution mitigation strategies.
- Policy DM 5 (Green and Blue Infrastructure) is a positive policy that provides for green and blue infrastructure including for recreational use which can potential divert recreational pressure away from the designated sites.
- Policy DM 6 (Designated and Undesignated Open Spaces) is a positive policy as it provides for open spaces that can detract recreational pressure away from internationally designated sites and requires no net loss of open space.
- Policy DM 7 (Heritage Assets) is a development management policy relating to heritage assets including Registered Parks and Gardens. These spaces can act to divert recreational pressure away from internationally designated sites and this policy requires no net loss.
- Policy DM 10 (Housing Design and Quality) is a positive policy as it encourages the inclusion of amenity/ garden space, green infrastructure and open space. These have potential to divert recreational pressure away from internationally designated sites.
- Policy SP 6 (The Natural Environment, Landscape Character and Green and Blue Infrastructure) is a positive policy that provides for the retention and extension of green infrastructure which has potential to divert recreational pressure away from internationally designated sites. This policy includes the requirement for CIL/S106 agreements where appropriate green infrastructure cannot be provided on site.
- Furthermore, Policy DM 11 (Waste Recycling Facilities on New Development) is a development management policy relating to waste recycling storage facilities on new development sites. This is

[50] Greenspaces permanently and continuously accessible to the public

a positive policy as it is likely to reduce any occurrences of fly tipping within an internationally designated site as a result of new development.

5.4 Within the context of these policies, recreational pressure on each internationally important site is discussed below.

Lee Valley SPA/Ramsar site

5.5 The following SSSI's are components of the SPA/ Ramsar site:

- Turnford & Cheshunt Pits SSSI straddles the boundary between Epping Forest District and Broxbourne and lies 300m from the settlement of Waltham Abbey. Most of the site is owned by the Lee Valley Regional Park Authority and is managed as a Country Park (River Lee Country Park).
- Rye Meads SSSI is located approximately 70 metres north of Epping Forest District and 2.6km from the nearest significant village within that district (Lower Nazeing, with a population c. 4,500). The site is a Nature Reserve and is owned by Thames Water and the RSPB who manage the site with Herts and Middlesex Wildlife Trust.
- Amwell Quarry SSSI is located 2.5km north west of the District boundary. The site is a National Nature Reserve. It is owned and managed by Herts and Middlesex Wildlife Trust.

5.6 The Local Plan allocates a total 3146 dwellings between 1.1km and 2.9km from the SPA/Ramsar site on 13 development sites at Waltham Abbey, Roydon (near Harlow) and Nazeing. It does not allocate any dwellings closer to the SPA/Ramsar site than 1.1km and 2,189 of the dwellings (69% of the total) are located over 2.5km from the SPA. The majority of these (66% of the total) are the sites that comprise the SP 5.2 Water Lane (2,100 dwellings) located 2.9km from the Rye Meads part of the SPA/Ramsar site at its closest. Moreover, visiting Rye Meads from the Roydon area is more convoluted than suggested by a simple measure of 'as the crow flies' due to the intervening railway line and River Stort and the existence of a toll on Rye Road[51]. As such, the toll-free route requires one to drive north onto the A414, west along the A414 and then south into Hoddesdon to reach the reserve.

5.7 There are several reasons why this analysis considers that recreational pressure effects on this site from development in Epping Forest District are unlikely to result in adverse effects on integrity even 'in combination':

- Amwell Quarry SSSI (Amwell Nature Reserve) and Rye Meads SSSI (Rye Meads Nature Reserve) are both laid out in considerable detail with a network of hides (ten at Rye Meads, three at Amwell) and clearly marked footpaths/boardwalks with screening vegetation that are specifically laid out and designed to route people away from the sensitive areas and minimise disturbance while at the same time accommodating high numbers of visitors. Additionally, no dogs are allowed (except registered assistance dogs) and the wet and marshy/open water nature of the habitats on site inherently limits off-track recreational activity, rendering it difficult to accomplish and unappealing. For these reasons it is considered that the vulnerability of Amwell Nature Reserve and Rye Meads Nature Reserve to the potential adverse effects of recreational activity that can affect other less well-managed sites is very low. In Turnford and Cheshunt Pits SSSI, recreational activity is similarly regulated through zoning of water bodies. The majority of the site is already managed in accordance with agreed management plans in which nature conservation is a high or sole priority.
- Two of the three faunal species for which the SPA and Ramsar site are designated – gadwall and shoveler – are not inherently highly sensitive to disturbance and are readily able to adapt (habituate) to the presence of shore-based human recreational activities without being flushed (as opposed to water-based activities which are potentially highly disturbing).
- Turnford & Cheshunt Pits is located within the Lee Valley Country Park, which is part of the Lee Valley Regional Park. In their responses to the Local Plan Examination the Lee Valley Regional Park Authority did not raise any concerns regarding future recreational pressure on the SPA from growth in Epping Forest District.

[51] Although the toll is modest (currently £0.5) it is nonetheless likely to discourage casual visitors from using that route.

- The closest allocated housing sites in Epping Forest District Local Plan (SR-0099 (WAL.R2) providing 316 dwellings and SR-0541 (WAL.R5) providing 53 dwellings) are more than 1km from the closest part of the SPA/Ramsar site (Turnford & Cheshunt Pits SSSI) and considerably further than that from other parts. Various investigations into the habits of recreational visitors to nationally and internationally important wildlife sites have found that the majority of dog walkers and casual walkers are generally disinclined to walk very far to visit sites for recreation. For example, in one of the most thorough studies visitor surveys were conducted at the Thames Basin Heaths Special Protection Area. The study found that the average distance between the visitor's home postcode and Thames Basin Heaths SPA when arriving by foot was 0.8 km, with 75% of foot-based visitors living within a 0.9 km straight line distance from the visitor survey point. Other surveys show a similar broad pattern, since there is a natural limit as to how far most people are prepared to walk to visit a particular countryside site, even when it is large and appealing. The Thames Basin Heaths is also extensively visited by people travelling by car, who typically live 5km from the SPA. However, that site has an abundance of parking whereas parking in the vicinity of Rye Meads, Turnford & Cheshunt Pits and Amwell Quarry will naturally restrict the number of car-based visitors at any time and, unlike Epping Forest SAC, informal roadside verge parking is very limited.

5.8 Nonetheless, Epping Forest District Council recognises that case-by-case decisions need to be made for individual planning applications. To facilitate this, Policy DM 2 (Epping Forest SAC and Lee Valley SPA) has been proposed for modification. It includes the following protective text: '*B. New development that will have an adverse effect on integrity either alone, or in combination with other plans or projects, will not be permitted unless sufficient measures are secured and delivered to ensure that there will be no harm to the integrity of the protected sites'* . and this will apply explicitly to Lee Valley SPA/Ramsar site.

5.9 With these precautions in place it is concluded that there will be no recreational adverse effect on the integrity of Lee Valley SPA/Ramsar site.

Wormley-Hoddesdonpark Woods SAC

5.10 The site is a large, attractive area of ancient woodland with extensive public access and close to large urban centres. The majority of the woods in the complex are in sympathetic ownership, with no direct threat (Wormley-Hoddesdonpark Wood, for example, is managed by The Woodland Trust). No visitor survey data that identifies the recreational catchment could be sourced for Wormley-Hoddesdonpark Woods. However, data does exist for other large woodland internationally important sites, such as Ashdown Forest[52] and Epping Forest SAC. These indicate that core visitor catchments (i.e. the zone within which the majority (c. 75%) of regular, frequent visitors are concentrated) tend to lie between c. 5km (Epping Forest) and 6-7km (Ashdown Forest) from the site. If the more precautionary figure of 7km is used for Wormley Hoddesdonpark Woods in the absence of bespoke visitor data for this site, the zone would include some small villages in the north-west of Epping Forest District (such as Nazeing, Lower Nazeing and Bumbles Green), but none of the larger settlements.

5.11 Natural England's Site Improvement Plan (SIP)[53] indicates that the site is heavily used by the public for recreational purposes. However, it also indicates that recreational activity is generally well-managed. Sensitive management of access points and routes by the site's main owners has been largely successful in mitigating the potential adverse effects of this high level of use. As such, general recreational pressure is not indicated in the Site Improvement Plan as a current or future obstacle to achieving or maintaining favourable conservation status and preserving the integrity of the SAC.

5.12 Recreation is actively promoted on this site and most recreation is concentrated on well-established paths. Most of the complex is covered by a High Forest Zone Plan (Hertfordshire County Council 1996) which sets out a framework for woodland management across the whole area. It aims to restore a varied age structure and natural stand types through sustainable forestry.

[52] Clarke RT, Sharp J & Liley D. 2010. Ashdown Forest Visitor Survey Data Analysis (Natural England Commissioned Reports, Number 048) and subsequent analyses
UE Associates and University of Brighton. 2009. Visitor Access Patterns on the Ashdown Forest: Recreational Use and Nature Conservation
[53] http://publications.naturalengland.org.uk/file/6541134543192064 [accessed 12/08/16]

5.13 The Local Plan does not propose to allocate any new residential sites at all within 2.9km of the SAC. The closest residential site is EPF-1105-17 (RUR.T5) providing a single travellers pitch. The next closest residential development site is SR-0150 (NAZE.R2) located 3.9km from the SAC and providing for 25 dwellings in Lower Nazeing. The Local Plan proposes to allocate a total of eight housing sites (2296 dwellings) and five traveller sites within 7km of the SAC as identified below:

- SP 5.2 Water Lane - Approximately 2,100 homes
- SR-0011 (NAZE.R1) in Lower Nazeing– Approximately 63 dwellings
- SR-0150 (NAZE.R2) in Lower Nazeing – Approximately 25 dwellings
- SR-0169 (ROYD.R1) in Roydon – Approximately 7 dwellings
- SR-0197-N (ROYD.R2) in Roydon – Approximately 21 dwellings
- SR-0300c (NAZE.R3) in Lower Nazeing – Approximately 39 dwellings
- SR-0473 (NAZE.R4) in Lower Nazeing – Approximately 21 dwellings
- SR-0976 (ROYD.R4) in Roydon – Approximately 20 dwellings
- T-E_11 (RUR.T2) in Hamlet Hill, Roydon – Approximately 1 pitch
- T_I_02 (RUR.T3) in Roydon Hamlet, Roydon – Approximately 4 pitches
- GRT_N_07 (WAL.T1) in Waltham Abbey – Up to 5 pitches
- GRT-1_08 (RUR.T1) in Roydon – Up to 2 pitches
- EPF/1105/17 (RUR.T5) Lower Nazeing, Nazeing – Up to 1 pitch

5.14 Based on the issues identified in the Site Improvement Plan and the fact that concerns about recreational pressure on this site have not been flagged by Natural England during the preparation of the Local Plan and its HRA, which commenced in 2012, there is no basis to conclude that such an increase would result in an adverse effect on the integrity of the SAC.

In Combination

5.15 The Local Plan includes both new allocations (i.e. sites that do not currently have planning permission) and sites that have already received planning permission, but which have not yet been implemented. The housing requirement for Epping Forest District over the Local Plan period 2011-2033 (including commitments and completed development) is 11,400 new homes.

5.16 Some parts of East Herts District also lie within the likely recreational catchment of the SAC (assumed as a worst case 7km), but the HRA of the East Herts District Plan identifies that the District Plan does not propose to allocate any new housing sites at all within 3km of the SAC and the nearest large housing site is 5km distant, to the east of Ware. It concludes that these will not be significant even in combination. The East Herts Local Plan was adopted on 23 October 2018. Additionally, Wormley-Hoddesdonpark Woods SAC is located within the borough of Broxbourne. The screening assessment of Broxbourne's draft Local Plan[54] (undertaken in December 2016) enabled this impact pathway to be screened out alone and in combination with other projects and plans. Broxbourne Local Plan was adopted on 23 June 2020. Based on these conclusions and the quantum and location of new housing within Epping Forest District it is considered that it would not result in an adverse effect on integrity in combination.

[54] https://www.broxbourne.gov.uk/sites/default/files/Documents/Planning/pp_LC-218_Broxbourne_HRA_Screening_8_051216JE-compressed.pdf [accessed 06/11/2016]

Epping Forest SAC

5.17 Epping Forest SAC receives a great many visits per year (estimated at over 4 million across the Forest as a whole including the area covered by the SAC) and discussions with the City of London Corporation have identified long-standing concerns about increasing recreational use of the Forest resulting in damage to its interest features. A programme of detailed formal visitor surveys has been undertaken in 2017 and 2019 and has identified that 75% of visitors to Epping Forest SAC arise from within approximately 6km (6.2km) of the site. This is relevant because the 75th percentile is often used to define the core recreational catchment of an internationally important site. However, within that 6.2km zone visitors are not evenly spread; the vast majority of Essex-resident visitors live within 3km of the SAC with few living further afield. For example, only 3 visitor postcodes recorded in the 2017 visitor survey were between 3km and 6.2km of the SAC in Epping Forest District; almost all visitors resident in Epping Forest District (irrespective of visit frequency or activity) lived within 3km of the SAC. The 6.2km distance appears to be influenced particularly by residents to the south of the SAC in north London who are dispersed over a wider area. Nonetheless, Epping Forest District Council is using 6.2km as a definition of the core catchment of Epping Forest SAC.

5.18 Residential site allocations and traveller sites located wholly or in part within 6.2km of Epping Forest SAC are provided in Table 8.

Table 9: Site Allocations Providing Residential Development and/or traveller sites within 6.2km of Epping Forest SAC

THOR.R1	THOR.R2
LOU.R18	LOU.R6
WAL.R7	WAL.R5
EPP.R1 (West)	EPP.R8
EPP.R2 (East)	LOU.R7
SP5.1 (Latton Priory)	EPP.R9
SP5.2 (Water Lane)	CHIG.R8
THYB.R1	BUCK.R3
WAL.R1	NAZE.R4
WAL.R2	LOU.R9
WAL.R3	LOU.R10
NWB.R3 (North Weald Bassett)	CHIG.R9
BUCK.R1	CHIG.R10
WAL.R4	WAL.R6
BUCK.R2	CHIG.R11
LOU.R12	LOU.R11

THYB.R2	LOU.R13
COOP.R1	THYB.R3
EPP.R4	LOU.R4
LOU.R3	LOU.R14
CHIG.R4	LOU.R15
CHIG.R5	LOU.R16
EPP.R5	EPP.R11
EPP.R6	RUR.T3
EPP.R7	WAL.T1

5.19 There are fifty sites listed in Table 8: 48 housing sites and 2 gypsy & traveller sites. Of these, 39 sites (amounting to 2,105 dwellings/pitches and including 58% of WAL.R1 and WAL.R2 which straddle the 3km line) are located within 3km of the SAC, the zone within which almost all current EFDC-resident visitors recorded in the survey were located. Seven of these sites (LOU.R18, LOU.R6, LOU.R7, BUCK.R1, BUCK.R2, BUCK.R3 and THYB.R3)[55] totalling 116 dwellings are located very close to the SAC (within 400m, which has been used as it is a widely used definition of a five-minute walk). These are all in Theydon Bois, Loughton or Buckhurst Hill where there is already extensive housing development adjacent to the SAC. This represents a very small proposed increase in the total amount of housing within this zone. For example, there are currently 23,118 households within 400m of the SAC according to 2011 Census data, so if each of these allocations constituted a new household (and in practice they may not all be occupied simultaneously or by people who don't already live within 400m of the SAC) it would be an increase of 0.5%.

5.20 Of the seven sites that are very close to (within 400m of) the SAC all are fairly small with three sites being for 10 dwellings or less and the largest being for 41 dwellings, separated from the SAC by a thick belt of existing housing. Since Epping Forest SAC is already known to be under pressure from high levels of recreation, additional recreational activity resulting from new residential development within 3km of the SAC in Epping Forest District would result in an adverse effect 'in combination' with growth in adjacent authorities (notably the London Boroughs of Waltham Forest and Redbridge, which are also core centres of SAC visitor origin) without mitigation. This would arise directly through recreational pressure itself and through the interlinked impact pathway of urbanisation resulting from increased presence of people within and around the SAC (e.g. littering, fires, introduction of invasive species and fly tipping).

5.21 The remaining sites are located between 3km and 6.2km from the SAC. These are CHIG.R4, CHIG.R10, SP5.1 (Latton Priory), SP5.2 (Water Lane), THOR.R1, NWB.R3 (North Weald Bassett), THOR.R2, RUR.T3, NAZE.R4, WAL.R2 (42%), WAL.T1 and COOP.R1. Of these, three large sites (SP5.1, SP5.2 and NWB.R3) will be responsible for delivering a total of 3,878 dwellings between them, or 86% of the 4,517 dwellings to be delivered in the 3km to 6.2km zone. The visitor survey indicates that few current visitors to the SAC derive from the 3km to 6.2km zone since this area is generally rural with scattered villages. However, the delivery of three large sites totalling almost 4,000 dwellings *could* result in changes to the patterns of activity and potentially result in a greater proportion of visitors to the SAC deriving from the 3km to 6.2km zone if those new garden villages are not rendered recreationally self-sufficient.

5.22 Epping Forest District Council has been working with partners to produce a strategic mitigation strategy for Epping Forest SAC[56]. Since that commitment was made governance arrangements are being put in place

[55] Technically site EPP.R1 is also located within 400m but the area concerned is the far south-western tip, adjacent to the M25 and is very unlikely to be suitable for housing.
[56] The MoU states that '*It is intended this Joint Strategy will be in agreed and published prior to the determination of any of the planning applications on sites around Harlow that are part of The Spatial Option detailed in the "Distribution of OAN across West Essex and East Hertfordshire" MoU. If the Joint Strategy is not in place when planning applications are submitted,*

coordinated by Natural England and this commitment has been reflected in Local Plan policy. The first step in development of this strategy, through undertaking an updated visitor survey of the SAC was completed and a second visitor survey was undertaken in September 2019. EFDC's Cabinet approved an interim recreational mitigation strategy on 18th October 2018 as a material consideration in the determination of planning applications. In reviewing the interim mitigation strategy Natural England commented in a letter to the Council dated 1st October 2018 that '*This interim proposal provides a solid base on which to further develop the final Mitigation Strategy…*' The interim strategy will be replaced by the long-term mitigation strategy.

5.23 The recreation mitigation strategies for some European sites consist of both Strategic Access Management and Monitoring (SAMM) strategies and the provision of Suitable Alternative Natural Greenspace (SANG) for all net new housing within the core recreational catchment, but this is by no means ubiquitous and is certainly not mandatory. There are many European sites where the recreation mitigation strategy consists solely of SAMM payments. This includes sites which are under high levels of recreational pressure and exert a significant sub-regional recreational draw, such as the Essex Coast European sites, the Solent European sites, or Cannock Chase SAC. The recreation mitigation strategy for the Epping Forest District Local Plan goes further than purely seeking SAMM payments as it also targets SANG to where it is most likely to be effective, and includes the implementation of site specific Infrastructure projects. The strategy is as follows:

1. All housing within 3km of the SAC, together with the North Weald Bassett and Waltham Abbey Strategic Masterplan Areas, will need to pay towards delivery of the Epping Forest SAC SAMM strategy[57]. This is because whilst the established Zone of Influence (ZOI) is 6.2km both the 2017 and 2019 visitor surveys show that of Epping Forest District residents who visit the SAC the vast majority live within 3km[58] and the two identified SMA's are the ones wholly or partly beyond 3km most likely to change the pattern of recreational activity. The Council is confident that adequate funding to deliver the SAMM measures will be derived by confining the SAMM charge to the identified allocations and that this approach is the one which is the most compliant with CIL Regulations.

2. In addition to the SAMM strategy, Suitable Alternative Natural Greenspace (SANG) at a minimum rate of 8ha/1000 population[59] will be required for four of the five Strategic Masterplan Areas: North Weald Bassett, Latton Priory, Water Lane and South Epping:
   a. SANG is required for South Epping on the basis that it is by far the largest allocation within 3km of the SAC and part of the site is within easy walking distance of the SAC and is connected to it via a footbridge over the M25.
   b. SANG is required for North Weald Bassett, Latton Priory and Water Lane on the basis that these allocations are sufficiently large that they could change patterns of recreational activity, and should therefore be recreationally self-sufficient, even though they lie entirely beyond the 3km zone within which most current Epping Forest District resident visitors to the SAC originate. Parts of the North Weald Bassett, Latton Priory and Water Lane Masterplan Areas even lie entirely beyond the 6.2km core catchment of the SAC. Nevertheless, the Council requires applicants to take account of the need to provide an element of SANG to account for visitors arising from these areas in order to 'future proof' these developments.

3. The remaining Strategic Masterplan Area (Waltham Abbey North) and all allocations at the settlements of Waltham Abbey, Debden, Theydon Bois, Loughton, and Buckhurst Hill will be required to make a financial contribution towards the delivery of one of three Strategic Infrastructure Projects (Enhancements at Lee Valley Regional Park, Enhancements to the Roding Valley Recreation Ground

applicants will be required to submit the necessary information to ascertain whether any adverse impacts will be caused in Epping Forest, and if necessary any mitigation measures that may be necessary'.

[57] Interim Approach to Managing Recreational Pressures on the Epping Forest Special Area of Conservation. October 2018. (EB134). Note that 'interim' here simply means the strategy was produced at an early stage in the Local Plan Examination and is still being finalised. It does not denote that effective measures have been omitted or that this is a slimline strategy.

[58] The core catchment of the SAC is 6.2km as defined by the zone within which 75% of visitors derive. However, visitor postcodes are not evenly spread across this zone. Visitors within Epping Forest District overwhelmingly live within 3km of the SAC. It is primarily London residents who are more dispersed and pull the core catchment of the SAC out to 6.2km.

[59] A rate of delivery is an effective way of defining a minimum extent of provision, but each proposed SANG must be considered on its own merits in terms of detailed design and attractiveness and therefore the 8ha/1000 people rate of provision will not be inflexible. For example, experience indicates that any SANG (irrespective of the size of the population it is intended to serve) must be a minimum of 10ha in size (and quite possibly larger) in order to accommodate an adequate length of circular walk.

and PROW Improvements linking to The Woodland Trust site in Theydon Bois). These allocations have been identified for additional measures beyond payment of SAMM because:

a. Both the 2017 and 2019 Visitor Surveys show that very few EFSAC visitors derive from the Waltham Abbey area, but Waltham Abbey North (expected to commence development in 2023/24 and complete development in 2030) is sufficiently large that it could change patterns of recreational activity at the SAC. However, it is also much closer to the Lee Valley Regional Park (approximately 300m distant) than it is to the SAC, giving strong opportunities to enhance access to that alternative recreational draw and the surrounding Green Lanes by making financial contributions towards the implementation of a number of projects identified within the Area 6 Strategy developed by the LVRP Authority[60]. These same enhancements will also cater for the 96 other dwellings allocated at Waltham Abbey; and

b. Debden, Theydon Bois, Loughton, and Buckhurst Hill all lie within easy walking distance of, and have direct access to, Epping Forest SAC by virtue of directly abutting the site. As such, it is accepted that more than just SAMM measures should be provided in relation to allocations in these settlements to act as an alternative offer to the SAC. The c. 600 new dwellings allocated at these settlements will therefore be required to make payments to delivering two Strategic Infrastructure Projects (Roding Valley Recreation Ground and improved access to The Woodland Trust site in Theydon Bois). The two largest sites LOU.R4 Borders Lane playing fields (allocated for 217 homes) and LOU.R9 Land at former Epping Forest College (allocated for 111 homes) will be within easy walking distance of Roding Valley Recreation Ground (although there is also a car park at that site) and will also be required to provide on-site natural accessible greenspace. The on-site greenspace will be too small to constitute SANG but will contribute to the overall network of accessible new GI at Loughton.

4. The 315 dwellings allocated outside the Strategic Masterplan Areas between 3km and 6.2km of the SAC will not be required to make financial contributions to SAMMs to mitigate for recreational pressure impacts, since so few visitors to the SAC derive from beyond 3km in Epping Forest District. Those visitors arising from these areas also visit the SAC on a far less regular basis than people who live closer to the site. Moreover, 105 of those dwellings constitute specialist housing at Chigwell (Site CHIG.R4) which are likely to make a negligible contribution to recreational visits to the SAC. However, the SAMM strategy has been assembled to identify all available and effective measures that could be deployed within the SAC itself to manage recreational access and these measures are not tied to the zones within which people live. It is far more extensive than SAMM strategies at SACs where a much smaller quantum of growth is planned, such as Burnham Beeches SAC, and is commensurate with those European sites that constitute a sub-regional draw. It is therefore considered that the measures to be delivered will effectively address recreational visits from new Epping Forest District residents even if they live more than 3km from the SAC. Moreover, there are opportunities, if a subsequent planning application HRA or Local Plan Review deems it necessary, for the two allocations at Thornwood (THOR.R1 Land at Tudor House for approximately 124 homes and THOR.R2 Land West of High Road for approximately 48 homes) to be mitigated by potential additional carrying capacity at Latton Priory or in North Weald Bassett where the Council, as landowner, is exploring the potential for using some of its land for SANG purposes. This provision would be over and above that necessary to avoid or mitigate any adverse effect on the integrity of the SAC arising from residential development.

5.24 The two Infrastructure Projects identified in the Epping Forest GI Strategy to serve Debden, Theydon Bois, Loughton, and Buckhurst Hill are intended as a minimum to address the recreational impact of the c. 300 dwellings expected at these settlements over the first five years of the Local Plan. As the infrastructure projects are developed, they may well be able to address all c. 600 dwellings allocated at these settlements over the Local Plan period. For example, if SANG were to be provided for these 300-600 dwellings it would

[60] These are:
i. for Gunpowder Park to create a more flexible visitor hub and provide the core range of services including refreshment facilities, an indoor public visitor space and park information point
ii. for the management and enhancement of Gunpowder Park, Sewardstone Marsh and Patty Pool Mead as a key access to nature site with habitat improvements to be undertaken throughout
iii. Management activities for the existing wet woodland habitats at Osier Marsh and Sewardstone Marsh in order to maintain and expand their special wildlife interest
iv. enhancements to visitor access by extending boardwalks and improving interpretation
v. the enhancement of floodplain grassland and fen habitat on Sewardstone Marsh and the wet grassland habitat of Patty Pool Mead to be improved to provide nesting opportunities for breeding waders.

require c. 6ha to c.11.5ha of SANG using the 8ha/1000 population metric. In other words, that is the amount of newly accessible natural greenspace required assuming it was currently entirely unused for recreation. The sites associated with the two Infrastructure Projects are already used for recreational purposes, including for informal recreational use such as dog-walking, but total more than 80ha, consisting of c.44ha at Roding Valley Recreation Ground (after discounting the cricket pitches, tennis courts and children's play areas and not including Roding Valley Meadows LNR) and c.38ha at Theydon Bois Wood. At Roding Valley Recreation Ground there is also the opportunity at Roding Valley Meadows to improve connections to and footpaths within the c. 18.5ha of Roding Valley Nature Reserve west of the River Roding).

Location and extent of Roding Valley Recreation Ground (south-west) and Roding Valley Meadows LNR (north-east)

5.25 There should thus be ample carrying capacity for these sites to accommodate the additional visitors from the allocated sites, which will represent just a 3% increase in total households in these settlements[61], assuming as a precaution that all c.600 dwellings are occupied by people who don't already live in these settlements. This is particularly the case since these projects are intended to increase the existing recreational capacity of these sites. Although no formal visitor survey has been possible at time of writing (March 2021) due to COVID-19 restrictions, visits to the sites to inform the Green Infrastructure Strategy have identified low levels of recreational use at Theydon Bois Wood and in the northern part of Roding Valley Recreation Ground (with higher levels of activity in the southern part), and significant opportunities to enhance capacity of the latter through reconfiguring the playing field provision, improving footpaths, publicity, wayfinding and access, and adding more habitat diversity and features to provide an interesting and attractive visitor experience, particularly in the north of the Recreation Ground site. Moreover, the Council land ownership at Roding Valley Recreation Ground includes the adjacent lake, such that the Council can improve views of and access to that feature, which will provide a strong visitor focal point, as will views across the River Roding to Roding Valley Meadows SSSI. This will be further investigated as each project is developed, including visitor surveys when possible. The dispersed nature of the residential allocations coupled with the location and configuration of the Infrastructure sites, and the access points to them, are such that new visitors would not be focussed in one area but rather would be dispersed across the extent of these sites.

[61] There are 19,472 existing households. Source 2011 Census: 1613 existing households in Theydon Bois ward, 1907 in Loughton Alderton ward, 1965 in Loughton Broadway, 1840 in Loughton Fairmead, 1795 in Loughton Forest, 1943 in Loughton Roding, 1773 in Loughton St Johns, 1742 in Loughton St Marys, 1985 in Buckhurst Hill East and 2909 in Buckhurst Hill West. Total of 19,472 households

Photograph of Roding Valley Recreation Ground showing clear opportunity for footpath improvement and ecological enhancement/habitat diversification

View across Theydon Bois Wood to central London

5.26 The two projects currently identified within the GI Strategy are intended as a starting point from which a broader list of Infrastructure Projects can be identified through the Local Plan Review process as necessary to ensure that development in these settlements can be addressed. It is therefore not envisaged that these two projects will be the only such projects to be brought forward over the plan period east of Epping Forest SAC and the list of Infrastructure Projects will be kept live. For example, Epping Forest Conservators have a number of 'Buffer Lands' around the SAC which could play a very effective role in drawing recreational pressure away from the SAC and therefore future infrastructure project proposals could investigate supporting, promoting and enhancing access to these sites.

5.27 Although Chigwell and Epping both lie at least partly within 3km of the SAC neither lies within easy walking distance except the South Epping Strategic Masterplan Area, which in any event is required to provide a bespoke SANG (see above). Therefore, allocations that lie within 3km of the SAC in these settlements (amounting to 349 dwellings at Epping and Chigwell) will only be required to make SAMM payments. In addition to the effectiveness of the SAMM in addressing recreational pressure, the Conservators of Epping

Forest have recently resolved to approve the implementation of a car park charging scheme in some of the car parks in Epping Forest. While this is not part of the formal mitigation strategy it is very likely to reduce the number and/or frequency of recreational visits to the SAC and thus be of considerable benefit in protecting the SAC alongside the mitigation strategy.

5.28 It is also important to recognise that Office of National Statistics (ONS) household projections indicate that the average household size in Epping Forest District will continue to reduce over the Plan period (from 2.40 persons per household based on 2018 data to 2.34 persons in 2033). This means that there is likely to be a reduction in the number of existing residents within 3km of the SAC with a resultant reduction in the visitors arising from existing homes. Although further SANG are not currently considered to be necessary, the Council as landowner is exploring the potential for using some of its land for SANG purposes at North Weald Bassett (not linked to the Strategic Masterplan Area allocation) as set out above. In the event future Local Plan Reviews indicate additional SANG capacity is required (such as to address housing at Epping outside the Strategic Masterplan Area), opportunities would thus be available to draw upon.

5.29 With regard to the four large masterplan areas that will provide specific SANG, Epping Forest District Council has chosen to adopt the SANG standard of 8ha per 1,000 additional population, which is the most widely used standard nationally. This level of SANG was originally based on the recommendations of the South East Plan Technical Assessor, although it has since been applied far more widely that just the Thames Basin Heaths. While a lower rate of SANG provision has been identified around some Internationally important sites, the Council has chosen to take the most precautionary approach for Epping Forest SAC. It is recognised that the recreational impact pathway for the TBHSPA was focused on the disturbance of ground nesting birds from dog-walking activities.

5.30 For the Epping Forest SAC the recreational pressure impact pathway is focused on the harm to its woodland and other habitats caused by walkers, horses and cyclists, including as a result of deposition of dog faeces. It is known from the 2017 and 2019 Epping Forest Visitor Surveys that dog-walkers make up a significant component of the visitor profile for the SAC, followed by walkers. Therefore, whilst the interest features of the TBHSPA and the Epping Forest SAC differ, the visitor profile with the greatest impact and therefore the most appropriate approach to avoiding and mitigating that harm is similar. Research undertaken since the initial implementation of the TBHSPA approach has indicated that the approach adopted has achieved this objective. Ultimately, however, what is more important than the rate of provision is that each SANG established is a large (minimum 8-10ha) appealing open space that is appropriately managed and promoted to residents, since residents will not determine whether or not to visit a SANG based on an abstract rate of provision but on the inherent features of the SANG itself.

5.31 The pre-amble to Policy DM2 sets out the Council's stance in some detail: '…*The Council recognises that additional residential development within parts of the District is likely to give rise to further visitor pressure on the Forest that needs to be either avoided or mitigated. These parts of the District are defined by a 'Zone of Influence' which has been established using evidence from visitor surveys in 2017 and 2019. The current 'Zone of Influence' is 6.2km but this may change over the course of the period of this Plan as a result of future visitor surveys that are scheduled to be undertaken as part of the Monitoring Framework for the Forest. In order to protect the vulnerable habitats within the Forest the Council will secure the provision or enhancement of alternative spaces and corridors that can relieve the recreational pressure on the Forest. This can be achieved by increasing public access to land that is not in the Forest and altering the character of existing open spaces and the links between open spaces. These approaches are intended to improve access for walkers, dog walkers, cyclists and horse riders to recreational spaces other than the Forest as well as provide for additional space for wildlife and plant species. In order to achieve this objective, the Council has adopted a Green Infrastructure Strategy which provides the District wide framework for providing new areas of Suitable Alternative Natural Greenspace (SANG) related to a number of the Masterplan areas together with identified opportunities to provide an alternative recreational offer to the Forest, including through enhancements to existing open spaces. These measures will be implemented by developers of relevant sites or through securing financial contributions for the implementation of measures by the Council and its partners.*

5.32 *The Council does, however, recognise that there are no mechanisms for preventing new residents from using the Forest and that there is therefore a need to address this by working with the Conservators of Epping Forest to implement Site Access Management and Monitoring (SAMM) measures within the Forest itself. The Council has adopted an 'Interim Approach to Managing Recreational Pressure on the Epping Forest Special Area of Conservation' which identifies a range of measures to be implemented and monitoring activities to be undertaken over the course of the period of the Plan. The Interim Approach also identifies the level of financial contributions that will be secured from relevant residential developments within the 'Zone of Influence.' The Council will continue to work with neighbouring authorities and the Conservators of Epping Forest to update and refine these projects and programmes and the approach to securing financial contributions over the course of the Plan period.*

5.33 Policy DM2 Part A states that '*The Council will expect all relevant development proposals to assist in the conservation and enhancement of the biodiversity, character, appearance and landscape setting of Epping Forest and the Lea Valley. The Council will expect all relevant development proposals to ensure that there is no adverse effect on the site integrity of the Epping Forest Special Area of Conservation (SAC) and the Lee Valley Special Protection Area (SPA). Green Infrastructure Strategy*

5.34 *'*Policy DM2 Part B states that '*New development that will have an adverse effect on integrity either alone, or in combination with other plans or projects, will not be permitted unless sufficient measures are secured and delivered to ensure that there will be no harm to the integrity of the protected sites. For the Epping Forest SAC, the need for a strategic approach has been identified and such measures will therefore include those identified in the Mitigation Strategies adopted by the Council relating to air pollution and recreational pressure, which will be reviewed and updated where monitoring indicates this is necessary over the Plan period. For the avoidance of doubt, the relevant strategies for the Epping Forest, which have been adopted by the Council as a material consideration in the determination of planning and other relevant development related applications, are as follows:*

i) An Air Pollution Mitigation Strategy;

ii) An Approach to managing Recreational Pressure on the Epping Forest Special Area of Conservation (SAMM Strategy); and

iii) A Green Infrastructure Strategy.

B1 – Epping Forest Air Pollution Mitigation Strategy – To mitigate for potential or identified adverse effects on air quality arising from additional development in the District, all development giving rise to a net increase in average annual daily traffic, will be required to be mitigated in accordance with appropriate measures including those identified in the most up-to-date Air Pollution Mitigation Strategy adopted by the Council as a material consideration in the determination of planning and other relevant development related applications and proposals. Measures have been specifically identified in the Strategy to ensure no adverse effect on the integrity of the Epping Forest SAC. Development which is required to deliver measures on site or contribute to the delivery of off-site measures and the undertaking of monitoring will not be consented until such measures, and any necessary financial contributions required for their delivery, are secured.

B2 – Epping Forest SAMM Strategy - To mitigate for potential or identified adverse recreational effects of additional residential development within the Epping Forest SAC Zone of Influence development proposals will be required to make a financial contribution towards the implementation of the SAMM strategy, in accordance with the most up-to date strategy adopted by the Council.

B3 – Epping Forest Green Infrastructure Strategy – To mitigate for potential or identified adverse recreation effects of additional residential development in the Epping Forest SAC Zone of Influence, including from strategic developments, the Council will ensure both provision of and access to sufficient Suitable Alternative Natural Greenspace (SANG), and/or the implementation of enhancements to existing Green and Blue Infrastructure assets. Such provision and enhancements should be in accordance with the site-specific policies contained within this Plan and the most up-to-date adopted Green Infrastructure Strategy. These measures include:

i) providing new natural greenspaces; or

ii) improving access to natural greenspaces; or

iii) *improving the recreation facilities, naturalness, and habitat quality of existing greenspaces; or*

iv) *improving the connectivity between greenspaces where this would not result in an adverse effect on the integrity of any designated site.*

5.35 *Relevant development proposals will be required to make a financial contribution towards the delivery of off-site projects in accordance with the adopted Green Infrastructure Strategy.*

5.36 In addition to the trampling effects of recreational pressure a number of SAMM measures will address related effects of recreation and urbanisation as listed in the Interim Mitigation Strategy for the SAC, including increased fire risk, spread of disease, spread of alien plants and littering, such as the visitor engagement campaigns and SAC Ambassadors. For the long-term strategy further SAMM measures could be included to more directly address fly-tipping and litter removal costs if necessary, thus reducing pressure on the Corporation of London's budget for other activities, as currently the Corporation spends approximately £250,000 per a year on these activities. Moreover, Policy DM 11 (Waste Recycling Facilities on New Development) is a development management policy relating to waste recycling storage facilities on new development sites. This is a positive policy as it is likely to reduce any occurrences of fly tipping within an internationally designated site as a result of new development. In addition, Policy DM2 part C states that '…*In recognition of the risks posed to the Epping Forest SAC from urbanisation effects over and above that resulting from recreational pressures (including from fly-tipping, the introduction of non-native plant species and incidental arson) planning applications for development will not be permitted within 400m perpendicular to the boundary of the Epping Forest SAC, unless it can be demonstrated through project level HRA that the development would not generate any such impacts'.* Note that this is not intended as a prohibition on development within 400m but will trigger additional scrutiny of developments within 400m of the SAC (chosen as discussed earlier because it is a widely used definition of a c. 5 minute walk) at the planning application level and, if necessary, additional mitigation.

5.37 It is considered that the long-term Strategic Access Mitigation and Monitoring Strategy, the Green Infrastructure Strategy, the requirement for each Masterplan Area to provide SANG and Policies DM2: Epping Forest SAC and Lee Valley SPA, SP6: The Natural Environment, Landscape Character and Green and Blue Infrastructure, Policy DM5; Green and Blue Infrastructure, Policy DM6: Designated and Undesignated Open Spaces, Policy DM7: Heritage Assets, provide an appropriate framework to ensure that Epping Forest SAC is protected from the adverse effects of new development through recreational pressure and urbanisation and thus ensure no adverse effect on the SAC would materialise in practice, either alone or in combination with other plans and projects.

5.38 The following policies referenced in the supporting text for Policy D2 will also contribute to the delivery of mitigation: Policy SP2 (Place Shaping), Policy SP3 (Development and Delivery of Garden Communities in the Harlow and Gilston Garden Town), Policy SP4 (Garden Town Communities), Policy SP6 (The Natural Environment, Landscape Character and Green and Blue Infrastructure), Policy DM1 (Habitat Protection and Improving Biodiversity), Policy DM5 (Green and Blue Infrastructure), Policy DM9 (High Quality Design), the Places Policies in Chapter 5 and the site specific requirements in Part 2 of the Local Plan.

Loss of Existing Green Space

5.39 It should be noted that no site allocations would result in the loss of areas of existing green infrastructure that are used for recreational activities.

In Combination

5.40 All authorities that plan to deliver net new housing within 6.2km of the SAC will contribute cumulatively to an in combination recreational pressure effect without mitigation. This will certainly include the London Borough of Waltham Forest and the London Borough of Redbridge. However, it is the responsibility of each relevant authority to ensure that they mitigate adequately for their contribution to any adverse effect on integrity. The framework for them to do so exists via participation in the specific joint-working arrangements including through the Co-operation for Sustainable Development Member Board and Officers Group and the Epping Forest SAC Oversight Group, and the resulting recreation management strategy. Epping Forest District Council are required to address the Local Plan contribution to the in combination effect but are not required to address the contributions of other local authorities. However, working with Natural England the relevant authorities are developing governance arrangements to oversee the implementation of the SAMM measures.

6. Appropriate Assessment: Air Quality at Epping Forest SAC

6.1 Having ascertained earlier that the forecast 'in combination' change in pollutant concentrations (the pollutant dose) will exceed 1% of the critical level for NOx, ammonia and 1% of the critical load for nitrogen deposition, and that the majority of these emissions are attributable to planned growth in Epping Forest District, it is therefore necessary to undertake further investigation as an appropriate assessment.

6.2 The following policies and site allocations were deemed to potentially have likely significant effects upon Epping Forest SAC, as a result of increased air pollution.

- Policy SP 1 (Spatial Development Strategy 2011-2033). Provides for a minimum of 11,400 new homes, provision for Traveller sites and 23ha of new employment land within Epping Forest District during the Plan period.
- Policy SP 3 Development & Delivery of Garden Communities in the Harlow and Gilston Garden Town provided for through three strategic allocations within Epping Forest District during the Plan period at Latton Priory, Water Lane and East of Harlow. A further Garden Community is to be delivered in Gilston (in East Herts District).
- Policy SP 4 Garden Town Communities. Allocates approximately 3,900 dwellings within the three strategic sites of Latton Priory, the Water Lane and East of Harlow that lie within Epping Forest District during the Plan period.
- Policy E 1 Employment Sites. Provides for the retention and enhancement of existing employment sites and that redevelopment, renewal, intensification or extension of sites will be encouraged. In addition, new employment sites allocations provided for through Policies SP2, SP 5 and Chapter 5. The quantum and location of new employment site allocations is set out at Table 3.1.
- All residential and employment sites in combination as set out in Chapter 5: Places.

6.3 Modelling of mitigation scenarios for all growth 'in combination' (i.e. the Local Plan plus growth in surrounding authorities) investigated a range of initiatives, including a Clean Air Zone (CAZ) encompassing the SAC, closure of roads to HGVs and focussing on driving a shift from LGVs to Ultra Low Emission Vehicles (or simply newer Euro standards), rather than targeting cars. Many of these initiatives were rejected as being insufficiently effective (i.e. not reducing the pollutant doses sufficiently to support a conclusion of no adverse effect on integrity). Since they have been rejected as insufficient, they are not discussed in this report. Ultimately, two broad initiatives were selected being quantifiable in the modelling and most likely to be sufficiently effective:

1. Increasing the percentage of the vehicle fleet that constitutes ULEVs to 4-5% by 2024 and 12-15% by 2033, particularly through targeting conversion of petrol cars (these being a major source of ammonia) to ULEVs (e.g. electric cars)[62]; and
2. A CAZ, which is considered to be needed from 2025 and would not only drive renewal of the vehicle fleet (removing older vehicles with higher NOx emissions) but would also be key to achieving the conversion to ULEVs by 2033 with an appropriately targeted charging regime; and

6.4 These are in addition to a suite of mitigation measures covered in the EFDC Interim Air Pollution Mitigation Strategy such as increasing opportunities for sustainable transport use, increasing cycling provision in developments and improving broadband connections, that will be effective in contributing to achieving the target shift to ULEVs but are not directly quantifiable or modellable. Physical amendments to Honey Lane junction and Robin Hood Roundabout were considered but are not part of the strategy in any scenario due to the potential adverse effects on the integrity of the Epping Forest SAC arising from the physical works required and/or their efficacy. After the first iteration of modelling of mitigation solutions was undertaken the

[62] Note that an equivalent benefit would be achieved by suppressing the forecast increase in vehicle movements in the SAC to the same degree. Petrol cars have been identified as a specific target because of their ammonia emissions which contribute materially to nitrogen deposition at the SAC. In practice, it is likely that the necessary air quality targets would be achieved by a more complex change in the vehicle fleet involving petrol cars, diesel cars and LGVs.

potential effectiveness of a Right Turn Ban at the junction at the junction of Forest Side with Honey Lane was also modelled and incorporated into the mitigation strategy.

6.5 The analysis in this section of the report discusses each pollutant sequentially (NOx, ammonia and nitrogen deposition), first in an unmitigated 2033 growth scenario (modelling Scenario 4) and then in the mitigated 2033 growth scenario (modelling Scenario 4.5ULEVev)[63]. Comparing each scenario with the forecast 2033 baseline scenario (Scenario 3) enables the pollutant dose to be discerned, which is fundamental to determining whether an adverse effect on integrity will arise, particularly where (for both ammonia and nitrogen deposition) the relevant critical levels and loads will be exceeded in all scenarios (baseline, future baseline and with growth). If the critical level or load is already exceeded and will continue to be exceeded even without any growth, then consideration of critical level/load exceedance alone is insufficient for impact assessment and the focus must include the relative magnitude of the forecast dose.

6.6 In order to characterise the magnitude of pollutant impact, the 'in combination' dose for all pollutants (NOx, ammonia and nitrogen) has been interpreted as follows:

- Imperceptible = 1% of the critical level/load or below, in line with Natural England guidance[64]
- Small = up to 5% of the critical level/load
- Medium = up to 10% of the critical level/load
- Large = 10% of the critical level/load or more
- Very large = 20% of the critical level/load or above

6.7 This generally follows the categorisation approach traditionally used in traffic related air quality assessments. In using these thresholds, attention has been paid to paragraph 5.5.2.6 of the Institute of Air Quality Management guidance regarding assessment of air pollution on ecological sites[65] which clarifies that '*the 1% and 10% screening criteria should not be used rigidly and, not to a numerical precision greater than the expression of the criteria themselves'*. An example is then given of 1.1% being effectively 1%. In other words, in the view of IAQM the thresholds above should be reported to whole percentages (i.e. 1% rather than 1.0%) using rounding up or down of the first decimal place. That is therefore how the thresholds have been used when it comes to interpreting these 'in combination' results.

Oxides of Nitrogen

6.8 APIS[66] states that '*It is likely that the strongest effect of emissions of nitrogen oxides across the UK is through their contribution to total nitrogen deposition'* but also acknowledges that direct effects of NOx may arise in certain circumstances, such as when total NOx concentrations are high[67] or in the presence of elevated sulphur dioxide. APIS states that: '*There is substantial evidence to suggest that the effects of NO_2 are much more likely to be negative in the presence of equivalent concentrations of SO_2'*. Therefore, NOx as a pollutant in itself is discussed in this section.

2033 Unmitigated scenario (difference between Scenario 4 and the 2033 baseline)

6.9 It is noted that the 'in combination' NOx dose could be dismissed entirely without further consideration in the following situations:

[63] The focus in this section is on the 2033 results because this is when the effect of the Local Plan will be greatest. In order to inform the timing of mitigation introduction NOx, ammonia and nitrogen deposition for an early year in plan delivery (2024) were also modelled. These data are reported in Appendix E and discussed later in Section 6 of this HRA. They are relevant to determining when mitigation measures are required to be introduced over the Local Plan period.
[64] http://publications.naturalengland.org.uk/publication/4720542048845824
[65] https://iaqm.co.uk/text/guidance/air-quality-impacts-on-nature-sites-2020.pdf
[66] http://www.apis.ac.uk/overview/pollutants/overview_NOx.htm
[67] There is no formal definition of 'high' total concentrations of NOx but Table 2 in Chapter 11 of World Health Organisation, Air Quality Guidelines (Second Edition) (2000) indicates that 85 μgm^{-3} is the lowest long-term (6 month plus) exposure concentration at which experimental studies have shown significant effects of NO_2 on higher plants.
Source: https://www.euro.who.int/__data/assets/pdf_file/0005/123098/AQG2ndEd_11no2level.pdf?ua=1

1. Where the 'in combination' dose due to growth does not exceed 1% of the critical level (0.3 µgm^{-3})[68]; and/or
2. Where the total[69] NOx concentrations are not forecast to exceed the critical level (30 µgm^{-3}) at all in 2033

6.10 With growth, but in the absence of any mitigation, transects J, L, M and N would meet these criteria throughout their entire length i.e. experience an imperceptible 'in combination' NOx dose and/or total NOx concentrations below the critical level.

6.11 However, many other transects would experience large to very large doses at the roadside and up to 20-40m back from the road:

- Transects A1, A2, A3, C1, C2, D1, D1a, D2, D2a, H, I and K would all experience a large 'in combination' dose up to c.5m from the roadside. For transects D1, D1a, D2 and D2a the dose at the roadside would be very large: between 30% and 40% of the critical level.
- Transect C1 would experience a very large dose (50% of the critical level) at the roadside, remaining large up to 20m from the roadside
- Transect E1 would experience a very large dose (33% of the critical level) at the roadside, remaining large up to 10m from the roadside
- Transect E2 would experience a very large dose (50% of the critical level) at the roadside, remaining large up to 20m from the roadside
- Transect O would experience a large dose up to 17.5m from the roadside; and
- Transect P would experience a very large dose (33% of the critical level) at the roadside, remaining large and exceeding the critical level up to 41m from the roadside

6.12 The largest dose forecast in an unmitigated scenario would be 15.3 µgm^{-3} (50% of the critical level) at the roadside of transect C1.

2033 Mitigated scenario (Difference between Scenario 4.5ULEZEV and the 2033 baseline)

6.13 With growth plus a CAZ and measures to drive a 30% shift in petrol car ownership to electric vehicles by 2033 (such that 12-15% of all vehicles using roads through Epping Forest SAC are ULEVs by that year, or traffic growth within the SAC is suppressed to an equivalent extent), all transects would experience either an imperceptible 'in combination' NOx dose and/or total NOx concentrations below the critical level, at all points, except for the following:

- On transect O (Honey Lane) a medium residual 'in combination' NOx dose (up to 2.3 µgm^{-3}) and exceedance of the critical level is forecast up to 12.5m from the roadside;
- On transect C1 (Wake Arms Roundabout) a large residual 'in combination' dose (up to 5.4 µgm^{-3}) and exceedance of the critical level is forecast up to 20m from the roadside;
- Transects C2, D1, D1a, D2, E1, E2 (all Wake Arms Roundabout) and transect I would still have a large NOx dose and exceedance of the critical level, but only up to 5m from the roadside (10m for E2); and
- Transect P (into the SAC from Wake Arms Roundabout itself) is forecast to have a medium NOx dose and exceedance of the critical level up to 30m from the roadside.

[68] This threshold is taken from the Natural England guidance document 'Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations' (June 2018) http://publications.naturalengland.org.uk/file/5431868963160064
[69] Total concentrations are the roadside dose due to additional traffic, plus the roadside dose due to existing traffic, plus the background concentrations in the grid square

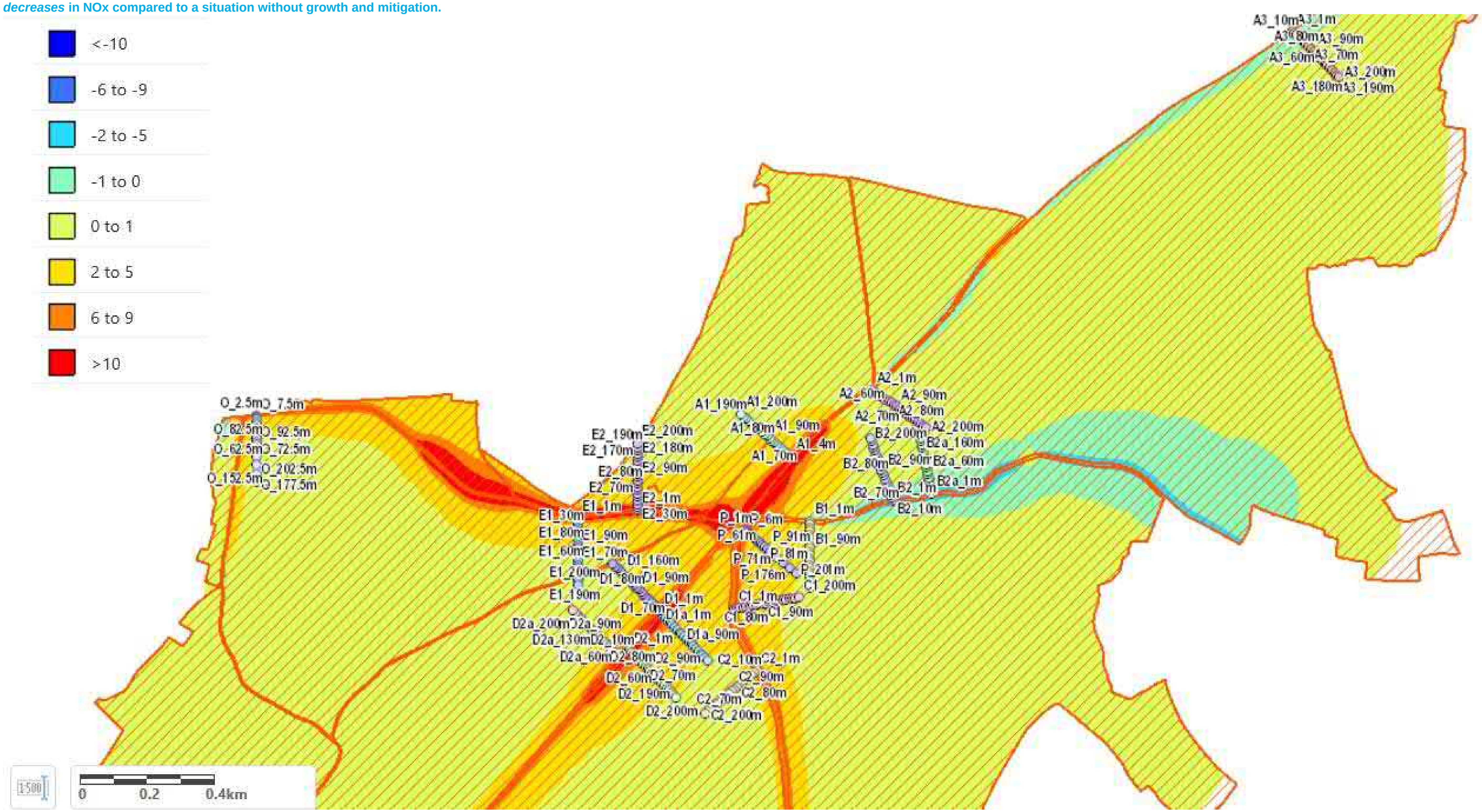
6.14 The largest dose forecast in a Mitigated Scenario would be 8.3 μgm^{-3} (28% of the critical level) at the roadside of transect D1a. In contrast, NOx concentrations on transects B2 are forecast to be better than they would be with no growth (by up to 1 μgm^{-3}) up to 30m from the roadside.

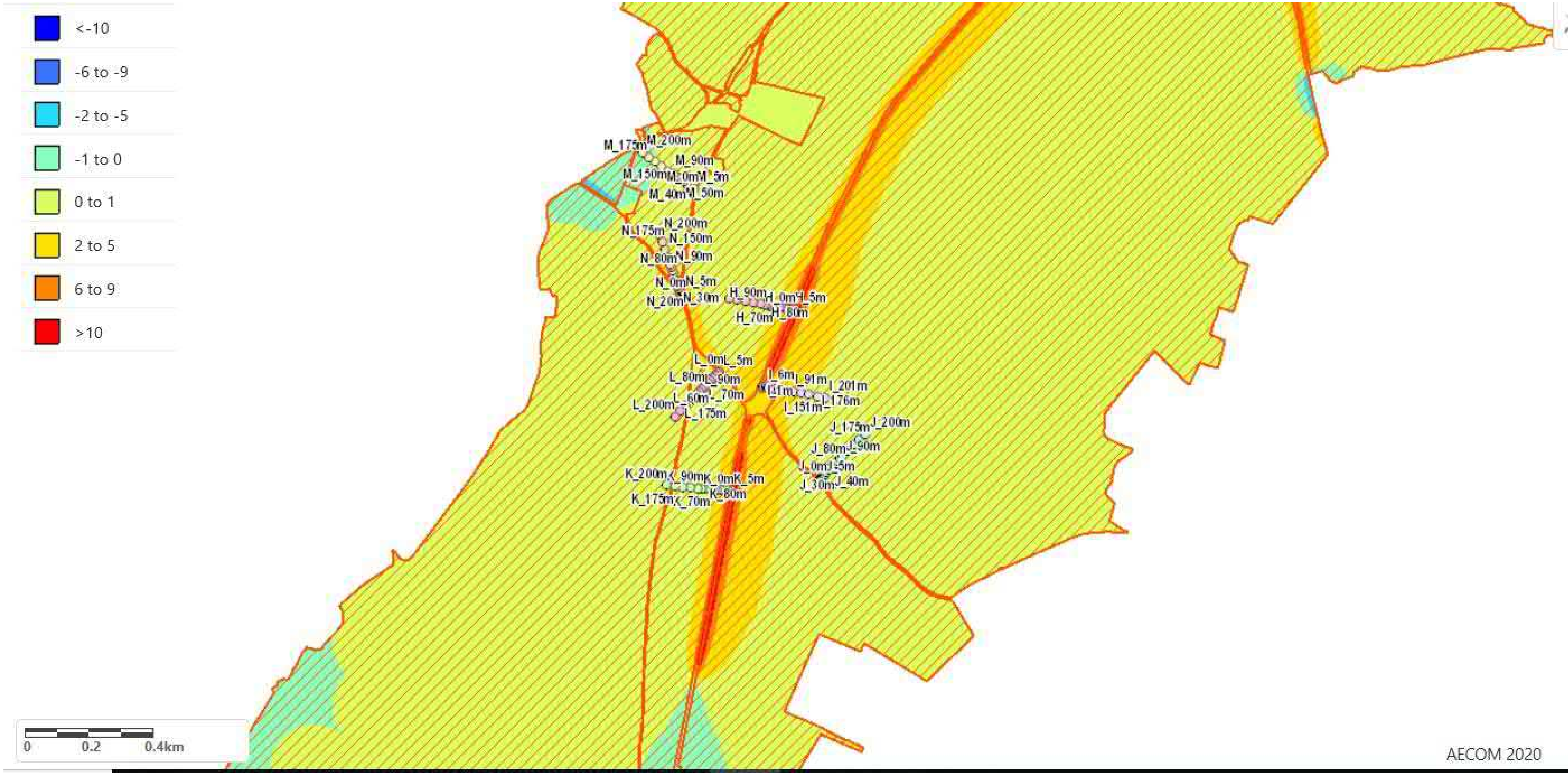
6.15 Since the transects are only at certain locations, isopleth mapping overleaf (Figures 5 to 8) shows a) the total area of SAC subject to particular NOx doses under the Mitigated Scenario, and b) the area of SAC over which the critical level for NOx will continue to be exceeded in 2017, 2033 future baseline and 2033 with growth and mitigation. 'Cooler' colours on the map denote either an imperceptible 'in combination' dose (lime green) or a net reduction in NOx compared to a situation with no growth or mitigation (greens and blues, the deeper the blue the greater the net reduction). 'Warmer' colours depict net increases in NOx ranging from a small dose (dark yellow), through a medium dose (orange) to a large dose (red).

6.16 Using the isopleth modelling results, under the mitigated scenario 90% of the SAC around the modelled links would experience effectively zero 'in combination' NOx dose (i.e. a dose calculated to be between -1% and 1% of the critical level). Seven percent would experience a small NOx dose and less than 2% would experience an 'in combination' dose larger than 5% of the critical level. Large NOx doses will still be experienced within the SAC up to 40m from the roadside on the A121 between Wake Arms Roundabout and the petrol station, the A121 from Wake Arms Roundabout to Honey Lane, and Epping New Road (A104) south of Wake Arms Roundabout, compared to the 2033 baseline.

6.17 The isopleth maps (Figure 8) also show that the critical level for NOx will continue to be exceeded up to c. 30m from the roadside on these links. However, due to improvements in vehicle emissions technology, this is nonetheless a major improvement on the 2017 (baseline) situation (Figure 6) where the critical level was exceeded up to 370m from the roadside on all approaches to Wake Arms Roundabout. Even on the three aforementioned links the degree of exceedance of the critical level (as well as the physical extent of exceedance) under the Mitigated Scenario is forecast to be much smaller in 2033 than it was in 2017; a maximum of 30m and 61 μgm^{-3} in 2033, compared to a maximum of 370m and 120 μgm^{-3} in 2017. Around Robin Hood Roundabout the exceedance of the critical level modelled up to 80m from the roadside for 2017 disappears entirely in the 2033 Mitigated Scenario.

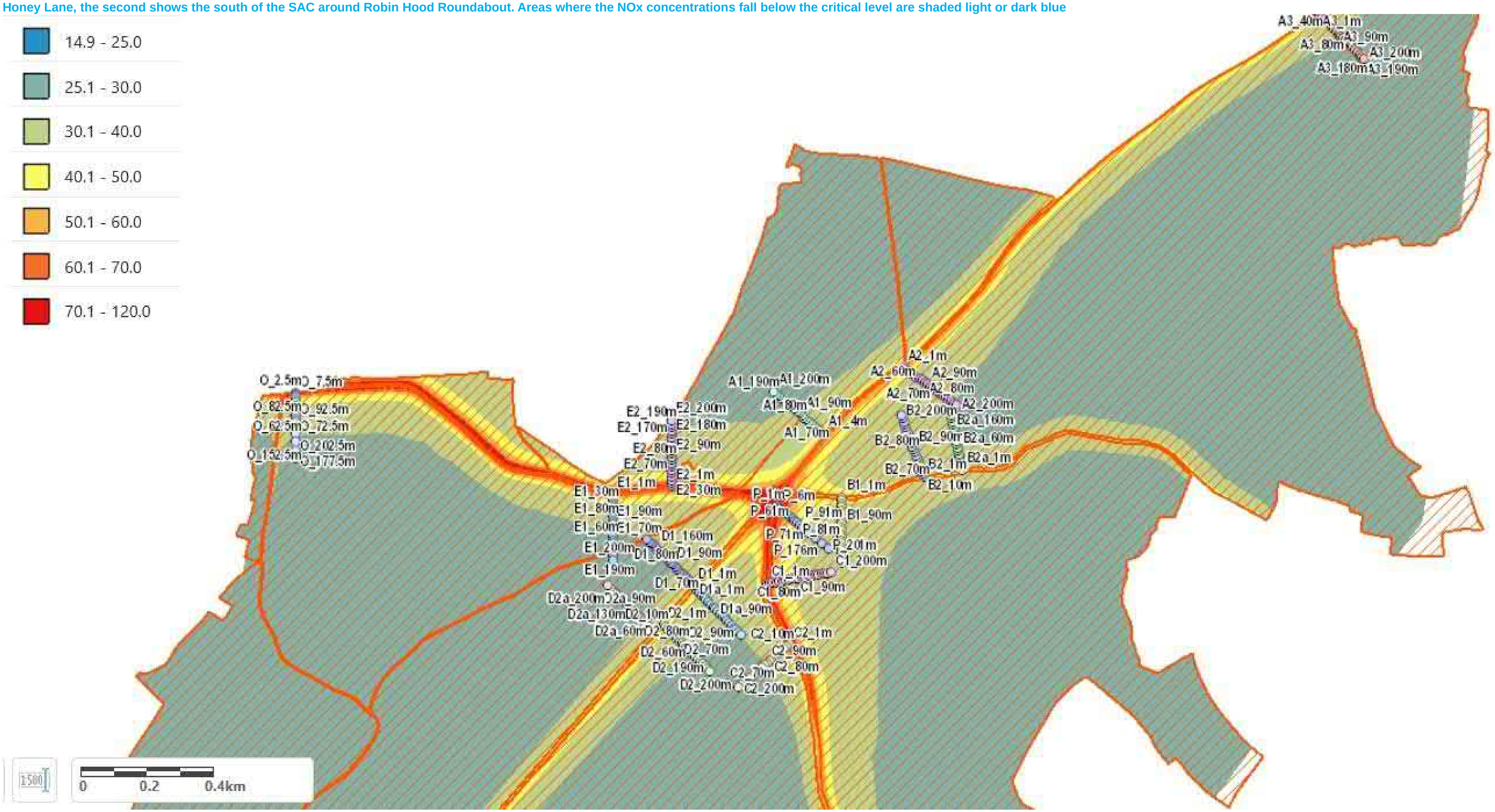
Figure 5. Two screencaps showing the NOx concentration model results as isopleths overlain on all transects and the Epping Forest SAC boundary (hatching). The first shows the north of the SAC around Wake Arms Roundabout and Honey Lane, the second shows the south of the SAC around Robin Hood Roundabout. The colours show the post-mitigation residual NOx does for 2033 as a percentage of the critical level. Red denotes a 'large' residual NOx dose (10% or more of the critical level), orange denote a 'medium' residual NOx dose (6% to 9% of the critical level), dark yellow denotes a 'small' dose (2-5% of the critical level), lime green denotes an imperceptible dose (less than 1% of the critical level). Greens and blues denote *decreases* in NOx compared to a situation without growth and mitigation.





<-10
-6 to -9
-2 to -5
-1 to 0
0 to 1
2 to 5
6 to 9
>10
0
0.2
0.4km
AECOM 2020

Figure 6. Two screencaps showing the <u>total</u> NOx concentrations in 2017 (base year) as isopleths overlain on all transects and the Epping Forest SAC boundary (hatching). The first shows the north of the SAC around Wake Arms Roundabout and Honey Lane, the second shows the south of the SAC around Robin Hood Roundabout. Areas where the NOx concentrations fall below the critical level are shaded light or dark blue



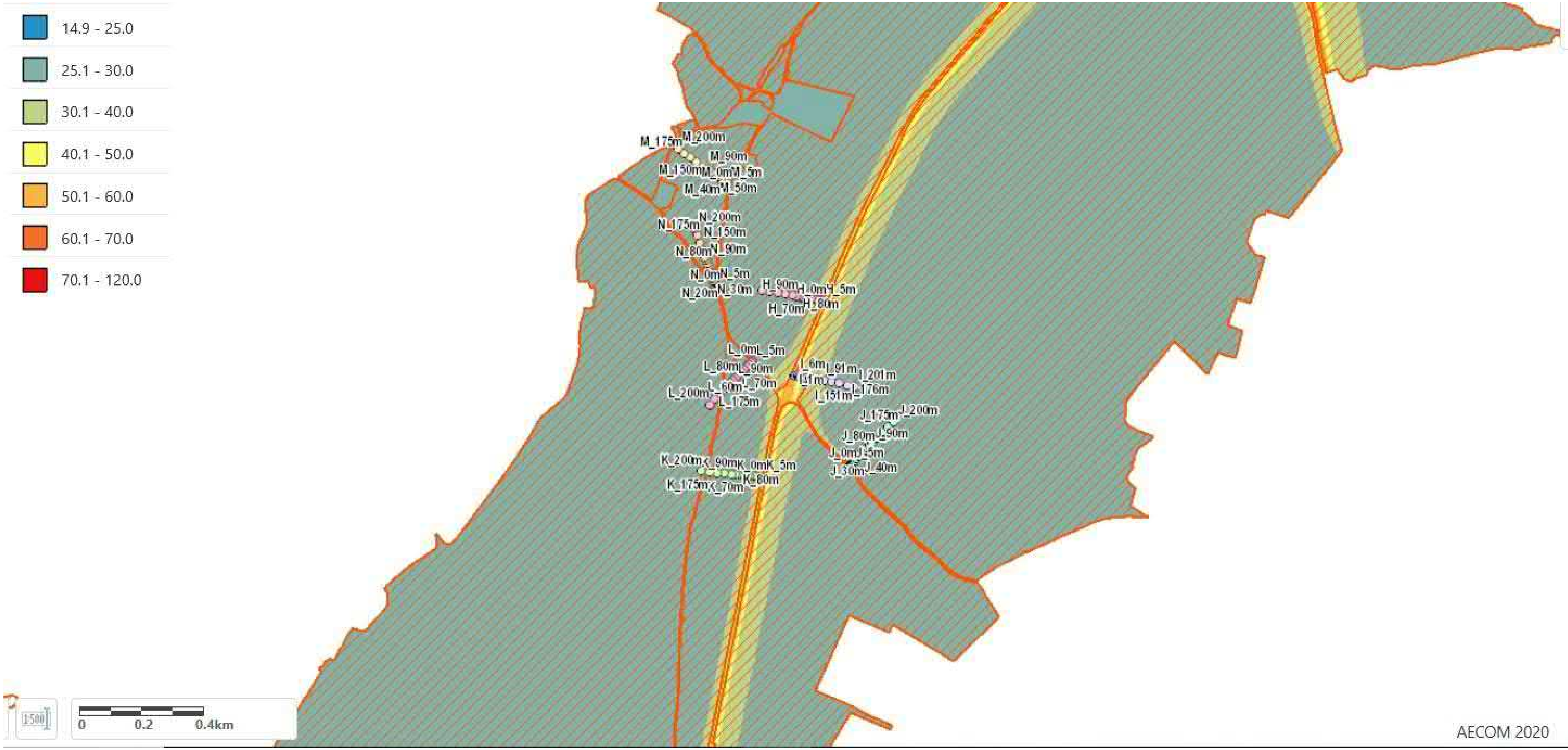
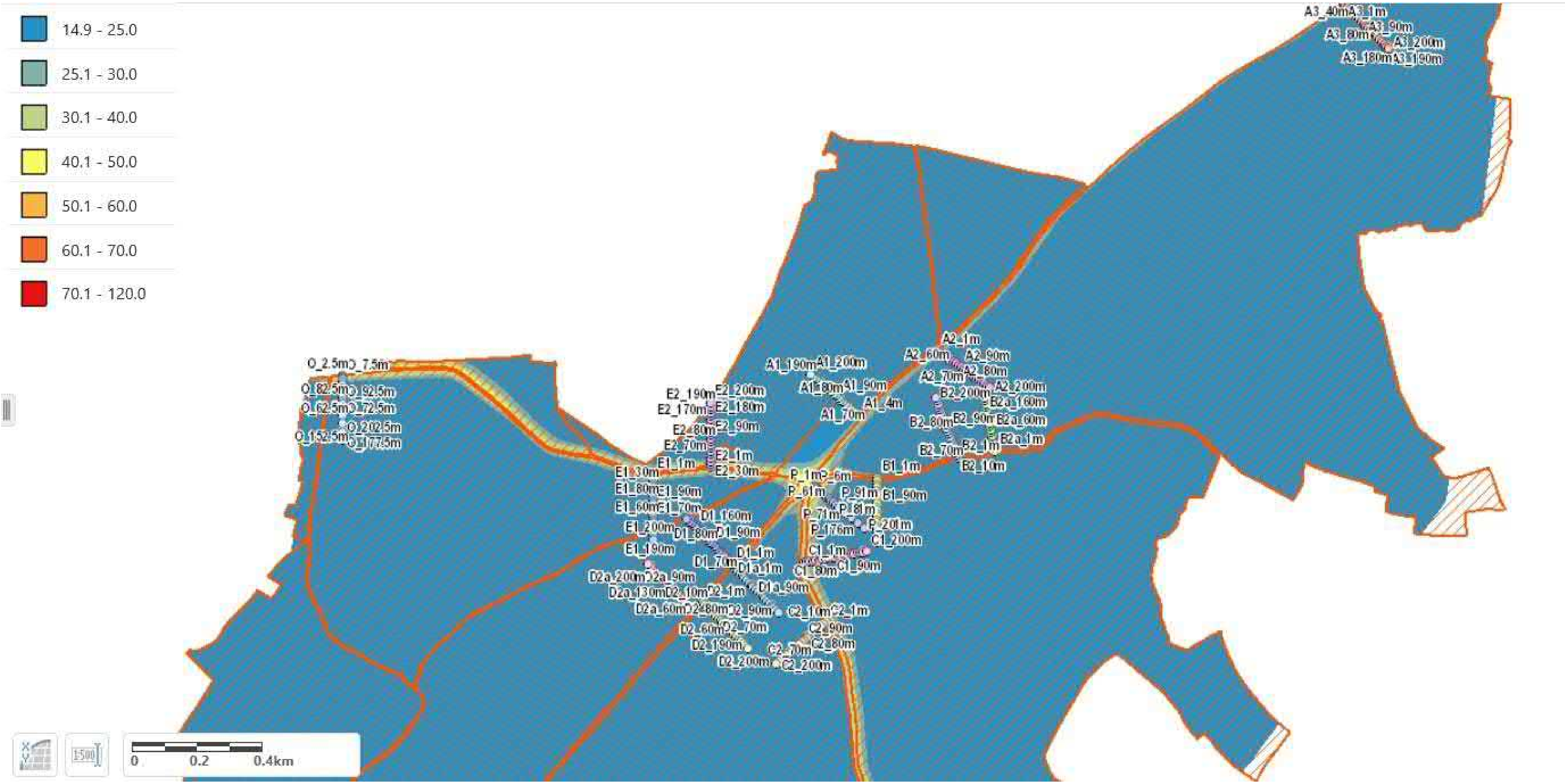
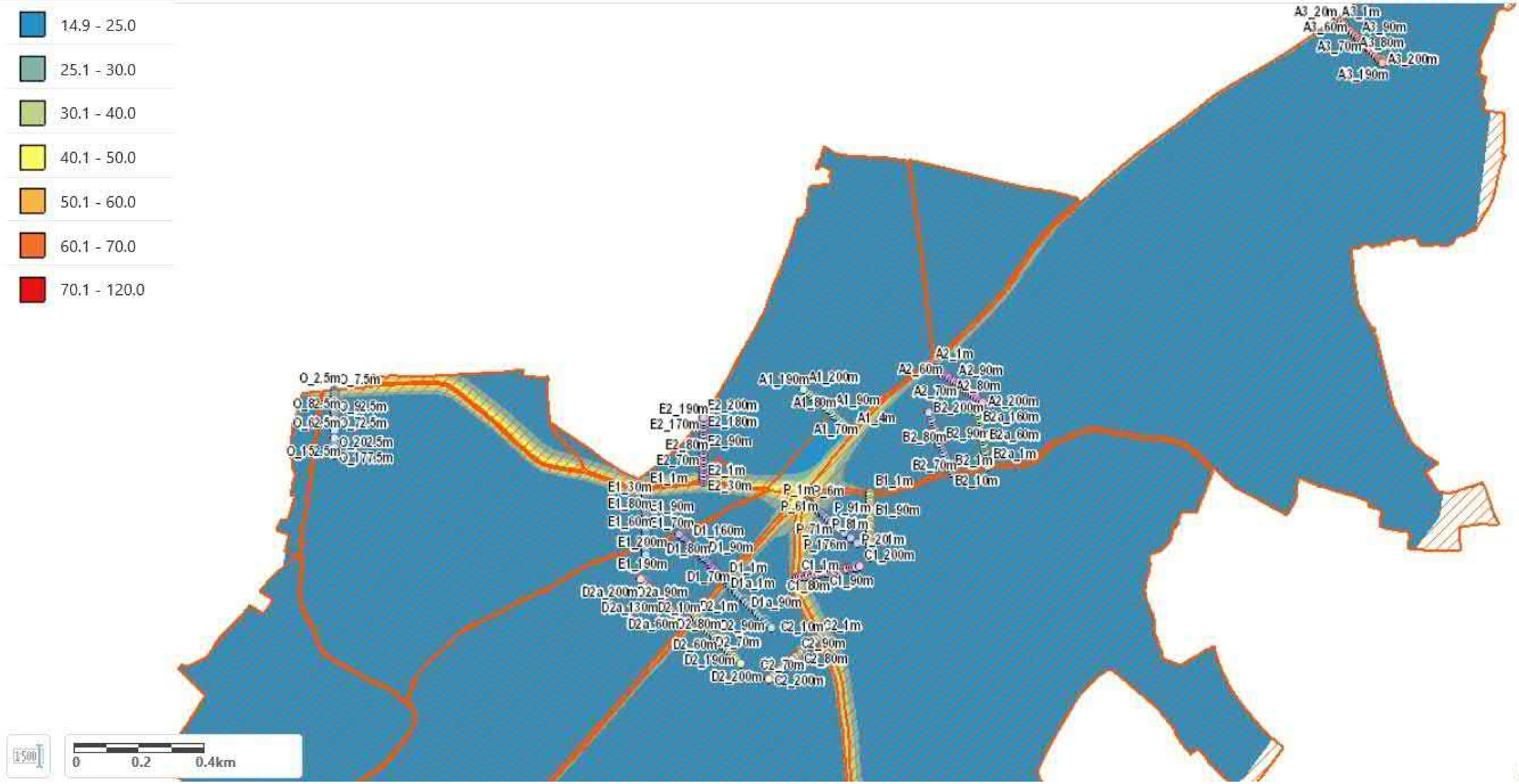

14.9 - 25.0
25.1 - 30.0
30.1 - 40.0
40.1 - 50.0
50.1 - 60.0
60.1 - 70.0
70.1 - 120.0
0
0.2
0.4km
AECOM 2020

Figure 7. Two screencaps showing the total NOx concentrations model results in 2033 <u>without</u> growth and mitigation (i.e. the modelled future baseline) as isopleths overlain on all transects and the Epping Forest SAC boundary (hatching). The first shows the north of the SAC around Wake Arms Roundabout and Honey Lane, the second shows the south of the SAC around Robin Hood Roundabout. Areas where the NOx concentrations fall below the critical level are shaded light or dark blue




14.9 - 25.0
25.1 - 30.0
30.1 - 40.0
40.1 - 50.0
50.1 - 60.0
60.1 - 70.0
70.1 - 120.0
0
0.2
0.4km
AECOM 2020

Figure 8. Two screencaps showing the total NOx concentrations model results in 2033 with both growth and mitigation (i.e. the mitigated Local Plan scenario) as isopleths overlain on all transects and the Epping Forest SAC boundary (hatching). The first shows the north of the SAC around Wake Arms Roundabout and Honey Lane, the second shows the south of the SAC around Robin Hood Roundabout. Areas where the NOx concentrations fall below the critical level are shaded light or dark blue



14.9 - 25.0
25.1 - 30.0
30.1 - 40.0
40.1 - 50.0
50.1 - 60.0
60.1 - 70.0
70.1 - 120.0
0 0.2 0.4km
AECOM 2020

6.18 In summary, the Mitigated Scenario is forecast to considerably reduce both the NOx dose and the area of the SAC that is exposed to that dose when compared to the dose in the Unmitigated Scenario, as well as significantly reducing the area of SAC exposed to total NOx concentrations above the critical level when compared to the 2017 baseline. As such, most of the SAC would experience an imperceptible 'in combination' dose and/or total NOx concentrations below the critical level. Medium to large doses and exceedance of the critical level would still be present around Wake Arms Roundabout and on some of its approach roads, up to 30m from the roadside.

6.19 To put it another way, in a mitigated scenario 61 out of 464 modelled transect points (13%) are forecast to experience an 'in combination' NOx dose (i.e. not just due to the Epping Forest District Local Plan) greater than imperceptible **and** would occur in locations where total NOx concentrations would exceed the critical level, while only 19 (4%) are forecast to experience an 'in combination' dose that was greater than 'small'. The vast majority of these points (80%) are located within 5m of the roadside. In contrast, 15 of the modelled transect points (3%) are forecast to experience total NOx concentrations slightly lower (better) than they would with no growth or mitigation.

6.20 Moreover, it should be noted that even where total NOx concentrations would still exceed the critical level, they would only do so to a modest extent in a mitigated scenario, even at the roadside (i.e. typically total concentrations of 30 to 50 μgm^{-3} with a maximum of 61 μgm^{-3} at the roadside of transect C1, compared to 56 μgm^{-3} at the same location in the absence of growth and mitigation). In all instances, total concentrations would be considerably better by 2033 than they were in 2017, due to improvements in underlying vehicle emissions technology.

6.21 The Conservation Objectives for Epping Forest SAC include objectives to maintain or restore the structure and function (including typical species) of qualifying natural habitats, and the supporting processes on which qualifying natural habitats and the habitats of qualifying species rely. In order to achieve that objective the supplementary advice with specific regard to NOx for both heathland and woodland is to '*… restore concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk)*'. Growth in the 2033 mitigated scenario does not materially interfere with the achievement of that target. By 2033 99% of the SAC would be below the critical level under the Mitigated or Baseline Scenarios, compared to 85% in 2017.

6.22 Importantly, APIS identifies that negative effects of NO_2 in atmosphere (as distinct from its role in nitrogen deposition) are most likely to arise in the presence of equivalent concentrations of sulphur dioxide (SO_2). Vehicle exhausts do not emit SO_2 and APIS indicates that background SO_2 concentrations at the SAC (a maximum of 1.8 μgm^{-3}) are very low compared to NOx concentrations, or to the sulphur dioxide critical levels of 10-20 μgm^{-3}. Since the SO_2 concentrations are so low no synergistic effect with NOx is expected.

6.23 In submissions to the Local Plan Examination hearings, Natural England queried whether elevated ozone (O_3) might occur and thus result in synergistic effects with NOx. However, busy roadside areas will generally have relatively low O_3, as it reacts with the elevated NO emitted from exhausts to form NO_2. So higher NOx generally equates to lower O_3 at the local scale. As the reactions to form ozone from NOx and hydrocarbons are slow, O_3 concentrations will not be increased in Epping Forest due to the traffic travelling through the Forest and the net effect of the traffic in Epping Forest will be to reduce O_3 concentrations within the Forest.

6.24 NOx toxicity is therefore not expected in a mitigated scenario due to a combination of the forecast exceedance of the critical level (which would still occur in most locations even with no growth) being moderate, the low to imperceptible 'in combination' NOx dose forecast across the vast majority of the SAC even at roadside locations, and the low sulphur dioxide concentrations. Further consideration of the effects of NOx therefore focusses on its role in nitrogen deposition.

Ammonia

Unmitigated scenario (Scenario 4 compared with the 2033 future baseline)

6.25 With growth but no mitigation, the 'in combination' ammonia dose exceeds 1% of the most appropriate critical level (the 1 µgm^{-3} level set for lichens) throughout all transects except the furthest parts of transects K and L. It should be noted that the majority of this elevation in ammonia concentrations occurs within 10m of the roadside. This is in contrast to NOx, where the decline in concentrations with distance from the road is more gradual. The largest roadside dose ranges from a very large 20%-40% of the critical level (CL) at the roadside of transects A1 to A3, transect I (20% of the CL) and transect P (40% of the CL) to just 2% of the critical level at the roadside of transect M. Transect M is the outlier from all the other transects, with the dose falling to 1% of the critical level by 5m from the roadside. The largest dose forecast in an unmitigated scenario would be 0.43 µgm^{-3} (43% of the critical level) at the roadside of transect P (from Wake Arms Roundabout into the SAC).

6.26 As a precaution it is concluded that an adverse effect on integrity cannot be dismissed in an unmitigated scenario primarily due to the elevation in concentrations within 10m of the roadside. Review of the interim year modelling indicates that this would also be true in 2024 (see the section on mitigation where the 2024 results are discussed in more detail), which is relevant to when during the plan period mitigation needs to be introduced.

Mitigated scenario (Scenario 4.5ULEZEV compared to the 2033 future baseline)

6.27 With growth plus a CAZ, and measures to drive a 30% shift in petrol car ownership to ULEVs by 2033 (such that 12-15% of all vehicles using roads through Epping Forest SAC are ULEVs by that year), all transects would experience an imperceptible 'in combination' ammonia dose at all points, except for the following (note that this section is only interpreting the transect data; maps of the spatial extents affected by particular doses are presented later, before a conclusion is reached):

- A small residual 'in combination' ammonia dose (up to 5% of the critical level) would be experienced at the roadside of transect L
- A medium residual 'in combination' ammonia dose (up to 8% of the critical level) would be experienced up to 10m from the roadside of transect N, with a small residual dose up to 90m from the roadside.

6.28 The largest dose forecast in the Mitigated Scenario would be 0.08 µgm^{-3} (8% of the critical level) at the roadside of transect N. Moreover, all other transects would experience ammonia concentrations lower (i.e. better) than they would by 2033 with no growth or mitigation. For example, concentrations would be:

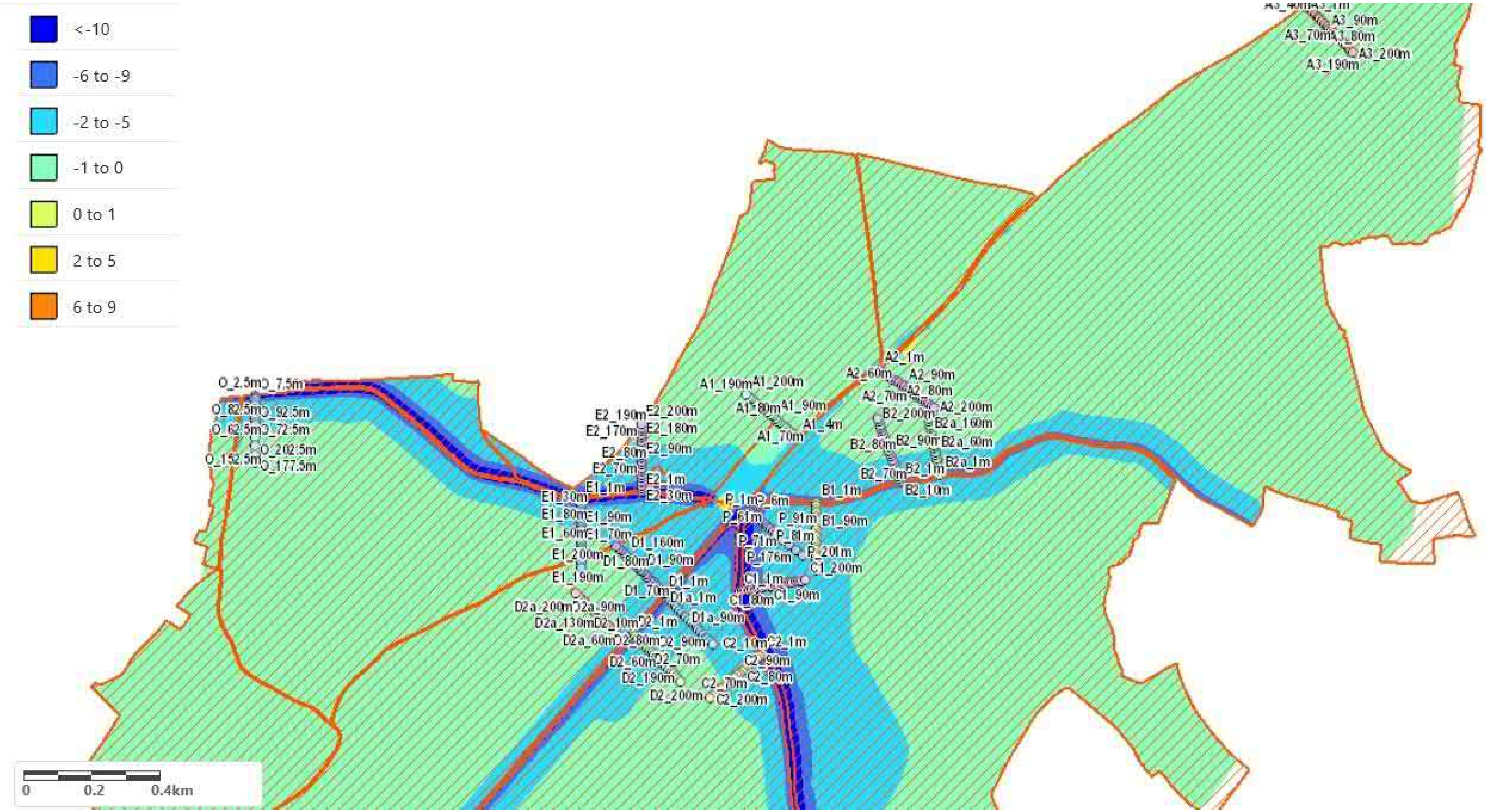
- Approximately 0.1 µgm^{-3} (10% of the critical level) better at the roadside of transects B1, B2, D1, D2, E1, H, I, O and P
- Approximately 0.2 µgm^{-3} (20% of the critical level) better at the roadside of transects C2 and E2; and
- Approximately 0.4 µgm^{-3} (40% of the critical level) better at the roadside of transect C1.

6.29 In other words, a total of 13 modelled transect locations would experience an 'in combination' ammonia dose greater than imperceptible (3% of the total), only one of these would be greater than small, and the majority of these (86%) would be on transect N. In all, 95% of the modelled transect locations would experience ammonia concentrations either better than, or no worse than, they would be in a situation with no growth or mitigation.

6.30 Therefore, except for a single transect (Transect N up to 10m from the roadside), mitigation would mean that ammonia concentrations would be better than the future baseline concentrations or, at the roadside of transect L, would only be slightly worse than in a situation with no growth at all.

6.31 Since the transects are only at certain locations, isopleth mapping (Figures 9 to 14) shows the total area of SAC subject to particular ammonia doses, and that over which the critical level for ammonia will continue to be exceeded. These isopleths show that under a Mitigated Scenario 12% of the SAC would experience a reduction in ammonia compared to the 2033 Baseline Scenario, 87% would experience a negligible dose, 0.3% would experience a small dose and 430 m^2 (0.003%) would experience a medium dose. The entirety of the medium and small doses would be localised a) along the length of the road (known as Cross Roads) between Robin Hood Roundabout and the junction where the southern end of Paul’s Nursery Road meets Avey Lane/Cross Roads and b) a small patch to the south of Woodridden Hill (A121) and the junction with Wake Arms Roundabout, These are also subject to medium to large nitrogen doses under the Mitigated Scenario and are discussed further in the nitrogen deposition section below to minimise repetition.

Figure 9. Two screencaps showing the ammonia concentrations model results as isopleths overlain on all transects and the Epping Forest SAC boundary (hatching). The first shows the north of the SAC around Wake Arms Roundabout and Honey Lane, the second shows the south of the SAC around Robin Hood Roundabout. The maps show the residual ammonia does with both growth and mitigation. Orange denotes a 'medium' residual ammonia dose (6% to 9% of the critical level), dark yellow denotes a 'small' dose (2-5% of the critical level), lime green denotes an imperceptible dose (less than 1% of the critical level). Greens and blues denote *decreases* in ammonia compared to a situation without growth and mitigation.



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0.4km

Figure 10. Screencap showing the model results as isopleths overlain on transects N, L and H and veteran tree and rare species records from Epping Forest Conservators. The irregular dark orange polygons denote a 'medium' residual ammonia dose (6% to 9% of the critical level), dark yellow denotes a 'small' dose (2-5% of the critical level), lime green denotes an imperceptible dose (less than 1% of the critical level). Greens and blues denote *decreases* in ammonia compared to a situation without growth or mitigation. Green, yellow and red diamonds represent the location of different species of veteran trees as provided by Epping Forest Conservators, while the pink squares represent locations of the plant *Hieracium sabaudum*. Yellow triangles represent records of the rare moss *Zygodon forsteri* also provided by the Epping Forest Conservators.

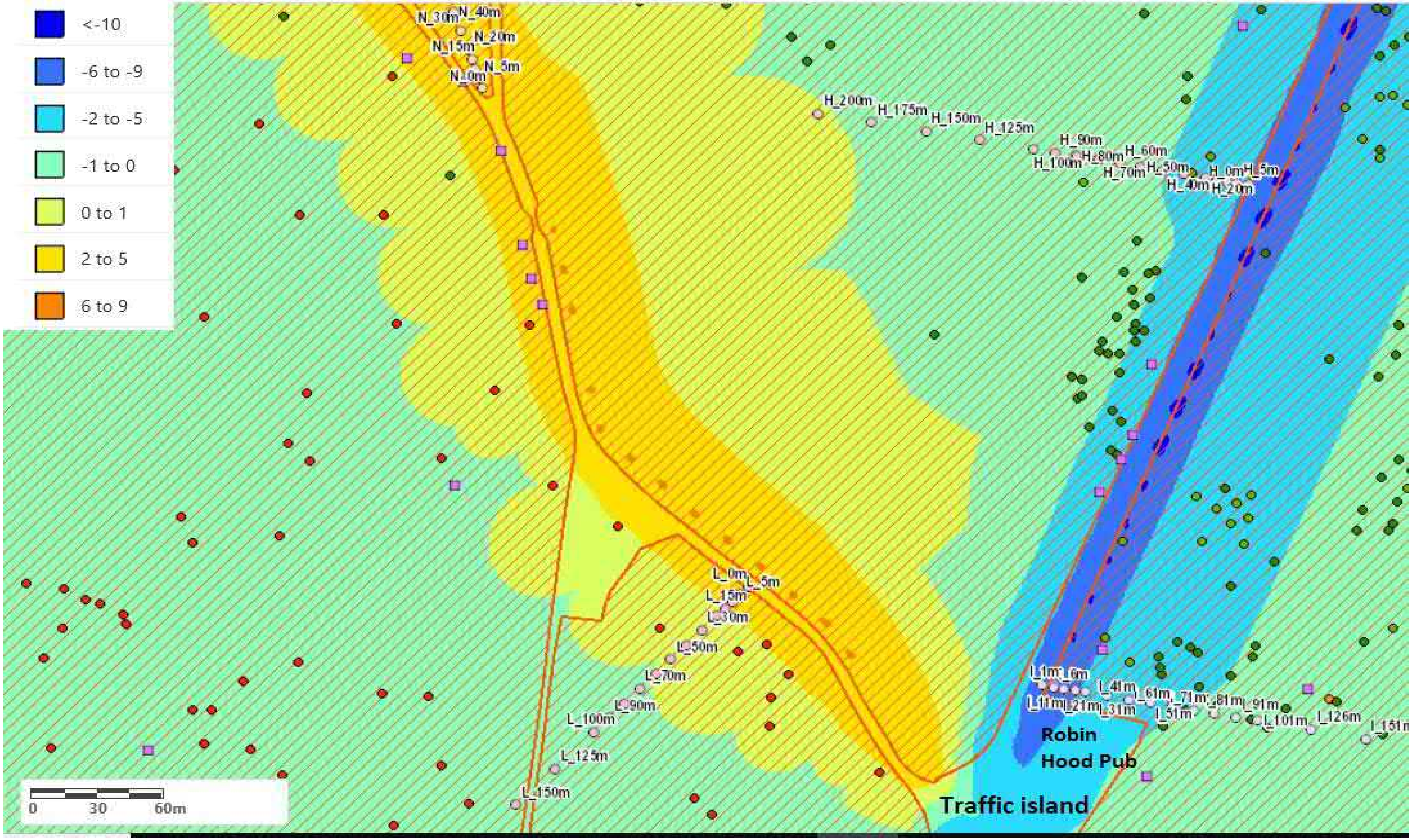


Figure 11. Screencap showing isopleth results overlain on Wake Arms Roundabout, transect P and veteran tree and rare species records from Epping Forest Conservators. The Irregular orange polygon represents a 'medium' residual ammonia dose (6% to 9% of the critical level), dark yellow denotes a 'small' dose (2-5% of the critical level), lime green denotes an imperceptible dose (less than 1% of the critical level). Greens and blues denote *decreases* in ammonia compared to a situation without growth or mitigation. It can be seen that around much of Wake Arms Roundabout ammonia is forecast to be better with mitigation and growth than in a situation with no growth at all (various shades of blue and green). Green, yellow and red diamonds represent the location of different species of veteran trees as provided by Epping Forest Conservators, while the pink squares represent locations of the plant *Hieracium sabaudum*. Yellow triangles represent records of the rare moss *Zygodon forsteri* also provided by the Epping Forest Conservators.

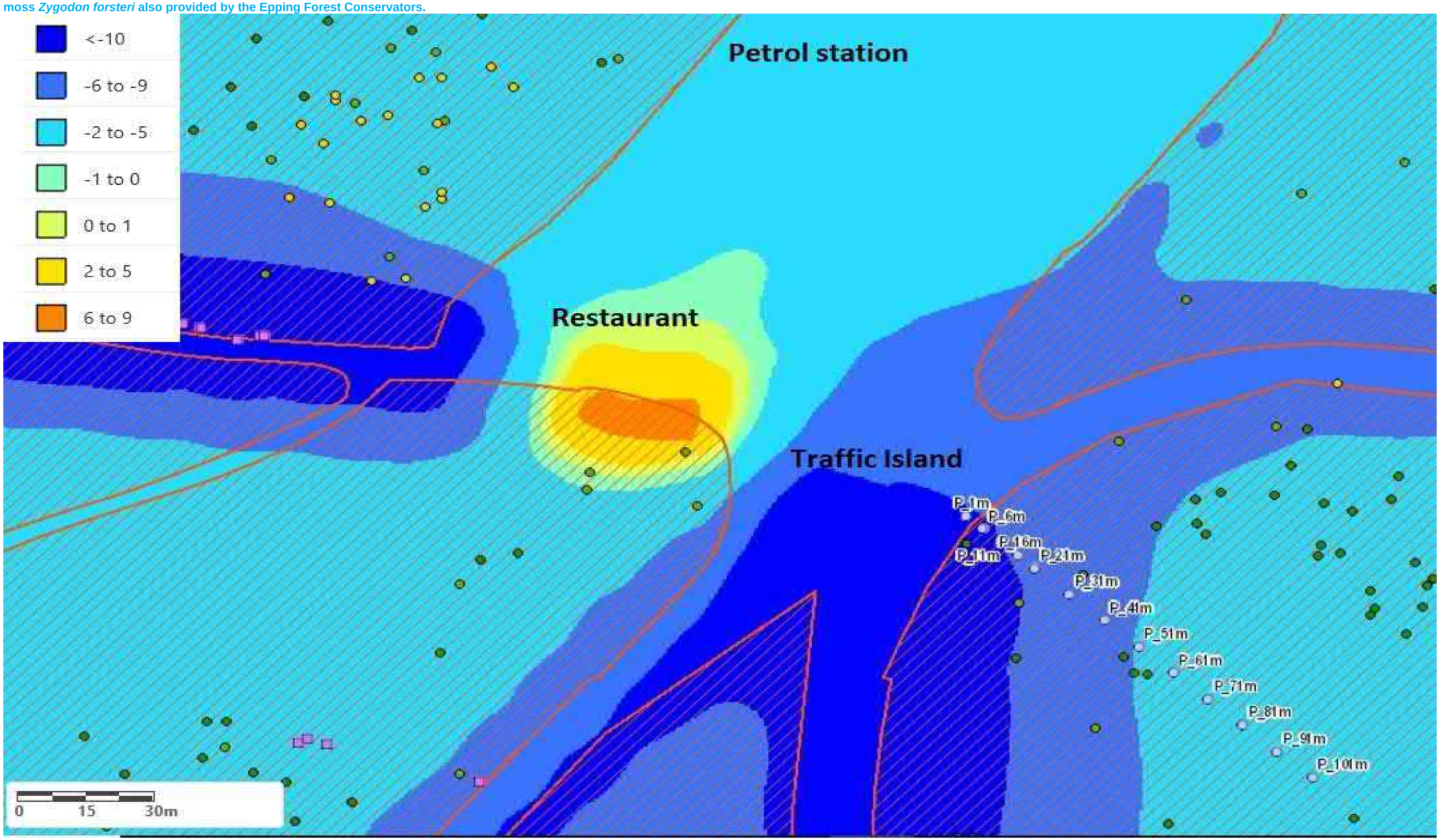
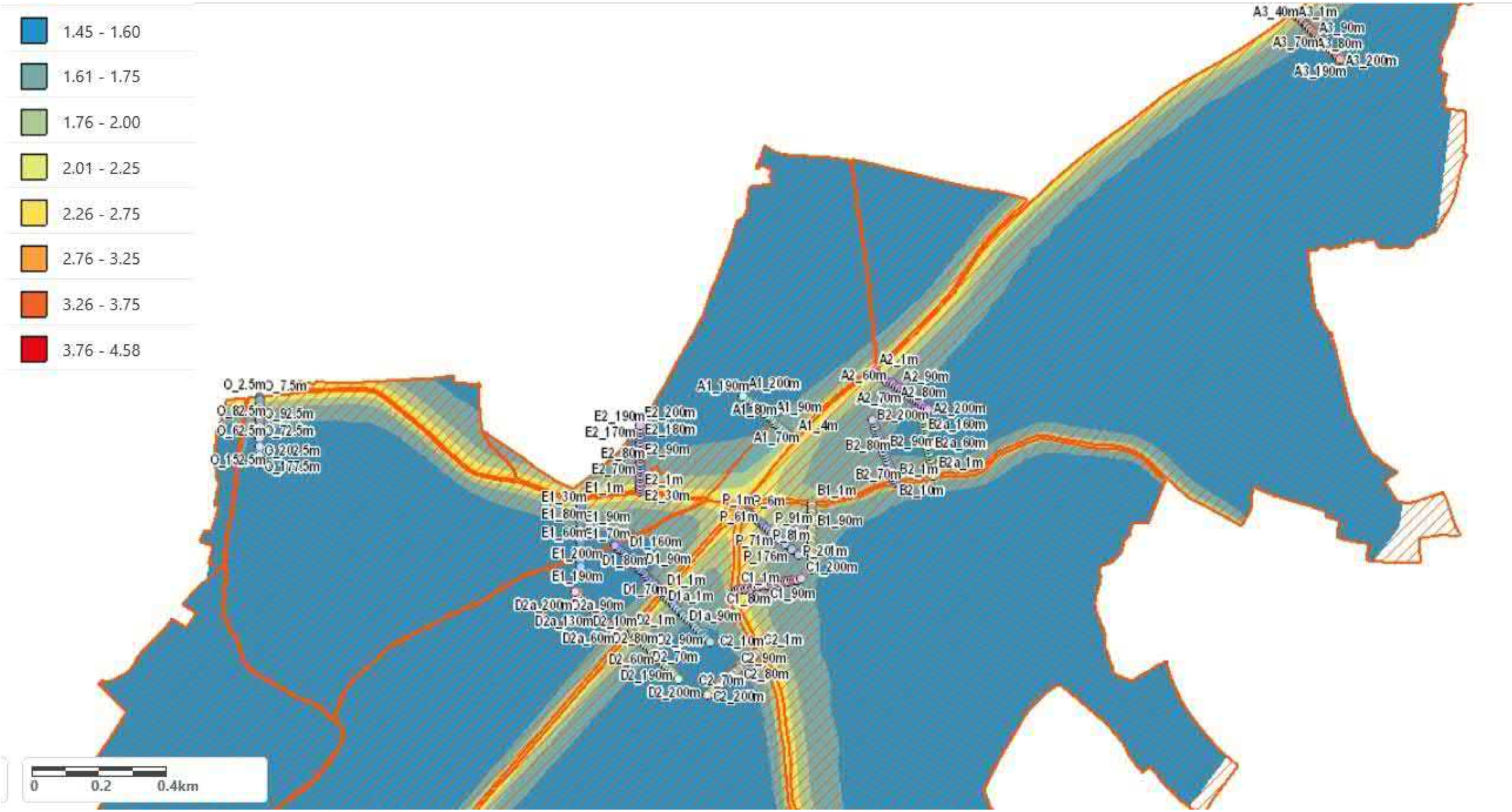


Figure 12. Two screencaps showing the total ammonia concentrations model results in 2017 as isopleths overlain on all transects and the Epping Forest SAC boundary (hatching). The first shows the north of the SAC around Wake Arms Roundabout and Honey Lane, the second shows the south of the SAC around Robin Hood Roundabout. There are no areas under any scenario where the ammonia concentrations fall below the critical level



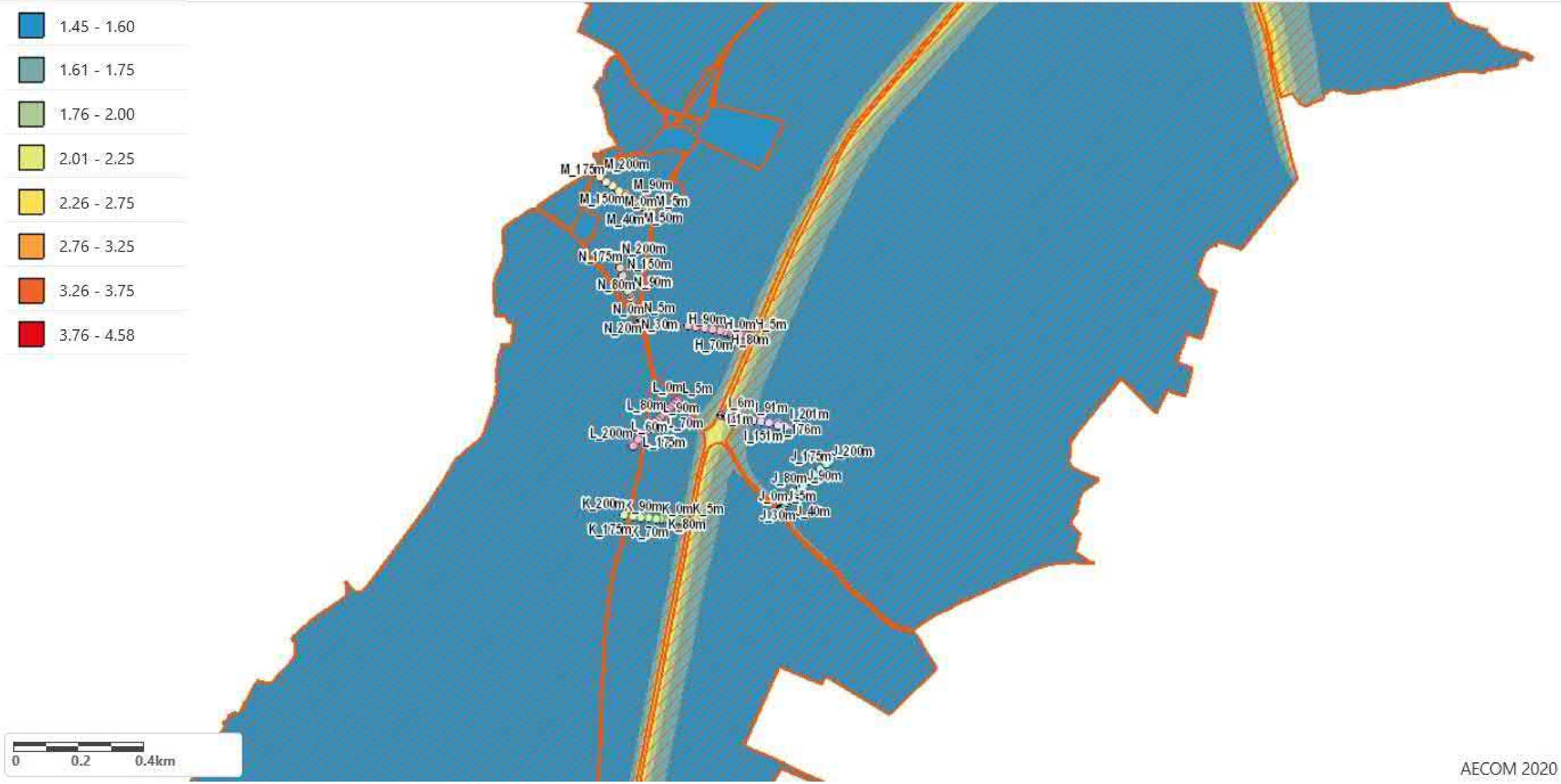
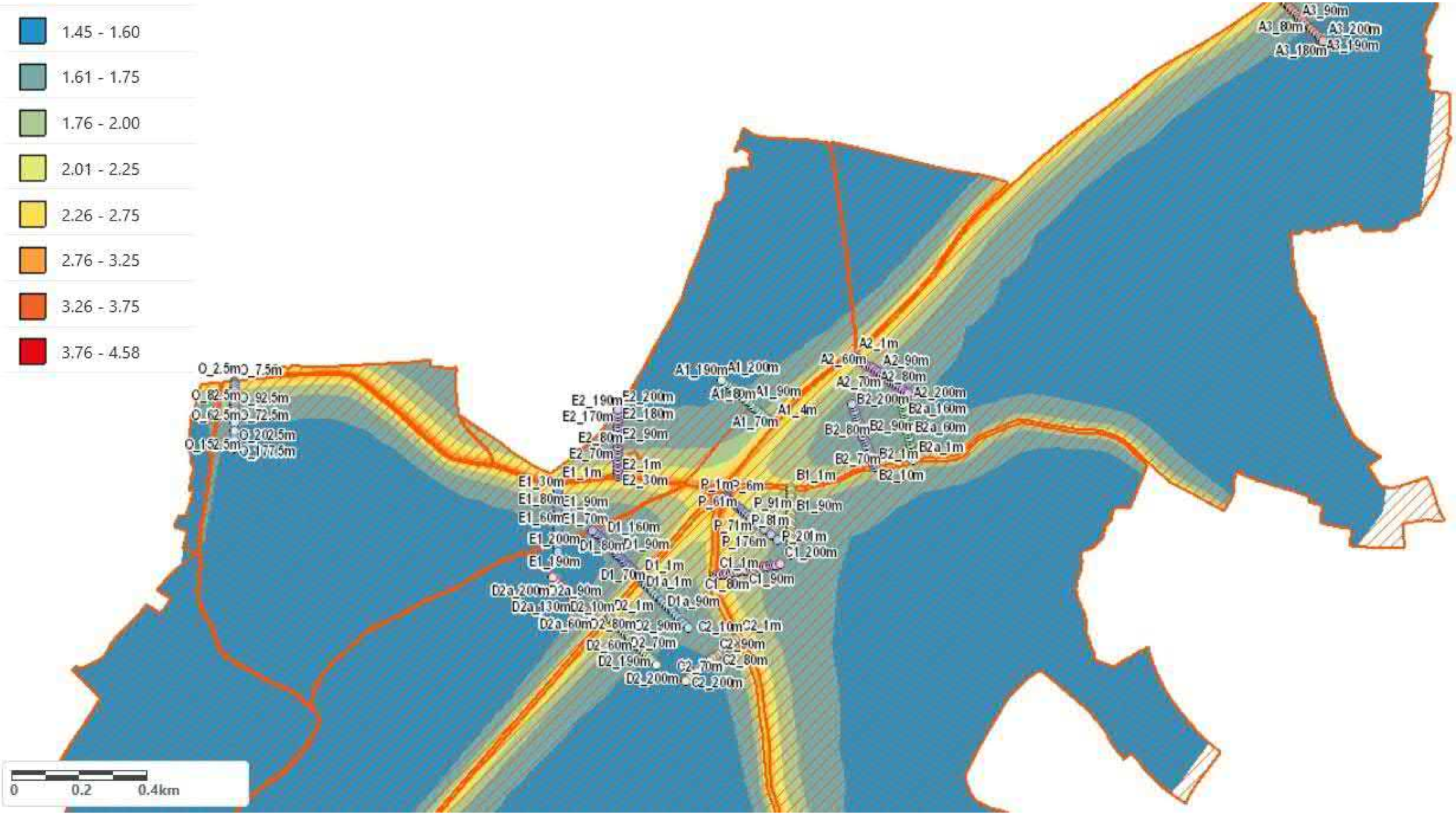
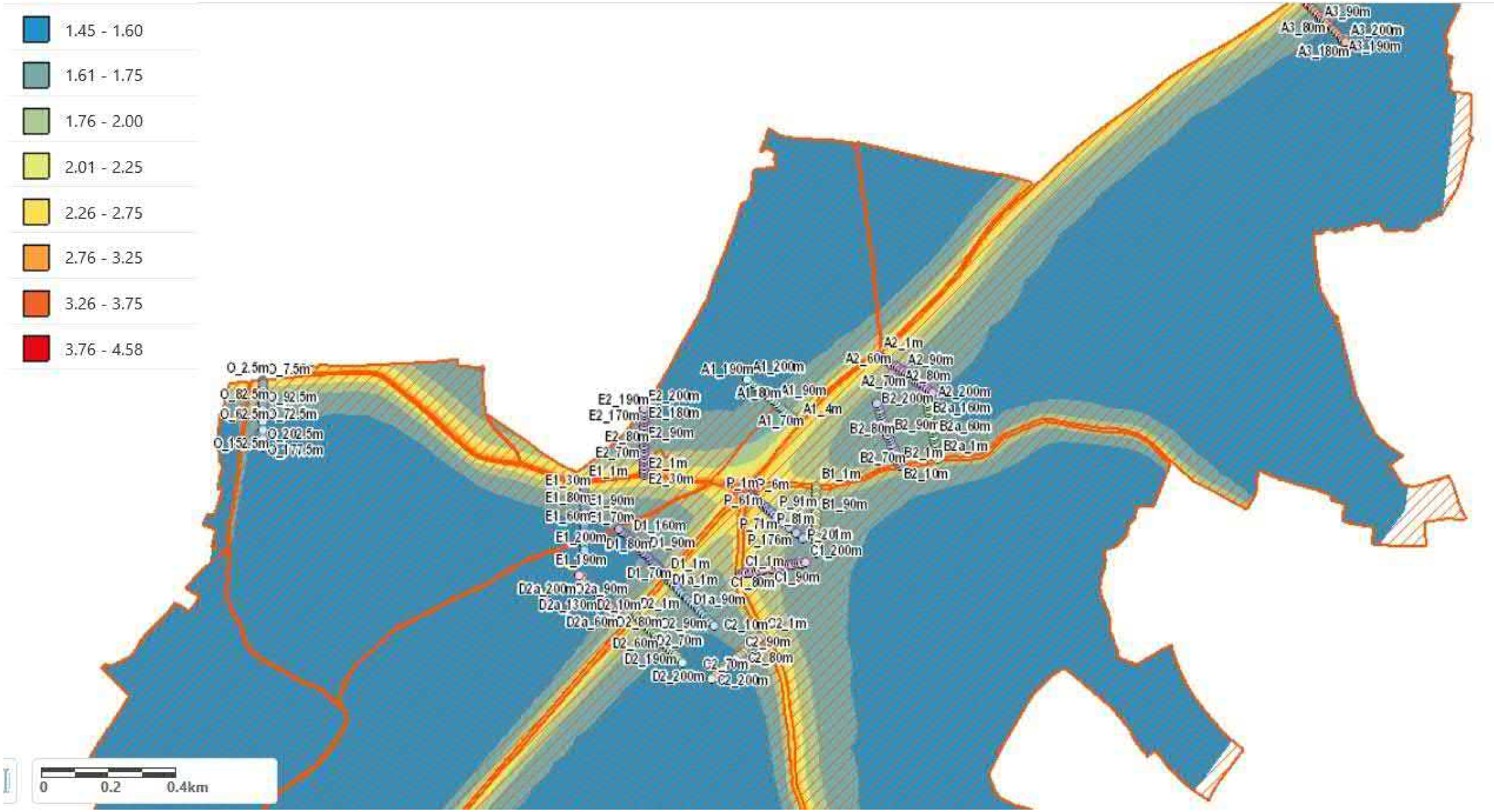

1.45 - 1.60
1.61 - 1.75
1.76 - 2.00
2.01 - 2.25
2.26 - 2.75
2.76 - 3.25
3.26 - 3.75
3.76 - 4.58
0
0.2
0.4km
AECOM 2020

Figure 13. **Two screencaps showing the total ammonia concentrations model results in 2033 without growth and mitigation as isopleths overlain on all transects and the Epping Forest SAC boundary (hatching). The first shows the north of the SAC around Wake Arms Roundabout and Honey Lane, the second shows the south of the SAC around Robin Hood Roundabout. There are no areas under any scenario where the ammonia concentrations fall below the critical level**




1.45 - 1.60
1.61 - 1.75
1.76 - 2.00
2.01 - 2.25
2.26 - 2.75
2.76 - 3.25
3.26 - 3.75
3.76 - 4.58
0
0.2
0.4km
AECOM 2020

Figure 14. Two screencaps showing the total ammonia concentrations model results in 2033 <u>with both growth and mitigation</u> as isopleths overlain on all transects and the Epping Forest SAC boundary (hatching). The first shows the north of the SAC around Wake Arms Roundabout and Honey Lane, the second shows the south of the SAC around Robin Hood Roundabout. There are no areas under any scenario where the ammonia concentrations fall below the critical level




1.45 - 1.60
1.61 - 1.75
1.76 - 2.00
2.01 - 2.25
2.26 - 2.75
2.76 - 3.25
3.26 - 3.75
3.76 - 4.58
0
0.2
0.4km

6.32 The Conservation Objectives for Epping Forest SAC include objectives to maintain or restore the structure and function (including typical species) of qualifying natural habitats, and the supporting processes on which qualifying natural habitats and the habitats of qualifying species rely. In order to achieve that objective the supplementary advice with specific regard to ammonia for both heathland and woodland is to '*…restore concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk)*'. Figure 11 above shows the modelled predictions indicate no prospect of ammonia concentrations at Epping Forest SAC falling below the critical level for lichens (1µgm^{-3}) by 2033 even with no growth. However, the Mitigated Scenario does ensure that 12% of the SAC will experience a dose that is *better* than that which would be experienced under the 2033 baseline and 87% will experience a dose that is no worse. In most roadside locations the Mitigated Scenario results in ammonia concentrations being 6-10% of the critical level lower than in the 2033 baseline situation. As a result, 82% of the SAC would experience ammonia concentrations below 1.6 µgm^{-3} with growth plus mitigation, compared to 81% under the 2033 baseline. It is therefore regarded as not likely to interfere with achievement of the Conservation Objectives and may contribute positively in many locations within the SAC if compared with a situation with no growth.

6.33 When considering whether the conservation objective is undermined, it is also necessary to assess how the predicted increased ammonia will affect the features in the specific locations, and whether this causes an adverse impact on site integrity accounting for the attributes of the specific SAC locations. For the locations with predicted increases in ammonia for the mitigated scenario (i.e., transects J, L & N, see Figure 9 above), the 'direct' impact of increased ammonia on lichens (i.e. 'direct' from ammonia rather than as a contribution within total nitrogen deposition which is dealt with elsewhere) is most likely to consist of reduced percentage cover of lichens rather than actual loss of acidophytes from the assemblage, given that ammonia concentrations will be below 2ug/m^3. Moreover, no rare or notable lichen species are shown in the specified areas using available data. Whilst a 'direct' impact of this nature is undesirable, it is noteworthy that locations J, L & N are also predicted to experience significantly reduced total NOx concentrations (compared with the 2017 levels) over the same period (compare Figure 5 and Figure 8 above), such that total concentrations by the end of the plan period will be well below the NOx Critical Level. This would be expected to benefit lichen percentage cover. Although these pollutants act in different ways and should not be regarded as directly tradeable in terms of scale or impact, in this case the reduced NOx levels may be regarded as likely to minimise the scale of adverse 'direct' impact on lichen percentage cover attributable to the predicted localised increases in ammonia emissions given the lichen assemblages at these specific locations. Overall the mitigated scenario would not therefore interfere with achievement of the Conservation Objectives and would in fact contribute positively relative to a situation with no growth by ensuring lower ammonia concentrations over 12% of the SAC.

6.34 In addition, because the lowest critical level for ammonia is itself small (being 1 µgm^{-3}) concentrations of ammonia that are close to the limit of detection of CEH ALPHA samplers (e.g. 0.02-0.05 µgm^{-3})[70], would still equate to 2-5% of the critical level and thus exceed the 1% of the critical level threshold. Moreover, seasonal and inter-annual fluctuations in ammonia concentrations far exceed the annual mean 'dose' that is modelled to occur due to traffic growth in a mitigated scenario. This is illustrated by long-term ammonia monitoring undertaken at a range of locations. Scrutiny of ammonia data from the UKEAP national ammonia monitoring network for three sites in the South of England covering 2010-2019 show that the variation in ammonia concentrations throughout a year can be as high as 3-4 µg/m^3 and at rural sites concentrations generally fluctuate by more than 1 µg/m^3 (100% of the critical level) throughout the year due to constantly varying factors such as meteorology. In other words, the residual doses on transects J, L and N fall well within the expected variance in existing ammonia concentrations, are unlikely to be statistically significant and could never be detected in the field.

6.35 Finally, it is important to note that this modelling could be considered precautionary:

a) some of the forecast 'in combination' traffic leading to these reported doses would not arise from Epping Forest District and is therefore not the Council's responsibility to mitigate, whereas for the purposes of this exercise the Council has identified measures sufficient to address the entire 'in combination' dose through the SAC, rather than simply that attributable to their Local Plan;

[70] CEH ALPHA samplers are suitable to measure concentrations of ammonia across the range 0.02-100 µgm^{-3} (monthly monitoring) and 0.05-400 µgm^{-3} (weekly monitoring) (https://www.ceh.ac.uk/services/air-samplers).

b) the Garden Villages have higher modal shift targets than the standard modal shift allowed for in this modelling so in practice there may be greater modal shift than has been allowed;
c) In practice, it is unlikely that all of the net new housing included in this modelling would come forward during the plan period. This element of potential non-delivery is a well-known planning premise and the emerging Local Plan addresses this by proposing to allocate sites which collectively would exceed the number of dwellings required in Policy SP1;
d) The traffic modelling used to underpin the air quality modelling used to inform this HRA assumes that all sites are 'greenfield'. Therefore, no account has been taken of those sites which currently generate traffic (i.e. gross rather than net traffic generation figures have been used). In addition, it takes no account of existing trips changing from vehicles to more sustainable modes;
e) The government's Clean Air Strategy 2019 has identified a number of actions unrelated to traffic that it would undertake to support reductions in the effects on habitats from ammonia, particularly regarding agriculture. These measures have not been accounted for in the reported modelling but may mean total ammonia concentrations at 2033 are lower than modelled;
f) As well as the CAZ and ULEV shift initiatives that are included in this modelling, the Mitigation Strategy produced by the Council contains a collection of measures that are <u>not</u> directly included in this modelling because their benefits cannot be quantified. However, they are still expected to play a role in reducing ammonia concentrations when combined with each other, and with the mitigation measures that <u>have</u> been modelled[71];
g) The Mitigation Strategy indicates the potential introduction of a 'trigger release' policy. Such a trigger would ensure that the site could not come forward for development until it could be demonstrated through future monitoring and modelling that the development of the site would not have an adverse effect on integrity or an unacceptably delayed achievement of the conservation objectives for the Forest;
h) The Council is committed to reviewing the modelling and Mitigation Strategy with each five-year plan review. This would not only allow the projections in this modelling to be checked against on-site monitoring data but could allow currently novel measures (identified for completeness in the Mitigation Strategy) to be trialled and implemented. If effective it may be possible to incorporate them in future modelling iterations. It also enables account to be taken of future autonomous measures arising from, for example, by the UK Government, such as bringing forward the date for the banning of petrol, diesel and hybrid cars or introducing national scrappage schemes. These factors mean that 2033 concentrations would be lower than forecast in this modelling. The primary mechanism for the approach to monitoring and review is provided by Policy D8 of the emerging Local Plan and the Air Pollution Mitigation Strategy, which states that '*Where appropriate, the Council will commence an earlier review of the Local Plan to address significant changes in circumstances. The Council will promptly commence a review of the Local Plan and update relevant policies accordingly if… the monitoring to be undertaken in the relevant adopted Mitigation Strategies as set out in Policy DM2, together with updated modelling outputs and Habitat Regulations Assessment indicates that the Council, as competent authority, can no longer conclude that the delivery of planned development will not cause adverse effects on the integrity of the Epping Forest Special Area of Conservation. This will include consideration of any delay in securing and delivering the required measures set out in those strategies. In considering these matters the Council will consult with Natural England and have regard to its advice.'*

6.36 In practice, therefore, it is possible that the 'mitigated scenario' ammonia doses would be lower than those reported in these data.

6.37 Taking all this into account, it is considered that, provided a CAZ is introduced from 2025 (based on the current modelling outputs), and the identified Council initiatives to shift ownership of petrol cars to electric vehicles are introduced from plan adoption and can achieve a 30% conversion of petrol cars to ULEVs by 2033, the integrity of the SAC would not be adversely affected by ammonia attributable to planned growth in the district and would generally be <u>positively</u> affected by the planned mitigation measures.

[71] Note that these are distinct from measures that have been modelled but rejected as being ineffective

Nitrogen deposition

Unmitigated scenario (Scenario 4 compared with the 2033 future baseline)

6.38 With growth but no mitigation, the ‘in combination’ nitrogen dose exceeds 1% of the critical load (10 kgN/ha/yr for both heathland and forest) throughout all transects except the furthest parts of transects C2, D2a and E1 (though only where heathland is present), K, L and M. For the other transects the dose at the roadside is normally very large, ranging between 21%-34% of the critical load (transects A1 to A3, C1 (where forest is present), D1, D1a, D2, E1, E2, H, I and K). The greatest dose is forecast to be equivalent to 45% of the critical load (4.51 kgN/ha/yr) at the roadside of transect P. Transect M is the exception from all the other transects, with the dose falling to 1% of the critical load by 5m from the roadside. It can be seen that the pattern closely follows that for ammonia, which is unsurprising since the modelling suggests that ammonia is responsible for approximately 70% of nitrogen deposited from traffic.

6.39 Therefore, an adverse effect on integrity cannot be dismissed with confidence in an unmitigated scenario. Review of the interim year modelling indicates that this would also be true in 2024 (see the section on mitigation where the 2024 results are discussed in more detail) which is relevant to when mitigation needs to be introduced.

Mitigated scenario (Scenario 4.5ULEZEV compared to the 2033 future baseline)

6.40 With growth plus a CAZ and initiatives to drive a 30% shift in petrol car ownership to electric vehicles by 2033 (such that 12-15% of all vehicles using roads through Epping Forest SAC are ULEVs by that year) all transects would experience an imperceptible ‘in combination’ nitrogen dose at all points, except for the following:

- There would be a small residual ‘in combination’ dose on transect A1 of 2-3% of the critical load, up to 20m from the roadside. In other words, the difference with and without growth is subtle being 36.01 kgN/ha/yr at the roadside in a situation without growth compared to 36.31 kgN/ha/yr with growth and mitigation;
- There would be a small residual ‘in combination’ dose (2% of the CL) on transects J and K, but only at the roadside itself.
- There would be a medium residual ‘in combination’ dose of 6% of the CL at the roadside of transect L but this immediately (within a few metres) falls to a small residual dose of 2-3% of the CL which persists up to 15m from the roadside.
- There would be a medium residual ‘in combination’ dose of 6-8% of the CL up to 20m from the junction where the southern end of Paul’s Nursery Road meets Avey Lane/Cross Roads on Transect N, falling to a small residual dose of 2-3% of the CL up to 100m from the same junction.

6.41 The largest dose forecast in a Mitigated Scenario would be 0.83 kgN/ha/yr (8% of the critical load) at the roadside of transect N. Therefore, except for a single transect (Transect N up to 20m from the junction where the southern end of Paul’s Nursery Road meets Avey Lane/Cross Roads), the nitrogen dose would only be slightly worse than in a situation with no growth at all.

6.42 Moreover, it is important to note that:

1. Some of the growth leading to these localised residual doses does not derive from Epping Forest District and is therefore not the Council’s responsibility to mitigate, whereas for the purposes of this exercise the Council has identified measures sufficient to address the entire ‘in combination’ dose through the SAC, rather than simply that attributable to their Local Plan; and
2. Transects B1, B2, C1, C2, E1, E2, I, O and P would all be significantly better than the future baseline with growth plus mitigation (i.e. up to 1 kgN/ha/yr lower at the roadside rising to 2 kgN/ha/yr at the roadside of C1).

6.43 In other words, only 4 out of 464 modelled transect locations (1%) would experience an ‘in combination’ nitrogen dose greater than ‘small’ and all but one of these four is on a single transect (N) close to the roadside, the other being at the immediate roadside of transect L. Eighteen transect locations (4%) would experience a ‘small’ nitrogen dose and 56% of those would be on transect N up to 100m from the roadside, with most of the remainder on transect L up to 15m from the roadside. In contrast, 349 of the modelled transect locations (75%) would experience lower (better) nitrogen deposition rates than would occur without growth or mitigation. In total, therefore, 5% of modelled transect locations (localised to two areas of the SAC) would experience an ‘in combination’ nitrogen dose greater than negligible and 75% would experience a net improvement in nitrogen deposition.

Isopleth mapping

6.44 This can also be seen more broadly over the SAC by scrutinising isopleth (contour) maps produced using the modelling data to aid visualisation of the modelling outputs. Note that these isopleth maps have been created such that the relevant nitrogen deposition velocities apply to the different areas of heathland and woodland around the SAC. Using the isopleth modelling results, under the mitigated scenario 94% of the SAC around the modelled links would experience effectively zero ‘in combination’ nitrogen dose. Only 0.5% would experience a small dose and only 0.06% of the SAC would experience a medium to large dose. In contrast, 5% would experience a net reduction in nitrogen deposition rates compared to the 2033 baseline.

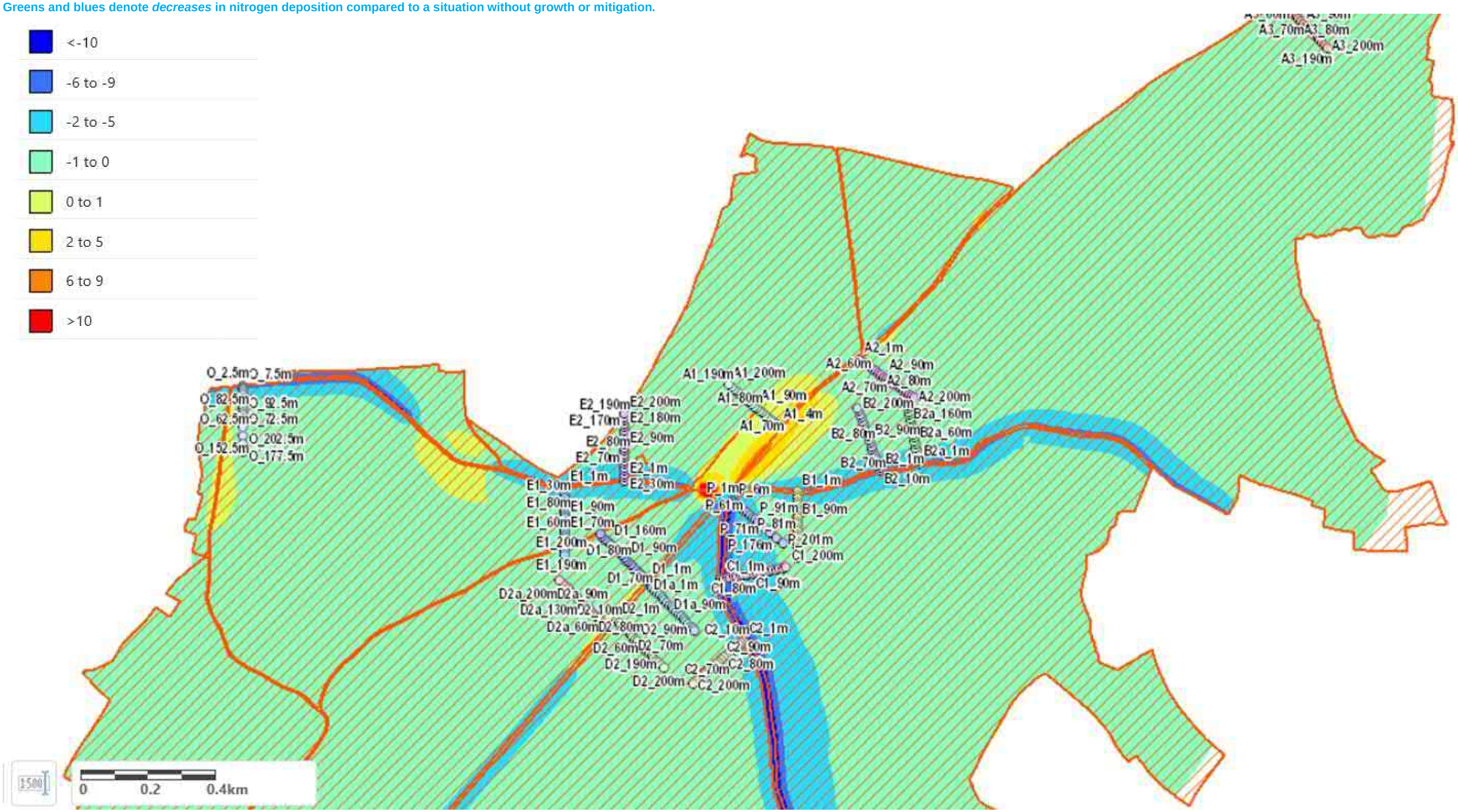
6.45 Note that the modelled area of the SAC does not include those parts of the SAC in London, so the percentages above are precautionary.

6.46 Figure 15 overleaf shows the net change in nitrogen deposition when 2033 with growth and mitigation are compared with the same year (2033) in the absence of any growth or mitigation. ‘Cooler’ colours on the map denote either an imperceptible ‘in combination’ dose (lime green) or a net reduction in nitrogen deposition compared to a situation with no growth or mitigation (greens and blues, the deeper the blue the greater the net reduction). ‘Warmer’ colours depict net increases in nitrogen deposition ranging from a small dose (dark yellow), through a medium dose (orange) to a large dose (red).

6.47 It is easily observed that the vast majority of the SAC will experience either a negligible dose or a very slight net reduction in nitrogen deposition, compared to the 2033 baseline, once both mitigation and growth are included. It is also notable that all but one of the approach roads to Wake Arms Roundabout and Honey Lane would experience a net reduction in nitrogen deposition due to the mitigation (various shades of blue), such that total nitrogen deposition would actually be lower than it would be with no growth.

6.48 There are three localised areas on Figure 15 where residual ‘in combination’ nitrogen doses greater than imperceptible would still be observed: a small patch to the south of Woodridden Hill (A121) and the junction with Wake Arms Roundabout, a short stretch of Epping Road north of Wake Arms Roundabout and the road known as Cross Roads which lies between Robin Hood Roundabout and the junction where the southern end of Paul’s Nursery Road meets Avey Lane/Cross Roads (the location of Transect N)’. These are shown in Figures 16 and 17 and are discussed in turn below. Reference to the earlier isopleth maps for ammonia shows that the pattern replicates that overleaf, except that the ammonia dose to the small patch south of Woodridden Hill (A121) and the junction with Wake Arms Roundabout is medium in scale rather than large, and there is no residual dose above imperceptible along Epping Road. This indicates that ammonia emissions are the main contributor to nitrogen deposition.

Figure 15. Two screencaps showing the nitrogen deposition model results as isopleths overlain on all transects and the Epping Forest SAC boundary (hatching). The first shows the north of the SAC around Wake Arms Roundabout and Honey Lane, the second shows the south of the SAC around Robin Hood Roundabout. The maps show the residual nitrogen doses with both growth and mitigation, as a percentage of the critical load. Red denotes a 'large' residual nitrogen dose (10% or more of the critical load), orange denote a 'medium' residual nitrogen dose (6% to 9% of the critical load), dark yellow denotes a 'small' dose (2-5% of the critical load), lime green denotes an imperceptible dose (less than 1% of the critical load). Greens and blues denote *decreases* in nitrogen deposition compared to a situation without growth or mitigation.



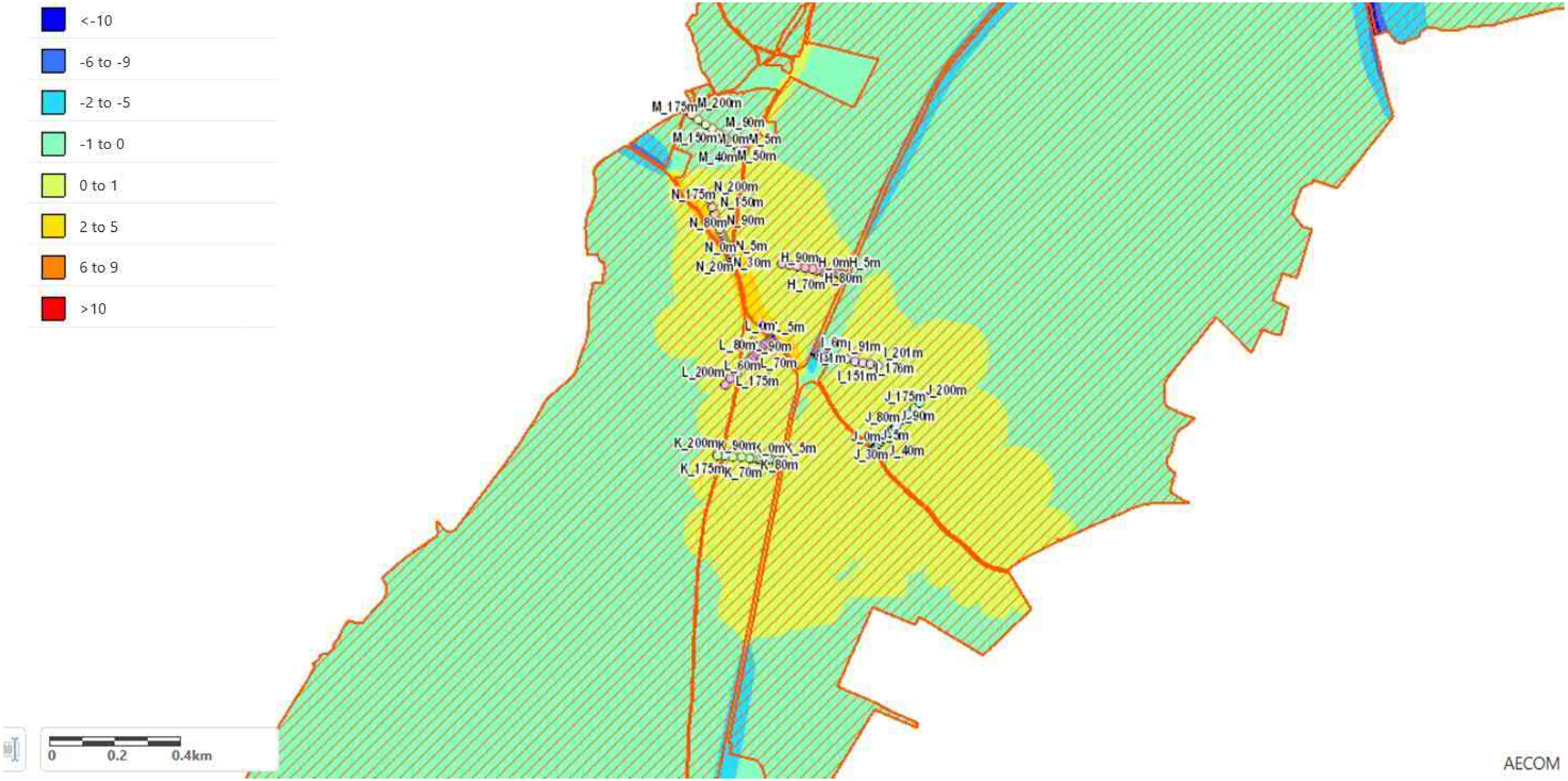

<-10
-6 to -9
-2 to -5
-1 to 0
0 to 1
2 to 5
6 to 9
>10
0
0.2
0.4km
AECOM

Figure 16. Screencap showing the model results as isopleths overlain on transects N, L and H and veteran tree and rare species records from Epping Forest Conservators. The blue lines parallel to the road represent a 10m distance back from the roadside, the Irregular dark orange polygons denote a 'medium' residual nitrogen dose (6% to 9% of the critical load), dark yellow denotes a 'small' dose (2-5% of the critical load), lime green denotes an imperceptible dose (less than 1% of the critical load). Greens and blues denote *decreases* in nitrogen deposition compared to a situation without growth or mitigation. There are no areas of red shading because no large residual doses are forecast. Green, yellow and red diamonds represent the location of different species of veteran trees as provided by Epping Forest Conservators, while the pink squares represent locations of the plant *Hieracium sabaudum*. Yellow triangles represent records of the rare moss *Zygodon forsteri* also provided by the Epping Forest Conservators.

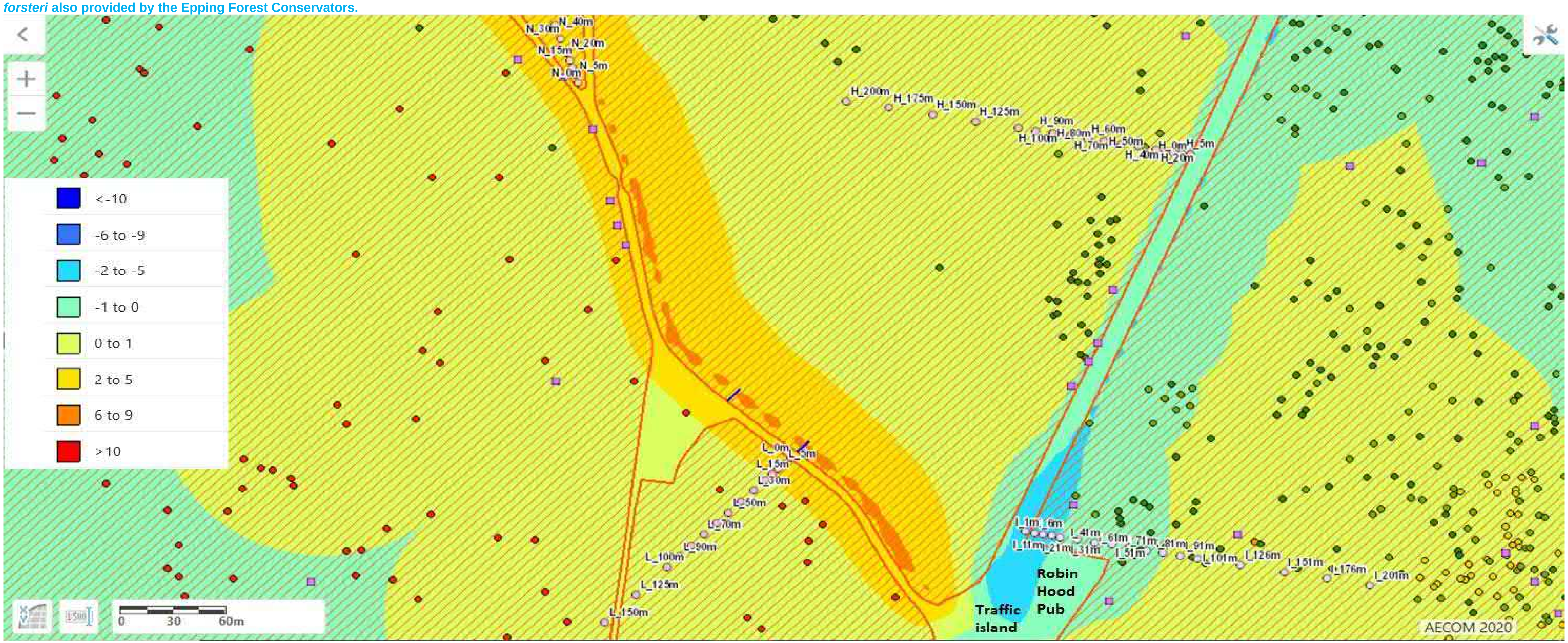


Figure 17. Screencap showing isopleth results overlain on Wake Arms Roundabout, transects A1, B1, P and E2 and veteran tree and rare species records from Epping Forest Conservators. The blue line parallel to the road represents a 20m distance back from the roadside, the Irregular red polygon represents the only area in Epping Forest SAC where a residual large dose (10% of the critical load or above) is still forecast in a mitigated scenario. Dark orange polygons denote a 'medium' residual nitrogen dose (6% to 9% of the critical load), dark yellow denotes a 'small' dose (2-5% of the critical load), lime green denotes an imperceptible dose (less than 1% of the critical load). Greens and blues denote *decreases* in nitrogen deposition compared to a situation without growth or mitigation. It can be seen that around much of Wake Arms Roundabout nitrogen deposition is forecast to be better with mitigation and growth than in a situation with no growth at all (various shades of blue and green). Green, yellow and red diamonds represent the location of different species of veteran trees as provided by Epping Forest Conservators, while the pink squares represent locations of the plant *Hieracium sabaudum*. Yellow triangles represent records of the rare moss *Zygodon forsteri* also provided by the Epping Forest Conservators.

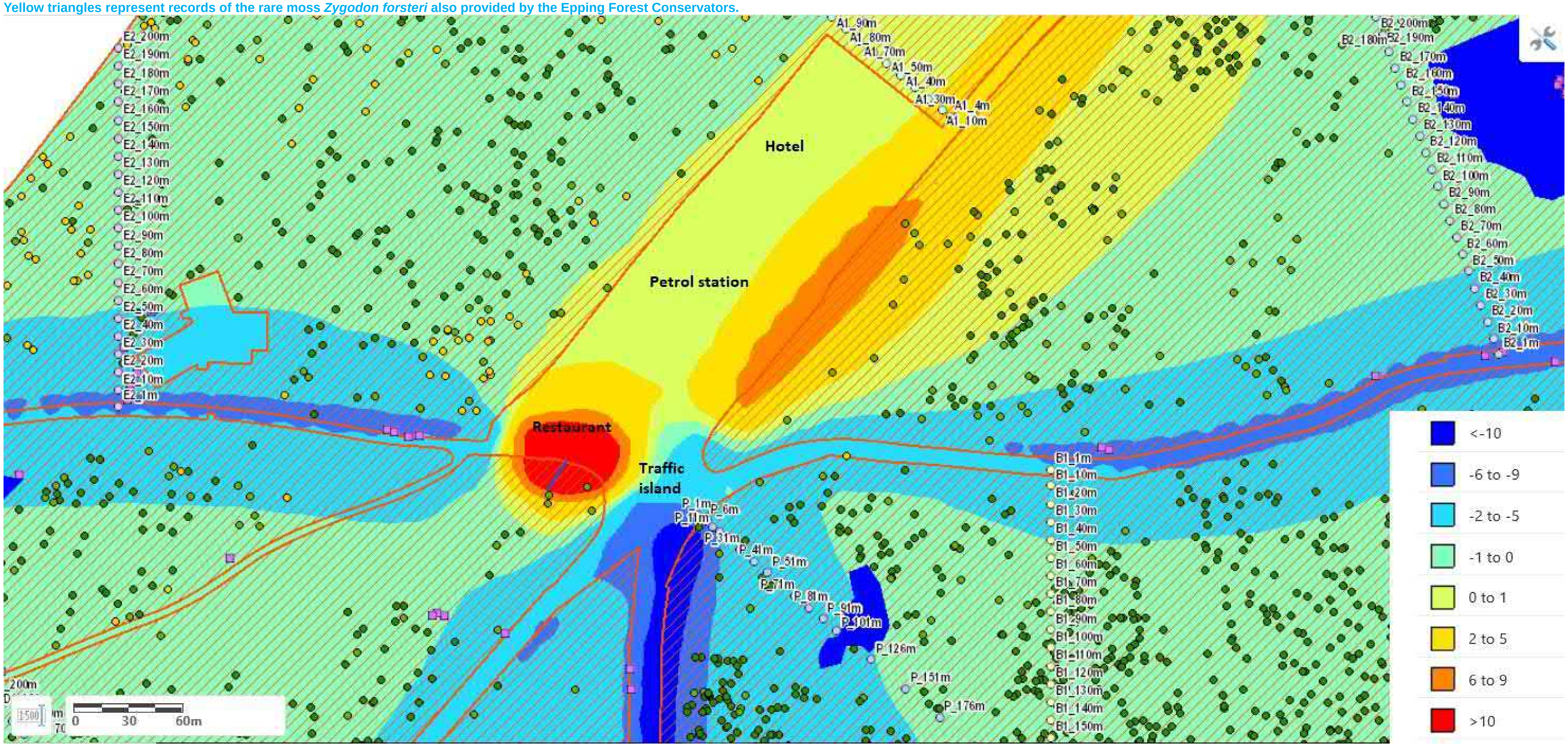
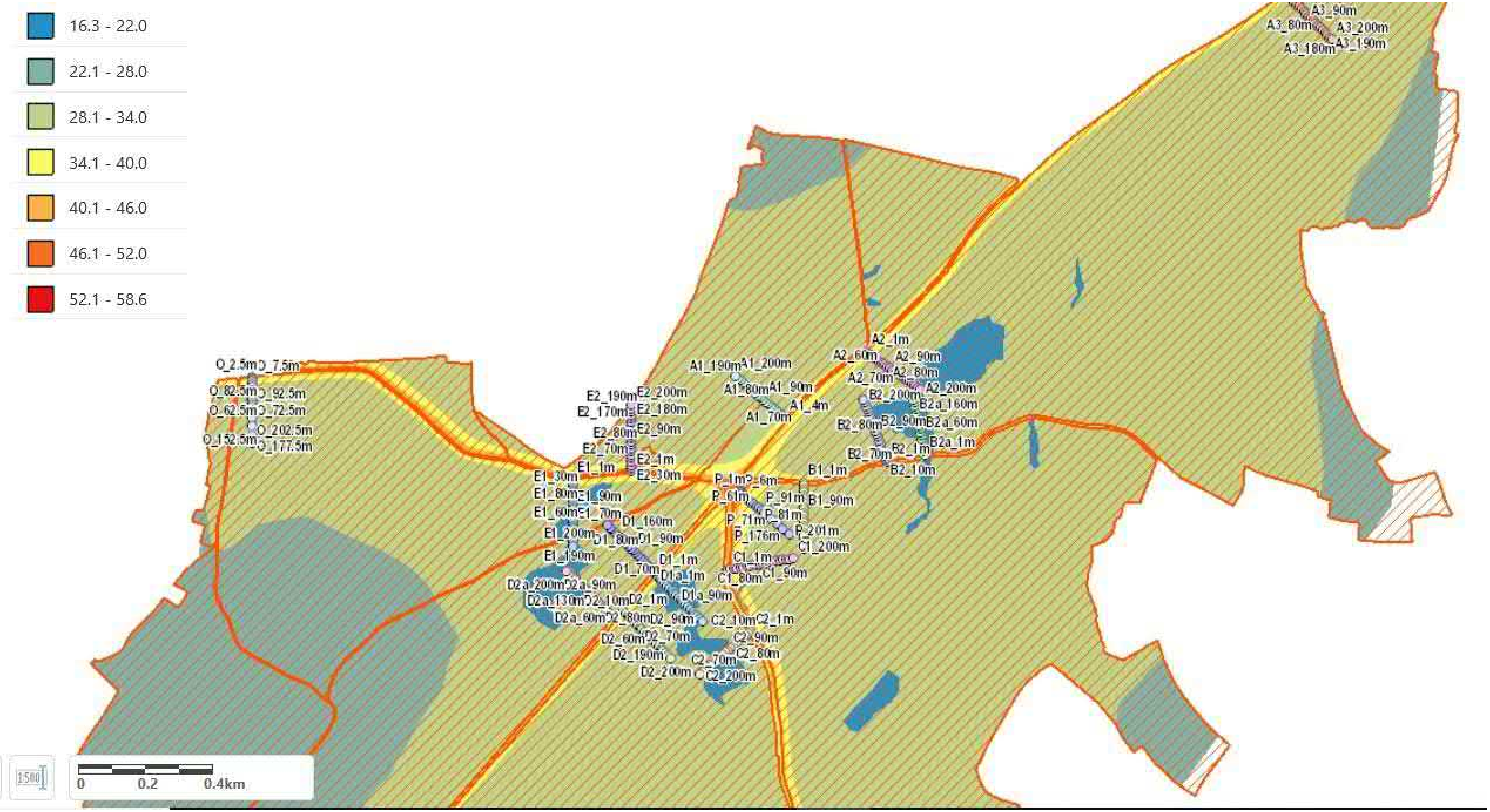
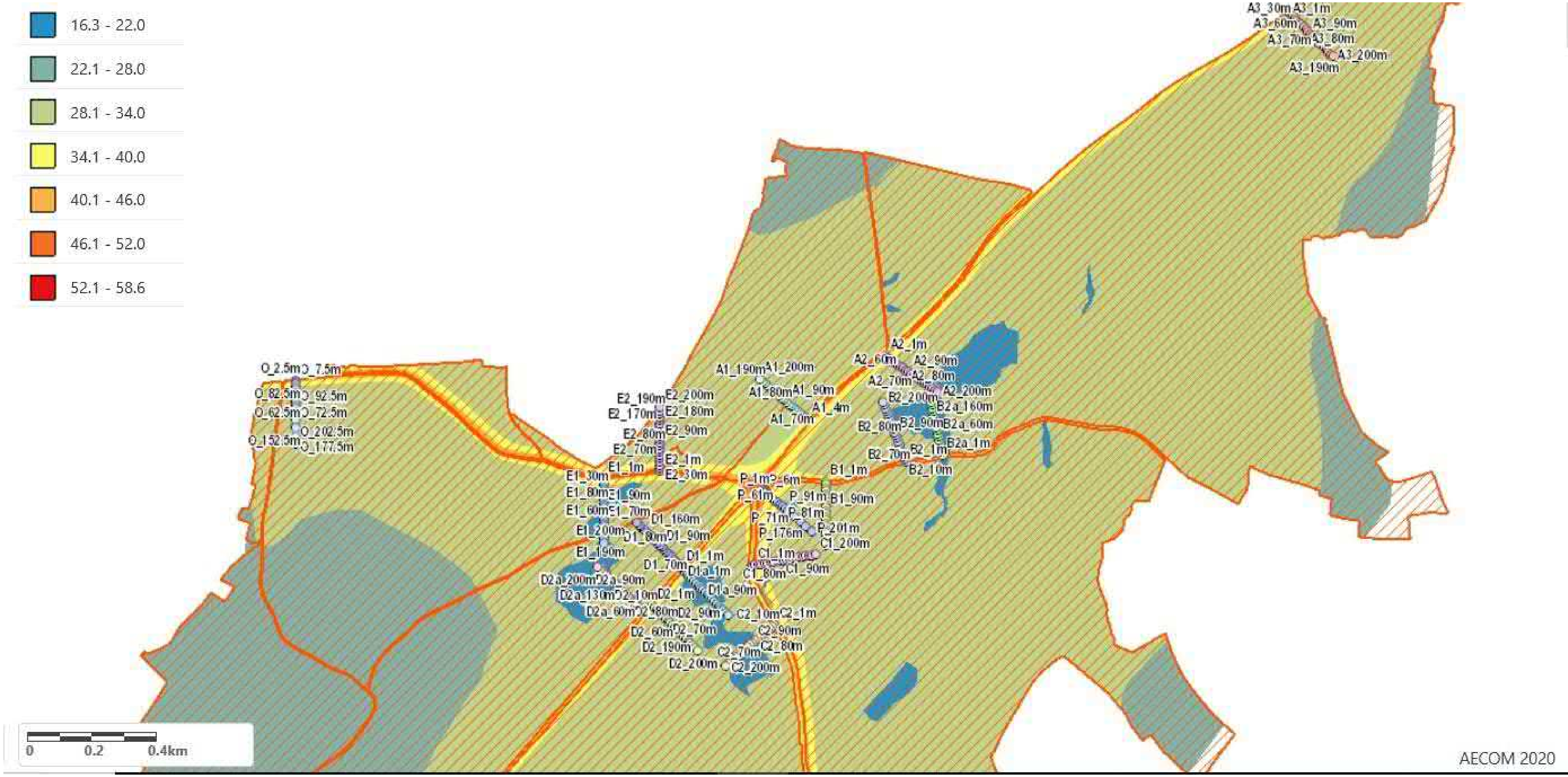


Figure 18. Two screencaps showing the total nitrogen deposition model results in 2017 as isopleths overlain on all transects and the Epping Forest SAC boundary (hatching). The first shows the north of the SAC around Wake Arms Roundabout and Honey Lane, the second shows the south of the SAC around Robin Hood Roundabout. There are no areas under any scenario where the nitrogen deposition rate falls below the critical load



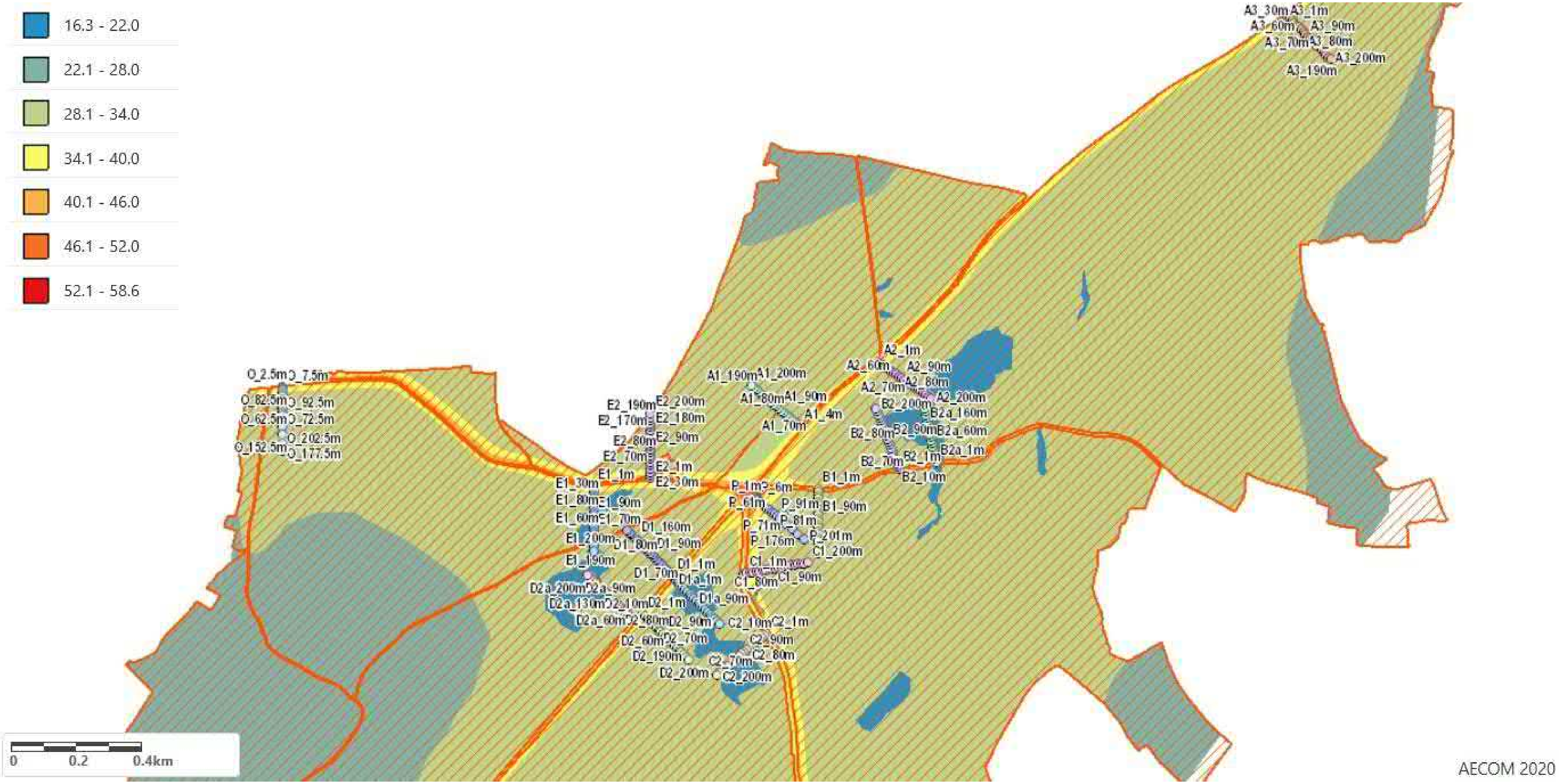

16.3 - 22.0
22.1 - 28.0
28.1 - 34.0
34.1 - 40.0
40.1 - 46.0
46.1 - 52.0
52.1 - 58.6
M_175m
M_200m
M_90m
M_150m
M_0m
M_5m
M_40m
M_50m
N_175m
N_200m
N_150m
N_80m
N_90m
N_0m
N_5m
N_20m
N_30m
H_90m
H_0m
H_5m
H_70m
H_80m
L_0m
L_5m
L_80m
L_90m
L_60m
L_70m
L_200m
L_175m
I_6m
I_91m
I_201m
I_176m
I_151m
J_175m
J_200m
J_80m
J_90m
J_0m
J_5m
J_30m
J_40m
K_200m
K_90m
K_0m
K_5m
K_175m
K_70m
K_80m
0
0.2
0.4km
AECOM 2020

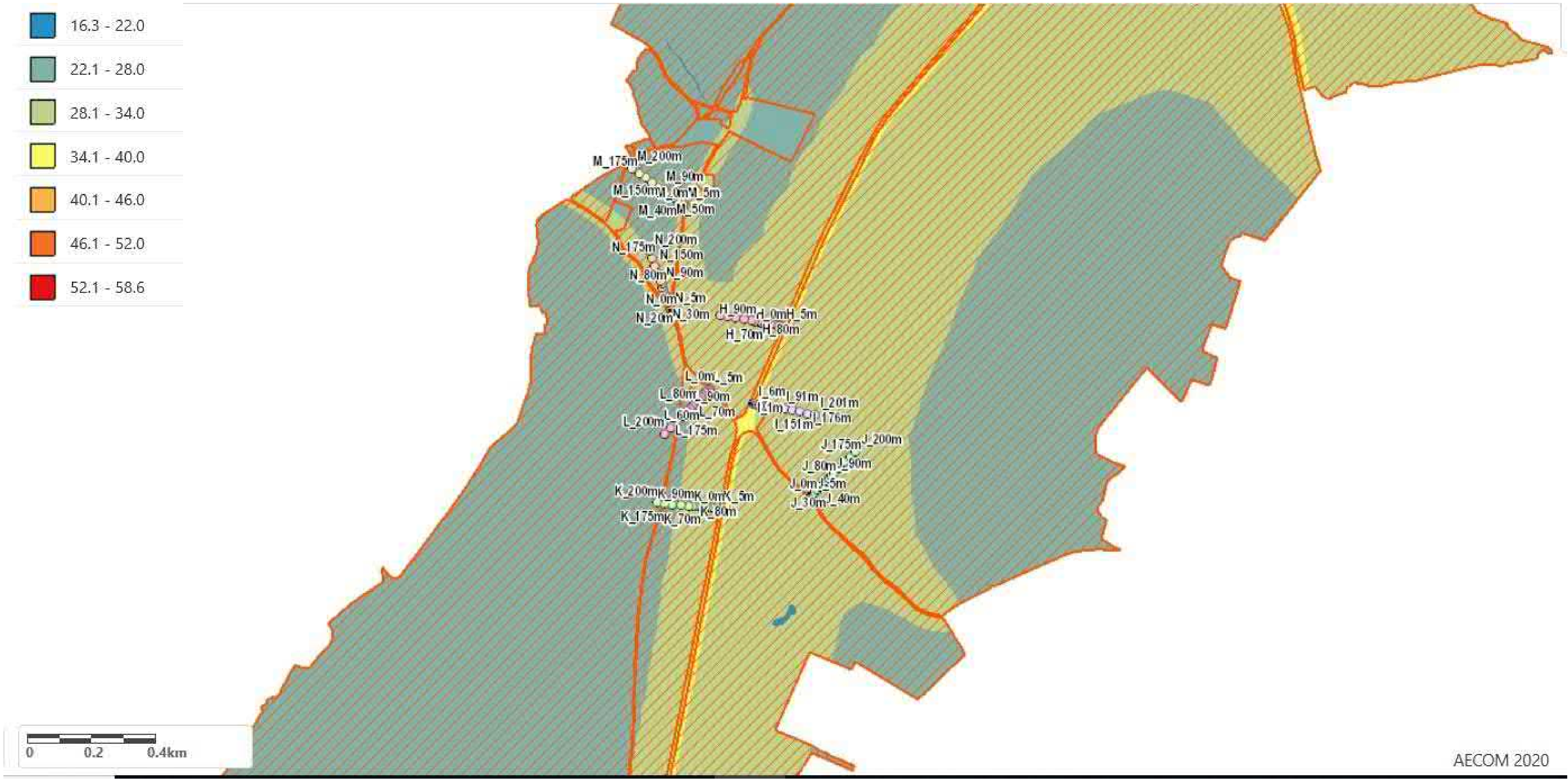
Figure 19. Two screencaps showing the total nitrogen deposition model results in 2033 without growth or mitigation as isopleths overlain on all transects and the Epping Forest SAC boundary (hatching). The first shows the north of the SAC around Wake Arms Roundabout and Honey Lane, the second shows the south of the SAC around Robin Hood Roundabout. There are no areas under any scenario where the nitrogen deposition rate falls below the critical load




16.3 - 22.0
22.1 - 28.0
28.1 - 34.0
34.1 - 40.0
40.1 - 46.0
46.1 - 52.0
52.1 - 58.6
0
0.2
0.4km
AECOM 2020

Figure 20. Two screencaps showing the total nitrogen deposition model results in 2033 with both growth and mitigation as isopleths overlain on all transects and the Epping Forest SAC boundary (hatching). The first shows the north of the SAC around Wake Arms Roundabout and Honey Lane, the second shows the south of the SAC around Robin Hood Roundabout. There are no areas under any scenario where the nitrogen deposition rate falls below the critical load




16.3 - 22.0
22.1 - 28.0
28.1 - 34.0
34.1 - 40.0
40.1 - 46.0
46.1 - 52.0
52.1 - 58.6
0 0.2 0.4km
AECOM 2020

6.49 Focussing attention on the area around Transect N (High Beech junction) Figure 16 above shows the distribution of sensitive features. On this screen capture, the irregular orange polygons represent locations where a ‘medium’ nitrogen and ammonia dose is forecast in the mitigated scenario. Green, yellow and red diamonds represent the location of different species of veteran trees as provided by Epping Forest Conservators, while the pink squares represent locations of the plant *Hieracium sabaudum*. Yellow triangles represent records of the rare moss *Zygodon forsteri* also provided by the Epping Forest Conservators. The blue perpendicular lines represent a 10m distance from the roadside.

6.50 Note that the isopleth map does not show the medium residual nitrogen dose at the tip of Transect N that has already been discussed. This is an artefact of the isopleth creation method in GIS for this location due to the narrow nature of this sliver of woodland at the V junction between two roads. However, the isopleth map does show that in addition to the medium residual dose within the southernmost 20m tip of transect N, a medium residual dose (6-9% of the critical load) is also forecast in patches within 10m of the roadside along most of the length of the road (known as Cross Roads) between Robin Hood Roundabout and the junction where the southern end of Paul’s Nursery Road meets Avey Lane/Cross Roads. This is not shown in the transect modelling because there is no transect in that location. It is the result of queuing traffic in this location. The medium doses disappear north of transect N and are not present along any other road in a mitigated situation.

6.51 No mapped veteran trees or plants on the Conservators rare plant register lie within the area to be subject to a ‘medium’ nitrogen and ammonia dose, although most of it does constitute SAC habitat (beech forest) and Natural England has confirmed that mature oaks in this area do display signs of stress (thinner canopies, twig dieback, leaf tips brown and curling) which could be associated with traffic emissions. Natural England have also confirmed that the area within 10m of the road does contain a veteran beech tree (tag number 19973), not shown on the mapping, which is also exhibiting signs of stress. Additionally, in some areas close to the T junction and Robin Hood Roundabout there are locally abundant sycamore seedlings and saplings, often associated with nettle and bramble in patches. Increases in nitrogen deposition present a risk of expansion of these nitrogen-liking species at the expense of Beech seedlings and some vulnerable characteristic ground flora observed on site, such as *Polytrichum* moss (seen as close as 5m from roadside).

6.52 The total area (including the tip of transect N) is very small, measuring 0.16ha (0.01% of the total SAC). The most that might be expected in this area is a slight difference in botanical composition compared to a situation with no growth, but the area would continue to constitute beech forest. As such it is considered that a residual medium dose in this location would not undermine the integrity of the SAC, or significantly interfere with its achievement of conservation objectives, particularly remembering that, in contrast, 12% of the SAC would experience a net reduction in ammonia concentrations compared to the 2033 baseline and 5% would experience a net reduction in nitrogen deposition rates compared to the 2033 baseline, such that the mitigation strategy will aid the achievement of the Conservation Objectives for the SAC regarding lowering pollutant concentrations and deposition rates to below the critical level and load.

6.53 Moreover, since the modelling reported above was undertaken the Council has received a proposal for introducing a ‘Right Turn Ban at the junction of Forest Side with Honey Lane which would prevent the queues that cause this residual medium dose from forming. While such a ban would potentially mean more vehicles travelling past Honey Lane junction to Wake Arms Roundabout and then turning south down Epping New Road, the blue shading on Figure 5 shows that these roads are forecast to experience a net reduction in nitrogen deposition in the mitigated scenario meaning that they would have capacity to take increased flows. An investigation of the effects of such a Right Turn Ban on the HRA air quality modelling was undertaken in late 2020 and is presented in Appendix F. It concludes that either a full or partial Right Turn Ban would be beneficial in that they both reduce the orange (medium) nitrogen and ammonia dose areas west of Robin Hood Roundabout that were otherwise forecast under the 2033 mitigated scenario (i.e. even with a CAZ and a significant shift from petrol cars to electric vehicles), without materially increasing the extent or location of yellow (small), orange (medium) or red (large) dose areas around Wake Arms Roundabout.

6.54 Moving to Figure 17, this shows the only part of the SAC forecast to be subject to a large residual in combination nitrogen dose even with mitigation (a core of this area will also be subject to a medium residual ammonia dose). The area involved is a small patch a maximum of 20m deep, opposite the Miller & Carter Steakhouse and totalling 630m^2. If the surrounding orange medium dose area is included, it increases to 910m^2. It is shown in the photograph below.

6.55 It can be clearly seen that the area affected by the large dose (up to 20m from the road) is mainly road verge with some young tree growth. A veteran English oak (the one ringed in red) does lie within the affected area but, although there is some evidence in the literature for negative effects on soil mycorrhizae, leaf chlorosis and increased risk of pathogen infection, and this tree does display some signs of stress, nitrogen deposition is not believed to have a direct, major effect on tree growth in the UK[72] and this is only one veteran tree out of the many in the SAC. Stress can be caused by factors other than air pollution; for example, there are clearly buried services in this location which could have caused root severance and damage.

6.56 Nonetheless, pollution cannot be discounted as a factor and there is an opportunity for the Council to investigate a slight northern realignment of the junction of Woodridden Hill (A121) with the traffic island that would shift the affected area further north towards the extensive tarmac and road verge on the opposite side of the road and thus away from this patch of SAC. Note that this is not currently part of the mitigation strategy and is only raised here for further consideration. It would be subject to its own HRA if it was determined to undertake such a realignment. In addition, the Council will develop a veteran tree management plan[73] that aims to increase the resilience of this tree and other veteran trees in this general area[74]. A commitment to Veteran Tree Management Plans is included in the Air Pollution Mitigation Strategy.

6.57 Figure 15 also shows that there is a 147m long and (at its broadest) 17m wide strip not covered by any transects on the eastern side of Epping Road that will be exposed to a medium residual nitrogen (although not ammonia) dose. It measures 0.2ha and also contains a single veteran English oak tree. It does not contain any records of rare plant species and is shown on the left of the below photograph. As with the forecast medium residual dose around transect N, the most that might be expected in this area is a slight difference in botanical composition compared to a situation with no growth, but the area would continue to constitute beech forest. As such it is considered that a residual medium nitrogen dose in this location would not undermine the integrity of the SAC, or significantly interfere with its achievement of conservation objectives, particularly remembering that, in contrast, 12% of the SAC would experience a net reduction in ammonia concentrations compared to the 2033 baseline and 5% would experience a net reduction in nitrogen deposition rates compared to the 2033 baseline.

[72] http://www.apis.ac.uk/node/965
[73] Veteran Trees: A Guide to Good Management. Available at: http://publications.naturalengland.org.uk/publication/75035
[74] Beyond the area subject to a large residual dose, the area subject to a medium-scale residual dose (20-30 metre from the roadside) includes a veteran Oak pollard which according to Natural England is also displaying similar signs of stress but an increased moss cover of 10%. From 30-50m from the road there are two veteran Oak pollards forecast to be subject to small residual doses that are in a similar in canopy condition with epiphytic moss/lichen cover reduced to 5% in the tree closest to the A104 road. There are also a number of veteran Beech trees with a higher canopy cover (60%) and on various sheltered mossy banks patches of the lichen *Cladonia* and cushion moss *Leucobryum* were present. These mossy patches occurred up to a distance of 75 metres near to old veteran Beech trees and also included the heather *Calluna vulgaris*.

Summary

6.58 In summary, both the transect results and the isopleth mapping show that in a mitigated scenario, the vast majority of the SAC will experience either a negligible NOx, ammonia or nitrogen dose, or a net reduction in ammonia and nitrogen deposition, compared to the 2033 baseline, once both mitigation and growth are included. It is also notable that all but one of the approach roads to Wake Arms Roundabout and Honey Lane would experience a net reduction in nitrogen deposition due to the mitigation, such that total nitrogen deposition would actually be lower than it would be with no growth. A total of 12% of the SAC (155ha) would experience a net reduction in ammonia concentrations compared to the 2033 baseline and 5% (72ha) would experience a net reduction in nitrogen deposition rates compared to the 2033 baseline.

6.59 Moreover, the areas are very small as a proportion of the SAC as a whole and the main role of NOx at the total concentrations forecast is as a source of nitrogen.

Pollutant	Areas in hectares subject to an increase in pollution relative to 2033 baseline (percentage of SAC)			Areas in hectares subject to a decrease in pollution relative to 2033 baseline (percentage of SAC)		
	Small dose	**Medium dose**	**Large dose**	**Small dose**	**Medium dose**	**Large dose**
NOx *(only areas where critical level is exceeded are included)*	1.7 (0.1%)	5.7 (0.4%)	5.4 (0.4%)	0	0	0
Ammonia	3.9 (0.3%)	<0.1 (<0.01%)	0	122.4 (9.3%)	22.7 (1.7%)	10.4 (0.8%)
Nitrogen	6.4 (0.5%)	0.6 (0.05%)	0.2 (0.02%)	62.3 (4.7%)	8.0 (0.6%)	2.3 (0.2%)

6.60 The Conservation Objectives for Epping Forest SAC as introduced in Section 3 of this report include objectives to maintain or restore the structure and function (including typical species) of qualifying natural habitats, and the supporting processes on which qualifying natural habitats and the habitats of qualifying species rely. In order to achieve that objective the supplementary advice with specific regard to NOx, ammonia and nitrogen deposition for both heathland and woodland is to '*…restore concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk)*'. The isopleth maps show that the critical level for NOx will continue to be exceeded up to c. 30m from the roadside on three links: on the A121 between Wake Arms Roundabout and the petrol station, the A121 from Wake Arms Roundabout to Honey Lane, and Epping New Road (A104) south of Wake Arms Roundabout. However, due to improvements in vehicle emissions technology, this is nonetheless a major improvement on the 2017 (baseline) situation where the critical level was exceeded up to 370m from the roadside on all approaches to Wake Arms Roundabout. Approximately 99% of the SAC will have fallen below the critical level for NOx by 2033 under both the 2033 baseline and Mitigated Scenarios. There is no prospect of ammonia concentrations or nitrogen deposition rates at Epping Forest SAC falling below the critical level for lichens (1µgm^{-3}) or critical load for beech woodland or heathland (10 kgN/ha/yr) by 2033 even with no growth. However, the Mitigated Scenario would not interfere with achievement of the Conservation Objectives and would in fact contribute positively relative to a situation with no growth by significantly increasing the amount of SAC subject to lower ammonia concentrations and nitrogen loads.

6.61 There are three areas where residual 'in combination' nitrogen doses greater than imperceptible would still be observed by 2033: a small patch to the south of Woodridden Hill (A121) and the junction with Wake Arms Roundabout, a short stretch of Epping Road north of Wake Arms Roundabout, and the road known as Cross Roads which lies between Robin Hood Roundabout and the junction where the southern end of Paul's Nursery Road meets Avey Lane/Cross Roads (the location of Transect N). At two of these three locations an ammonia dose greater than imperceptible would also be experienced. However, the worst affected area (a small patch 20m from Woodridden Hill at Wake Arms Roundabout) does not represent SAC habitat (woodland or heathland) being mainly road verge, only 8 veteran trees out of the vast number of veteran trees in the SAC are in these zones (such that it is not considered the forecast residual dose would materially interfere with the SAC objective to restore at least a third of ancient/veteran trees in open locations or with open halo around them) and no species on the Epping Forest Conservators rare species register lie in these areas. This last point is relevant because one of the specific objectives for the SAC is to maintain the abundance of the species listed (including the moss *Zygodon forsterii)* to enable each of them to be a viable component of the beech woodland on acid soils SAC feature.

6.62 Furthermore, there is an opportunity for Council to explore additional possible solutions that may address or minimise these residual issues, consisting of realigning the western approach to Wake Arms Roundabout slightly north, introducing a 'no right turn' ban at the junction between Honey Lane and Forest Side (see Appendix F), and/or introducing veteran tree management plans for specific trees, such as the eight identified above.

6.63 It is also important to note that this modelling could be considered precautionary:

a) some of the forecast 'in combination' traffic leading to these reported doses would not arise from Epping Forest District and is therefore not the Council's responsibility to mitigate, whereas for the purposes of this exercise the Council has identified measures sufficient to address the entire 'in combination' dose through the SAC, rather than simply that attributable to their Local Plan;

b) the Garden Villages have higher modal shift targets than the standard modal shift allowed for in this modelling so in practice there may be greater modal shift than has been allowed;
c) In practice, it is unlikely that all of the net new housing included in this modelling would come forward during the plan period. This element of potential non-delivery is a well-known planning premise and the emerging Local Plan addresses this by proposing to allocate sites which collectively would exceed the number of dwellings required in Policy SP1;
d) The traffic modelling used to underpin the air quality modelling used to inform this HRA assumes that all sites are 'greenfield'. Therefore, no account has been taken of those sites which currently generate traffic (i.e. gross rather than net traffic generation figures have been used). In addition, it takes no account of existing trips changing from vehicles to more sustainable modes.
e) The government's Clean Air Strategy 2019 has identified a number of actions unrelated to traffic that it would undertake to support reductions in the effects on habitats from ammonia, particularly regarding agriculture. These measures have not been accounted for in the reported modelling but may mean total ammonia concentrations at 2033 are lower than modelled;
f) As well as the CAZ and ULEV shift initiatives that are included in this modelling, the Mitigation Strategy produced by the Council contains a collection of measures that are not included in this modelling because their benefits cannot be quantified. However, they are still expected to play a role in reducing ammonia concentrations when combined with each other, and with the mitigation measures that have been modelled[75].
g) The Mitigation Strategy indicates the potential introduction of a 'trigger release' policy. Such a trigger would ensure that the site could not come forward for development until it could be demonstrated through future monitoring and modelling that the development of the site would not have an adverse effect on integrity or an unacceptably delayed achievement of the conservation objectives for the Forest.
h) The Council is committed to reviewing the modelling and Mitigation Strategy with each five-year plan review. This would not only allow the projections in this modelling to be checked against on-site monitoring data but could allow currently novel measures (identified for completeness in the Mitigation Strategy) to be trialled and implemented. If effective it may be possible to incorporate them in future modelling iterations. It also enables account to be taken of future autonomous measures arising from, for example, by the UK Government, such as bringing forward the date for the banning of petrol, diesel and hybrid cars or introducing national scrappage schemes. These factors mean that 2033 concentrations would be lower than forecast in this modelling. The primary mechanism for the approach to monitoring and review is provided by Policy D8 of the emerging Local Plan and the Air Pollution Mitigation Strategy, which states in Part C that '*Where appropriate, the Council will commence an earlier review of the Local Plan to address significant changes in circumstances. The Council will promptly commence a review of the Local Plan and update relevant policies accordingly if… the monitoring to be undertaken in the relevant adopted Mitigation Strategies as set out in Policy DM2, together with updated modelling outputs and Habitat Regulations Assessment indicates that the Council, as competent authority, can no longer conclude that the delivery of planned development will not cause adverse effects on the integrity of the Epping Forest Special Area of Conservation. This will include consideration of any delay in securing and delivering the required measures set out in those strategies. In considering these matters the Council will consult with Natural England and have regard to its advice.'*

6.64 In practice, therefore, it is possible that the 'mitigated scenario' nitrogen doses would in practice be lower than those reported in these data.

6.65 Taking all this into account, it is considered that, provided a CAZ is introduced from 2025, based on the current modelling outputs, the identified Council initiatives to shift ownership of petrol cars to electric vehicles are introduced from plan adoption and can achieve a 30% conversion of petrol cars to ULEVs by 2033, and the additional measures (such as a right turn ban at Honey Lane and veteran tree management plans) are included in the APMS, the integrity of the SAC would not be adversely affected by nitrogen deposition attributable to planned growth in the district to 2033 and would generally be positively affected by the planned mitigation measures, in terms of enabling the SAC to meet its conservation objectives.

[75] Note that these are distinct from measures that have been modelled but rejected as being ineffective

6.66 The relative value of the CAZ can be seen by examining that part of the nitrogen dose attributable solely to NOx in both Scenario 4 (unmitigated growth) and Scenario 4.5ULEZ (mitigation including a CAZ but no significant shift from petrol cars to electric vehicles). These data show that the introduction of a CAZ would reduce the roadside nitrogen dose attributable to NOx by a minimum of 30% (transect D1a), frequently by 60-80%, and in some cases (e.g. transect B1) by more than 100% (i.e. the CAZ not only offsetting the dose due to growth but resulting in slightly lower total deposition rates than in the absence of any growth). However, it can also be seen that even with a CAZ the nitrogen dose due to growth would still be a medium dose at the roadside of most transects and, in some cases (such as transect D1a), a large dose. This underlines the need for additional measures to drive a shift to electric vehicles even if no account was taken of ammonia emissions from traffic.

Necessary mitigation: Uptake of newer Euro6 standard petrol and diesel vehicles and a significant increase in Ultra-Low Emission Vehicles (ULEVs)

6.67 The modelling undertaken for the Local Plan makes it clear that in order to conclude no adverse effect on the integrity of the SAC a significant shift is required from older Euro standard vehicles to newer Euro standard vehicles <u>and</u> (in order to address ammonia emissions) from petrol cars to Ultra-Low Emission Vehicles (ULEVs)[76]. Having identified the target for shifting petrol cars to ULEVs in the modelling, strong, clear initiatives to maximise the shift are required for inclusion in the Mitigation Strategy. Note that although the conversion of petrol cars to ULEVs is what has been modelled for the Local Plan, adequately suppressing the forecast increase in traffic movements through the SAC such as through minimising parking availability or having 'ULEV only' spaces where appropriate and enforceable would have an equivalent benefit in removing emissions.

6.68 There is some uncertainty regarding the approach taken to model ammonia concentrations using emission rates for road traffic vehicles as emissions are not regulated in the same way as nitrogen oxides; however, the precautionary modelling undertaken suggests that to reduce the pollutant dose (particularly ammonia) that would otherwise occur by 2033 to an acceptable level, a minimum 30% conversion of petrol cars to ULEVs would be required by that year. The modelling also suggests that a conventional Clean Air Zone (CAZ) alone would <u>not</u> achieve a large enough shift to ULEVs. This is because the aim of a standard CAZ is to focus on NOx and particulate matter by promoting uptake of more recent Euro standards of conventional vehicles. Based upon the current knowledge of emissions of ammonia from road traffic, a simple shift from older to newer Euro standards would do a great deal to tackle NOx but little to address ammonia[77]. However, since there is greater knowledge, research and regulation regarding road traffic emissions of NOx, and NOx remains a significant source of nitrogen, the implementation of a CAZ is an important part of the overall strategy. Moreover, the CAZ charging framework will be a very useful tool in driving the conversion of petrol cars to ULEVs.

6.69 During 2019, 79,747 ULEVs were registered for the first time in Great Britain, an increase of 26% on 2018. The 2018 registrations were themselves up 20% on 2017 and 53% on 2016. In 2019 ULEVs accounted for 2.7% of all new vehicle registrations, up from 2.1% in 2018, 1.7% in 2017 and 1.2% in 2015[78]. A similar effect could be achieved by suppressing the forecast growth in traffic movements through the SAC.

6.70 Table 10 presents the composition of the car fleet operating through EFSAC derived from 2017 and 2019 ANPR data, and subsequently projected using Defra's Emission Factor Toolkit (v9.0) Fleet Projection Tool. The data show that there was a 100% increase in electric cars recorded using the EFSAC roads from 2017 to 2019.

[76] Electric cars are the specific type of ULEV that has been modelled. There are other emerging technologies (notably hydrogen) but these would have the same benefit for the SAC as they do not emit NO_2 or ammonia. A general shift in vehicles from petrol/diesel to electric will be encouraged by the mitigation strategy but it will be particularly important to target petrol cars due to their ammonia emissions.
[77] Emissions of NOx from road traffic are decreasing due to the implementation of tighter European type approval standards (Euro Standards). However, ammonia is produced by the control systems that are designed to reduce emissions of NOx from road traffic vehicles, and there are currently no limitations on emissions of ammonia. Emissions of ammonia are greater from petrol than from diesel cars, whilst the converse is generally the case for NOx.
[78] Sources of data: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/800502/vehicle-licensing-statistics-2018.pdf
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/882196/vehicle-licensing-statistics-2019.pdf

6.71 Applying Defra's EFT Fleet Projection Tool, it has been modelled that, without taking any specific measures at either the local or national scale, approximately 1% of the vehicle fleet using the EFSAC roads would be made up of electric cars in 2024, and approximately 2% would be made up of electric cars in 2030 (the latest year available in Defra's EFT). Note that the EFT ULEV conversion projections are low because they currently take no account of the government policy to ban the sale of all new petrol and diesel cars and vans from 2030 (with hybrids added from 2035) and are based entirely on voluntary consumer choice without significant encouragement or stimulation.

6.72 Table 10 shows that a 30% conversion would mean electric cars or other ULEVs accounting for 12-15% of the overall vehicle fleet in Epping Forest SAC by 2033 (rather than 2% in the absence of any measures either locally or by central government), with a similar reduction in petrol cars. This shift is equivalent to ~3000 car journeys a day by 2033, on the busiest roads in EFSAC (A121 and Epping Road)[79]. A similar effect could be achieved by suppressing the forecast growth in traffic movements through the SAC.

Table 10 - Car fleet composition - presented as percentage of vehicle fleet in terms of vehicle-km travelled using EFSAC. Ranges are provided as the percentage varies depending on the road in question.

Scenario / ANPR dataset	All cars as % of total traffic flow through EFSAC	% Petrol Car	% Diesel Car	% Full Hybrid Petrol Cars	% Plug-In Hybrid Petrol Cars	% Full Hybrid Diesel Cars	% Battery EV Cars
2017 ANPR	75-88%	35-46%	32-42%	1.3-2.3%	0.5-0.9%	<0.1-0.1%	<0.1-0.2%
2019 ANPR	73-85%	39-48%	30-33%	2.1-3.1%	0.9-1.2%	<0.1-0.1%	0.2-0.4%
Interim Year (base) - 2024	73-85%	36-45%	29-31%	4.0-5.2%	1.3-1.5%	1.1-1.2%	0.9-1.0%
Interim Year (10% shift from petrol to electric car)	73-85%	33-41%	29-31%	4.0-5.2%	1.3-1.5%	1.1-1.2%	4.5-5.5%
End of Plan (base) - 2030	73-85%	35-44%	25-27%	5.0-6.1%	4.0-5.6%	2.0-2.3%	1.8-2.1%
End of Plan (30% shift from petrol to electric car)	73-85%	24-31%	25-27%	5.0-6.1%	4.0-5.6%	2.0-2.3%	12-15%

Note: A range in percentages is presented as the vehicle fleet mix varies between the roads in EFSAC, as defined by the ANPR data.

6.73 Significantly, given the Local Plan assessment year of 2033, UK government policy is for 100% of new cars and vans registered in the UK to be a ULEV (i.e. electric vehicle or similar e.g. hydrogen) by 2030, although it is not currently included in the EFT projections. This is to be achieved by a total ban on the sale of new petrol and diesel cars and vans from that year. Therefore, a rapid acceleration in uptake in ULEVs can be expected over the plan period (particularly in the last 5-year period), and it is thus entirely possible that something approaching a 30% shift from petrol cars to ULEVs by 2033 could be achieved even without specific steps being taken by EFDC. For example, global electric car sales rose 43% in 2020 due to a considerable reduction in battery costs, and further falls in battery prices are predicted to bring the price of electric cars below that of equivalent petrol and diesel models, even without subsidies, by approximately 2025. It is also important to note that the 30% shift from petrol to electric cars is calculated based upon vehicle trips through EFSAC as opposed to the number of vehicles on the road. It therefore follows that a change of one petrol car to electric would have a disproportionate impact if it makes several journeys through forest.

6.74 However, passively relying on car owner reactions to government policy would not provide sufficient likelihood that the target 30% conversion of petrol cars to ULEVs would occur by 2033. Therefore, specific initiatives that are within the control of EFDC and designed to stimulate and encourage the replacement of petrol cars with electric vehicles are required.

6.75 According to Brook Lyndhurst (2015)[80], the evidence suggests that a package of well-designed financial incentives plus non-financial incentives, and possibly also investment in public charging infrastructure, may be the most effective

[79] Traffic flow on Epping Road in mitigated 'end of plan' scenario is 24,083 AADT. Percentage of petrol cars as proportion of vehicle fleet = 42.2% (10,165 AADT). 30% of 10,165
[80] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/464763/uptake-of-ulev-uk.pdf

means of increasing electric vehicle uptake (electric vehicles currently being the most common type of ULEV).

6.76 With that in mind EFDC need to have the following operating to enable a conclusion of no adverse effects on integrity:

1) Minimising the increase in traffic flows through the SAC as much as possible, by strongly limiting parking availability in sustainable locations, encouraging ULEV-only[81] parking spaces where these are enforceable and introducing controlled parking zones to discourage on-street parking.

2) Introducing initiatives to support walking, cycling and increased public transport use and ensuring these are included in planning consents where possible and appropriate.

3) Introducing a series of initiatives from the point of plan adoption that are directly intended to stimulate uptake of ULEVs to maximise the likelihood of achieving the conversion of 30% of petrol cars using the modelled roads to ULEVs by 2033 (beyond those that can be built into the CAZ as discussed above). These essentially involve:
   a) Awareness Raising Campaigns to promote the benefits of electric vehicles, the availability of charging infrastructure, and falling electric vehicle prices due to falling battery costs, to residents of Epping Forest District and particularly those who live in settlements surrounding the SAC;
   b) Ensuring that electric vehicle charging infrastructure is universally available in public and private parking spaces and that a significant proportion of new parking spaces have active EV charging provision (particularly rapid charging provision); and
   c) Positively incentivising the uptake of electric vehicles by (for example) introducing schemes to directly assist with ULEV purchase, adjusting the charging framework of any CAZ such that drivers of electric vehicles pay little to no tariff and providing electric vehicle owners with benefits such as free parking.

4) Introducing a Clean Air Zone covering the SAC from 2025. At its simplest this would involve charging people driving into the zone for doing so, every time they do so, based upon the age and type of their vehicle. The aim would be to encourage motorists to replace older vehicles compliant with outdated emissions standards with newer vehicles compliant with the latest emissions standards, particularly Ultra-Low Emission Vehicles or ULEVs, through a graduated charging system (for example, zero charge for ULEV owners, or an increased charge for petrol car owners). It would potentially also encourage those motorists who were able to utilise other routes to use those instead of the roads through the SAC. As a precaution no dynamic reassignment has actually been assumed in our modelling; however, it could be built into the CAZ as a deliberate objective of the charging strategy

6.77 The CAZ and initiatives to stimulate uptake of ULEVs are described in the EFDC document ‘Epping Forest Interim Air Pollution Mitigation Strategy’ and would be delivered in accordance with Policy DM2 of the Local Plan which states in part B1 that ‘*Epping Forest Interim Air Pollution Mitigation Strategy – To mitigate for potential or identified adverse effects on air quality arising from additional development in the District, all development giving rise to a net increase in average annual daily traffic, will be required to be mitigated in accordance with appropriate measures including those identified in the most up-to-date Air Pollution Mitigation Strategy adopted by the Council as a material consideration in the determination of planning and other relevant development related applications and proposals. Measures have been specifically identified in the Strategy to ensure no adverse effect on the integrity of the Epping Forest SAC. Development which is required to deliver measures on site or contribute to the delivery of off-site measures and the undertaking of monitoring will not be consented until such measures, and any necessary financial contributions required for their delivery, are secured.’*.

[81] Using the current DVLA/DfT definition, Ultra low emission vehicles (ULEVs) are ‘*vehicles that emit less than 75g of carbon dioxide (CO_2) from the tailpipe for every kilometre travelled, with a capability of travelling a minimum range of 10 miles with zero CO2 emissions’*. Since the original focus of development ULEVs was CO_2 the standard definition includes some hybrids. Hybrids will still have an effect on the SAC through emissions of NOx when operating when the battery is exhausted. Therefore, the definition of ULEVs relevant to Epping Forest SAC would exclude hybrids.

6.78 The supporting text for the policy expands upon this stating that '*In relation to air pollution the Council has adopted an Interim Air Pollution Mitigation Strategy (APMS) which sets out specific measures that the Council will implement during the lifetime of the Local Plan. These measures range from those which will help to limit the increase in the level of traffic using roads through the Epping Forest SAC and significantly increase the uptake of electric vehicles, through to the implementation of a 'Clean Air Zone' should future monitoring demonstrate that it is required. The APMS also includes targets against which progress will be assessed together with a Monitoring Framework, which includes for future on-site monitoring. This Monitoring Framework is necessary to ensure that progress towards the achievement of these targets is assessed and inform any necessary changes that may need to be made to the targets and measures and identified in the APMS or the Local Plan in terms of the quantum and location of development being proposed'*. .

6.79 Items 1, 2 and 3(a)-(c) above, concerning minimising parking in sustainable locations, maximising electric vehicle charging infrastructure and delivering opportunities for walking, cycling and public transport use, are directly facilitated by Policy T1 (Sustainable Transport Choices) of the Local Plan and would therefore be introduced and effective from the point of Local Plan adoption. Indeed, this policy is already being implemented where planning consent is being granted. This policy requires all development which results in an increase in vehicle parking spaces to ensure that those spaces have direct access to an electric vehicle charging point. Where appropriate and enforceable the Council will also seek minimum parking for petrol and diesel vehicles and/or ULEV-only parking spaces. Page 203 of the emerging Local Plan refers to '*Reduced Parking Development as being residential development which provides only the necessary on-site residents' car parking required to service the essential needs of the development. On sites subject to reduced parking development, provision should be made for on-site car clubs/car sharing or pooling arrangements, visitor parking and blue badge holders, and contributions will be sought for implementing Controlled Parking Zones in the vicinity of the development*'. Paragraph 3.92 of the emerging Local Plan states that '*Where practicable and for sites within 400m of a London Underground Station and/or within a Town Centre or comparable sustainable location, the Council will seek reduced parking provision, including car free development.".*

6.80 The APMS also includes a tariff to be paid by new residential development (commercial development mitigation to be determined on a case-by-case basis), commits to Awareness Raising Campaigns and commits to introducing electric vehicle charging points at all Council owned car parks, particularly around Epping Forest, commencing from the point of plan adoption or sooner. This latter is not part of a Local Plan policy since it does not constitute development. The Council has recently appointed a sustainable transport officer pursing this and other projects such as Demand Responsive Transport.

6.81 These are important initiatives since various pieces of research suggest that public charging infrastructure may have an equal or greater impact on EV uptake than financial incentives[82].

6.82 Initiatives towards Item 3(c) are to be further developed over the first part of the plan period such that they can be introduced as soon as possible, and prior to 2025.The more rapidly and easily deliverable initiatives will be in place from the point of plan adoption. The following are currently envisaged:

- 'In kind' incentives, such as:
    - the relaxation of parking charges for ULEVs
    - allowing ULEVs to use bus priority lanes; and/or
    - allowing ULEVs to park in places (e.g. Epping town centre) where ordinary cars are not permitted to park, or to park there for longer where there would be no operational highway issues in doing so. For example, Figenbaum and Kolbenstvedt (2013), based on an extensive evidence review, suggest that access to bus lanes have been as important to electric vehicle uptake in Norway as the main financial incentives for electric vehicles in regions with large-rush hour traffic (as is certainly the case around Epping), because of the time savings they afford electric vehicle owners. While the roads through Epping Forest SAC itself do not have bus lanes, providing a general freedom for ULEVs to use bus lanes , such as those within the Harlow and Gilston Garden Town, would incentivise residents of the District, including those in settlements around the SAC, to purchase ULEVs.

[82] Page 35 of Uptake of ULEVs (Brook Lyndhurst, 2015)
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/464763/uptake-of-ulev-uk.pdf

- Monies derived from the CAZ could be used to fund incentives which encourage people to buy ULEV's. Those motorists who are most likely to make frequent trips through the SAC would receive a greater financial incentive.
- Individual developers could provide incentives directly to residents to convert from petrol cars to ULEVs and this could be built into s106 agreements.
- The charging strategy for the CAZ could be structured in order to discourage petrol car owners from driving in the SAC at all.
- Publicising the ecological issues and air quality issues associated with not converting. This could also be used to counter-act perceptions about ULEVs. For example, people tend to think ULEV range is poor but despite early predictions that ULEVs would only be driven for low mileages, recent research in the UK and other countries indicates privately owned ULEVs are being driven for comparable mileages to ordinary cars.

6.83 These would all stand a high likelihood of being effective measures as the most commonly cited barriers to private car buyers buying an ULEV in the future are range concerns, purchase price and a lack of knowledge about/familiarity with ULEVs[83].

6.84 It is important to note that the assumption underlying the CAZ in AECOM's modelling is that it will encourage people to replace older Euro standard vehicles with newer ones and the assumed standards are in-line with those of a conventional CAZ:

- Euro 3 for motorcycles, mopeds, motorised tricycles and quadricycles (L category),
- Euro 4 (NOx) for petrol cars, vans, minibuses and other specialist vehicles,
- Euro 6 (NOx and PM) for diesel cars, vans and minibuses and other specialist vehicles,
- Euro VI (NOx and PM) for lorries, buses and coaches and other specialist heavy vehicles (NOx and PM).

6.85 Out of 141,463 vehicle journeys identified in the 2019 ANPR data survey, 33% of journeys (46,132) were made by vehicles that were not compliant with the standards outlined above. As discussed, the CAZ can be adjusted for Epping Forest SAC as a method of maximising uptake of ULEVs; for example, the charging strategy for a conventional CAZ primarily aims to target diesel vehicles and encourage owners of such vehicles to acquire the newest Euro standards vehicles (Euro 6) so as to reduce emissions of NOx and particulate matter. The Epping Forest SAC could have its charging framework adjusted to also target petrol car owners in order to reduce emissions of ammonia and be set so as to encourage such vehicle owners who make regular/frequent trips through the SAC to either move to ULEVs or avoid driving through the SAC entirely.

6.86 International comparisons suggest a positive relationship between financial incentives and ULEV uptake, and that the longer incentives are in place the greater the uptake, thus further underlining the value of introducing the initiatives prior to 2025 in order to maximise their value in achieving the necessary targets by 2033. However, there are also examples of countries with high incentives but low ULEV uptake. Therefore, the uptake in ULEVs and, in particular, the shift from petrol cars to ULEVs on the roads through the SAC would need to be monitored, tracked across each five-year review period. This could be done using number plate recognition as was undertaken to obtain the baseline fleet breakdown, as well as vehicle counts and monitoring queue lengths. If, at a given five-year review, progress was not sufficient then the incentives, CAZ and mitigation measures would need to be adjusted or the Plan updated to reduce the quantum of development.

[83] Ibid

6.87 In order to inform the relative pace of conversion to ULEVs, and track progress with air quality improvements following plan adoption, NOx, ammonia and nitrogen deposition for an early year in plan delivery (2024) were modelled. Since the amount of growth delivered by that time is much smaller than by 2033 the NOx, ammonia and nitrogen doses are naturally also much smaller. However, testing of growth and mitigation scenarios indicates that in an unmitigated 2024 Scenario large ammonia doses of up to 0.09 μgm^{-3}, large NOx doses of up to 10.6 μgm^{-3} and large nitrogen doses of up to 1.47 kgN/ha/yr would be recorded, underlining the fact that sufficient mitigation to achieve a minimum 10% shift from petrol cars to ULEVs (i.e. 4-5% of the Epping Forest vehicle fleet being ULEVs) would be needed by 2024/2025 in order to keep all forecast ammonia and nitrogen doses small to imperceptible on all transects (the exception being a temporary medium dose up to 10m from the roadside on transect E1 and at the immediate roadside of transect N)[84]. In other words, introduction of mitigation cannot be deferred until the CAZ is implemented in 2025 but must begin before the CAZ is in place and significant effort will be required to achieve the 2024 targets. This is largely because the modelled growth for 2024 includes not only future growth (not currently built or with planning consent) between 2020 and 2024, but also all housing and employment consented in Epping Forest District since the start of the Local Plan period (2011).

6.88 Since the AECOM modelling indicates that both a CAZ <u>and</u> measures to achieve a shift of petrol cars to ULEVs by 2033 are required, the review targets against which effectiveness would be measured are proposed to be:

- A minimum 10% conversion of petrol cars to ULEVs by 2025, in other words, 4-5% of the Epping Forest SAC vehicle fleet to be ULEVs by this year;
- The introduction of a Clean Air Zone from 2025;
- A minimum 20% conversion of petrol cars to ULEVs by 2029 and the continued effectiveness of the CAZ in comparison to its modelled effectiveness; and
- A minimum 30% conversion of petrol cars to ULEVs by 2033 (12-15% of the Epping Forest SAC vehicle fleet being ULEVs by this year) and continued effectiveness of the CAZ in comparison to its modelled effectiveness.

6.89 Since there can be no absolute certainty the necessary percentage conversions of petrol cars to ULEVs (or comparable suppression of forecast additional trips) will be achieved, a safeguard is required to ensure no adverse effect on SAC integrity arises. Epping Forest District Council is introducing the initial pre-CAZ measures (i.e. those outlined in paragraph 6.76 above) and then monitor the effectiveness of those measures. If, by 2025, the 10% conversion (i.e. 4% of traffic being ULEVs) wasn't achieved then the Council, through Policy D8, has made it clear that the release of any further growth would be contingent on a review of the plan and/or the implementation of the CAZ/other measures that did achieve that 10% conversion, unless the forecast mitigated air quality results for 2025 were achieved by other means. Similarly, if the total package of mitigation measures including the CAZ did not appear to be on track to achieve the necessary air quality targets by 2029 and 2033 compared to their forecast effectiveness, the release of further growth would be contingent on alternative measures to achieve those targets being identified, unless the forecast mitigated air quality results for 2029/2033 were achieved by other means. This would therefore protect the SAC from the uncontrolled release of growth failing to keep pace with air quality improvements.

6.90 In addition to these targets, other factors could also result in the achievement of the air quality modelling predictions, such as a lower increase in traffic growth than that assumed in the modelling. Therefore, on site air quality and traffic monitoring will also be key elements in assessing effectiveness.

[84] Even this level of mitigation at this early point in the plan period would leave residual large NOx doses at 2025, but these would be temporary and, as already discussed in Chapter 5, the main role of NOx at the concentrations forecast would be as a source of nitrogen.

6.91 A Natural England site visit indicates that heathland plants may occur at approximately 30-40m from the roadside at transect E1, and that the rare sundew *Drosera intermedia* is located approximately 60m from this roadside. These are both areas forecast to experience a temporary small nitrogen dose in 2024 even under a mitigated scenario. Natural England advice identifies that similar species have exhibited increases in mortality with increased nitrogen fertilization affecting both survival and reproduction at rates above 10 kgN/ha/yr and the baseline deposition rates at this location are well above this load and will continue to be so by 2024/25. Maintaining and restoring a viable population of *Drosera* species as part of the wet heath feature is a listed conservation objective for the Epping Forest SAC. The likely increase in nitrogen that may be attributed to the EFDC Local Plan Mitigated Scenario for 2024 at this location is predicted to be small (when considered as a percentage of the 10 kgN/ha/yr Critical Load) and is predicted to only be a temporary situation, with declines in dose by 2033 to levels *below* the predicted 2033 baseline (without growth). However, Natural England highlighted the risks of even small increases in Total Nitrogen deposition to this small population, recognising that it is a vulnerable plant of importance to the character of the SAC wet heath population (this being the only site in Essex) and that detrimental effects on *Drosera* species have been recorded to occur above 4kgN/Ha/Year. The Supplementary advice to Epping Forest Conservation Objectives advises as follows: *'It should be noted that the bog pools and transitional bog communities supporting Sphagnum moss species of the H1/M16 mosaic may be more vulnerable to Nitrogen deposition than the overall dry heath habitat and therefore require a lower critical load of between 5 – 10kg N/ha/year. Furthermore, where transitions to include acid grasslands exist, these areas may also require a lower critical load of 8 kg N/ha/year. This should be taken into account when making judgments about the restoration and conservation of the H1/M16 mosaic and H1/acid grassland areas, either on a unit basis where detailed survey-based information exists or on a precautionary basis for the whole heathland resource'.*

6.92 Local site-based measures may therefore be necessary in the short term until 2025 to increase the resilience of the aforementioned *Drosera* species and align with the SAC conservation objectives. This would recognise this species is a key attribute of the wet heath SAC feature and address any possible effects of predicted increases in nitrogen deposition rate between Local Plan adoption and 2024/25. Local site-based measures such as Veteran Tree Management Plans for the veteran oak at Wake Arms Roundabout may also be necessary in the longer term even with the introduction of a CAZ and the 30% shift from petrol cars to ULEVs by 2033. Natural England have also advised that the extent and abundance of the cushion moss *Leucobryum* be surveyed and monitored in the vulnerable areas as part of the necessary monitoring programme to inform the Local Plan interim reviews. All of these have been included in the Interim APMS.

6.93 The table below includes Natural England's suggestions for site-based measures that could be taken forward for both *Drosera intermedia* and veteran trees.

SAC feature	Measure	Beneficial - Evidence
Wet heath – *Drosera intermedia*	Increase the range of wet conditions within site through targeted turf removal and scrapes.	There is some evidence that increased wetness of wet heath may counter the damaging effects of air pollutants on some of the constituent scarce species (see Payne et al 2016). In N polluted areas, increased wetness can improve habitat suitability for bog species, although the continued excess N deposition will restrict the range of species that may occur. Although initial site investigations have sought to better understand the specific eco-hydrology of Sunshine Plain it is not clear whether any targeted measures to conserve the perched water table are feasible. Acknowledging this current constraint whilst also recognizing that active intervention is necessary to increase the resilience of this *Drosera intermedia* population, it is regarded as likely to be beneficial to create increased variation in local microtopography in targeted areas to provide a range of colonisation opportunities with varying levels of soil moisture (see IUCN Review of Peatland Biodiversity). This should aim to be compatible with recently practiced conservation management techniques such as turf stripping, scrapes and grazing in Epping Forest heathland. It should however be undertaken at a smaller and more localised scale with careful consideration of the existing population, the surrounding notable

		vegetation and micro-topography with consideration of the water table and the function of the humus layer in soil water retention. The larger scale works described have all been shown to locally increase heathland flora diversity when compared with adjacent heathland areas, and support abundant germinating Heather and Cross leaved Heath. Additionally conservation grazing has been shown to significantly reduce the dominance and tussock cover of Molinia and increase the cover of bare ground, germinating Heather and scarce sedges (Dagley & Samuels 1999).
Woodland – veteran Beech	Soil Mulching	Flores Fernández et al. (2019) demonstrated that mulch aided the recovery of soil structure of a compacted forest soil in Germany. Mulching also increases fine root growth in the surface horizons, and enhances soil biological functioning. It is important to apply mulch to an appropriate thickness (between 5 cm to 7.5 cm maximum), to facilitate rainfall percolation and oxygen diffusion into the underlying soil. Mulching is clearly a management intervention which moves beyond natural litter accumulation beneath trees, but it appears to fit with the ethos of the Adaptation Principles listed in Annex AM3 of Moffat (2019). Mulch will also provide nutrients available for uptake by the tree, and help to counter any deficiencies due to inherent soil infertility, the effects of atmospheric pollution and nutrient removal by vegetation. The RHS website gives further guidance on the practice of mulching (see RHS mulching advice).
Woodland – veteran Oak	Soil Mulching	See mulching above – Oak and Beech may beneficially require different mulch quality and decisions need to account for soil conditions etc. For example, see limitations described for veteran Oak at Sherwood Forest https://barton-hyett.co.uk/2018/04/10/thinking-arbs-day-sherwood-forest/ Also, alignment with Hatfield Forest research work undertaken by University of Reading and National Trust best practice (National Trust pers. comm.). This involves use of appropriate Epping Forest-derived mulch and consideration of soil aeration techniques where appropriate.

6.94 As set out above monitoring would also be used to track the actual change in pollutant concentrations against the projections in the HRA modelling, as ensuring actual pollutant concentrations match or exceed modelled forecasts is ultimately the objective of both the CAZ and the target percentage shifts from petrol cars to ULEVs set out in the preceding paragraphs. This will consist not only of regular repeats of the baseline air quality monitoring but also the location of a continuous monitoring station in the SAC. For example, if vehicles other than petrol cars convert to ULEVs that may still result in an improvement in pollution, as would there be if there are reductions in the predicted growth in traffic and queue lengths. Other external influences which may have a beneficial effect to air quality within the Epping Forest SAC include the proposed changes to the London ULEZ in 2021 to extend it to cover all of London within the North and South Circulars and to the changes in Vehicle Emission Standards in the London LEZ which extends to the edge of parts of the District boundary. None of this alters the mitigation requirements for the dose attributable to the Local Plan but could mean pollutant concentrations and deposition rates are closer to the critical level and critical load by 2033 than is forecast in the HRA modelling.

6.95 Potentially, the housing numbers for the plan period would also need to be adjusted but that is a possibility at a five-year Local Plan review in any event. This is facilitated by Policy D8 of the Local Plan, which facilitates review of the Plan to address significant changes in circumstances including if monitoring indicates that the Council, as competent authority, can no longer conclude that the delivery of planned development will not cause adverse impacts on Epping Forest Special Area of Conservation. The review would be undertaken in consultation with Natural England. This policy would serve as a brake on development if issues with delivery of the mitigation strategy, or its effectiveness, arise.

7. Appropriate Assessment: Water Abstraction

7.1 The following site allocations and policies could not be dismissed in the initial sift from potentially posing likely significant effects upon the Lee Valley SPA/ Ramsar site internationally designated sites as a result of changes to water levels due to abstraction for public water supply. They are therefore discussed further in this Chapter:

<u>Policies</u>

- Policy SP 1: Spatial Development Strategy 2011-2033
- Policy E 1 (Employment Sites). Provides for new employment sites as well as improvements to existing sites; however no quantum of development is identified.

<u>Site Allocations</u>

- All residential and employment sites in combination as set out in Chapter 5: Places

7.2 Policies within the Plan do provide a positive contribution towards reducing the need for water supply as follows:

- The pre-amble to Policy DM 2 (Epping Forest SAC and the Lee Valley SPA) provides a positive contribution to the plan ensuring that no likely significant effects occur as a result of the Plan. It provides for HRA of projects or plans that are *'likely to give rise to significant impact on the integrity of the sites'.*
- Policy DM 19 (Sustainable Water Use). This is a positive development management policy that provides for enhanced water use efficiency, thus reducing the need for water abstraction. This policy also provides for the tightening the consumption of water to 110 litres per person per day or less (i.e. 30% less than the average).

Lee Valley SPA/Ramsar site

7.3 Almost all settlements within Epping Forest District receive their potable water supply through Affinity Water. Within its catchment Affinity Water abstracts water from tributaries of Lee Valley SPA/Ramsar site.

7.4 The Lee Valley SPA/Ramsar site consists of four Sites of Special Scientific Interest, of which Turnford and Cheshunt Pits SSSI, Rye Meads SSSI and Amwell Quarry SSSI all lie on the Hertfordshire/Essex border. Walthamstow Reservoirs SSSI lies within the London Borough of Waltham Forest. Walthamstow Reservoirs is a sealed storage reservoir and part of the public water supply infrastructure for London. Rye Meads is unlikely to ever suffer from a shortage in water quantity due to its close relationship with Rye Meads Wastewater Treatment Works. However, the quarries could theoretically be adversely affected if groundwater abstraction for public water supply was sufficiently great to cause drawdown of water levels.

7.5 Affinity Water's current Water Resource Management Plan covers the period up to 2080 and states that an HRA of the WRMP has been undertaken and that they have been able to demonstrate sufficient alternative supply options to ensure that adverse effects on Internationally important sites can be avoided. As such, it can be concluded that delivery of the Epping Forest District Local Plan will not result in adverse effects on Lee Valley SPA/Ramsar site through excessive water drawdown, either alone or in combination with other plans and projects.

8. Appropriate Assessment: Water Quality

8.1 The following site allocations and policies could not be dismissed in the initial sift from potentially posing likely significant effects upon the Lee Valley SPA/ Ramsar site internationally designated sites as a result of changes to water quality from treated wastewater discharge. They are therefore considered further in this Chapter:

Policies

- Policy SP 1 (Spatial Development Strategy 2011-2033)
- Policy E 1 (Employment Sites). Provides for new employment sites as well as improvements to existing sites; however no quantum of development is identified.

Site Allocations

- All residential and employment sites in combination as set out in Chapter 5: Places

8.2 Policies within the Plan do provide a positive contribution towards good water quality as follows:

- The pre-amble to Policy DM 2 (Epping Forest SAC and the Lee Valley SPA) provides a positive contribution to the plan ensuring that no likely significant effects occur as a result of the Plan. It provides for HRA of projects or plans that are '*likely to give rise to significant impact on the integrity of the sites*'.
- policy DM 16 (Sustainable Drainage Systems). By definition, sustainable drainage systems would not result in likely significant effects upon internationally designated sites. This is a positive policy as it aims to result in a net improvement in water quality discharge to a sewer, improve water quality and reduce runoff.
- Policy DM 18 (On Site Management of Waste Water and Water Supply). This is a positive development management policy as it ensures that the public sewerage network has sufficient capacity to serve existing and new development, thus preventing a reduction in water quality.

Lee Valley SPA/Ramsar site

8.3 Change in water quality is the main pathway through which the Lee Valley SPA/Ramsar site could be adversely affected. Two parts of the Lee Valley SPA/Ramsar site lie within East Herts: Amwell Quarry and Rye Meads. The nearest proposed development site to a part of Lee Valley SPA/Ramsar site is 760m distant, so direct surface water runoff effects on water quality will not arise. However, Rye Meads consists of non-operational land at and around the Rye Meads Wastewater Treatment Works (WwTW). Parts of the SPA consist of open water but other parts consist of fen or marsh vegetation that would theoretically be susceptible to nutrient enrichment from treated wastewater.

8.4 'Poor fens' (i.e. acidic fens) are strongly nitrogen limited. In other words, nitrogen availability is the factor which ultimately controls vegetation response to other nutrients and a small change in nitrogen inputs can result in a major change in the vegetation composition. In contrast, other types of fen with a relatively alkaline pH (called 'rich' fens) such as those at Rye Meads are phosphorus-limited, meaning that phosphorus availability is the factor which ultimately controls vegetation response to other nutrients. This also applies to fluvial flood-plain grasslands like those at Rye Meads SSSI. In a phosphorus limited system, high nitrogen availability will not result in a deleterious effect on vegetation provided that phosphorus availability is controlled[85]. That is not to say that nitrogen inputs would therefore be irrelevant, but it does mean that when nitrogen is already in excess (and phosphorus inputs can be controlled) a proportionate response must be made to the risk posed by small additional nitrogen inputs. Effluent discharges from Rye Meads Sewage Treatment Works (STW) into Tollhouse Stream. The stream flows through the SSSI and has been known to back up into the marsh grassland parts of the SSSI during periods of high flow.

8.5 The current discharge consent for Rye Meads WwTW has been subjected to a review by the Environment Agency and Thames Water (Review of Consents) specifically for the purpose of determining whether the current consented phosphorus limits on the discharge are leading to an adverse effect on the Lee Valley SPA/Ramsar site, and if so, to amend the consent in order to avoid such an effect. As such, provided effluent from new development within the Rye

[85] '*In a nutrient limited system, excess of the non-limiting nutrient may not result in any signs of enrichment in the vegetation as the plants are unable to make use of one nutrient without sufficient amounts of the other*'. Source: Understanding Fen Nutrients http://www.snh.gov.uk/docs/A416930.pdf

Meads catchment can be accommodated within the existing volumetric discharge consent for the WwTW it can be concluded with confidence that an adverse effect on the SPA/Ramsar site is unlikely to occur from this pathway.

8.6 However, once the WwTW ceases to have capacity within its existing discharge consent for effluent from additional dwellings, it will be necessary for Thames Water to apply to the Environment Agency to increase the consented discharge volume, or direct flows to an alternative treatment facility. The Environment Agency is very unlikely to consent to an increase in discharge volume from the WwTW unless the phosphate concentration within the effluent can be further tightened to ensure no deterioration in water quality in Tollhouse Stream. There is a technical limit (known as the limit of Best Available Technology) to how much phosphorus removal a WwTW can incorporate. If this situation arises, there is a risk that future dwellings within the catchment could not be accommodated at Rye Meads WwTW, requiring an alternative treatment solution that does not as yet exist. Investigating these issues was one of the purposes of the Rye Meads Water Cycle Study (2009). Water quality is therefore an important pathway to investigate with regard to future development within the Rye Meads WwTW catchment.

8.7 With regard to Epping Forest District, as identified in Table 4 the Garden Communities around Harlow and the settlement of Lower Sheering are located within the catchment of Rye Meads WwTW, and are likely to provide approximately 3,970 new dwellings between them. The bulk of wastewater volumes treated by the WwTW come from Stevenage, Welwyn Garden City and Harlow but settlements in Epping Forest District also make a contribution, particularly the Garden Towns around Harlow.

8.8 The current discharge consent for Rye Meads WwTW has been subjected to a review by the Environment Agency and Thames Water (Review of Consents) specifically for the purpose of determining whether the current consented phosphorus limits on the discharge are leading to an adverse effect on the Lee Valley SPA and Ramsar site, and if so, to amend the consent in order to avoid such an effect. The Harlow WCS[86] undertook a headroom assessment of Rye Meads WwTW in relation to committed and planned future growth scenarios with Harlow and six neighbouring authorities (East Hertfordshire, North Hertfordshire, Stevenage, Welwyn Hatfield, Epping Forest and Broxbourne). The catchment of Rye Meads WwTW is expected to accommodate growth within Harlow as well as a large portion of development within the neighbouring six authorities. The WCS states: the *'headroom assessment undertaken by JBA … indicates that Rye Meads has capacity to accommodate growth within Harlow and surrounding authorities over the plan period, within the current permitted DWF discharge of 110 ML/d.*

8.9 Additionally, Rye Meads WwTW is undergoing an upgrade in treatment capacity and to improve discharge quality standards (up to 447,134 Population Equivalent) that is due for completion in 2019[87]. Thames Water currently expects that Rye Mead WwTW will have sufficient headroom capacity until 2036 and thus be able to cover the plan period. As such, since effluent from new development within the Rye Meads catchment can be accommodated within the existing volumetric discharge consent for the WwTW it can be concluded with confidence that an adverse effect on the SPA and Ramsar site is unlikely to occur from this pathway alone or in combination with other plans and projects.

8.10 However, it will be necessary to ensure that development within the catchment of Rye Meads WwTW to keep pace with the provision of wastewater treatment infrastructure and environmental capacity there.

[86] JBA Consulting (September 2018) Harlow Gilston Garden Town Water Cycle Study update (Final Report)
[87] Thames Water October2018 Position Statement On Development In The Greater Harlow Area

9. Summary of Conclusions

9.1 It is considered that with the delivery of the urbanisation/recreational pressure and air quality mitigation packages to which Epping Forest District Council is committed a sufficient protective framework exists to ensure that there will be no adverse effect on the integrity of any Internationally important sites including Epping Forest SAC.

Appendix A European Designated Sites Background

Epping Forest SAC

Introduction

Part of the Epping Forest SAC is located within Epping Forest District. Approximately 70% of the 1,600 hectare site consists of broadleaved deciduous woodland, and it is one of only a few remaining large-scale examples of ancient wood-pasture in lowland Britain. Epping Forest SAC supports a nationally outstanding assemblage of invertebrates, a major amphibian interest and an exceptional breeding bird community.

Reasons for Designation[88]

Epping Forest qualifies as a SAC for both habitats and species. Firstly, the site contains the Habitats Directive Annex I habitats of:

- Beech forests on acid soils with *Ilex* and sometime *Taxus* in the shrublayer.
- Wet heathland with cross-leaved heath; and
- Dry heath

Secondly, the site contains the Habitats Directive Annex II species Stag beetle *Lucanus cervus*, with widespread and frequent records.

Current Pressures and Threats[89]

- Air pollution
- Under grazing
- Public disturbance
- Changes in species distribution
- Inappropriate water levels
- Water pollution
- Invasive species
- Disease

Conservation Objectives

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

Lee Valley SPA and Ramsar Site

Introduction

The Lee Valley comprises a series of embanked water supply reservoirs, sewage treatment lagoons and former gravel pits along approximately 24 km of the valley. These waterbodies support internationally important numbers of wintering gadwall and shoveler, while the reedbeds support a small but internationally important population of bittern. In addition to the ornithological interest, the site also qualifies as a Ramsar site on account on rare and scarce plants and invertebrates present.

The Lee Valley SPA/Ramsar consists of four Sites of Special Scientific Interest, of which Turnford and Cheshunt Pits SSSI, Rye Meads SSSI and Amwell Quarry SSSI all lie on the Hertfordshire/Essex border. Walthamstow Reservoirs SSSI lies within London Borough of Waltham Forest. The Special Protection Area is managed by the Lee Valley Regional Park Authority and by Thames Water.

Reasons for Designation

The Lee Valley site is designated as an SPA[90]: for its Birds Directive Annex I and Ramsar site under criterion 6[91] for species that over-winter, and these are:

- Bittern Botaurus stellaris;
- Gadwall Anas strepera;
- Shoveler Anas clypeata.

In addition, the site qualifies as a Ramsar under criterion 2[92], by supporting the nationally scarce plant species whorled water-milfoil *Myriophyllum verticillatum* and the rare or vulnerable invertebrate *Micronecta minutissima* (a water-boatman).

Current Pressures and Threats[93]

- Water pollution
- Hydrological changes
- Public disturbance
- Inappropriate scrub control
- Fishing

[88] JNCC (2015) Natura 200 Standard Data Form: Epping Forest SAC
[89] Natural England (2015). Site Improvement Plan: Epping Forest SAC
[90] http://jncc.defra.gov.uk/page-2047-theme=default [accessed 09/11/2017]
[91] http://jncc.defra.gov.uk/pdf/RIS/UK11034.pdf [accessed 09/11/2017]
[92] Ibid
[93] http://publications.naturalengland.org.uk/file/5788502547496960 [accessed 09/11/2017]

- Air pollution
- Inappropriate cutting and mowing
- Invasive species

Conservation Objectives[94]

With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified (the 'Qualifying Features'), and subject to natural change;

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;

- The extent and distribution of the habitats of the qualifying features
- The structure and function of the habitats of the qualifying features
- The supporting processes on which the habitats of the qualifying features rely
- The population of each of the qualifying features, and,
- The distribution of the qualifying features within the site.

Wormley-Hoddesdonpark Woods SAC

Introduction

This SAC consists of two SSSIs – Wormley-Hoddesdonpark Woods North and Wormley-Hoddesdonpark Woods South and is situated on the southern border of East Herts, with part of the SAC in Broxbourne. The semi-natural woodland is of national importance as an example of lowland south-east sessile oak/hornbeam type with the pedunculate oak/hornbeam variant also present. Additionally, small ponds and streams are important habitats for bryophytes.

Reasons for Designation[95]

Wormley-Hoddesdonpark Woods qualifies as a SAC through its habitats, containing the Habitats Directive Annex I habitat:

- Oak-hornbeam forests – this is one of only two outstanding locations for such habitat in the UK.

Current Pressures and Threats[96]

- Disease
- Invasive species
- Air pollution
- Deer
- Illicit vehicle
- Woodland/ forestry management
- Recreation

[94] http://publications.naturalengland.org.uk/file/5168095937167360 [accessed 09/11/2017]
[95] http://jncc.defra.gov.uk/protectedsites/sacselection/sac.asp?EUCode=UK0013696 [accessed 09/11/2017]
[96] http://publications.naturalengland.org.uk/file/6541134543192064 [accessed 09/11/2017]

Conservation Objectives[97]

With regard to the SAC and the natural habitats and/or species for which the site has been designated (the 'Qualifying Features'), and subject to natural change;

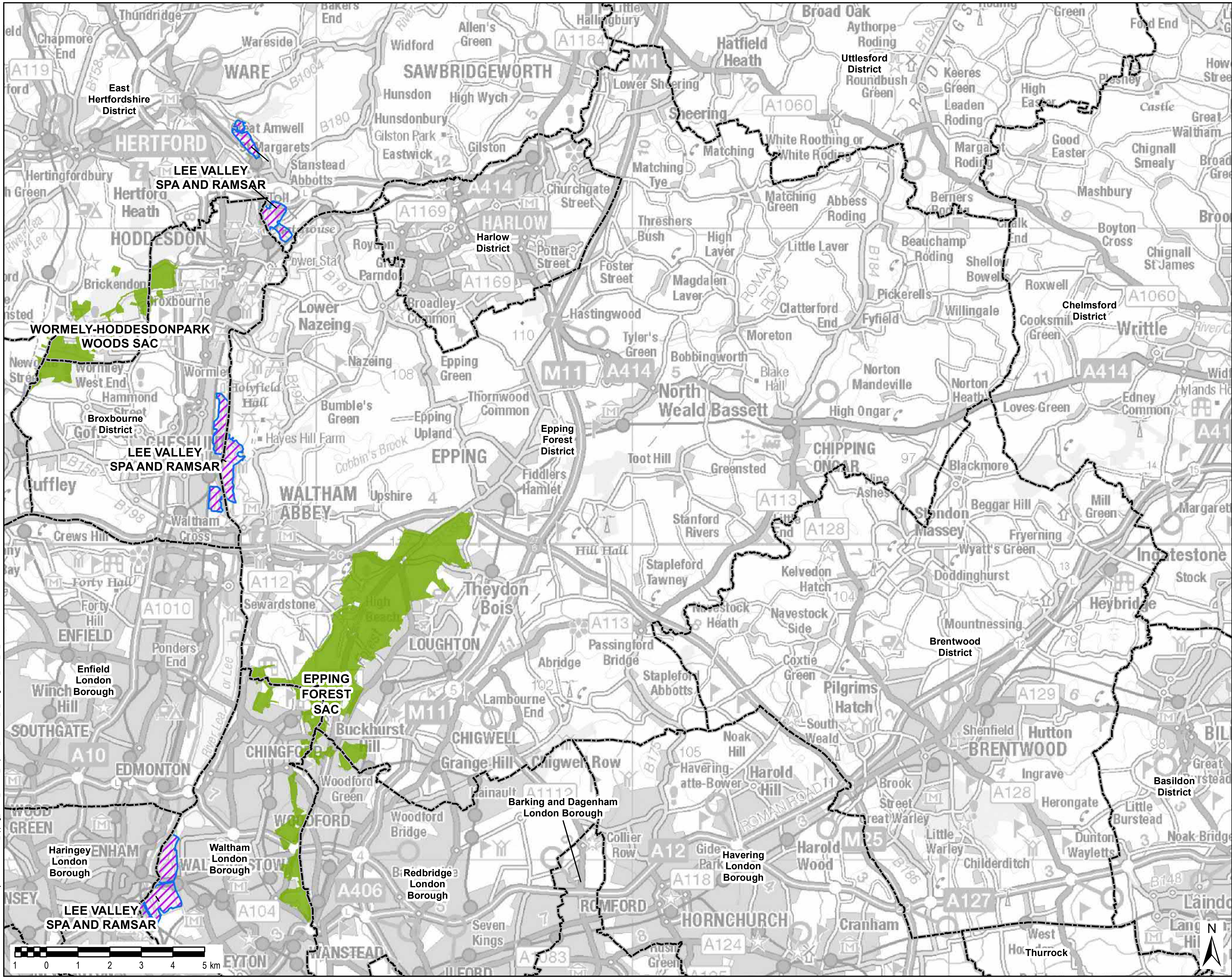
Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;

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

[97] http://publications.naturalengland.org.uk/file/6475250191564800 [accessed 09/11/2017]

Appendix B Maps

Figure B1: Locations of Internationally Designated Sites



LEGEND

- District Boundaries
- Ramsar
- Special Area of Conservation (SAC)
- Special Protection Area (SPA)

Purpose of Issue
DRAFT

Client
EPPING FOREST DISTRICT COUNCIL

Project Title
EPPING FOREST HRA

Drawing Title
LOCATIONS OF INTERNATIONALLY DESIGNATED SITES

Drawn	Checked	Approved	Date
CN	AH	IHH	19/10/2016

AECOM Internal Project No.	Scale @ A3
60512493	1:110,000

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Drawing Number
FIGURE A1

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01

File Name: I:\5004 - Information Systems\60512493_Epping_Forest_HRA02_Maps\A1_Locations_of_designated_sites_A3_20161018.mxd

Figure B2: Location of Site Allocations Relative to Epping Forest SAC

Epping Forest District Council
Legend
Epping Forest District Boundary
Proposed Green Belt Boundary
Allocations & Designations
Masterplan Area
Concept Framework Plan Area
Residential Allocation
Residential & Traveller Allocation
Traveller Allocation
Employment Designation
Employment Allocation
Mixed Use Allocation
Epping Forest SAC & Buffers
SAC
400m
1,000m
3,084m
6,176m
Masterplan Area required to provide strategic SANG
Date: September 2020
Scale: 1:50,000 @A0
Contains Ordnance Survey & Royal Mail Data
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N
East of Harlow Strategic Masterplan Area
Water Lane Strategic Masterplan Area
Latton Priory Strategic Masterplan Area
South Nazeing Concept Framework Plan Area
North Weald Airfield Strategic Masterplan Area
North Weald Bassett Strategic Masterplan Area
West Ongar Concept Framework Plan Area
Lee Valley Regional Park
Waltham Abbey North Strategic Masterplan Area
South Epping Strategic Masterplan Area

Appendix C Traffic Modelling Technical Note

Epping Forest Local Plan

Epping Forest Habitats Regulations Assessment - Traffic Modelling

06 August 2020

Epping Forest District Council / Essex Highways

B3553R9A

Epping Forest Local Plan

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Contents

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1. Introduction

Jacobs were commissioned by Epping Forest District Council (EFDC) to prepare a package of VISSIM microsimulation traffic models for the Epping Forest Special Area of Conservation (SAC) to inform air quality assessments in support of the Epping Forest District Local Plan Submission Version (LPSV) for Examination in Public (EiP). On completion of the EiP, the Inspector's Advice After Hearings (ED98[1]) sought additional assessment and mitigation proposals for air quality impacts in the SAC as well as Main Modifications to some development allocations.

This Technical Note updates previous traffic modelling assessments, submitted in January 2019 as Appendix C to the AECOM Habitats Regulation Assessment (HRA) as evidence (EB209[2]) for the EiP, to reflect the most recent data and forecast assumptions to support revised air quality assessments in the SAC.

It was agreed at the outset that the VISSIM modelling software provided the necessary speed, traffic and network performance outputs required to assess the more detailed traffic related impacts to air quality. Remaining consistent with the previous work, the models have been specifically developed to provide forecast traffic data for air quality assessment to be undertaken by AECOM.

The PTV VISSIM version 11.00-02 software was used in the development of the models for this study. The 2017 base models include AM and PM peak hours, which have been calibrated and validated in line with the Transport for London (TfL) VISSIM Model Audit Process (VMAP). The calibrated and validated peak hour base models have also been used to develop peak, inter-peak and out of peak models to assess the impact of Annual Average Daily Traffic (AADT) flows for the base year and 2033 as the end of the Plan period. An interim year traffic forecasts for 2024 has also been provided to represent a potential 5-year review period following the EiP date.

This Technical Note provides details to demonstrate the calibration and validation of the VISSIM models. A series of forecasting scenarios have been tested to assess the incremental and combined impact of traffic growth resulting from the EFD Local Plan Submission Version as well as growth in the other Housing Market Area (HMA) Districts and other neighbouring Districts and London Boroughs. Combinations of potential mitigation measures have also been tested to align with options being tested in a separate Transport Assessment Report in support of the LPSV. Details and a summary of outputs provided to AECOM of the scenarios tested are presented in this Note.

It should be noted, given the different data sets and modelling software used, results presented in this report may vary from outputs presented in the separate Transport Assessment Report, which provides a more detailed appraisal of the 'worst-case' peak hours and overall network mitigation.

[1] https://www.efdclocalplan.org/wp-content/uploads/2019/08/ED98-Epping-Forest-Post-hearing-Advice-Aug-2019-V1-final.pdf
[2] https://www.efdclocalplan.org/wp-content/uploads/2019/02/Epping-Forest-Local-Plan-HRA-2019_v3.pdf

2. Purpose and Scope of the Modelling

The primary purpose of this work is to provide traffic modelling scenarios and outputs, including predicted AADT traffic flows, expected queue lengths, queue duration, average vehicle speed, and proportion of heavy goods vehicles to the air quality consultants AECOM.

The models were developed in line with the Transport for London (TfL) VISSIM Model Audit Process (VMAP) as a sound source of industry best practice and to ensure consistency in the approach to model development.

A study area was agreed with Natural England and AECOM to include the highway network specifically within the Epping Forest Special Area of Conservation (SAC). The study area consists of 5 junctions centred on the intersection of the A121 / B1393 / A104 / B172 at the 5-arm roundabout known locally as 'Wake Arms Roundabout'. The study area extends west towards the M25 Junction 26, as far as the A121 Woodgreen / Honey Lane junction, south towards the A104 / Earl's Path 'Robinhood Roundabout' and further west to include a section of Avey Lane up to the A112 Sewardstone Road. Figure 2.1 shows the extent of the VISSIM modelling and the key junctions to be analysed.

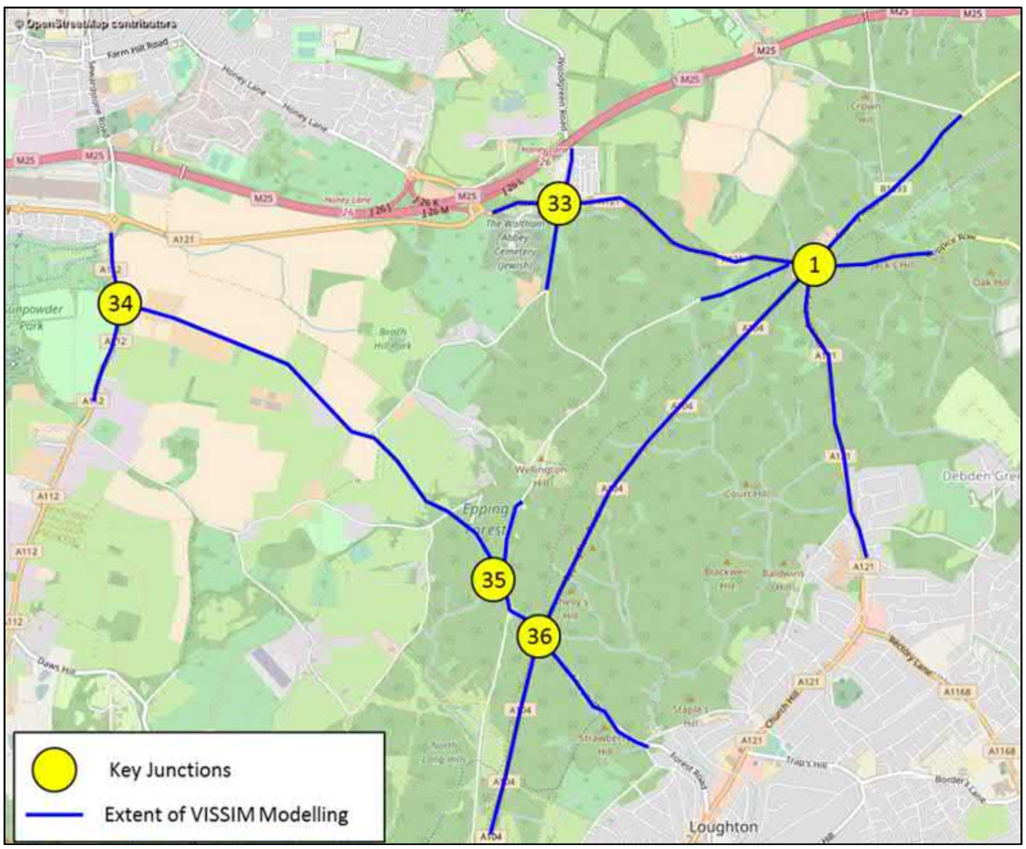

Figure 2-1: VISSIM Modelling Scope

The model extents encompass the following junctions:

- Junction 1: Wake Arms Roundabout – B1393 Epping Road/ B172/ A121 Golding's Hill/ A104 Epping New Road/ A121 Woodridden Hill (Wake Arms Roundabout)
- Junction 33: Woodgreen Road/ A121 Woodridden Hill/ Forest Side/ A121 Honey Lane
- Junction 34: A112 Sewardstone Road/ Avey Lane
- Junction 35: High Beech/ Cross Roads/ High Beech Loughton
- Junction 36: A104 Epping New Road/ Earle's Path/ Cross Roads (Robin Hood Roundabout)

3. Skeleton Model Build

3.1 Simulation Parameters

The model was prepared using TfL's VISSIM modelling template (VISSIM 5.40 template) as the underlying basis for industry-standard best practice model parameters. All parameters in the model use those set out in the template unless otherwise noted in this report.

The simulation period is 3600 seconds for the peak hour plus a 900 second warm up period and a 900 second cool down period (total 5400 seconds). The simulation resolution is set to 5.

3.2 Model Units

The measurement units have been left unchanged from the TfL VISSIM template. Model distances are therefore in metres and kilometres, speed in mph and acceleration in m/s^2.

3.3 Map Background

The model was coded using scaled aerial images incorporated within the VISSIM software.

3.4 Functions

No changes to the maximum and desired acceleration/deceleration profiles have been made from the TfL VISSIM 5.40 template.

3.5 Desired Speed Distributions

No changes have been made from the TfL VISSIM 5.40 Template.

3.6 Vehicle Data

No changes have been made to those vehicle types and vehicle classes in the TfL VISSIM template.

The model contains 3 Vehicle/User Classes:

- Cars/Taxis;
- Light Goods Vehicles (LGVs) / Medium Good Vehicles (MGVs); and
- Heavy Goods Vehicles (HGVs).

Cyclists and motorcyclists have not been included in the models.

3.7 Driving Behaviour

One new driving behaviour parameter set has been added to the model. This is called "Urban Merge". This is a duplicate of "Urban (motorized)" behaviour but with the minimum headway (front/rear) set to 0.30 metres. "Advanced Merging" has also been applied to assess more realistic lane change behaviour. These were coded at the following locations:

- Link 19 at Wake Arm Roundabout
- Links 37, 42, 43 and 44 at Robin Hood Roundabout

No other changes have been made to the default TfL VISSIM template driver behaviour settings.

3.8 Link Types

A new link type has been created called “Urban (motorized)_merge”. This uses the new driving behaviour parameter set described above.

3.9 Route Assignment Choice

The model was set up using dynamic assignment methods. However, as there is no route choice within the model, it is essentially a static model.

3.10 Network Structure

The network structure has been coded so that it matches the network layout and has been calibrated so that on-site behaviour is replicated.

4. Model Calibration

4.1 Survey Data

Traffic count surveys were carried out to determine the existing traffic flow patterns and period of peak hours at the roads and junctions around the study area. Automatic Number Plate Recognition (ANPR) surveys were undertaken on a single neutral day in February 2017 over the period 07:00 to 19:00 to determine the origin-destination movements through the network. Automatic Traffic Counts (ATCs) were conducted over two-week periods to provide confidence that the traffic flow data was representative of the neutral month.

Figure 4-1 below shows the locations of the ANPR and ATC surveys:

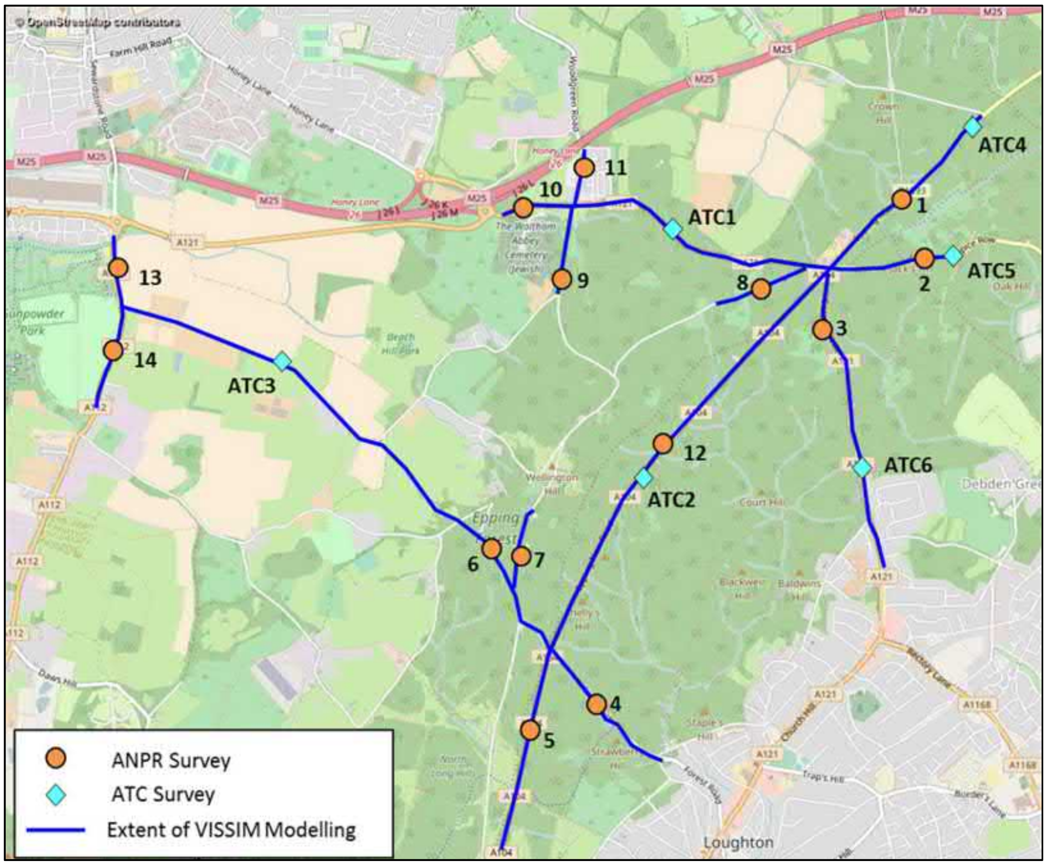

Figure 4-1: Traffic Survey Locations

4.2 Derivation of Peak Hours

An analysis of the traffic surveys was undertaken to determine the busiest hour for each of the peaks. The analysis showed that the busiest hours were 07:00 to 08:00 for the weekday AM peak and 17:00 – 18:00 for the weekday PM peak. The simulation start time and simulation periods for each of the two modelled peak periods are shown in Table 4-1:

Table 4-1: Model Simulation Start Time and Period

	Simulation Start Time	Simulation Period	Model Period
Weekday AM Peak	06:45	5400	07:00 to 08:00
Weekday PM Peak	16:45	5400	17:00 to 18:00

For each of the two peaks, the first 15 minutes represents the warm-up period and the last 15 minutes represents the cool-down period.

While the model has been set up using dynamic assignment methods, it is essentially a static model due to the lack of route choice options in the study area. Vehicle demand inputs have therefore been coded using origin and destination data taken directly from the ANPR survey. These were then factored based on the ANPR link count and ATC data.

The AM and PM peak hour models have been expanded to cover Inter-peak (IP) and Out of Peak (OP) average hour assessments using factors derived from observed count profiles. While these models were required to provide outputs for air quality assessments across the 24-hour period, it was not deemed proportionate to undertake a full re-validation exercise on specific observed data for these less congested time periods.

4.3 Public Transport

Bus routes and frequencies have been obtained online. However, the majority of bus schedules are outside of the modelled peak hours[3]. Thus, only route 66 has been included in the base modelling. The bus start times coded into the model have been offset from each other using a randomising algorithm so that buses do not enter the network at the same time.

4.4 Traffic Signal Data

No signalised junctions are present within the modelled study area.

4.5 Priority Rules / Conflict Areas

Priority rules have been used throughout the model to replicate give-way junctions, yellow boxes and other important observed behavioural characteristics. These have been calibrated so that the behaviour in the model matches those observed on site.

4.6 Reduced Speed Areas

Reduced speeds areas (RSAs) have been used to reduce vehicle speeds at bends and to calibrate stopline saturation flows. The speed profile used across turning movements varies according to the turn radii, with sharper turns having a lower speed profile than more gentle turns. It was also used as one of the indicators for the comparisons of observed speeds and journey time.

4.7 Link and Connector Structure / Network Operation

The network structure has been coded so that it matches the network layout and has been calibrated over multiple random seeds (see next section) so that on-site behaviour is replicated.

[3] http://www.essexbus.info

5. Model Validation

5.1 Traffic Flow Comparisons

Vehicle demand matrices were based on the origin and destination data taken directly from the ANPR surveys. ANPR data were also analysed and converted into turning movements. ATCs were carried out to ensure data was representative of a neutral period. Checks were undertaken to ensure that the survey data were analysed correctly.

The traffic flows measured from VISSIM are the average of 5 random seed runs. These have been validated using the GEH statistic for all links and turning movements in the model. The model was considered validated if at least 85% of turning movements had a GEH of 5 or less. The tables below summarise the GEH statistic results for both link and turning movements.

The full traffic flow validation results are provided in Appendix A and Appendix B . It should be noted that, while a formal validation exercise was not undertaken for the IP and OP periods, the model outputs were also sense-checked against observed traffic counts and flow profiles.

Table 5-1: Link Flow GEH Statistic Summary Results

	AM Peak	PM Peak
Number of turning movements	12	12
Percentage with a GEH of less than 5	92%	100%
Percentage with a GEH of less than 7.5	100%	100%

Table 5-2: Turning Flow GEH Statistics Summary Results

	AM Peak	PM Peak
Number of turning movements	66	66
Percentage with a GEH of less than 5	89%	91%
Percentage with a GEH of less than 7.5	94%	97%

5.2 Queue Length Analysis

The models have not been validated against observed queue lengths. This is principally because journey times are considered to be a better and more accurate validation criterion. As the TfL Modelling Guidelines state, queue survey data, whilst not a validation criterion, is useful when determining bottlenecks within the network. The model has therefore been checked to ensure that queues and areas of high congestion reasonably reflect what has been observed on street.

5.3 Journey Time Comparisons

Journey time surveys were carried out on a neutral day in April 2017 along three routes in the study area. Data from the TrafficMaster dataset (2016) were also analysed as supplementary data to get a good representation of a neutral time period. Figure 5-1 shows the journey time validation routes used for the purposes of this modelling.

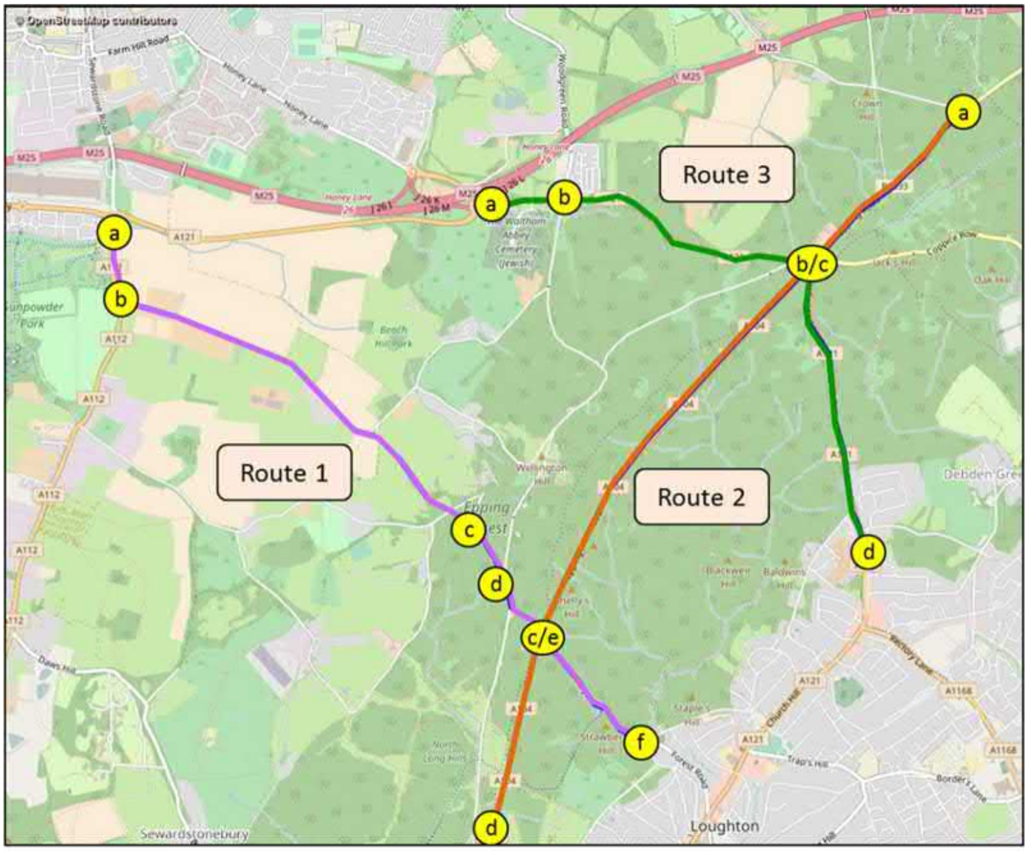

Figure 5-1: Journey Time Routes

Modelled journey times (both individual segment and total journey time) are within 15% of the observed on-street journey times. A detailed comparison is shown in Appendix C. The VISSIM journey time results are the average of the 5 random seed runs.

5.4 Error Logs

All of the model runs did generate error files. However, these error files were checked, and, in all cases, the error files generated were negligible and did not materially affect model validation. The number of vehicles being removed from the network is generally less than 10. The error files are therefore deemed to be non-critical and have been considered to be acceptable. Small error files with non-critical error messages are acceptable within TfL VMAP.

5.5 Other Modelling Issues

There are no other base modelling issues noted at this stage.

6. Future Model Development and Assumptions

6.1 Introduction

The calibrated base model networks were used as the basis for development of the proposed future year scenario models. The following traffic scenarios represent updated descriptions to reflect the latest AECOM methodology and inform the range of air quality assessment scenarios being undertaken.

- **Scenario 1 – 2014 Start of Plan**: backdated scenario reflecting the beginning of the Local Plan period using TEMPro growth to convert 2017 base year flows to 2014.
- **Scenario 2 – 2017 Baseline**: base model year for validation and forecasting purposes.
- **Scenario 3 – 2033 Baseline**: Projected End of Plan (2033) baseline including 'skeleton background' traffic growth only i.e. excluding all Local Plan development related traffic growth.
- **Scenario 4 – 2033 Local Plan No Modal Shift**: Projected End of Plan (2033) including background, all 'in-combination' and all development traffic growth from the updated Local Plan including Inspector's Advice (ED98). Scenario excludes anticipated modal shift associated with new development due to sustainable transport policies.
- **Scenario 5 – 2033 Local Plan With Modal Shift:** Projected End of Plan (2033) including background, all 'in-combination' and all development traffic growth from the updated Local Plan including Inspector's Advice (ED98). Scenario includes anticipated modal shift associated with new development due to sustainable transport policies. – **Please note that only AADT information from this scenario have been assessed by AECOM for air quality purposes to understand the impact of reasonable modal shift.**
- **Scenario 6 – 2024 Interim Year Assessment:** Projected Interim Plan Year (2024) including background, all 'in-combination' and all development traffic growth from the updated Local Plan including Inspector's Advice (ED98) up to 2024. Scenario excludes anticipated modal shift associated with new development due to sustainable transport policies.

6.2 TEMPro / RTF Traffic Growth

Overall traffic growth for each of the scenarios has been derived from a range of sources including the Department for Transport (DfT) TEMPro v7.2 planning tool, 2018 Road Traffic Forecasts (RTF) data for Light Goods Vehicles (LGVs) and Heavy Goods Vehicles (HGVs), and the Local Plan Submission Version (LPSV) development traffic (with the Inspector's Advice - ED98), extracted from the updated EFD Spreadsheet Model. The data has been applied incrementally to generate the different levels of traffic growth expected in each of the scenarios listed above.

In the first instance, the TEMPro v7.2 planning tool was interrogated for the average weekday period to determine external and background traffic growth forecasts throughout the District. TEMPro provides a forecast level of growth for an area, based on the predicted level of employment and housing specified in the regional development forecast for origins and destinations. The system allows adjustments to be made to jobs and housing numbers to reflect the most up to date planning data. This generally represents growth outside the District including other HMA authorities, Harlow, Uttlesford and East Hertfordshire, as well as neighbouring Broxbourne and outer eastern London Boroughs likely to have some level of impact on the SAC. The data also accounts for anticipated changes in car ownership.

The review and adjustment of TEMPro for the neighbouring authorities, both within the Housing Market Area (HMA) and the adjacent outer London Boroughs, sought to add in adopted Local Plan information, where possible, and supplement with emerging Local Plan information where known. These adjustments would therefore account for the full anticipated Local Plan growth in the wider area rather than just adopted Plan information including growth at Stansted Airport and London Plan targets.

In addition to TEMPro growth, updated 2018 Road Traffic Forecasts (RTF) growth for goods vehicles (LGV / HGV) has been weighted and applied to the overall calculation.

The combined calculation and assumptions used to determine traffic growth for the model years are summarised in Table 6-1. It should be noted that existing traffic and background traffic growth have not been adjusted to account for any realistic sustainable transport improvements, i.e. modal shift opportunities for existing residents/workers arising from potential new transport improvements coming forward across the Local Plan period. The growth forecasts are therefore considered a robust worst-case.

Table 6-1: Combined TEMPro / RTF Forecast Traffic Growth Factors from 2017 Base Year

Scenario	2014	2017	2023	2033
Scenario 1 – Start of Plan	0.962			
Scenario 2 – 2017 Baseline		1.000		
Scenario 3 – 2033 Baseline				1.115
Scenario 4 – 2033 Local Plan No Modal Shift				1.116
Scenario 5 – 2033 Local Plan with Modal Shift				1.116
Scenario 6 – 2024 Interim Year Assessment			1.061	

The TEMPro / RTF Growth Factors have been combined, where appropriate, with the assigned EFD committed and LPSV development traffic, from the updated separate EFD Spreadsheet Model, to generate each traffic scenario.

6.3 Modal Shift

The modal shift assumptions applied to Scenario 5 adopt a precautionary approach through the consideration of reasonable improvements to sustainable transport choices across the district and neighbouring destinations e.g. Harlow and London. The analysis considers the sustainable access policy requirements, included in the Local Plan, and proposed improvements set out in the Transport Assessment Report, to provide a balance of what can be reasonably delivered by developers and public transport operators to encourage modal shift at all new development. No consideration at this stage has been made for modal shift in background / existing traffic on the network nor have more ambitious improvements, which are likely to be delivered through the Harlow and Gilston Garden Town (HGGT) objectives. This equates to an approximate reduction of 5%-7% in Local Plan related new development traffic growth only and is deemed an appropriate approach to test the impact of reasonable sustainable modal shift.

7. Transport Modelling Outputs

7.1 Introduction

The transport model is used to provide predictions on how the local developments will impact the air quality and performance of the five key junctions in the study area. The following outputs were provided to AECOM for their air quality consultants:

- Annual Average Daily Traffic (AADT)
- Maximum Average Queue Length
- Average Queue Duration
- Average Speeds

Details of each of the outputs above are presented in the following sections below.

7.2 Annual Average Daily Traffic (AADT)

The AADTs were calculated by converting the 2017 modelled peak hour flows to average daily flows using factors derived from observed traffic counts. The AADTs of the forecast scenarios were then calculated by factoring the 2017 AADTs, TEMPro / RTF growth and Local Plan development growth.

As with the previously submitted traffic modelling, the increased demand applied in future scenarios resulted in some delays observed in the modelled network during the peak periods. This resulted in unreleased demand (around 10% of the total demand) occurring at the end of the peak modelled periods. Unreleased demand relates to trips that could not leave respective zones due to delays and queues, particularly along B1393 Epping Road. A separate sensitivity test was undertaken using the existing West Essex / East Hertfordshire (WEEH) Strategic VISUM model to obtain an order of magnitude of the level of trips that could divert to other parts of the wider network during periods of increased congestion. It should be noted that this was not a detailed traffic reassignment test and was used to ensure that a realistic level (rather than unconstrained level) of AADT was tested in each of the scenarios for consistency.

Sensitivity test results indicated that around 10% -12% of all traffic using the modelled network could divert to other routes to avoid the increased delay. While the VISSIM model demands were not modified, adjustments were then made to the AADTs to ensure that they were consistent and assessed on a like for like basis.

Figure 7-1 to Figure 7-5 provide a layout for each junction and Table 7-1 to Table 7-5 provide the corresponding AADTs for each of the five key junctions for all scenarios tested.

Junction 1: Wake Arms Roundabout

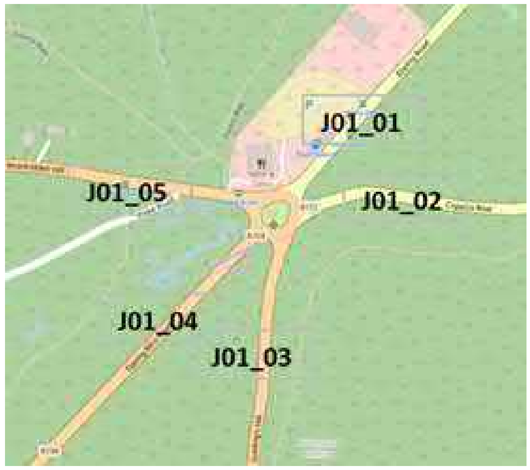

Figure 7-1: Junction 1 – Layout

Table 7-1: Junction 1 AADT

	2014	2017	2033			2024
Junction 01	**Baseline**	**Baseline**	**Baseline**	**Scenario 4**	**Scenario 5**	**Scenario 6**
J01_01	17,540	17,851	19,886	24,331	24,083	20,140
J01_02	8,125	8,067	8,987	9,419	9,419	8,838
J01_03	19,273	19,589	21,822	22,912	22,839	21,304
J01_04	13,866	14,559	16,219	18,255	18,102	15,929
J01_05	23,517	24,193	26,951	29,218	29,152	26,532
Total	**82,321**	**84,259**	**93,864**	**104,136**	**103,596**	**92,742**

Junction 33: Woodgreen Road/ A121 Woodridden Hill/ Forest Side/ A121 Honey Lane

Figure 7-2: Junction 33 – Layout

Table 7-2: Junction 33 AADT

	2014	2017	2033			2024
Junction 33	Baseline	Baseline	Baseline	Scenario 4	Scenario 5	Scenario 6
J33_01	2,065	2,127	2,369	2,425	2,425	2,289
J33_02	23,716	24,193	26,951	29,174	29,109	26,506
J33_03	2,071	2,127	2,369	2,724	2,702	2,472
J33_04	23,697	24,193	26,951	29,547	29,459	26,723
Total	**51,549**	**52,639**	**58,640**	**63,870**	**63,695**	**57,990**

Junction 34: A112 Sewardstone Road/ Avey Lane

Figure 7-3: Junction 34 – Layout

Table 7-3: Junction 34 AADT

	2014	2017	2033			2024
Junction 34	**Baseline**	**Baseline**	**Baseline**	**Scenario 4**	**Scenario 5**	**Scenario 6**
J34_01	13,994	14,559	16,219	17,489	17,467	16,042
J34_02	1,982	2,084	2,321	3,566	3,544	2,818
J34_03	13,969	14,559	16,219	16,248	16,248	15,433
Total	**29,944**	**31,202**	**34,759**	**37,303**	**37,259**	**34,292**

Junction 35: High Beech/ Cross Roads/ High Beech Loughton

Figure 7-4: Junction 35 – Layout

Table 7-4: Junction 35 AADT

	2014	2017	2033			2024
Junction 35	**Baseline**	**Baseline**	**Baseline**	**Scenario 4**	**Scenario 5**	**Scenario 6**
J35_01	1,012	1,042	1,161	1,506	1,484	1,304
J35_02	2,006	2,084	2,321	3,793	3,749	2,948
J35_03	1,017	1,063	1,185	2,326	2,304	1,684
Total	**4,036**	**4,189**	**4,666**	**7,624**	**7,536**	**5,937**

Junction 36: A104 Epping New Road/ Earle's Path/ Cross Roads (Robin Hood Roundabout)

Figure 7-5: Junction 36 – Layout

Table 7-5: Junction 36 AADT

	2014	2017	2033			2024
Junction 36	Baseline	Baseline	Baseline	Scenario 4	Scenario 5	Scenario 6
J36_01	13,734	14,559	16,219	18,255	18,109	15,920
J36_02	1,999	2,084	2,321	3,106	3,077	2,626
J36_03	14,047	14,559	16,219	18,927	18,781	16,259
J36_04	2,014	2,084	2,321	3,851	3,822	3,000
Total	**31,793**	**33,285**	**37,080**	**44,140**	**43,789**	**37,805**

7.3 Maximum Average Queue Length Comparison

The average queue lengths were extracted from the model every 10 minutes. These were then used to calculate the maximum average queue lengths for each of the junction arm presented in Table 7-6 to Table 7-15. Each junction shows the queue comparison for the appropriate modelled scenarios for both AM and PM peaks. Please note, Scenario 5 queue lengths have not been incorporated in the associated AECOM air quality assessments and have not been included in this Note.

Junction 1: Wake Arms Roundabout

When compared to the 2017 base model, all future scenarios show significant increases in modelled queue lengths. In the AM peak, these increases in queues were observed along Epping Road (JC01_QL01), B172 (JC01_QL02) and A121 Golding's Hill (JC01_QL03). And in PM peak, the queues were mainly in A121 Golding's Hill (JC01_QL03) and Epping Road (JC01_QL04).

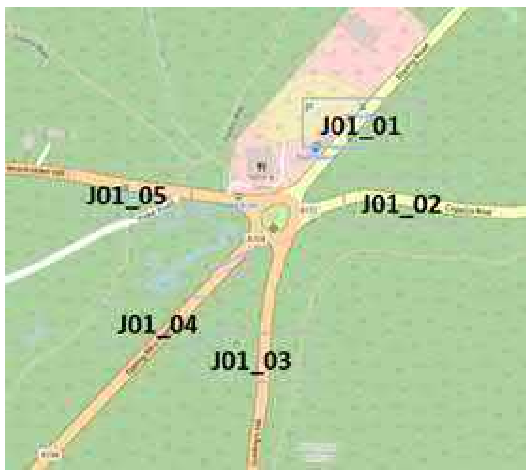

Figure 7-6: Junction 1 – Queue Length Reference

Table 7-6: Junction 1 - Average AM Peak Queue Length

AM Peak (meters)					
	2014	2017	2033		2024
Junction 01	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
JC01_01	930	969	1,087	1,118	1,100
JC01_02	94	321	863	917	915
JC01_03	285	477	1,335	1,409	1,338
JC01_04	53	71	97	64	91
JC01_05	4	13	11	28	50

Table 7-7: Junction 1 – Average PM Peak Queue Length

PM Peak (meters)					
	2014	2017	2033		2024
Junction 01	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
JC01_01	12	15	23	176	23
JC01_02	8	8	22	146	31
JC01_03	372	682	1,338	1,405	1,336
JC01_04	74	80	242	2,733	1,326
JC01_05	12	11	13	61	16

Junction 33: Woodgreen Road/ A121 Woodridden Hill/ Forest Side/ A121 Honey Lane

In this junction, the modelled queue lengths were mainly observed along A121 (JC33_QL02) during the AM peak.

Figure 7-7: Junction 33 – Queue Length Reference

Table 7-8: Junction 33 – Average AM Peak Queue Length

AM Peak (meters)					
	2014	2017	2033		2024
Junction 33	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
JC33_01	31	21	23	43	25
JC33_02	390	805	2,320	2,383	592
JC33_03	13	16	41	455	126
JC33_04	1	1	1	4	3

Table 7-9: Junction 33 – Average PM Peak Queue Length

PM Peak (meters)					
	2014	2017	2033		2024
Junction 33	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
JC33_01	4	6	10	25	9
JC33_02	1	38	1	879	2
JC33_03	18	45	39	422	54
JC33_04	2	35	12	41	3

Junction 34: A112 Sewardstone Road/ Avey Lane

This junction is non-signalised and priority is given to through movements along Sewardstone Road, hence, increases in modelled queue lengths are observed along Avey Lane.

Figure 7-8: Junction 34 – Queue Length Reference

Table 7-10: Junction 34 – Average AM Peak Queue Length

AM Peak (meters)					
	2014	2017	2033		2024
Junction 34	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
JC34_01	0	0	0	0	0
JC34_02	7	10	58	454	140
JC34_03	4	16	11	67	19

Table 7-11: Junction 34 – Average PM Peak Queue Length

PM Peak (meters)					
	2014	2017	2033		2024
Junction 34	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
JC34_01	0	0	0	0	0
JC34_02	9	9	46	547	155
JC34_03	3	3	7	6	14

Junction 35: High Beech/ Cross Roads/ High Beech Loughton

Traffic backlog were observed in the future scenarios, particularly in 2033 PM peak. This can be seen by the increase in queues, in 2033 Scenarios 4 and is due to the traffic backlog from Junctions 1 and 36.

Figure 7-9: Junction 35 – Queue Length Reference

Table 7-12: Junction 35 – Average AM Peak Queue Length

AM Peak (meters)					
	2014	2017	2033		2024
Junction 35	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
JC35_01	0	1	1	8	2
JC35_02	1	1	3	7	5
JC35_03	0	0	0	0	0

Table 7-13: Junction 35 – Average PM Peak Queue Length

PM Peak (meters)					
	2014	2017	2033		2024
Junction 35	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
JC35_01	0	0	0	230	1
JC35_02	0	1	1	308	1
JC35_03	0	0	0	149	0

Junction 36: A104 Epping New Road/ Earle's Path/ Cross Roads (Robin Hood Roundabout)

Due to the increase in demand, increases in modelled queue length were observed, particularly in 2033 Scenario 4.

Figure 7-10: Junction 36 – Queue Length Reference

Table 7-14: Junction 36 – Average AM Peak Queue Length

AM Peak (meters)					
	2014	2017	2033		2024
Junction 36	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
JC36_01	50	88	87	451	314
JC36_02	2	3	7	15	6
JC36_03	25	36	125	853	316
JC36_04	9	7	20	69	17

Table 7-15: Junction 36 – Average PM Peak Queue Length

PM Peak (meters)					
	2014	2017	2033		2024
Junction 36	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
JC36_01	19	19	33	92	32
JC36_02	1	1	1	20	2
JC36_03	8	8	12	820	35
JC36_04	1	2	4	397	7

The inter-peak (IP) and off-peak (OP) periods' maximum average queue length data are presented in Appendix D and Appendix E.

7.4 Queue Length Duration

Table 7-16 to Table 7-25 show the average queue duration for each of the five key junctions for all scenarios tested. It refers to the total time (mins) that vehicles would spend in queue conditions. In general, model results show that the maximum queue duration was in 2033 Scenario 4.

Junction 1: Wake Arms Roundabout

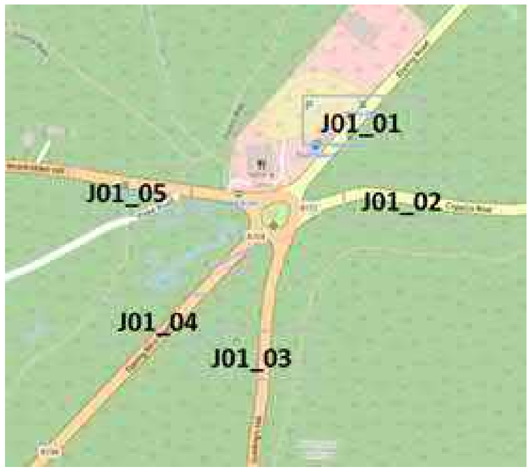

Figure 7-11: Junction 1 – Queue Length Duration Reference

Table 7-16: Junction 1 – Average AM Peak Queue Duration

AM Peak (minutes)					
	2014	2017	2033		2024
Junction 01	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J01_01	0.73	0.80	3.73	8.07	5.11
J01_02	0.47	0.98	5.54	6.37	7.51
J01_03	2.65	4.13	5.50	8.21	5.63
J01_04	0.64	0.75	1.00	2.96	1.65
J01_05	0.11	0.13	0.26	1.06	0.51

Table 7-17: Junction 1 – Average PM Peak Queue Duration

PM Peak (minutes)					
	2014	2017	2033		2024
Junction 01	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J01_01	0.13	0.14	0.18	0.55	0.17
J01_02	0.15	0.20	0.36	1.19	0.39
J01_03	1.08	2.15	3.72	7.53	4.21
J01_04	0.68	0.93	1.68	7.30	3.70
J01_05	0.11	0.12	0.16	0.53	0.17

Junction 33: Woodgreen Road/ A121 Woodridden Hill/ Forest Side/ A121 Honey Lane

Figure 7-12: Junction 33 – Queue Length Duration Reference

Table 7-18: Junction 33 – Average AM Peak Queue Duration

AM Peak (minutes)					
	2014	2017	2033		2024
Junction 33	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J33_01	0.26	0.29	0.38	0.85	0.37
J33_02	2.52	3.40	5.60	8.16	6.34
J33_03	0.24	0.21	0.89	6.28	1.80
J33_04	0.00	0.00	0.01	0.01	0.01

Table 7-19: Junction 33 – Average PM Peak Queue Duration

PM Peak (minutes)					
	2014	2017	2033		2024
Junction 33	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J33_01	0.14	0.20	0.24	0.49	0.20
J33_02	0.95	1.50	3.91	5.47	2.96
J33_03	0.25	0.34	0.53	6.81	0.85
J33_04	0.01	0.03	0.02	0.08	0.02

Junction 34: A112 Sewardstone Road/ Avey Lane

Figure 7-13: Junction 34 – Queue Length Duration Reference

Table 7-20: Junction 34 – Average AM Peak Queue Duration

AM Peak (minutes)					
	2014	2017	2033		2024
Junction 34	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J34_01	0.00	0.00	0.00	0.03	0.01
J34_02	0.58	0.68	3.65	15.80	5.44
J34_03	0.02	0.06	0.04	0.26	0.08

Table 7-21: Junction 34 – Average PM Peak Queue Duration

PM Peak (minutes)					
	2014	2017	2033		2024
Junction 34	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J34_01	-	0.00	-	0.00	0.00
J34_02	0.44	0.60	1.62	14.22	3.59
J34_03	0.01	0.01	0.01	0.01	0.01

Junction 35: High Beech/ Cross Roads/ High Beech Loughton

Figure 7-14: Junction 35 – Queue Length Reference

Table 7-22: Junction 35 – Average AM Peak Queue Duration

AM Peak (minutes)					
	2014	2017	2033		2024
Junction 35	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J35_01	0.01	0.01	0.01	0.07	0.01
J35_02	0.24	0.29	0.57	3.06	1.37
J35_03	0.01	0.03	0.03	0.06	0.04

Table 7-23: Junction 35 – Average PM Peak Queue Duration

PM Peak (minutes)					
	2014	2017	2033		2024
Junction 35	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J35_01	0.00	0.01	0.01	0.08	0.01
J35_02	0.23	0.44	0.86	1.38	1.37
J35_03	0.01	0.01	0.02	0.93	0.01

Junction 36: A104 Epping New Road/ Earle's Path/ Cross Roads (Robin Hood Roundabout)

Figure 7-15: Junction 36 – Queue Length Duration Reference

Table 7-24: Junction 36 – Average AM Peak Queue Duration

AM Peak (minutes)					
	2014	2017	2033		2024
Junction 36	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J36_01	0.78	1.04	2.72	5.19	3.66
J36_02	0.07	0.07	0.09	0.19	0.12
J36_03	0.18	0.23	0.44	3.77	1.41
J36_04	0.06	0.09	0.12	0.27	0.12

Table 7-25: Junction 36 – Average PM Peak Queue Duration

PM Peak (minutes)					
	2014	2017	2033		2024
Junction 36	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J36_01	0.37	0.60	1.16	2.33	1.77
J36_02	0.02	0.02	0.03	0.07	0.04
J36_03	0.05	0.07	0.09	1.20	0.17
J36_04	0.02	0.03	0.05	2.08	0.07

The inter-peak (IP) and off-peak (OP) periods' queue duration data are presented in Appendix F and Appendix G.

7.5 Average Speeds

Table 7-26 to Table 7-35 show the average peak hour speeds (mph) for each of the five key junctions for all scenarios tested. Results show that there is minimal difference in terms of speed improvements when comparing all future scenarios.

Junction 1: Wake Arms Roundabout

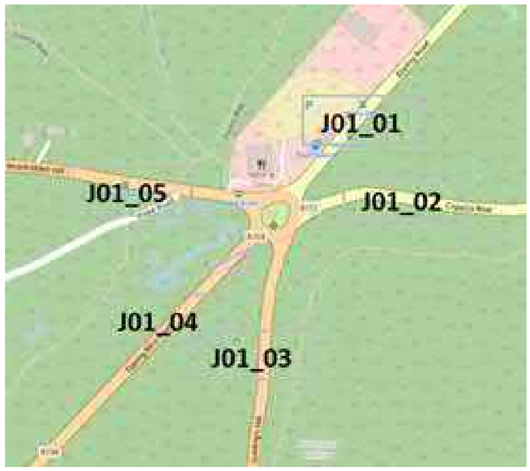

Figure 7-16: Junction 1 – Average Speeds Reference

Table 7-26: Junction 1 – Average AM Peak Speeds

AM Peak (mph)					
	2014	2017	2033		2024
Junction 01	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J01_01	30.20	29.64	29.81	26.25	28.16
J01_02	33.62	33.53	32.02	30.69	30.69
J01_03	31.58	31.44	30.64	29.19	30.55
J01_04	25.58	25.43	25.43	25.27	25.31
J01_05	22.20	21.81	20.60	20.13	20.06

Table 7-27: Junction 1 – Average PM Peak Speeds

PM Peak (mph)					
	2014	2017	2033		2024
Junction 01	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J01_01	31.16	30.91	30.85	30.37	30.95
J01_02	33.33	33.25	33.20	32.97	32.97
J01_03	30.90	30.76	29.21	26.69	29.53
J01_04	25.61	25.86	25.18	23.38	24.24
J01_05	21.75	20.49	16.82	18.34	20.85

Junction 33: Woodgreen Road/ A121 Woodridden Hill/ Forest Side/ A121 Honey Lane

Figure 7-17: Junction 33 – Average Speeds Reference

Table 7-28: Junction 33 – Average AM Peak Speeds

AM Peak (mph)					
	2014	2017	2033		2024
Junction 33	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J33_01	31.63	31.81	31.39	29.75	30.79
J33_02	22.20	21.81	20.60	20.13	20.06
J33_03	31.63	31.81	31.39	29.75	30.79
J33_04	22.20	21.81	20.60	20.13	20.06

Table 7-29: Junction 33 – Average PM Peak Speeds

PM Peak (mph)					
	2014	2017	2033		2024
Junction 33	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J33_01	32.13	31.27	31.40	29.92	31.04
J33_02	21.75	20.49	16.82	18.34	20.85
J33_03	32.13	31.27	31.40	29.92	31.04
J33_04	21.75	20.49	16.82	18.34	20.85

Junction 34: A112 Sewardstone Road/ Avey Lane

Figure 7-18: Junction 34 – Average Speeds Reference

Table 7-30: Junction 34 – Average AM Peak Speeds

AM Peak (mph)					
	2014	2017	2033		2024
Junction 34	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J34_01	22.20	21.81	20.60	20.13	20.06
J34_02	31.63	31.81	31.39	29.75	30.79
J34_03	22.20	21.81	20.60	20.13	20.06

Table 7-31: Junction 34 – Average PM Peak Speeds

PM Peak (mph)					
	2014	2017	2033		2024
Junction 34	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J34_01	21.75	20.49	16.82	18.34	20.85
J34_02	32.13	31.27	31.40	29.92	31.04
J34_03	21.75	20.49	16.82	18.34	20.85

Junction 35: High Beech/ Cross Roads/ High Beech Loughton

Figure 7-19: Junction 35 – Average Speeds Reference

Table 7-32: Junction 35 – Average AM Peak Speeds

AM Peak (mph)					
	2014	2017	2033		2024
Junction 35	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J35_01	31.63	31.81	31.39	29.75	30.79
J35_02	31.63	31.81	31.39	29.75	30.79
J35_03	31.63	31.81	31.39	29.75	30.79

Table 7-33: Junction 35 – Average PM Peak Speeds

PM Peak (mph)					
	2014	2017	2033		2024
Junction 35	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J35_01	32.13	31.27	31.40	29.92	31.04
J35_02	32.13	31.27	31.40	29.92	31.04
J35_03	32.13	31.27	31.40	29.92	31.04

Junction 36: A104 Epping New Road/ Earle's Path/ Cross Roads (Robin Hood Roundabout)

Figure 7-20: Junction 36 – Queue Length Duration Reference

Table 7-34: Junction 36 – Average AM Peak Speeds

AM Peak (mph)					
	2014	2017	2033		2024
Junction 36	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J36_01	25.58	25.43	25.43	25.27	25.31
J36_02	31.63	31.81	31.39	29.75	30.79
J36_03	25.58	25.43	25.43	25.27	25.31
J36_04	31.63	31.81	31.39	29.75	30.79

Table 7-35: Junction 36 – Average PM Peak Speeds

PM Peak (mph)					
	2014	2017	2033		2024
Junction 36	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J36_01	25.61	25.86	25.18	23.38	24.24
J36_02	32.13	31.27	31.40	29.92	31.04
J36_03	25.61	25.86	25.18	23.38	24.24
J36_04	32.13	31.27	31.40	29.92	31.04

The inter-peak (IP) and off-peak (OP) periods average speed data are presented in Appendix H and Appendix I.

8. Summary

Jacobs were commissioned by Epping Forest District Council (EFDC) to prepare a package of VISSIM microsimulation traffic models of the Epping Forest Special Area of Conservation (SAC) to support the Epping Forest District LPSV at EiP and in accordance with subsequent Advice from the Inspector.

The models have been specifically developed to provide forecast traffic data for an air quality assessment being prepared by AECOM. It was agreed at the outset that the VISSIM modelling software provided the necessary speed, traffic and network performance outputs required to assess the more detailed traffic related impacts to air quality.

This Technical Note details the base model calibration and validation of the VISSIM models. The Note demonstrates that the models validate sufficiently in line with the TfL Modelling Guidelines and Model Audit Process and can be considered fit for purpose.

Following the EiP and subsequent Advice from the Inspector, a series of updated traffic scenarios have been assessed to test the impacts of planned local developments on the Epping Forest Special Area of Conservation (SAC). These included base year, projected baseline, with and without sustainable modal shift. The traffic outputs from this report have been taken by AECOM, EFDC’s Air Quality Consultants, to test a range of air quality impacts and associated mitigation measures.

Appendix A. Link Flow Validation

AM Peak Traffic Comparison						
ATC No.	Road Name	Direction	Observed Traffic Volumes	Modelled Traffic Volumes	Difference-Total	GEH Total Vehicles
ATC 1	Woodridden Hill	EB	795	820	25	0.86
		WB	863	890	27	0.90
ATC 2	Epping New Road (South of Wake Arm Rbt)	NB	437	455	18	0.84
		SB	779	842	63	2.20
ATC 3	Avey Ln	EB	163	185	22	1.65
		WB	56	82	26	3.14
ATC 4	Epping New Road (North of Wake Arm Rbt)	NB	496	458	-38	1.75
		SB	802	958	156	5.26
ATC 5	B 172	EB	159	105	-54	4.69
		WB	433	489	56	2.60
ATC 6	Goldling's Hill	NB	524	588	64	2.73
		SB	767	729	-38	1.40

PM Peak Traffic Comparison							
ATC No.	Road Name	Direction	Link Number	Observed Traffic Volumes	Modelled Traffic Volumes	Difference-Total	GEH Total Veh
ATC 1	Woodridden Hill	EB	11	756	667	-89	3.35
		WB	12	878	816	-62	2.13
ATC 2	Epping New Road (South of Wake Arm Rbt)	NB	36	536	541	5	0.21
		SB	35	484	531	47	2.07
ATC 3	Avey Ln	EB	54	111	93	-18	1.77
		WB	53	93	95	2	0.23
ATC 4	Epping New Road (North of Wake Arm Rbt)	NB	21	696	769	74	2.72
		SB	59	666	689	23	0.87
ATC 5	B 172	EB	23	292	278	-14	0.85
		WB	24	320	314	-6	0.35
ATC 6	Goldling's Hill	NB	30	727	764	37	1.37
		SB	29	683	590	-93	3.69

Appendix B. Turning Flow Validation

AM Peak Traffic Comparison							
Junction No	Junction Name	Junction Arm	Direction	Observed Traffic Volumes	Modelled Traffic Volumes	Difference-Total	GEH Total Veh
JC1	Wake Arms Roundabout	A (B1393 - Epping Road)	A - A	113	155	41.54	3.59
			A - B	0	0	0.00	0.00
			A - C	129	237	107.89	7.97
			A - D	434	305	-129.42	6.73
			A - E	155	174	19.43	1.52
		B (B172)	B - A	12	9	-3.02	0.93
			B - B	12	7	-5.13	1.66
			B - C	26	45	18.58	3.11
			B - D	152	178	25.95	2.02
			B - E	290	213	-76.73	4.84
		C (A121 - Golding's Hill)	C - A	138	144	6.02	0.51
			C - B	11	8	-2.60	0.85
			C - C	5	10	4.50	1.62
			C - D	17	43	25.60	4.66
			C - E	352	309	-43.12	2.37
		D (A104- Epping New Road)	D -A	143	134	-8.84	0.75
			D - B	27	32	4.57	0.84
			D - C	10	13	2.71	0.80
			D - D	62	0	-62.29	11.16
			D - E	260	248	-11.76	0.74
		E (A121- Woodridden Hill)	E - A	32	22	-9.68	1.87
			E - B	66	60	-6.32	0.80
			E - C	382	419	36.73	1.84
			E - D	333	314	-19.02	1.06
			E -E	16	13	-3.25	0.85
JC33	Woodgreen Rd/ Woodridden Hill/ Forest Side/ Honey Ln	A (Woodgreen Rd)	A - A	3	3	-0.16	0.09
			A - B	155	152	-2.51	0.20
			A - C	24	21	-2.78	0.59
			A - D	31	25	-5.88	1.11
		B (A121 - Woodridden Hill)	B - A	55	51	-3.94	0.54
			B - C	46	47	0.60	0.09
			B - D	969	766	-203.04	6.89
		C (Forest Side)	C - A	9	6	-2.57	0.95
			C - B	117	136	18.52	1.64
			C - D	76	57	-18.99	2.33
		D (A121 - Honey Ln)	D - A	14	12	-1.84	0.51
			D - B	525	529	3.92	0.17
			D - C	72	57	-15.09	1.88
JC34	Sewardstone Rd/ Avey Ln	A (A112 - Sewardstone Rd - North Arm)	A - B	147	172	24.53	1.94
			A - C	1134	1139	4.74	0.14

AM Peak Traffic Comparison

Junction No	Junction Name	Junction Arm	Direction	Observed Traffic Volumes	Modelled Traffic Volumes	Difference- Total	GEH Total Veh
		B (Avey Ln)	B - A	31	57	25.58	3.85
			B - C	19	23	4.02	0.88
		C (A112 - Sewardstone Rd - South Arm)	C - A	486	490	4.33	0.20
			C - B	7	16	9.02	2.66
JC35	High Beech/Cross Roads/ High Beech Loughton	A (High Beech)	A - B	140	143	2.69	0.23
			A - C	2	1	-0.69	0.60
		B (Crossroads)	B - A	260	221	-39.49	2.54
			B - C	49	82	33.29	4.12
		C (High Beech Loughton	C - A	4	2	-1.93	1.12
			C - B	151	177	26.48	2.07
JC36	Epping New Rd/ Earl's Path/ Cross Roads	A (A104 - Epping New Rd - North Arm)	A - A	169	13	-156.42	16.38
			A - B	133	95	-37.85	3.55
			A - C	994	670	-323.59	11.22
			A - D	99	52	-46.70	5.38
		B (Earl's Path)	B - A	72	64	-7.64	0.93
			B - B	3	2	-1.11	0.70
			B - C	24	32	7.66	1.44
			B - D	74	72	-2.16	0.25
		C (A104 - Epping New Rd - South Arm)	C - A	357	375	18.31	0.96
			C - B	25	24	-0.72	0.15
			C - C	8	8	0.33	0.12
			C - D	136	148	11.68	0.98
		D (Cross Roads)	D - A	12	11	-0.99	0.29
			D - B	80	59	-21.04	2.52
			D - C	199	207	8.20	0.58
			D - D	52	34	-17.51	2.68

PM Peak Traffic Comparison

Junction No	Junction Name	Junction Arm	Direction	Observed Traffic Volumes	Modelled Traffic Volumes	Difference-Total	GEH Total Veh
JC1	Wake Arms Roundabout	A (B1393 - Epping Road)	A - A	14	43	28.66	5.35
			A - B	43	70	26.85	3.57
			A - C	342	346	4.06	0.22
			A - D	162	166	3.73	0.29
			A - E	80	68	-12.13	1.41
		B (B172)	B - A	77	127	49.75	4.92
			B - B	12	13	1.45	0.41
			B - C	54	46	-8.06	1.14
			B - D	47	42	-4.92	0.74
			B - E	114	88	-26.32	2.62
		C (A121 - Golding's Hill)	C - A	361	361	0.12	0.01
			C - B	47	88	40.80	4.96
			C - C	7	7	0.45	0.17
			C - D	34	91	56.53	7.14
			C - E	251	182	-69.21	4.70
		D (A104- Epping New Road)	D -A	90	117	27.14	2.67
			D - B	50	32	-18.39	2.87
			D - C	17	13	-4.44	1.14
			D - D	35	0	-35.14	8.38
			D - E	401	372	-28.73	1.46
		E (A121- Woodridden Hill)	E - A	122	120	-1.93	0.18
			E - B	107	70	-36.93	3.93
			E - C	245	179	-65.89	4.53
			E - D	257	234	-22.72	1.45
			E -E	65	110	45.08	4.82
JC33	Woodgreen Rd/ Woodridden Hill/ Forest Side/ Honey Ln	A (Woodgreen Rd)	A - A	4	2	-2.26	1.28
			A - B	71	55	-16.14	2.03
			A - C	8	6	-1.76	0.67
			A - D	39	51	11.85	1.77
		B (A121 - Woodridden Hill)	B - A	112	61	-51.31	5.51
			B - C	124	114	-10.10	0.93
			B - D	926	633	-293.03	10.50
		C (Forest Side)	C - A	13	8	-4.71	1.46
			C - B	40	42	2.08	0.33
			C - D	135	130	-5.02	0.44
		D (A121 - Honey Ln)	D - A	60	99	39.28	4.41
			D - B	666	563	-102.58	4.14
			D - C	192	186	-5.54	0.40
JC34	Sewardstone Rd/ Avey Ln	A (A112 - Sewardstone Rd - North Arm)	A - B	75	84	8.98	1.01
			A - C	772	793	20.79	0.74
		B (Avey Ln)	B - A	125	82	-42.74	4.20

PM Peak Traffic Comparison							
Junction No	Junction Name	Junction Arm	Direction	Observed Traffic Volumes	Modelled Traffic Volumes	Difference-Total	GEH Total Veh
			B - C	25	15	-10.21	2.28
		C (A112 - Sewardstone Rd - South Arm)	C - A	961	990	29.09	0.93
			C - B	32	10	-21.58	4.73
JC35	High Beech/Cross Roads/ High Beech Loughton	A (High Beech)	A - B	302	227	-74.76	4.60
			A - C	3	1	-1.78	1.29
		B (Crossroads)	B - A	171	153	-17.64	1.39
			B - C	70	93	23.34	2.59
		C (High Beech Loughton	C - A	1	0	-1.25	1.58
			C - B	105	92	-13.35	1.34
JC36	Epping New Rd/ Earl's Path/ Cross Roads	A (A104 - Epping New Rd - North Arm)	A - A	40	6	-34.46	7.15
			A - B	117	86	-31.43	3.12
			A - C	331	384	53.27	2.82
			A - D	44	53	9.33	1.34
		B (Earl's Path)	B - A	93	89	-4.17	0.44
			B - B	8	3	-4.55	1.98
			B - C	23	16	-6.71	1.53
			B - D	39	52	12.72	1.88
		C (A104 - Epping New Rd - South Arm)	C - A	385	360	-24.95	1.29
			C - B	0	3	3.00	0.00
			C - C	5	3	-1.92	0.96
			C - D	85	103	18.24	1.88
		D (Cross Roads)	D - A	80	84	3.69	0.41
			D - B	86	46	-40.28	4.95
			D - C	176	148	-27.53	2.16
			D - D	35	37	2.17	0.36

Appendix C. Journey Time Validation

Scenario	Route	Direction	Section	Description	Distance (m)	Observed Average Travel Time (seconds)	Modelled Average Travel Time (seconds)	Difference	Variation
AM PEAK	JT1	EB	A-B	Meridian Way/Sewardstone Rd - Avey Ln	448	42	47	4	0.10
			B-C	Avey Ln/Sewardstone Rd - Mott St	2340	187	178	-9	-0.05
			C-D	Mott St - High Beach	395	48	48	0	0.01
			D-E	High Beach - Epping New Rd Roundabout	512	51	46	15	-0.10
			E-F	Epping New Rd Roundabout - Earl's Path/Staples Rd	906	76	72	-4	-0.06
		WB	F-E	Epping New Rd Roundabout - Earl's Path/Staples Rd	818	86	75	18	-0.13
			E-D	High Beach - Epping New Rd Roundabout	596	46	52	-29	0.12
			D-C	Mott St - High Beach	396	52	46	-5	-0.11
			C-B	Avey Ln/Sewardstone Rd - Mott St	2341	219	225	6	0.03
			B-A	Meridian Way/Sewardstone Rd - Avey Ln	450	57	54	-3	-0.06
	JT2	SB	A-B	B1393 Epping Rd to Wake Arms Roundabout	1213	174	165	73	-0.06
			B-C	Wake Arms Roundabout to A104 Epping New Rd mid-point	2738	155	275	121	0.78
			C-D	Robin Hood Roundabout to A104 Epping New Rd (south)	882	113	103	-10	-0.09
		NB	D-C	A104 Epping New Rd (south) to Robin Hood Roundabout	808	85	95	10	0.11
			C-B	Robin Hood Roundabout to A104 Epping New Rd	2719	196	277	81	0.41
			B-A	B1393 Epping Rd to Wake Arms Roundabout	1284	77	90	13	0.18
	JT3	EB	A-B	A121 Honey Ln / M25 J26 to A121 Honey Ln j/w Forest Side	480	92	88	-4	-0.05
			B-C	A121 Honey Ln j/w Forest Side to A121 Wake Arms r'bout	1523	164	165	2	0.01
			C-D	A121 Wake Arms r'bout to A121 Goldings Hill	1457	132	126	32	-0.05
		WB	D-C	A121 Goldings Hill to A121 Wake Arms r'bout	1339	353	400	46	0.13
			C-B	A121 Wake Arms r'bout to A121 Honey Ln j/w Forest Side	1640	343	337	-6	-0.02
			B-A	A121 Honey Ln / M25 J26 to A121 Honey Ln j/w Forest Side	471	106	94	-13	-0.12

Scenario	Route	Direction	Section	Description	Distance (m)	Observed Average Travel Time (seconds)	Modelled Average Travel Time (seconds)	Difference	Variation
PM PEAK	JT1	EB	A-B	Meridian Way/Sewardstone Rd - Avey Ln	448	37	41	10	0.12
			B-C	Avey Ln/Sewardstone Rd - Mott St	2340	193	173	-21	-0.11
			C-D	Mott St - High Beach	395	47	46	-1	-0.02
			D-E	High Beach - Epping New Rd Roundabout	512	35	39	5	0.14
			E-F	Epping New Rd Roundabout - Earl's Path/Staples Rd	906	77	74	-3	-0.03
		WB	F-E	Epping New Rd Roundabout - Earl's Path/Staples Rd	818	60	68	9	0.14
			E-D	High Beach - Epping New Rd Roundabout	596	48	51	-20	0.06
			D-C	Mott St - High Beach	396	54	48	-6	-0.11
			C-B	Avey Ln/Sewardstone Rd - Mott St	2341	262	238	33	-0.09
			B-A	Meridian Way/Sewardstone Rd - Avey Ln	450	75	49	-26	-0.34
	JT2	SB	A-B	B1393 Epping Rd to Wake Arms Roundabout	1213	107	118	38	0.10
			B-C	Wake Arms Roundabout to A104 Epping New Rd mid-point	2738	149	250	101	0.68
			C-D	Robin Hood Roundabout to A104 Epping New Rd (south)	882	105	99	-7	-0.06
		NB	D-C	A104 Epping New Rd (south) to Robin Hood Roundabout	808	87	80	-6	-0.07
			C-B	Robin Hood Roundabout to A104 Epping New Rd	2719	338	315	-23	-0.07
			B-A	B1393 Epping Rd to Wake Arms Roundabout	1284	82	99	17	0.21
	JT3	EB	A-B	A121 Honey Ln / M25 J26 to A121 Honey Ln j/w Forest Side	480	77	83	6	0.08
			B-C	A121 Honey Ln j/w Forest Side to A121 Wake Arms r'bout	1523	160	165	5	0.03
			C-D	A121 Wake Arms r'bout to A121 Goldings Hill	1457	117	121	29	0.03
		WB	D-C	A121 Goldings Hill to A121 Wake Arms r'bout	1339	255	286	100	0.12
			C-B	A121 Wake Arms r'bout to A121 Honey Ln j/w Forest Side	1640	337	316	-21	-0.06
			B-A	A121 Honey Ln / M25 J26 to A121 Honey Ln j/w Forest Side	471	102	99	-3	-0.03

Appendix D. Maximum Average Queue Length Comparisons (IP)

Junction 1: Wake Arms Roundabout

IP Peak (meters)					
	2014	2017	2033		2024
Junction 01	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
JC01_QL01	9	13	18	378	20
JC01_QL02	2	2	3	14	2
JC01_QL03	7	7	14	1,179	19
JC01_QL04	16	17	29	668	31
JC01_QL05	3	4	5	10	4

Junction 33: Woodgreen Road/ A121 Woodridden Hill/ Forest Side/ A121 Honey Lane

IP Peak (meters)					
	2014	2017	2033		2024
Junction 33	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
JC33_QL01	4	7	28	26	9
JC33_QL02	8	14	580	2,770	1,177
JC33_QL03	3	3	8	79	20
JC33_QL04	1	1	3	11	4

Junction 34: A112 Sewardstone Road/ Avey Lane

IP Peak (meters)					
	2014	2017	2033		2024
Junction 34	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
JC34_QL01	0	0	0	0	0
JC34_QL02	4	4	6	25	9
JC34_QL03	1	1	1	3	1

Junction 35: High Beech/ Cross Roads/ High Beech Loughton

IP Peak (meters)					
	2014	2017	2033		2024
Junction 35	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
JC35_QL01	0	0	0	0	0
JC35_QL02	0	0	0	1	0
JC35_QL03	0	0	0	0	0

Junction 36: A104 Epping New Road/ Earle's Path/ Cross Roads (Robin Hood Roundabout)

IP Peak (meters)					
	2014	2017	2033		2024
Junction 36	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
JC36_QL01	7	10	13	42	17
JC36_QL02	1	0	1	1	1
JC36_QL03	6	11	10	35	14
JC36_QL04	0	1	2	6	2

Appendix E. Maximum Average Queue Length Comparisons (OP)

Junction 1: Wake Arms Roundabout

OP Peak (meters)					
	2014	2017	2033		2024
Junction 01	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
JC01_QL01	0	0	0	0	0
JC01_QL02	0	0	0	0	0
JC01_QL03	0	0	0	0	0
JC01_QL04	0	0	0	1	0
JC01_QL05	0	0	0	0	0

Junction 33: Woodgreen Road/ A121 Woodridden Hill/ Forest Side/ A121 Honey Lane

OP Peak (meters)					
	2014	2017	2033		2024
Junction 33	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
JC33_QL01	0	0	0	0	0
JC33_QL02	0	0	0	0	0
JC33_QL03	0	0	0	0	0
JC33_QL04	0	0	0	0	0

Junction 34: A112 Sewardstone Road/ Avey Lane

OP Peak (meters)					
	2014	2017	2033		2024
Junction 34	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
JC34_QL01	0	0	0	0	0
JC34_QL02	0	0	0	0	0
JC34_QL03	0	0	0	0	0

Junction 35: High Beech/ Cross Roads/ High Beech Loughton

OP Peak (meters)					
	2014	2017	2033		2024
Junction 35	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
JC35_QL01	0	0	0	0	0
JC35_QL02	0	0	0	0	0
JC35_QL03	0	0	0	0	0

Junction 36: A104 Epping New Road/ Earle's Path/ Cross Roads (Robin Hood Roundabout)

OP Peak (meters)					
	2014	2017	2033		2024
Junction 36	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
JC36_QL01	0	0	0	1	0
JC36_QL02	0	0	0	0	0
JC36_QL03	0	0	0	0	0
JC36_QL04	0	0	0	0	0

Appendix F. Average Queue Duration (IP)

Junction 1: Wake Arms Roundabout

IP Peak (minutes)					
	2014	2017	2033		2024
Junction 01	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J01_01	0.13	0.18	0.22	1.17	0.25
J01_02	0.04	0.04	0.05	0.18	0.04
J01_03	0.08	0.09	0.14	2.77	0.16
J01_04	0.26	0.31	0.40	2.59	0.40
J01_05	0.06	0.07	0.12	0.28	0.12

Junction 33: Woodgreen Road/ A121 Woodridden Hill/ Forest Side/ A121 Honey Lane

IP Peak (minutes)					
	2014	2017	2033		2024
Junction 33	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J33_01	0.16	0.25	0.67	0.82	0.45
J33_02	0.27	0.33	1.61	4.97	1.86
J33_03	0.17	0.18	0.39	1.97	0.41
J33_04	0.01	0.01	0.01	0.03	0.01

Junction 34: A112 Sewardstone Road/ Avey Lane

IP Peak (minutes)					
	2014	2017	2033		2024
Junction 34	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J34_01	0.00	0.00	0.00	0.00	0.00
J34_02	0.23	0.22	0.35	0.68	0.39
J34_03	0.00	0.00	0.01	0.01	0.00

Junction 35: High Beech/ Cross Roads/ High Beech Loughton

IP Peak (minutes)					
	2014	2017	2033		2024
Junction 35	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J35_01	0.00	0.00	0.00	0.01	0.00
J35_02	0.08	0.09	0.14	0.31	0.15
J35_03	0.01	0.01	0.02	0.01	0.01

Junction 36: A104 Epping New Road/ Earle's Path/ Cross Roads (Robin Hood Roundabout)

IP Peak (minutes)					
	2014	2017	2033		2024
Junction 36	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J36_01	0.19	0.22	0.30	1.06	0.35
J36_02	0.01	0.01	0.02	0.02	0.02
J36_03	0.05	0.05	0.07	0.18	0.09
J36_04	0.02	0.03	0.04	0.09	0.04

Appendix G. Average Queue Duration (OP)

Junction 1: Wake Arms Roundabout

OP Peak (minutes)					
	2014	2017	2033		2024
Junction 01	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J01_01	0.00	0.00	0.00	0.00	0.00
J01_02	0.01	0.00	0.00	0.01	0.00
J01_03	0.00	0.01	0.01	0.01	0.01
J01_04	0.01	0.01	0.01	0.02	0.01
J01_05	0.01	0.01	0.02	0.01	0.01

Junction 33: Woodgreen Road/ A121 Woodridden Hill/ Forest Side/ A121 Honey Lane

OP Peak (minutes)					
	2014	2017	2033		2024
Junction 33	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J33_01	0.00	0.00	0.00	0.00	0.00
J33_02	0.02	0.02	0.02	0.03	0.03
J33_03	0.00	0.01	0.01	0.01	0.02
J33_04	0.00	0.00	0.00	0.00	0.00

Junction 34: A112 Sewardstone Road/ Avey Lane

OP Peak (minutes)					
	2014	2017	2033		2024
Junction 34	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J34_01	0.00	0.00	0.00	0.00	0.00
J34_02	0.00	0.00	0.00	0.01	0.01
J34_03	0.00	0.00	0.00	0.00	0.00

Junction 35: High Beech/ Cross Roads/ High Beech Loughton

OP Peak (minutes)					
	2014	2017	2033		2024
Junction 35	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J35_01	0.00	0.00	0.00	0.00	0.00
J35_02	0.00	0.01	0.00	0.01	0.01
J35_03	0.00	0.00	0.00	0.00	0.00

Junction 36: A104 Epping New Road/ Earle's Path/ Cross Roads (Robin Hood Roundabout)

OP Peak (minutes)					
	2014	2017	2033		2024
Junction 36	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J36_01	0.01	0.01	0.01	0.01	0.01
J36_02	0.00	0.00	0.00	0.00	0.00
J36_03	0.00	0.00	0.00	0.00	0.00
J36_04	0.00	0.00	0.00	0.00	0.00

Appendix H. Average Speeds (IP)

Junction 1: Wake Arms Roundabout

IP Peak (mph)					
	2014	2017	2033		2024
Junction 01	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J01_01	31.78	31.49	31.62	30.68	31.07
J01_02	33.15	33.30	33.28	33.42	33.31
J01_03	31.59	31.66	31.22	31.00	31.31
J01_04	26.11	25.90	25.54	25.11	25.55
J01_05	24.91	25.05	21.78	20.53	21.49

Junction 33: Woodgreen Road/ A121 Woodridden Hill/ Forest Side/ A121 Honey Lane

IP Peak (mph)					
	2014	2017	2033		2024
Junction 33	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J33_01	32.10	32.26	32.09	32.09	31.34
J33_02	24.91	25.05	21.78	21.78	21.49
J33_03	32.10	32.26	32.09	32.09	31.34
J33_04	24.91	25.05	21.78	21.78	21.49

Junction 34: A112 Sewardstone Road/ Avey Lane

IP Peak (mph)					
	2014	2017	2033		2024
Junction 34	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J34_01	24.91	25.05	21.78	20.53	21.49
J34_02	32.10	32.26	32.09	30.03	31.34
J34_03	24.91	25.05	21.78	20.53	21.49

Junction 35: High Beech/ Cross Roads/ High Beech Loughton

IP Peak (mph)					
	2014	2017	2033		2024
Junction 35	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J35_01	32.10	32.26	32.09	30.03	31.34
J35_02	32.10	32.26	32.09	30.03	31.34
J35_03	32.10	32.26	32.09	30.03	31.34

Junction 36: A104 Epping New Road/ Earle's Path/ Cross Roads (Robin Hood Roundabout)

IP Peak (mph)					
	2014	2017	2033		2024
Junction 36	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J36_01	26.11	25.90	25.54	25.11	25.55
J36_02	32.10	32.26	32.09	30.03	31.34
J36_03	26.11	25.90	25.54	25.11	25.55
J36_04	32.10	32.26	32.09	30.03	31.34

Appendix I. Further Scenario Tests - Average Speeds (OP)

Junction 1: Wake Arms Roundabout

OP Peak (mph)					
	2014	2017	2033		2024
Junction 01	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J01_01	33.96	33.80	33.12	33.06	33.40
J01_02	35.82	35.50	35.31	34.99	35.45
J01_03	33.35	33.40	33.74	33.02	33.05
J01_04	31.68	31.43	30.74	30.06	30.74
J01_05	30.35	30.22	29.64	29.14	29.40

Junction 33: Woodgreen Road/ A121 Woodridden Hill/ Forest Side/ A121 Honey Lane

OP Peak (mph)					
	2014	2017	2033		2024
Junction 33	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J33_01	34.51	35.05	35.19	34.17	34.63
J33_02	30.35	30.22	29.64	29.14	29.40
J33_03	34.51	35.05	35.19	34.17	34.63
J33_04	30.35	30.22	29.64	29.14	29.40

Junction 34: A112 Sewardstone Road/ Avey Lane

OP Peak (mph)					
	2014	2017	2033		2024
Junction 34	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J34_01	30.35	30.22	29.64	29.14	29.40
J34_02	34.51	35.05	35.19	34.17	34.63
J34_03	30.35	30.22	29.64	29.14	29.40

Junction 35: High Beech/ Cross Roads/ High Beech Loughton

OP Peak (mph)					
	2014	2017	2033		2024
Junction 35	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J35_01	34.51	35.05	35.19	34.17	34.63
J35_02	34.51	35.05	35.19	34.17	34.63
J35_03	34.51	35.05	35.19	34.17	34.63

Junction 36: A104 Epping New Road/ Earle's Path/ Cross Roads (Robin Hood Roundabout)

OP Peak (mph)					
	2014	2017	2033		2024
Junction 36	Baseline	Baseline	Baseline	Scenario 4	Scenario 6
J36_01	31.68	31.43	30.74	30.06	30.74
J36_02	34.51	35.05	35.19	34.17	34.63
J36_03	31.68	31.43	30.74	30.06	30.74
J36_04	34.51	35.05	35.19	34.17	34.63

Appendix D Air Quality Modelling Technical Note

Epping Forest Special Area of Conservation

Air Quality Assessment Modelling Methodology for 2020 Habitat Regulations Assessment
Technical Note

Epping Forest District Council

20 August 2020

Quality information

Prepared by	Checked by	Verified by	Approved by
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Revision History

Revision	Revision date	Details	Authorized	Name	Position
0					

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Tables

1. Introduction

1.1 An air quality assessment was undertaken in 2018/19 to assess the potential impact of road traffic emissions on the Epping Forest Special Area of Conservation (EFSAC) and used to inform the Habitats Regulations Assessment 2019 (HRA 2019), prepared to support the Epping Forest Local Plan Submission Version (LPSV). The methodology has been updated for the Habitats Regulations Assessment 2020 (HRA 2020).

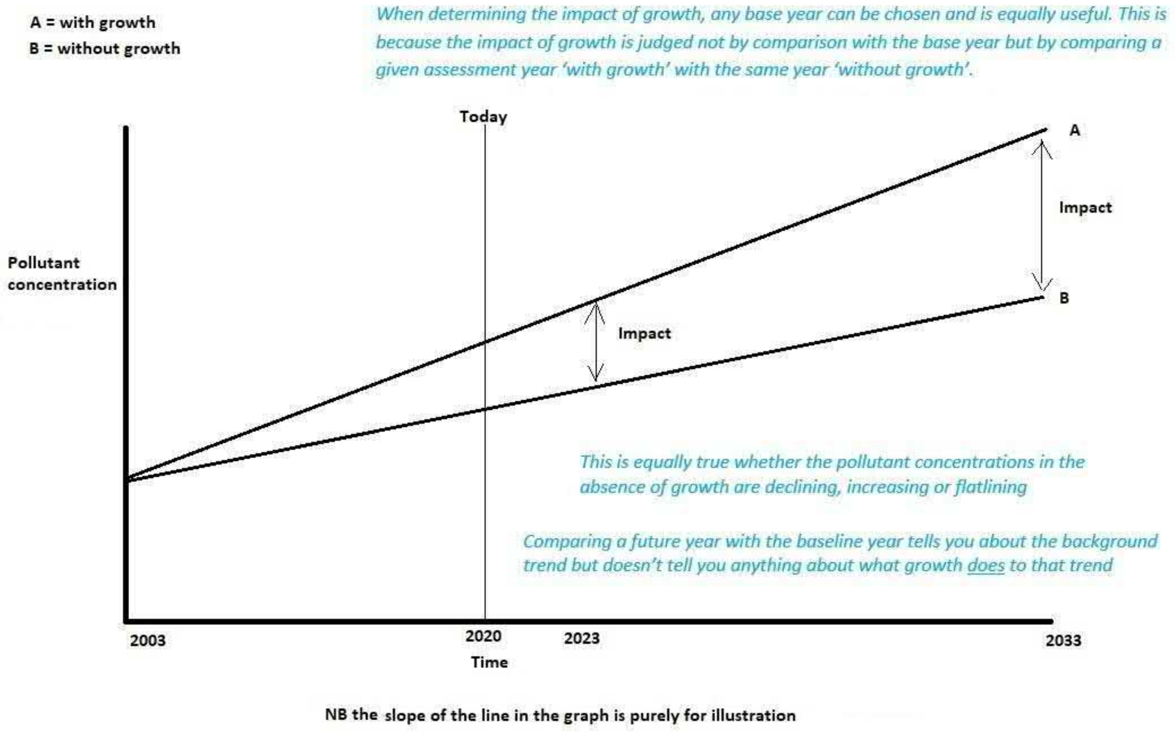
1.2 Key road links within 200m of the EFSAC were included in the model to inform both the HRA 2019 and HRA 2020. . Habitats within EFSAC are sensitive to concentrations of oxides of nitrogen (NOx) and ammonia (NH_3) and nutrient nitrogen levels and these can be affected by emissions from road traffic. These pollutants were assessed for the 2019 HRA and continue to be the focus of the 2020 air quality assessment.

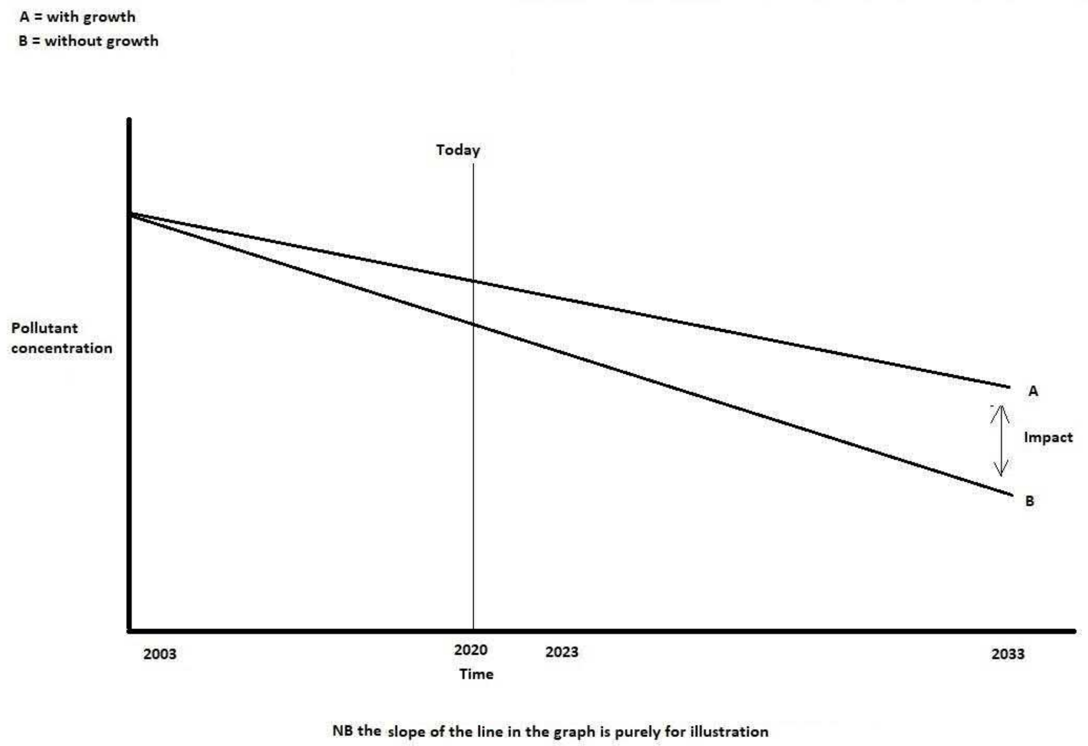
1.3 Epping Forest District Council (EFDC) and the technical team have taken the opportunity to review the assumptions applied in the 2018/19 modelling assessment to ensure that the most appropriate information is used to provide a robust analysis of the likely future traffic conditions. The following scenarios are discussed in the HRA, with a full list of modelled scenarios presented in Appendix A:

- ***Scenario 2 2017*** 2017 Baseline for verification (monitoring data collected in 2018-19, annualised to 2017);
- Projected End of Plan (2033)
    - ***Scenario 3 Future Base*** baseline (no Local Plan);
    - ***Scenario 4*** with Local Plan;
    - ***Scenario 4.5ULEZev*** with Local Plan and mitigation;
- Interim year (2024)
    - ***Scenario 6 Base*** baseline (no Local Plan);
    - ***Scenario 6a*** with Local Plan;
    - ***Scenario 6aULEZev10*** with Local Plan and mitigation.

1.4 The impact of the Local Plan is assessed by comparing the scenarios (both with and without mitigation) against the ‘future base’ scenario for the appropriate year. The ‘future base’ includes growth in traffic that would be expected if the Local Plan were not to go ahead.

Figure 1: Illustration of long-term increasing (top) and decreasing (bottom) pollutant trends and the calculated impact assessed in HRA





2. Model set-up

2.1 The detailed dispersion model, ADMS-Roads (version 5.0.0.1, released March 2020) has been used to model concentrations of both NOx and NH_3 from road traffic in the EFSAC. Meteorological data for 2017 from Stansted airport has been used in the modelling assessment, as it was in the 2019 HRA. Details are provided in Table 1.

Table 1: General ADMS-Roads Model Conditions

Variable	*ADMS-Roads Model Input*
Surface roughness	1 m at dispersion site; 0.2m at meteorological measurement site
Minimum Monin-Obukhov length for stable conditions	10 m
Terrain types	Flat
Receptor locations	x, y coordinates determined by GIS, z=0m
Emissions	NO_x, NH_3
Road traffic emission factors	NOx – Emission Factor Toolkit (EFT) Version 9.0 NH_3 - Calculator for Road Emissions of Ammonia (CREAM) For both tools, 2017 emission factors have been applied in the baseline scenario to match the monitoring data, 2024 emission factors in interim year scenarios, and 2030 emission factors in end-of-plan scenarios
Meteorological data	1 year (2017) hourly sequential data from Stansted Airport meteorological station
Emission profiles	Variation in traffic flow: 20% AM peak: 0700-1000h (3 hours) 38% Inter-peak: 1000-1600h (6 hours) 21% PM peak: 1600-1900h (3 hours) 22% Off-peak: 1900-0700h (12 hours)
Receptors	Selected receptors / transects and gridded receptors with kriging interpolation to produce contour plots
Model output	Long-term annual mean NO_x concentrations Long-term annual mean NH_3 concentrations

3. Representation of queuing traffic

3.1 The junctions included in the air quality modelling study are presented in Appendix B. The methodology used to estimate emissions from queuing traffic for the HRA 2019 was based on the Cambridge Environmental Research Consultancy (CERC) methodology. The CERC methodology is one of a number of valid approaches to modelling emissions from queueing traffic. Since the original modelling was completed EFDC/AECOM have verified with CERC the application of the methodology given in CERC's note 60, from 2004.

3.2 The method provides an estimate of the number of vehicles per lane that would pass a point when travelling at 5km/h, assuming an average vehicle length of 4m, which equates to a traffic flow of 30,000 Annual Average Daily Traffic (AADT) if the queue was continuous for 24 hours per day. CERC clarified that this should be applied instead of the forecast traffic flow, not additionally. As the 2019 HRA applied the 30,000 AADT flow for queuing traffic as well as the forecast vehicle flow, there was a 'double-counting' of emissions where queuing traffic was modelled. The 2020 air quality modelling has been amended to reflect this clarification.

3.3 The updated air quality model uses the appropriate vehicle flows for each of the time periods. The queue length for each time period has traffic speeds reduced to 5km/h for the duration of said period. This methodology is in-line with the LAQM.TG(16) methodology considering emissions of NOx for idling traffic ('*the EF may be assumed to be equal to that corresponding to the vehicle travelling at 5km/h (the lowest possible speed in the EFT*)' - paragraph 7.249), whilst also taking into account the diurnal variation in traffic flows and queue lengths. This provides a precautionary approach to estimating emissions of NOx from queuing traffic as it assumes the lowest possible speed in the EFT.

3.4 Queue length parameters previously reported, in the 2019 HRA, followed TfL's VISSIM Model Audit Process (VMAP) guidelines, which limited reported queue length outputs to 500m.. Applying this approach meant that the length of the queues on some links may have been underestimated. The updated methodology removes this limiting parameter and any queue lengths exceeding 500m are included in the revised VISSIM outputs and subsequent air quality modelling.

3.5 The removal of the TfL VMAP 500m queue length parameter increases reported and assessed queueing on some links and responds to representations made during the 2019 Examination Hearings, regarding the potential underestimation of certain queue lengths. This methodology is precautionary as the maximum of the modelled 10-minute queue lengths during each time period is applied for the duration of each time period.

3.6 The HRA 2019 calculated forecast traffic flows using factors from observed traffic counts to convert peak hour flows into 24-hour weekday rather than AADT flows. Recognising that modelling should also account for average weekend flows in any calculation, the updated methodology combines observed weekday and weekend traffic count data to derive appropriate expansion factors to calculate AADT flows. The 24-hour AADT flows are presented in Appendix C.

3.7 A further step has been taken, using the observed traffic count data, to apportion the total AADT flows into four time periods for air quality modelling so as to account for the variation in traffic flow through the day. This information is presented in Table 2.

Table 2: Time periods and distribution of AADT in air quality modelling

Period	Time	Duration	Traffic Flow (% of AADT)
AM peak	0700-1000h	3 hours	20%
Inter-peak	1000-1600h	6 hours	38%
PM peak	1600-1900h	3 hours	21%
Off-peak	1900-0700h	12 hours	22%

3.8 Given that there is no information on how emissions of NH_3 from road traffic vary with vehicle speed and that the emission factors have a greater level of uncertainty associated with them than those for NOx, it is not considered appropriate or even possible to estimate emissions of this pollutant from queuing traffic in the same way as emissions of NOx from road traffic. The approach taken to considering NH_3 is set out at paragraphs 5.6 – 5.13.

4. Vehicle fleet mix

4.1 An updated version of Defra's Emission Factor Toolkit (EFTv9.0) was published in May 2019. Version 9.0 provides an Advanced Fleet Option 'Fleet Projection Tool' that allows users to project their own, user defined, Euro fleet information from a Base Year to a future Projection Year, rather than using the generic average fleet mix. The guidance published alongside the toolkit gives the specific example of how this could be used as being '*a local Euro fleet derived from Automatic Number Plate Recognition (ANPR) surveys*.' The EFT also provides options to specify the Euro classification of the fleet used in the emission calculations to, as set out in the EFT guidance '*..more accurately reflect local conditions..*'. The use of this tool is considered to be beneficial in understanding the local conditions pertaining to the EFSAC and therefore allow a more targeted approach to any mitigation measures required and to support future monitoring.

4.2 ANPR surveys were undertaken in 2017 and 2019 and have been analysed to derive an 'Epping Forest SAC' (EFSAC) vehicle fleet mix in terms of vehicle type and Euro standards. The EFT v9.0 'Fleet Projection Tool' has been used to derive the evolution of the future vehicle fleet that would be expected to operate in the Forest.

4.3 The use of the ANPR datasets has multiple benefits to the air quality modelling assessment:

- Source apportionment – the predominant source of pollution can be accurately identified to inform more bespoke mitigation measures;
- Vehicle fleet evolution – The EFT v9.0 fleet projection tool has been used to inform future model scenarios, and specific mitigation measures which may affect the vehicle fleet composition;
- Periodic future ANPR surveys are proposed to track the evolution of the vehicle fleet in terms of emission standards and vehicle type. These will be scheduled to support the national requirement for Local Plans to be reviewed every five years. Should the vehicle fleet be found to have evolved in a different way to that which has been predicted in the air quality modelling, revised modelling will be undertaken to determine whether a) there is a need to update the Local Plan and b) whether proposed interventions set out in the Council's adopted Air Pollution Mitigation Strategy are required to be implemented or amended.

Analysis of current EFSAC vehicle fleet

4.4 Analysis of the 2019 ANPR data and the EFT's Basic Fleet Split for rural, urban and outer London roads indicated that the vehicle fleet using the roads through the EFSAC is most similar to the outer London fleet, as defined in EFT v9.0 for 2019. The HDV proportions from the ANPR survey data were between 2% and 2.5% whereas the HRA 2019 assumed 6-9% depending on the road link.

4.5 In terms of Euro Class split, the 2019 ANPR data shows that the car and LGV fleet using the roads through the EFSAC is for the main part newer than that in the EFT outer London fleet, but older than the EFT UK average outside of London. Older vehicles with less rigorous Euro standards are typically more prevalent in the local vehicle fleet for both 2017 and 2019 than the EFT default projections used in the HRA 2019.

4.6 Further details regarding the analysis of the 2017 and 2019 ANPR data are presented in the AECOM Technical Note, 'Comparing 2017 and 2019 ANPR Vehicle Composition with EFT National Default Fleets', February 2020 (see Appendix D).

Projection of EFSAC vehicle fleet

4.7 The Advanced Option 'Simple Entry Euro Compositions' in EFT v9.0 has been used to input User Defined Euro Classes (2017 ANPR data) for the 2017 baseline modelling scenario to reflect local conditions. The NOx/NO_2 results from the baseline modelling assessment were verified against monitoring data as set out in LAQM.TG(16), annualised to the same year.

4.8 The vehicle fleet used in the future assessment years is derived from the 2019 ANPR data using the Advanced Option 'Fleet Projection Tool' in EFT v9.0. This tool is designed specifically to allow the users to project their user defined Euro fleet information from the ANPR derived Euro fleet data to a future Projection Year. 'Option 1' was used to project the EFSAC vehicle fleet – this allowed the vehicle fleet to evolve in future years, in line with national estimates, but recognising that the local vehicle fleet was overall 'older' than the national fleet as identified in both the 2017 and 2019 ANPR surveys.

4.9 Further details regarding the projection of the EFSAC vehicle fleet to 2033 are presented in the AECOM Technical Note, 'Use of ANPR data to inform the projected vehicle fleet in EFSAC', March 2020 (see Appendix E).

4.10 The vehicle fleet composition for all scenarios assessed in the HRA 2020 are presented in Appendix F for the basic fleet split in terms of fuel and vehicle type, and Appendix G for the Euro standard fleet split, which provides an understanding of the age of vehicles.

5. Emission factors

Nitrogen Oxides

5.1 Updated NOx emission factors from the latest version of the EFT v9.0 were published in May 2019. These are used in the assessment rather than the superseded emission rates from v8.0.1 which were used in the 2019 HRA. The release of v9.0 of the EFT was accompanied by a number of updated tools (e.g. 'NOx-to-NO_2 toolkit') which are also used with the updated EFT. Version 10.0 of the EFT was released in August 2020, after the completion of the modelling exercise, and was therefore not used in the HRA 2020. .

5.2 There has previously been reason to consider the EFT future emission predictions with caution, including for example, because research has indicated that Euro 6 vehicles were not performing as expected[1] . Since then, various changes have been made to improve the EFT nationally, including the use of the COPERT emission factors[2] , and more recently the update to version 9.0 of the tool[3].

5.3 Recent research has been undertaken which shows that EFT v9.0 now reflects decreasing measured concentrations of NOx and NO_2 in the UK[4]. However, the research also suggests that EFT v9.0 future fleet predictions may overestimate future emissions of NOx from road traffic:

'*…on balance, the EFT is unlikely to over-state the rate at which NOx emissions decline in the future at an 'average' site in the UK. In practice, the balance of evidence suggests that NOx concentrations are most likely to decline more quickly in the future, on average, than predicted by the EFT. This does not mean that there will be no locations where the EFT over-states the rate of decline, but the most likely situation at most locations appears to be that the EFT will under-predict the rate at which NOx emissions fall in the near future.*'

5.4 This research suggests that the future EFSAC vehicle fleets derived from ANPR data and used in the modelling to inform the HRA 2020 and the Council's Air Pollution Mitigation Strategy provide an appropriately conservative fleet composition for use in the EFSAC model studies. As the future fleets are based upon recorded ANPR data and projected using information within the EFT v9.0 for the closest 'year' of assessment, the assumptions are considered to already include a level of caution. Following the recent evidence that suggests that the EFT standard fleets are likely to underpredict improvements in emissions, and the EFSAC projections give rise to higher emissions than the standard EFT fleets, the EFSAC fleet scenarios build in adequate conservatism whilst also remaining realistic. Therefore, the ANPR projections are considered to be cautious enough to not require an additional sensitivity test.

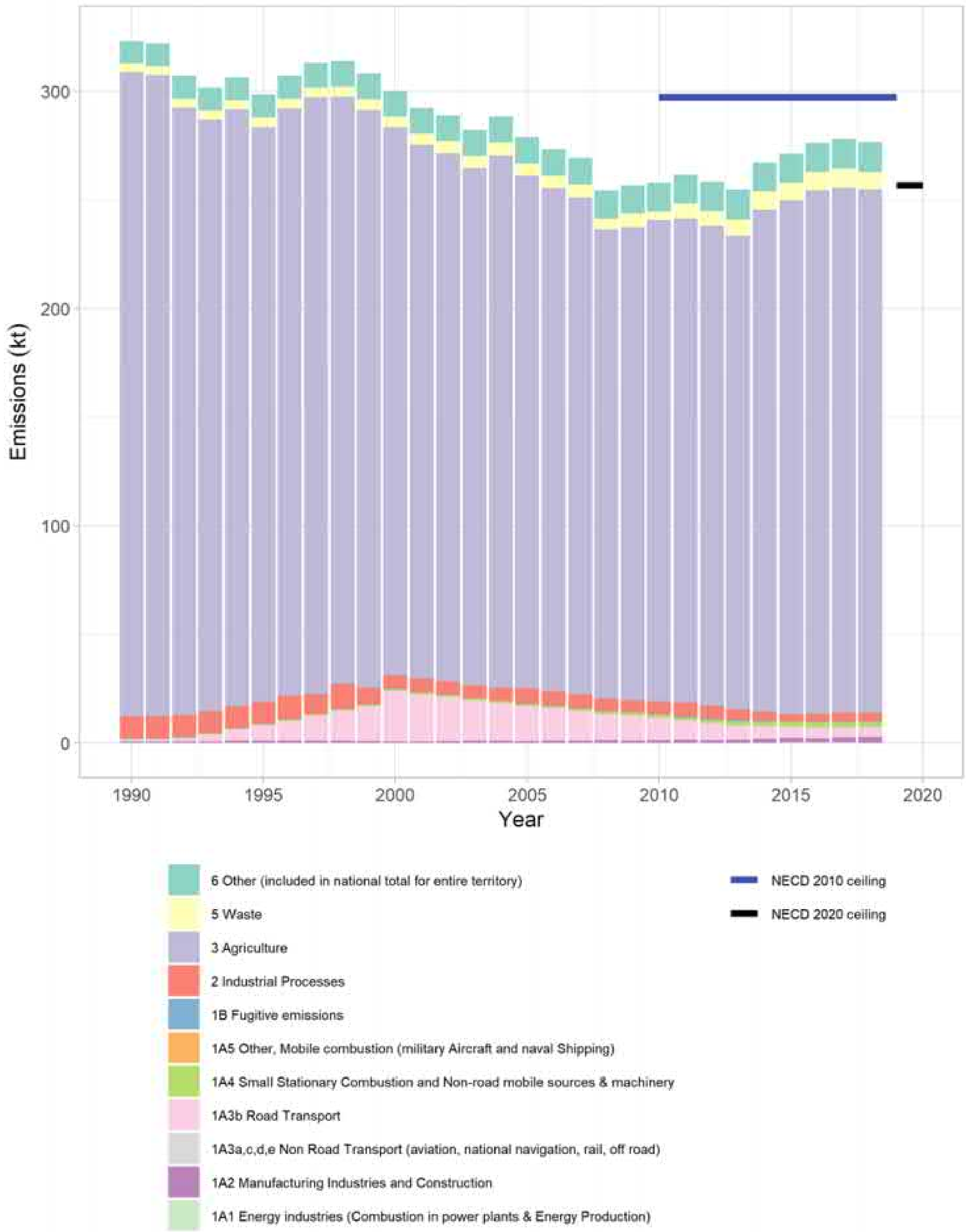
5.5 The future years assessed are 2024 (interim year) and 2033 (end of plan). The end of plan scenarios are assessed using emission rates for 2030 rather than 2033 as this is the latest year for which information is available in the EFT. Therefore, there is no assumption made for further beneficial changes in the vehicle fleet mix that would arise recognising that the last years of the Plan period are immediately before the scheduled implementation of the UK Government's ban on the sale of petrol, diesel and hybrid vehicles. The interim year is assessed using emission rates for 2024.

[1] Carslaw et al., 'Trends in NOx and NO_2 emissions and ambient measurements in the UK.' Prepared for Defra (version 3rd March 2011, available at: https://uk-air.defra.gov.uk/assets/documents/reports/cat05/1103041401_110303_Draft_NOx_NO2_trends_report.pdf
[2] https://copert.emisia.com/
[3] https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html
[4] 'Performance of Defra's Emission Factor Toolkit 2013 - 2019', Air Quality Consultants, February 2020. Available at: https://www.aqconsultants.co.uk/CMSPages/GetFile.aspx?guid=7fba769d-f1df-49c4-a2e7-f3dd6f316ec1

Ammonia

5.6 Agriculture is the most significant source of ammonia emissions nationally, contributing 87% of emissions in the UK in 2018 whilst waste contributed 3% of UK emissions, and road transport less than 2%, as shown in Figure 2. In general, agriculture is a diffuse source of ammonia – the locations of and emissions from agricultural sources are key to determining concentrations at a particular location.

Figure 2: Total UK Emissions by Source Sectors Ammonia (NH3), 1990-2018[5]



5.7 Ammonia emissions can be emitted from road vehicles equipped with catalyst devices, the purpose of which is to control NOx emissions. Ammonia is an unintended by-product of the NOx reduction process on the

[5] UK Informative Inventory Report (1990 to 2018), Ricardo Energy & Environment, March 2020. Available at: https://uk-air.defra.gov.uk/assets/documents/reports/cat07/2003131327_GB_IIR_2020_v1.0.pdf

catalyst and was more pronounced for early generation petrol cars with catalysts (Euro 1 and 2). Factors for later petrol vehicle Euro standards and diesel light duty vehicles are lower. The NH_3 factors for heavy duty vehicles are also low but increase for later Euro V and VI standards due to ammonia slip from the Selective Catalytic Reduction (SCR) system.

5.8 The Institute of Air Quality Management's (IAQM) guidance on assessment of air quality impacts on designated nature conservation sites (2020)[6] provides support for this view. In the May 2020 update it acknowledges that 'as road transport is a source of ammonia, albeit a small source compared to agriculture at a national level, consideration should be given to including it and its contribution to local nitrogen deposition.' However, the guidance does not endorse nor recommend the use of a specific tool or methodology to estimate emissions of ammonia. Furthermore, Natural England's internal guidance (Approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations, 2018) describes an assessment methodology that is based on the assumption that the only traffic emission of relevance to N deposition is NOx. Highways England's LA 105 air quality guidance does not consider ammonia or its contribution to nitrogen deposition. Assessments for Highways England must follow this guidance.

5.9 Unlike NOx, there is no national tool to estimate emissions of ammonia from road traffic. Emission rates of NH_3 are not included in the EFT as NH_3 from traffic is not an emission of concern for human health. Although it is acknowledged that not including emissions of ammonia may underestimate the traffic-related impact on nitrogen deposition to sensitive ecosystems, there is much less information available regarding emissions of ammonia from road traffic vehicles than NOx, and the information that is available has a high degree of uncertainty. Whilst emissions of NOx from road vehicles are regulated according to Euro standards, emissions of ammonia are not, meaning that emissions from individual vehicle types are highly uncertain as measurements are rarely made as it is not required for regulatory purposes in relation to human health.

5.10 The National Atmospheric Emissions Inventory (NAEI) provides NH_3 emission factors from road traffic based on information from the EMEP/EEA Emissions Inventory Guidebook (2016, July 2018 update)[7] and COPERT 5 source. The figures provided are fleet averages for a single year. These data were previously used in the 2019 HRA as they were the best available at the time of modelling, however there was no account taken for the variation in emission rates in future years according to changes in Euro standards.

5.11 In February 2020, Air Quality Consultants developed and published the Calculator for Road Emissions of Ammonia (CREAM) tool[8], '*in order to allow tentative predictions regarding trends in traffic-related ammonia emissions over time*'[9]. The tool is based upon remote sensing results, published real-world fuel consumption data and ambient measurements recorded in Ashdown Forest (2014-2016). However, to the best of our knowledge, the CREAM tool and methodology have not been peer reviewed.

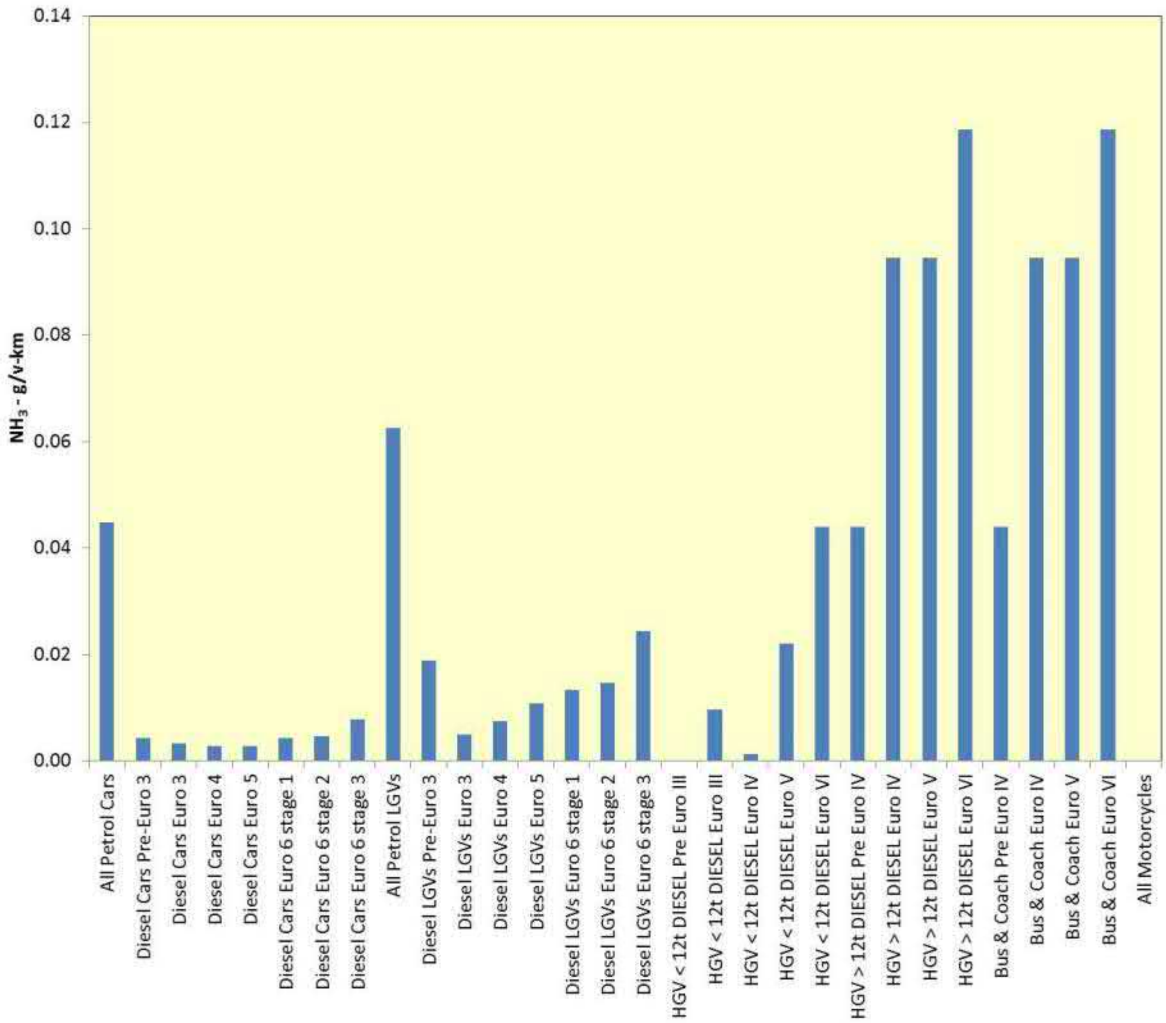
5.12 The report that was published along-side the CREAM tool states that:

> "*It should be recognised that these emissions factors remain uncertain. Using them to make future year predictions will clearly be an improvement on any assessment which omits ammonia. They are also considered to be more robust than the emissions factors contained in the EEA Guidebook, which risk significantly under-predicting ammonia emissions. The emissions factors contained in the CREAM model can be considered to provide the most robust estimate of traffic-related ammonia possible at the present time, but they may be updated in the future as more information becomes available*."

5.13 In the absence of an alternative tool from Defra, Natural England or other nature conservation bodies, emission factors for ammonia from the CREAM tool have been used in the 2020 air quality modelling. As CREAM is a 'locked' tool, it was not possible to apply the bespoke EFSAC vehicle fleet information regarding Euro standards in the same way as it has for the EFT. The 'London - Outer' fleet composition was adopted as the EFSAC is considered to be most similar to the EFT outer London fleet, and the two tools share the same default fleet data (see AECOM 'Vehicle Fleet Projection' report for comparison). The predicted emissions per vehicle are presented in Figure 3.

[6] https://iaqm.co.uk/text/guidance/air-quality-impacts-on-nature-sites-2020.pdf
[7] https://www.eea.europa.eu/publications/emep-eea-guidebook-2016/part-b-sectoral-guidance-chapters/1-energy/1-a-combustion/1-a-3-b-i/view
[8] Air Quality Consultants, CREAM V1A, February 2020. Available at: https://www.aqconsultants.co.uk/resources/calculator-for-road-emissions-of-ammonia
[9] Air Quality Consultants, 'Ammonia Emissions from Roads for Assessing Impacts on Nitrogen-sensitive Habitats', February 2020. Available at: https://www.aqconsultants.co.uk/CMSPages/GetFile.aspx?guid=3aa4ec2e-ee4e-4908-bc7a-aeb0231b4b37

Figure 3: Predicted emissions of ammonia per vehicle in CREAM tool[8]



6. Comparison with monitoring data

Nitrogen Oxides

6.1 A revised verification of the modelling outputs has been undertaken using the full nine month set of site-specific monitoring data undertaken in 2018-2019 (the HRA 2019 used verified data based on six months of data). This has been annualised to 2017, to correspond with the traffic flows and ANPR data collected and used in the 2017 baseline model, in-line with Defra guidance (LAQM.TG(16)).

6.2 Table 3 provides a comparison of modelled and monitored concentrations of NOx up to 10m from the roadside. Overall the model was found to underestimate monitored concentrations. A verification factor of 1.86 was calculated with an RMSE of 6.3 µg/m^3 (compared against an RMSE of 9.8 µg/m^3 before adjustment at the same sites).

6.3 It is worth noting that even after adjustment, model performance at the roadside is weakest. This is in line with the IAQM guidance[10] which flags that concentrations within 2m of the road '*can be unreliable*' and '*may not represent areas of relevance to the assessment*'.

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

Table 3: Comparison of measured and monitored NOx Concentrations (µg/m³) – 2017 annual mean equivalent concentrations

Site ID	Modelled Road NOx Contribution (µg/m³)	Monitored Road NOx Contribution (µg/m³)	Modelled Vs. Monitored NOx (Roads) %	Adjustment factor	Adjusted Modelled NOx Roads (µg/m³)	Adjusted Modelled Vs. Monitored NOx (Roads) %
T1_N0	36.0	55.7	-35%	1.5	67.0	20%
T1_N5	26.5	32.5	-19%	1.2	49.3	51%
T1_N10	14.7	23.2	-36%	1.6	27.4	18%
T2_N0	28.5	85.8	-67%	3.0	53.1	-38%
T2_N5	19.6	35.8	-45%	1.8	36.5	2%
T2_N10	17.7	28.2	-37%	1.6	32.9	17%
T2_N0	28.5	85.8	-67%	3.0	53.1	-38%
T2_N5	19.6	35.8	-45%	1.8	36.5	2%
T2_N10	17.7	28.2	-37%	1.6	32.9	17%
T4_N0	14.7	45.8	-68%	3.1	27.4	-40%
T4_N5	9.6	24.7	-61%	2.6	17.8	-28%
T4_N10	6.1	18.2	-66%	3.0	11.4	-38%
T5_N0	8.2	26.0	-69%	3.2	15.2	-42%
T5_N5	6.2	14.4	-57%	2.3	11.5	-20%
T5_N10	4.4	12.5	-64%	2.8	8.3	-34%
T6_N0	44.5	65.3	-32%	1.5	83.0	27%
T6_N5	32.3	29.8	8%	0.9	60.2	102%
T6_N10	21.9	26.1	-16%	1.2	40.8	56%
T7_N0	15.7	44.1	-65%	2.8	29.2	-34%
T7_N5	10.9	28.8	-62%	2.6	20.3	-29%
T7_N10	8.2	21.1	-61%	2.6	15.2	-28%
T8_N0	16.1	40.0	-60%	2.5	30.0	-25%
T8_N5	10.2	22.5	-54%	2.2	19.1	-15%
T8_N10	7.6	21.3	-65%	2.8	14.1	-34%
T10_N10	10.9	12.0	-9%	1.1	20.3	69%
T11_N0	8.6	41.3	-79%	4.8	16.1	-61%

T11_N5	6.4	18.1	-64%	2.8	12.0	-34%
T11_N10	4.3	15.9	-73%	3.7	8.0	-50%
Overall calculated NOx adjustment factor				**1.86**		

Ammonia

6.4 Defra monitors NH_3 concentrations as part of the UK Eutrophying and Acidifying Atmospheric Pollutant (UKEAP) at 95 sites across the UK. DELTA samplers (DEnuder for Long-Term Atmospheric sampling) are used at 59 of these sites. DELTA samplers are considered to provide the most robust estimates of NH_3 concentrations but require an electrical supply to operate so are not practical for many rural or habitat sensitive monitoring sites. A secondary network of ALPHA samplers (Adapted Low-cost Passive High Absorption) are employed at a further 49 sites to assess regional and local scale variability in NH_3 concentrations.

6.5 The ALPHA method is calibrated against the DELTA method at 12 sites within the network with a bias adjustment factor of 0.33, which is applied to the ALPHA results. .

6.6 A comparison of measurements made in 2018 with both ALPHA and DELTA of samplers indicates that the NH_3 measurements made using ALPHA samplers have a greater level of uncertainty associated with them than the more robust DELTA samplers (Table 4). The ALPHA sampler measurements were in the range -23% to +38% of the DELTA sampler measurements. There appears to be more variation in the ratios than would be the case with NO_2 diffusion tube results (compared with chemiluminescent analysers[11]), bearing in mind that national bias adjustment factors have already been applied to the ALPHA results.

Table 4: Measured Ammonia Concentrations (μg/m^3) by DELTA and ALPHA Samplers at UKEAP sites in 2018

Site	DELTA	ALPHA	Ratio
Auchencorth Moss	0.98	1.26	1.29
Glensaugh	0.37	0.35	0.92
Lynclys Common	2.39	2.36	0.99
Moorhouse	0.58	0.75	1.29
Rothmansted	1.16	1.48	1.28
Stoke Ferry	2.11	2.92	1.38
Sourhope	1.19	0.92	0.77

6.7 Diffusion tubes were used to measure NH_3 in the National Acid Monitoring Network up until 2000. The tubes have been used to measure NH_3 for many decades but with mixed success. Some studies found them to perform satisfactorily whilst others found them to substantially overestimate NH_3 at ambient levels. Although NH_3 diffusion tubes can be shown to perform adequately, CEH recommends that any implementation should be supported by ongoing reference data[12].

6.8 Due to their ready availability and ease of deployment, ammonia diffusion tubes were used to monitor concentrations of the pollutant in EFSAC from May 2018 to February 2019 with some tubes co-located with

[11] Chemiluminescent analysers measure the concentration of nitrogen oxide (NO), nitrogen oxides (NOx) and nitrogen dioxide (NO_2).
[12] CEH, Development and types of passive samplers for monitoring atmospheric NO_2 and NH_3 concentrations, The Scientific World , 2001.

an ALPHA sampler to enable bias adjustment of the results to improve their accuracy. The locations of the tubes were agreed with the Conservators of Epping Forest.

6.9 A three-month co-location study was undertaken from December 2018 to February 2019 at the London Cromwell Road UKEAP network site in order to derive a bias adjustment factor for the EFSAC diffusion tube survey. The Cromwell Road monitoring station is equipped with the ALPHA passive sampler that measures gaseous ammonia on a monthly basis. A bias adjustment factor of 0.59 was calculated, indicating that the diffusion tubes overestimated NH_3 concentrations by approximately 40% on average in comparison to the ALPHA sampler. This bias adjustment factor was applied to the diffusion tube results.

6.10 At some of the monitoring sites in EFSAC, three tubes were exposed, whilst at other sites, only one tube per month was exposed. There was a large variation in the individual measurements made at the sites with three tubes, during many of the months of the survey indicating that the precision (ability of a measurement to be consistently reproduced) of the tubes was poor.

6.11 It should therefore be noted that NH_3 measurements made using diffusion tubes, as undertaken in EFSAC, have a much higher level of uncertainty associated with them compared with diffusion tubes for NO_2 and ALPHA samplers for NH_3. This greater level of uncertainty should be borne in mind when considering the modelling results..

6.12 A comparison of the modelled and monitored concentrations (annualised to 2017) is presented in Table 5 for monitoring locations up to 10m from the road. The comparison shows that the model both under- and over-estimates concentrations across the EFSAC. The difference between modelled and measured concentrations, before any adjustment, is less for NH_3 than for NO_x. As such, and given the level of uncertainty of the diffusion tube results, an adjustment factor has not been applied to the modelled ammonia concentrations.

Table 5: Comparison of measured and monitored NH_3 Concentrations ($\mu g/m^3$) – 2017 annual mean equivalent concentrations

Site ID	Modelled Road NH_3 Contribution ($\mu g/m^3$)	Monitored Road NH_3 Contribution ($\mu g/m^3$)	Modelled Vs. Monitored NH_3 (Roads) %
T1_A0 (Tri)	1.09	1.20	-9%
T1_A5	0.84	0.92	-9%
T1_A10	0.49	0.90	-46%
T3_A0 (Tri)	1.54	1.70	-10%
T3_A5	0.88	1.22	-28%
T3_A10	0.56	0.42	33%
T4_A0 (Tri)	0.73	1.29	-44%
T4_A5	0.47	0.86	-45%
T4_A10	0.29	0.63	-53%
T6_A0 (Tri)	1.64	1.92	-15%
T6_A5	1.20	0.83	45%
T8_A0 (Tri)	0.89	1.13	-21%
T8_A5	0.56	0.72	-22%
T8_A10	0.41	0.48	-14%

7. Background concentrations and deposition rates

7.1 The updated NOx background maps issued to accompany EFT v9.0 (based on 2017 traffic data) are used in the air quality modelling. Background concentrations of NOx for the year 2024 are used for the interim year scenarios and for 2030 for the end-of-plan scenarios. In-line with best practice, the trunk and primary A road contributions within the grid square have been removed since emissions from these sectors are included in the air quality model.

7.2 Background NH_3 concentrations and nitrogen deposition rates for the 3-year average 2016-2018 have been used for all scenarios. This information was obtained from the APIS website for the 5 km grid square containing the relevant receptor. Future trends in background concentrations of ammonia are more uncertain than that for NOx. As a precautionary approach, no change was projected in background ammonia concentrations or nitrogen deposition in future years.

7.3 However, with regard to background concentrations and nitrogen deposition rates over the duration of a Local Plan period, the 2020 IAQM guidance states that '*it seems reasonable to either assume no change or to assume that emissions will change in line with the requirements of the 2016 National Emissions Ceiling Directive*'. The approach taken in the EFSAC modelling is therefore considered to be a precautionary approach as it is reasonable to anticipate a decrease in background total nitrogen deposition by 2033 due to decreasing NOx emissions resulting in decreasing wet and dry deposition of nitrogen. Measures that are also expected to contribute towards a decrease within this timescale are the penetration of 'cleaner' vehicles in the national fleet e.g. Euro 6 (reduced NOx emissions), and the implementation of mitigation measures outlined in the 2019 Clean Air Strategy[13] for agricultural ammonia emissions. The UK Government's decision to ban the sale of petrol, diesel and hybrid vehicles from 2035 is also likely to have a beneficial effect.

8. Deposition velocities

8.1 The deposition rate used in the assessment for the HRA 2019 was based on published guidance in the Design Manual for Roads and Bridges (DMRB), Volume 11, Chapter 3, Part 1 Air Quality which was current at the time. This guidance was updated in November 2019 and now contains deposition rates for short and tall vegetation.

8.2 Nitrogen deposition has been calculated for all scenarios based on both 'heathland' and 'tall vegetation' deposition velocity factors. The data are presented as contour plots for selected scenarios, with the appropriate deposition velocity used for the appropriate area.

8.3 The deposition rates of NO_2 and NH_3 applied are consistent with those presented in the IAQM guidance, "A guide to the assessment of air quality impacts on designated nature conservation sites" (v1.1 May 2020)[14], and the Air Quality Technical Advisory Group (AQTAG) guidance[15]:

- grassland: NO_2 deposition velocity = 0.0015 m/s;
- forest: NO_2 deposition velocity = 0.003 m/s;
- grassland: NH_3 deposition velocity = 0.02 m/s;
- forest: NH_3 deposition velocity = 0.03 m/s.

8.4 It should be noted that the deposition rates of NO_2 given in Highways England's recently released and updated DMRB guidance for air quality, LA 105[16], are consistent with those cited in the 2020 IAQM guidance (grassland and similar habitats: 1 µg/m^3 of NO_2 = 0.14 kg N/ha/year; forests and similar habitats: 1 µg/m^3 of NO_2 = 0.29 kg N/ha/year). Highways England's LA 105 air quality guidance does not consider ammonia or its contribution to nitrogen deposition, and therefore does not cite deposition rates for NH_3.

8.5 The AQTAG / IAQM deposition velocities provide a constant rate at which the pollutant deposits to the specific surface. Research has, however, shown that the deposition rate of NH_3 is concentration dependent, with lower deposition velocities at higher concentrations. One study demonstrated that deposition velocities were a factor of 10 lower close to the source and a factor of two lower at 60m from the source before approaching what was expected beyond 100m from the source17. This research suggests that simple scaling techniques are not appropriate for this purpose thereby implying that a simple scaling factor to estimate deposition from NH_3 is likely to result in an overestimate of the contribution of ammonia to nitrogen deposition and that overestimate is likely to be large close to the source.

8.6 Given the uncertainty relating to the NH_3 measurements using diffusion tubes in EFSAC and the greater uncertainty in NH_3 emissions from road traffic relative to those of NOx, the nitrogen deposition calculations with NH_3 contributions included using a simple scaling factor to estimate deposition rates should be treated with caution.

[13] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/770715/clean-air-strategy-2019.pdf
[14] https://iaqm.co.uk/text/guidance/air-quality-impacts-on-nature-sites-2020.pdf
[15] Air Quality Technical Advisory Group, 2014, AQTAG06 Technical guidance on detailed modelling approach for an appropriate assessment for emissions to air.
[1616] https://www.standardsforhighways.co.uk/dmrb/search/10191621-07df-44a3-892e-c1d5c7a28d90
[17] Cape et al., 'Concentration-dependent deposition velocities for ammonia: moving from lab to field', http://nora.nerc.ac.uk/id/eprint/2777/1/N2777_Cape.pdf

9. Modelled Mitigation Measures

Modal shift

9.1 The modal shift assumptions applied to the 'end of plan' scenario with mitigation in place, adopt a precautionary approach through the consideration of reasonable improvements to sustainable transport choices across the district and neighbouring destinations e.g. Harlow and London. The analysis considers the sustainable access policy requirements and proposed improvements to provide a balance of what can be reasonably delivered by developers and public transport operators to encourage modal shift at all new development. No consideration at this stage has been made for modal shift in background / existing traffic on the network nor have the significantly more ambitious modal shift targets to be delivered through the development of Harlow and Gilston Garden Town. The modal shift used in the EFSAC air quality modelling equates to an approximate reduction of 5%-7% in Local Plan related new development traffic growth and is deemed an appropriate approach to test the impact of reasonable sustainable modal shift.

Clean Air Zone

9.2 The purpose of a Clean Air Zone (CAZ) is to improve air quality, and more specifically to reduce levels of NO_2 and particulate matter to help achieve the UK's national air quality objectives[18]. They are designed to deliver the cleanest possible fleet (in terms of NOx and particulate matter) by mandating minimum emission standards for vehicles using roads within a CAZ.

9.3 The Central London fleet mix – in terms of Euro standards – was applied to the EFSAC vehicle fleet in order to demonstrate the efficacy of a CAZ in EFSAC. This is considered appropriate as the EFSAC is in close proximity to outer London (5-10 km north-east of the North Circular Road), and there are plans to expand the Ultra-Low Emissions Zone (ULEZ) from 25 October 2021 up to the North Circular Road[19].

9.4 The vehicle fleet mix in terms of Euro standards for all modelled scenarios is presented in Appendix G.

Electric vehicles

9.5 Whilst emissions of NOx from road vehicles are regulated according to Euro standards, emissions of ammonia are not. This means that emissions of ammonia from individual vehicle types are highly uncertain, particularly as measurements are rarely made as it is not required for regulatory purposes.

9.6 As such, the only way that emissions of ammonia from road traffic can be limited with certainty, is by reducing on-road emissions altogether e.g. switching to electric vehicles. An analysis of the modelled data at the transects indicated that the dominant source of ammonia emissions, as modelled using the CREAM tool, was petrol cars, accounting for 67% to 80% of road traffic emissions of road traffic ammonia in the 'end of plan' unmitigated scenario (scenario 4.5). It was subsequently calculated that, based on the current available information, a 30% reduction in petrol cars would need to be achieved, in addition to the CAZ, to be able to demonstrate no adverse effect on the integrity of the EFSAC as a result of Local Plan development.

Other measures not modelled

9.7 Consideration was given to restricting access through the EFSAC to HDVs and / or LGVs. The ANPR data analysis showed that less than 2% of the traffic using the roads in EFSAC are HDVs, and approximately 19% are LGVs (predominantly diesel).

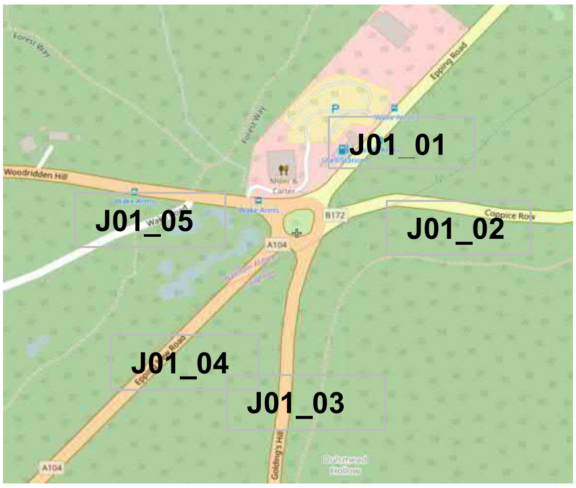
9.8 Analysis of emissions data from the unmitigated 'end of plan' scenario indicated that on their own, neither of these measures would sufficiently reduce modelled emissions of NOx and ammonia to conclude no adverse effect on the integrity of the EFSAC as a result of Local Plan development These measures were therefore not prioritised for modelling, although they are included as potential measures in the Council's emerging Air Pollution Mitigation Strategy as they would provide some air quality improvement benefits.

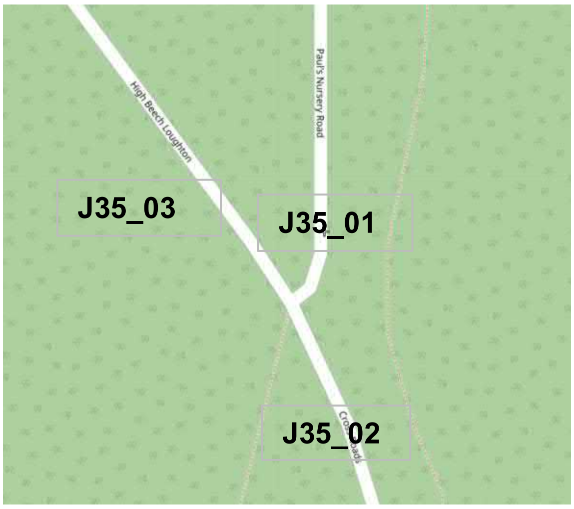
[18] https://uk-air.defra.gov.uk/assets/documents/Air_Quality_Objectives_Update.pdf
[19] The ULEZ boundary around central London will be extended to create a larger zone up to, but not including, the North and South Circular Roads https://tfl.gov.uk/modes/driving/low-emission-zone/about-the-lez

Appendix A – EFSAC modelled scenarios

Scenario	Description
Scenario 2	2017 Baseline
Scenario 3	2033 Baseline (includes growth from 2017, but no further Local Plan development)
Scenario 4	2033 with Local Plan (no change to Honey Lane junction)
Scenario 4.5	2033 with Local Plan (no change to Honey Lane junction but with modal shift)
Scenario 4.5ULEZ	2033 with Local Plan (As Scenario 4.5 and with ULEZ)
Scenario 4.5ev	2033 with Local Plan (As Scenario 4.5 and with 30% shift of petrol to electric cars)
Scenario 4.5ULEZev	2033 with Local Plan (As Scenario 4.5 and with ULEZ and 30% shift of petrol to electric cars)
Scenario 5	2033 with Local Plan (with changes to Honey Lane junction and modal shift)
Scenario 5a	2033 with Local Plan (As Scenario 5 and with ULEZ)
Scenario 6	2024 baseline (includes growth from 2017, but no further Local Plan development)
Scenario 6a	2024 with Local Plan (no change to Honey Lane junction)
Scenario 6b	2024 with Local Plan (with changes to Honey Lane junction)
Scenario 6ev	2024 with Local Plan (As Scenario 6a and with 20% shift of petrol to electric cars)
Scenario 6ev10	2024 with Local Plan (As Scenario 6a and with 10% shift of petrol to electric cars)
Scenario 7a	2033 with Local Plan (As Scenario 5a and with 30% shift of petrol to electric cars)

Appendix B – EFSAC modelled junctions





Appendix C – EFSAC 24hour AADT by link road and scenario

Link	Scenario 2 2017	Scenario 3 2033 Base	Scenario 4 2033 w LP	Scenario 4.5ULEZev 2033 w LP & mitigation	Scenario 6 2024 Base	Scenario 6a 2024 w LP	Scenario 6aULEZev10 2024 w LP & mitigation
J01_01	17,851	19,886	24,331	24,083	18,922	20,140	20,140
J01_02	8,067	8,987	9,419	9,419	8,551	8,838	8,838
J01_03	19,589	21,822	22,912	22,839	20,764	21,304	21,304
J01_04	14,559	16,219	18,255	18,102	15,433	15,929	15,929
J01_05	24,193	26,951	29,218	29,152	25,644	26,532	26,532
J33_01	2,127	2,369	2,425	2,425	2,254	2,289	2,289
J33_02	24,193	26,951	29,174	29,109	25,644	26,506	26,506
J33_03	2,127	2,369	2,724	2,702	2,254	2,472	2,472
J33_04	24,193	26,951	29,547	29,459	25,644	26,723	26,723
J35_01	1,042	1,161	1,506	1,484	1,104	1,304	1,304
J35_02	2,084	2,321	3,793	3,749	2,209	2,948	2,948
J35_03	1,063	1,185	2,326	2,304	1,127	1,684	1,684
J36_01	14,559	16,219	18,255	18,109	15,433	15,920	15,920
J36_02	2,084	2,321	3,106	3,077	2,209	2,626	2,626
J36_03	14,559	16,219	18,927	18,781	15,433	16,259	16,259
J36_04	2,084	2,321	3,851	3,822	2,209	3,000	3,000

Appendix D – Comparing 2017 and 2019 ANPR Vehicle Composition with EFT National Default Fleets

Epping Forest Special Area of Conservation

Comparing 2017 and 2019 ANPR Vehicle Composition with EFT National Default Fleets
Technical Note

Epping Forest District Council

20 February 2020

Quality information

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Tables

1. Introduction

1.1 This Technical Note has been prepared by AECOM on behalf of Epping Forest District Council (EFDC) to provide a comparison between the local vehicle fleet captured using Automatic Number Plate Recognition (ANPR) and the default national fleet inherent within two versions of Defra's Emissions Factors Toolkit[1] (EFT), for the years 2017 and 2019. This is in order to establish the variability between both the ANPR survey data and the EFT, and the variability between EFT versions themselves (version 8.0.1 and version 9.0). The implications that this variability may have on the resultant emissions calculations applied to the Local Plan modelling are discussed, and recommendations are made for the approach to be adopted in future modelling.

1.2 The comparison of Defra's EFT version 8.0.1, version 9.0 and the Epping Forest Special Area of Conservation (EFSAC) specific ANPR survey data establishes if there are grounds for applying an 'EFSAC' area vehicle fleet in the air quality modelling.

1.3 The first stage of analysis compares the 'Basic Fleet Split' information contained within EFT v8.0.1 and v9.0 and the local ANPR survey data in terms of the relative proportions of general vehicle categories within the national rural vehicle fleet (the road type used within the 2019 Habitats Regulations Assessment (HRA) air quality modelling for the Local Plan Submission Version).

1.4 The second stage of analysis considers the Euro emissions standards within each of the different vehicle categories. The Euro standard of each individual vehicle within a given category contributes to the overall emission rate calculated. In general, an older fleet with a greater prevalence of lower Euro standards (e.g. Pre-Euro 1 to Euro 3) will result in a higher emission rate than a newer fleet that is made up of more of the higher Euro standard vehicles (e.g. Euro 4 to 6d).

1.5 The third section considers whether the ANPR data indicates that the EFSAC is most like the EFT's average urban, rural or outer London vehicle fleet in terms of the relative proportions of general vehicle categories and the distribution of vehicles by Euro standard.

1.6 All discussion regarding emissions rates within this report is limited to emissions of NOx as there are no road traffic emissions of ammonia in Defra's EFT.

[1] https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html

2. Background and Methodology

Emission Factors Toolkit (EFT)

2.1 EFT Version 8.0.1, released in November 2017, incorporated European Environment Agency (EEA) COPERT 5[2] emission factors, and information on the UK fleet composition collected as part of updating the National Atmospheric Emissions Inventory (NAEI)[3]. The underlying fleet composition data are based on Department for Transport (DfT) data and projection figures from 2015. Version 8.0.1 took account of Euro 6 subcategories and incorporated a better representation of failure rates of both catalysts and Diesel Particulate Filters (DPFs) compared to earlier releases. The input tables for the 'Euro Compositions Advanced Option' no longer assumed failure rates within the presented proportions (default failure rates are subsequently assumed as part of the calculation procedure). Also, when using the 'Output % Contributions' from 'Euro Classes Advanced Option', the proportion of total emissions attributable to failed catalysts and DPFs is now presented separately within brackets alongside the emissions for each Euro category.

2.2 EFT Version 9.0 was released in May 2019, refining and updating the basic fleet assumptions with the latest DfT data. Version 9.0 was also released with the inclusion of a new Advanced Fleet Option 'Fleet Projection Tool' that allows users to project their user defined Euro fleet information from a Base Year (e.g. a local Euro fleet derived from ANPR surveys) to a future Projection Year.

2.3 The vehicle fleet applied in the 2017 baseline model for the 2019 HRA modelling was previously taken from the EFT v8.0.1 for 'Rural' roads, due to the rural nature of the area. One of the limitations of this approach is that both versions of the EFT assume that there are no electric cars or LGVs using rural roads, which effectively increases the emissions rates applied.

ANPR Surveys

2.4 An ANPR survey was conducted on 23 February 2017, a neutral day and at a time where there were no school holidays, in line with best practice, to capture the local fleet composition of traffic travelling within the EFSAC. The dataset contains approximately 39,000 unique vehicles and a total of 259,000 observations / movements. This data represents a single day of trips observed.

2.5 A further ANPR survey was undertaken for three days (15 to 17 October 2019) at eight different locations within the Epping Forest SAC in order to capture the majority of vehicles passing through the SAC. The survey dates were considered to be neutral days and at a time where there were no school holidays, in line with best practice. The 2019 dataset contains approximately 55,000 unique vehicles and a total of 160,000 observations / movements.

2.6 Of the two ANPR surveys, the percentage of successful DVLA matches was higher for 2019 (97.5% of 56,681 registration plates) than for 2017 (81.8% of 47,998 registration plates).

Data Analysis

2.7 Basic fleet split information was extracted from EFT versions 8.0.1 and 9.0 for both 2017 and 2019. The EFT disaggregates the vehicle fleet into 14 basic vehicle categories, namely:

- Petrol Car;
- Diesel Car;
- Taxi (black cab)[4];
- Petrol Light Goods Vehicle (LGV);
- Diesel LGV;
- Rigid Heavy Goods Vehicle (HGV);
- Articulated HGV;
- Bus and coach;

[2] https://copert.emisia.com/
[3] https://naei.beis.gov.uk/
[4] This vehicle category was only applicable to areas in London within EFT v8.0.1, but could be used outside of London in v9.0.

- Motorcycle;
- Hybrid Car (Petrol);
- Plug-In Hybrid Car (Petrol);
- Hybrid Car (Diesel);
- Electric Car; and
- Electric LGV

2.8 NO_x Euro emissions standards proportions of each of these 14 vehicle categories were extracted for 2017 and 2019 from EFT versions 8.0.1 and 9.0.

2.9 The ANPR survey data were analysed to extract the equivalent Basic Fleet Split and Euro emissions standards information for comparison with the EFT versions. The DVLA match data was processed to assign each matched vehicle to the equivalent EFT vehicle category. This was done based on type approval category[5], fuel type and gross vehicle weight. Where insufficient information was provided in the DVLA data to assign vehicles to an appropriate EFT category, other data fields were used to try to infill the gaps (e.g. vehicle wheel plan, number of axles, vehicle body shape). Euro emissions standards were also extracted from the DVLA data. Where Euro standard information was missing, infilling was carried out using vehicle registration date and vehicle type to assign an appropriate Euro standard.

2.10 An anonymised vehicle identifier was used to cross-reference the DVLA match data against the ANPR observation data so that the number of observations of each individual vehicle could be quantified. The use of total vehicle observations as opposed to individual vehicle counts is considered to better represent vehicle-kilometres travelled and also gives more weight to those vehicles that travel more frequently and / or greater distance. All subsequent analyses concerning the ANPR data has therefore been carried out on total vehicle observations rather than unique vehicles.

[5] https://www.vehicle-certification-agency.gov.uk/vehicletype/definition-of-vehicle-categories.asp

3. Vehicle Fleet Split

3.1 The results of the Basic Fleet Split comparisons between EFT versions 8.0.1 and 9.0, and the 2017 ANPR survey data are presented in Table 1 and Figure 1. The same comparisons for 2019 are presented in Table 2 and Figure 2. Whilst the EFT requires the user to input the percentage of heavy duty vehicles (HDV, heavy goods vehicles (HGV) plus buses and coaches), the total HDV percentage have been set at the 'default' (national average) percentages for rural roads. All discussion regarding emission rates is with reference to NOx emissions.

Basic Fleet Split 2017

3.2 The EFT analysis in this section is undertaken for the default rural fleet of 2017.

3.3 Between EFT versions 8.0.1 and 9.0, there are minor updates to the fleet make-up, with the main change being a reduction in diesel cars, which is compensated by small increases in the percentages of petrol cars and diesel LGVs.

3.4 The 2017 ANPR data exhibits a larger percentage of the fleet as petrol cars than the default assumptions for a rural fleet contained in the EFT, and comparatively a lesser proportion of the fleet as diesel cars. This would reduce the overall NOx emission rate calculated for a fleet derived from the ANPR data as compared to the default EFT assumptions.

3.5 Diesel LGVs are more prevalent within the ANPR survey data than the EFT default rural fleet. The proportion of petrol LGVs is low in both versions of the EFT (0.5%) and even lower in the EFSAC fleet from the 2017 ANPR data (0.1%).

3.6 The overall total percentage of HDV is relatively low in the 2017 ANPR data (2.5%) compared to that in the EFT national rural fleet in 2017 (5.5%). The HDV percentage applied in the 2019 HRA modelling was higher than this, varying between 6 to 9% across the EFSAC roads. This was derived from the Automatic Traffic Counter (ATC) data that was collected in 2017 and is discussed further in Appendix A. Use of the 2017 ANPR data with the lower HDV percentage would result in lower emission rates for the HDV categories than was estimated for the 2019 HRA.

3.7 The percentage of motorcycles are similarly lower in the ANPR data compared to the EFTs.

3.8 The ANPR data captures a greater percentage of the fleet as electric cars and hybrids, albeit small, than is the case within the EFT rural fleet. This would serve to reduce the overall emission rates.

Table 1. Basic Vehicle Split Comparisons Between EFT v8.0.1, 9.0 and 2017 ANPR

Vehicle Type	Proportion of Vehicle Fleet in 2017		
	EFT v8.0.1 (Rural – not London)	EFT v9.0 (Rural – not London)	Local 2017 ANPR Data*
Petrol Car	36.0%	36.3%	40.1% (+3.8%)
Diesel Car	40.5%	39.7%	36.0% (-3.7%)
Taxi (black cab)	0.0%	0.0%	0.7% (+0.7%)
Petrol LGV	0.5%	0.5%	0.1% (-0.3%)
Diesel LGV	15.0%	15.5%	18.2% (+2.7%)
Rigid HGV	2.6%	2.6%	2.0% (-0.6%)
Articulated HGV	2.4%	2.4%	0.3% (-2.1%)
Bus and coach	0.5%	0.5%	0.2% (-0.3%)
Motorcycle	0.9%	0.9%	0.1% (-0.8%)
Hybrid Car (Petrol)	1.1%	1.1%	1.4% (+0.3%)
Plug-In Hybrid Car (Petrol)	0.6%	0.4%	0.7% (+0.3%)
Hybrid Car (Diesel)	0.1%	0.1%	0.1% (-0.1%)
Electric Car	0.0%	0.0%	0.1% (0.1%)
Electric LGV	0.0%	0.0%	0.0% (<0.1%)

* Numbers in brackets represent variance from EFT v9.0. Percentages may not add up to exactly 100% due to rounding.

Basic Fleet Split 2019

3.9 The EFT analysis in this section is undertaken for the default rural fleet of 2019.

3.10 Between EFT versions 8.0.1 and 9.0, there are minor updates to the fleet make-up, with the main change to the rural fleet being a reduction in diesel cars, which is offset by small increases in the percentages of petrol cars and diesel LGVs.

3.11 The 2019 ANPR data exhibits a larger percentage of the fleet as petrol cars than the default assumptions contained in the EFT for the rural fleet, and comparatively a lesser proportion of the fleet as diesel cars. However, the total percentage of the vehicle fleet represented by cars is consistent across the ANPR data and the EFTs (approximately 75%). The relatively higher proportion of petrol cars in the ANPR data would reduce the overall NOx emission rate calculated for a fleet derived from the ANPR data as compared to the default EFT rural fleet assumptions.

3.12 Diesel LGVs are more prevalent within the 2019 ANPR survey data than the EFT default rural fleet. This is consistent with the 2017 ANPR data. The proportion of petrol LGVs is low in both versions of the EFT (0.4%) and even lower in the 2019 ANPR data (0.2%).

3.13 The total percentage of HDV is relatively low in the 2019 ANPR data (2.0%) and is broadly consistent with the 2017 ANPR data. Both rigid and articulated HGV percentages are somewhat lower in the ANPR than the EFT default rural fleet (1.0% and 2.2% lower, respectively). Use of the 2019 ANPR data HDV percentage rather than the percentage specified in the 2019 HRA modelling (6-9%) from the ATC data would result in lower emission rates for the HDV categories.

3.14 The percentage of motorcycles are similarly lower in the ANPR data compared to the EFTs.

3.15 The ANPR data captures a greater percentage of the fleet as electric cars and hybrids, albeit small, than is the case within the EFT rural fleet. This would serve to reduce the overall emission rates.

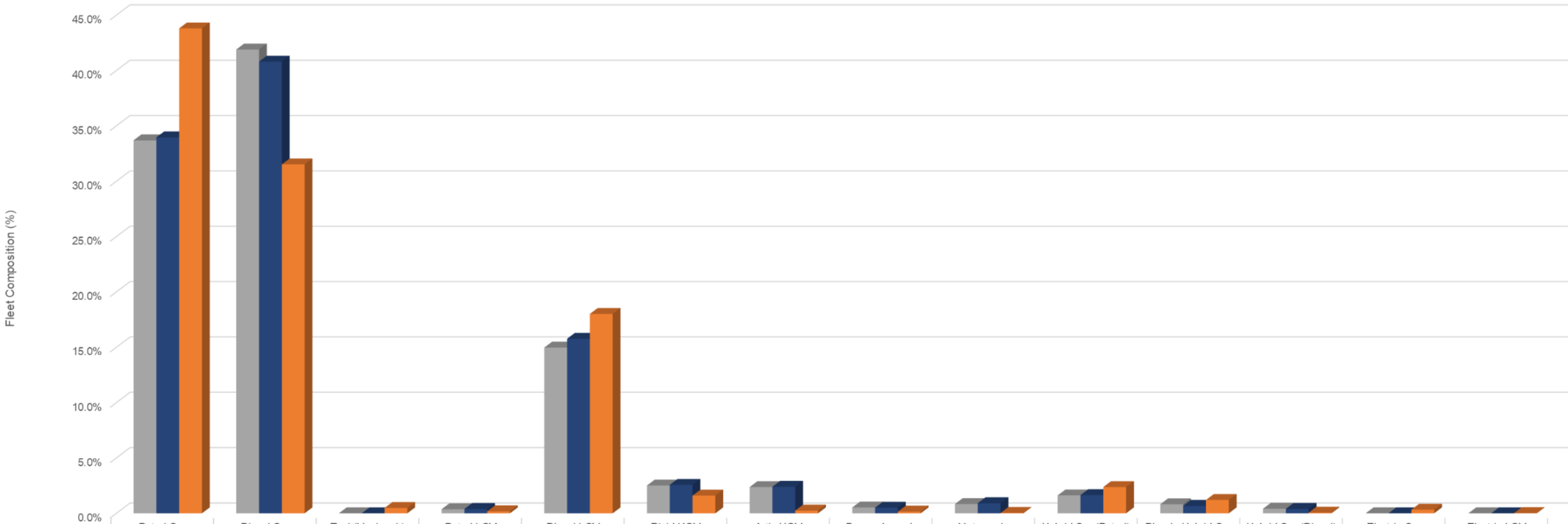
Table 2. Basic Vehicle Split Comparisons Between EFT v8.0.1, 9.0 and 2019 ANPR

Vehicle Type	Proportion of Vehicle Fleet in 2019 EFT v8.0.1 (Rural – not London)	EFT v9.0 (Rural – not London)	Local 2019 ANPR Data*
Petrol Car	33.7%	34.0%	43.8% (+9.8%)
Diesel Car	41.9%	40.8%	31.5% (-9.3%)
Taxi (black cab)	0.0%	0.0%	0.5% (+0.5%)
Petrol LGV	0.4%	0.4%	0.2% (-0.2%)
Diesel LGV	15.0%	15.8%	18.0% (+2.2%)
Rigid HGV	2.5%	2.6%	1.6% (-1.0%)
Articulated HGV	2.4%	2.4%	0.2% (-2.2%)
Bus and coach	0.5%	0.5%	0.2% (-0.3%)
Motorcycle	0.8%	0.9%	0.0% (-0.9%)
Hybrid Car (Petrol)	1.6%	1.6%	2.4% (+0.7%)
Plug-In Hybrid Car (Petrol)	0.8%	0.7%	1.2% (+0.5%)
Hybrid Car (Diesel)	0.4%	0.4%	0.1% (-0.3%)
Electric Car	0.0%	0.0%	0.3% (+0.3%)
Electric LGV	0.0%	0.0%	0.0% (<0.1%)

* Numbers in brackets represent variance from EFT v9.0. Percentages may not add up to exactly 100% due to rounding.

Figure 1. Basic Fleet Split Comparisons Between EFT v8.0.1, 9.0 and 2017 ANPR Data

Figure 2. Basic Fleet Split Comparisons Between EFT v8.0.1, 9.0 and 2019 ANPR Data



	Petrol Car	Diesel Car	Taxi (black cab)	Petrol LGV	Diesel LGV	Rigid HGV	Artic HGV	Bus and coach	Motorcycle	Hybrid Car (Petrol)	Plug-In Hybrid Car (Petrol)	Hybrid Car (Diesel)	Electric Car	Electric LGV
EFT v.8.0.1 (2019)	33.7%	41.9%	0.0%	0.4%	15.0%	2.5%	2.4%	0.5%	0.8%	1.6%	0.8%	0.4%	0.0%	0.0%
EFT v9.0 (2019)	34.0%	40.8%	0.0%	0.4%	15.8%	2.6%	2.4%	0.5%	0.9%	1.6%	0.7%	0.4%	0.0%	0.0%
ANPR 2019	43.8%	31.5%	0.5%	0.2%	18.0%	1.6%	0.2%	0.2%	0.0%	2.4%	1.2%	0.1%	0.3%	0.0%

Impact of Basic Fleet Breakdown on Emissions of NOx

3.16 To assess the potential impact of variations in the fleet breakdown on the resultant road vehicle emissions, NO_x emission rates were calculated using the EFTs for an arbitrary road link of 10,000 Annual Average Daily Traffic (AADT) flow and a speed of 40 km/h. The 'Detailed Option 3' traffic format was used, which requires percentages of petrol cars, diesel cars, black cab taxis (EFT version 9.0 only), LGVs, rigid HGVs, articulated HGVs, buses/coaches, and motorcycles to be specified.

3.17 Since it is not possible to input taxis as a separate vehicle class in EFT version 8.0.1, the taxis were grouped with diesel cars in the version 8.0.1 runs, as the surveyed taxis were all diesel fuelled.

3.18 NO_x emissions calculated using fleet breakdowns derived from the different data sources are presented in Table 3 and Table 4. For the EFT calculations, the default HDV proportions are applied as presented in Table 1 and Table 2, whilst for the ANPR runs the percentage HDV is derived from the ANPR observations[6].

Table 3. Calculated NO_x Emissions (g/km/s) Using Standard EFT Fleet Split Assumptions

Year	Road Type	Traffic Flow	Fleet Split	Speed (kph)	EFT V8.0.1	EFT V9
2017	Rural (not London)	10000	See Table 1 [a]	40	0.05812	0.05828
2019	Rural (not London)	10000	See Table 2 [b]	40	0.04889	0.04921

[a] Fleet split taken from Table 1, columns EFT v8.0.1 and EFT v9.0. [b] Fleet split taken from Table 2, columns EFT v8.0.1 and EFT v9.0.

Table 4. Calculated NO_x Emissions (g/km/s) Using ANPR Data Fleet Split

Year	Road Type	Traffic Flow	Fleet Split	Speed (kph)	EFT V8.0.1	EFT V9
2017	Rural (not London)	10000	See Table 1 [a]	40	0.05217	0.05239
2019	Rural (not London)	10000	See Table 2 [a]	40	0.04125	0.04154

[a] Fleet split taken from Table 1, column Local 2017 ANPR data. [b] Fleet split taken from Table 2, , column Local 2019 ANPR data.

3.19 In all calculations, using EFT v9.0 results in similar but marginally higher road NO_x emission rates compared to EFT v8.0.1, although all of the differences are less than 1%. The highest NO_x emission rates in both 2017 and 2019 are calculated using EFT v9.0 and the standard EFT rural fleet split assumptions therein.

3.20 Using the ANPR data to determine the vehicle fleet split (HDV/LDV) results in calculated emission rates that are lower (by between 10 and 16%) than both versions of the EFT using default rural fleet splits for 2017[6] and 2019. This is primarily due to the lower proportions of diesel cars, and rigid and articulated HGVs in the ANPR-derived fleet split compared to the EFT default rural fleet. Despite the higher proportion of diesel LGVs in the ANPR fleet, the impact on emissions is much smaller than the reduction in emissions due to the lower proportions of diesel cars and HGVs.

[6] Note that the user-defined HDV proportions in the current study are marginally lower than those applied in the 2019 HRA (6 to 9%), however they are greater than those derived from the ANPR data, therefore the conclusions of the analysis relative to the 2019 HRA remain valid.

4. Vehicle Euro Class Breakdown

4.1 Table 5 to Table 10 present comparisons of the vehicle fleet Euro Class breakdown derived from the two versions of the EFT (rural roads) and the ANPR data for 2017 and 2019. The tables cover for conventional light-duty vehicles, hybrid light-duty vehicles and taxis, heavy-duty vehicles, and buses and coaches.

4.2 Figure 3 to Figure 14 are located in Appendix C, and present the comparisons of the vehicle fleet Euro Class breakdown in graphical form.

Light-Duty Vehicles

4.3 The Euro Class breakdown for conventional cars (Table 5) obtained from EFT versions 8.0.1 and 9.0 for the rural fleet agree closely with one another. A notable difference between version 8.0.1 and 9.0 is the sub-division of Euro 6 cars into the additional Euro 6c and 6d classes. However, the sum of the Euro 6 sub-divisions obtained from version 9.0 compares closely to the Euro 6 total from version 8.0.1 for the conventional car categories.

4.4 The ANPR data for both 2017 and 2019 indicate that the local car fleet is older than the corresponding national rural default figures contained in the EFT databases. For example, in 2019 the percentages of Euro 3 and Euro 4 petrol and diesel cars derived from the ANPR data are up to 4.2% higher than the equivalent Euro classes in EFT version 9.0. Correspondingly, the percentages of the newest vehicles (i.e. Euro 6 and its sub-divisions) are lower than the EFT projections.

4.5 A similar pattern is evident in the LGV data (Table 6); the percentages of Euro 3 and Euro 4 LGVs (and Euro 5 diesel LGVs) in the 2017 and 2019 ANPR data are higher than the respective EFT rural fleet proportions, whereas Euro 5 and Euro 6 proportions are lower. This indicates that the local LGV fleet is older than the national rural average.

4.6 The Euro Class breakdown obtained from EFT versions 8.0.1 and 9.0 for the rural fleet show a close agreement for the full-hybrid cars category, the only real difference being the additional disaggregation of the Euro 6 category in version 9.0 (Table 7). For plug-in hybrid cars, the 2017 EFT percentage of Euro 6 cars for rural roads is collectively around 20% higher in version 9.0 than in version 8.0.1, suggesting the uptake of these vehicles has been more rapid than was previously anticipated. A similar pattern is shown for 2019. The ANPR data for full hybrid and plug-in hybrid petrol cars indicates that the local vehicle fleet is older than the national average figures of the EFT rural fleet. There are higher proportions of Euro 3 to Euro 5 full hybrids in both years of ANPR data compared to the corresponding EFT projections. Correspondingly, the percentage of Euro 6 vehicles is lower. For plug-in hybrid cars the same pattern is evident, with much higher proportions of Euro 5 vehicles compared to the EFT rural fleet.

4.7 Consistent with the other car categories, the ANPR data for diesel hybrid cars indicates an older local fleet than the national rural default projections (Table 8). The percentages of Euro 5 diesel hybrids in the 2017 and 2019 ANPR survey data are approximately 40% higher than the EFT rural default figures, and the Euro 6 percentages correspondingly lower.

4.8 The taxi (black cab) Euro Class breakdown for areas outside of Inner London was newly introduced in version 9.0 of the EFT and therefore comparisons with EFT version 8.0.1 are not possible. As is evident for the other light-duty vehicle categories, the local taxi fleet as determined from the ANPR data is older than the EFT projection (Table 8). In 2017, the percentages of Euro 3 and Euro 4 taxis are approximately 21% higher than the corresponding EFT figures, respectively, whilst the percentages of Euro 5 and Euro 6 vehicles are 12% and 30% lower than EFT figures. A similar pattern is seen for taxis in the 2019 data; however, the percentage of Euro 6 vehicles derived from the ANPR data is around 40% lower than the EFT fleet projection.

4.9 Overall, the analysis of the Euro Class breakdown of the local light-duty vehicle fleet, based on both the 2017 and 2019 ANPR surveys, suggest that the local fleet is older than the rural fleet default projections contained within the EFT. Higher proportions of earlier Euro standard vehicles using ANPR data would result in higher vehicle NOx emission rates than using the EFT default rural fleet proportions.

Heavy-Duty Vehicles

4.10 The Euro Class breakdown for heavy-goods vehicles (Table 9) determined from EFT versions 8.0.1 and 9.0 for the national rural fleet show a close agreement for all Euro standards. Version 9.0 of the EFT assumes a slightly higher percentage of Euro VI rigid HGVs compared to version 8.0.1 offset by slightly lower percentages of Euro V EGR and SCR vehicles. For articulated HGVs this pattern is reversed, with a slightly lower percentage of Euro VI vehicles and corresponding higher percentages of Euro V vehicles assumed in version 9.0.

4.11 For rigid HGVs, the ANPR data for 2017 and 2019 indicate that the local vehicle fleet is older than the rural fleet national average. The proportion of Euro VI rigid HGVs are 22% and 14% lower than the EFT projections for 2017 and 2019, respectively. This is offset by increased proportions of Euro III, Euro IV and Euro V vehicles.

4.12 For articulated HGVs, the 2017 ANPR data indicates a local articulated HGV fleet older than the default EFT rural fleet, with Euro VI vehicles approximately 28% lower in the ANPR data than the EFT. By contrast, in 2019, there is a very close agreement between the ANPR data and EFT with the ANPR-derived proportions for all Euro standards agreeing to within 1% of the EFT projections.

4.13 For buses and coaches, there is very close agreement in the Euro Class breakdown between the two versions of the EFT. The ANPR data indicates lower percentages of Euro VI buses and coaches than the national average rural fleet projections for both 2017 and 2019, indicating that the local vehicle fleet is older. The lower percentages of Euro VI buses are largely offset by relative higher percentages of Euro IV and Euro V vehicles.

4.14 Overall, the analysis of the Euro Class breakdown of the local heavy-duty vehicle fleet, based on both the 2017 and 2019 ANPR surveys, suggests that the local fleet is older than the default rural projections contained within the EFT. Higher proportions of earlier Euro standard vehicles using ANPR data would result in higher vehicle NOx emission rates than using the EFT default rural fleet proportions.

Table 5. Euro Class Split Comparisons Between EFT v8.0.1, v9.0 and ANPR, 2017 and 2019: Petrol and Diesel Cars

Euro Standard	Petrol cars			Diesel cars			Petrol cars			Diesel cars		
	2017 EFT 8.0.1	2017 EFT v9.0	2017 ANPR Data*	2017 EFT v8.0.1	2017 EFT v9.0	2017 ANPR Data*	2019 EFT v8.0.1	2019 EFT v9.0	2019 ANPR Data*	2019 EFT v8.0.1	2019 EFT v9.0	2019 ANPR Data*
Pre-Euro 1**	1.3%	1.3%	1.3% (-0.1%)	0.0%	0.0%	0.0% (<0.1%)	1.2%	1.2%	1.2% (<0.1%)	0.0%	0.0%	0.0% (<0.1%)
Euro 1	0.0%	0.0%	0.0% (<0.1%)	0.0%	0.0%	0.0% (<0.1%)	0.0%	0.0%	0.0% (<0.1%)	0.0%	0.0%	0.0% (<0.1%)
Euro 2	0.8%	0.8%	0.1% (-0.7%)	0.2%	0.2%	0.0% (-0.2%)	0.2%	0.2%	0.0% (-0.2%)	0.1%	0.1%	0.0% (<0.1%)
Euro 3	10.5%	10.3%	18.1% (+7.9%)	5.5%	5.4%	8.5% (+3.1%)	4.5%	4.5%	9.4% (+5.0%)	2.4%	2.3%	4.4% (+2.1%)
Euro 4	22.9%	22.5%	30.4% (+7.9%)	19.3%	18.8%	21.9% (+3.1%)	15.3%	15.1%	21.9% (+6.8%)	12.6%	12.4%	16.6% (+4.2%)
Euro 5	33.1%	33.2%	31.0% (-2.2%)	39.9%	40.0%	42.4% (+2.4%)	27.6%	27.9%	24.4% (-3.5%)	32.7%	32.9%	32.2% (-0.7%)
Euro 6	31.3%	19.8%	11.9% (-7.9%)	35.1%	22.4%	17.1% (-5.3%)	51.1%	16.6%	14.0% (-2.7%)	52.3%	18.2%	16.3% (-2.0%)
Euro 6c	-	12.1%	7.2% (-4.8%)	0.0%	13.2%	10.1% (-3.1%)	-	34.6%	29.0% (-5.5%)	-	34.1%	30.4% (-3.7%)
Euro 6d	-	-	-	0.0%	0.0%	0.0% (<0.1%)	-	-	-	-	0.0%	0.0% (<0.1%)

* Numbers in brackets represent variance from EFT v9.0. Percentages may not add up to exactly 100% due to rounding. ** Pre-Euro 1 category includes vehicles with failed catalysts.

Table 6. Euro Class Split Comparisons Between EFT v8.0.1, 9.0 and 2017 ANPR, 2017 and 2019: Petrol and Diesel LGVs

Euro Standard	Petrol LGVs			Diesel LGVs			Petrol LGVs			Diesel LGVs		
	2017 EFT 8.0.1	2017 EFT v9.0	2017 ANPR Data*	2017 EFT v8.0.1	2017 EFT v9.0	2017 ANPR Data*	2019 EFT v8.0.1	2019 EFT v9.0	2019 ANPR Data*	2019 EFT v8.0.1	2019 EFT v9.0	2019 ANPR Data*
Pre-Euro 1**	1.6%	1.6%	1.2% (-0.4%)	0.0%	0.0%	0.0% (<0.1%)	1.4%	1.4%	1.2% (-0.1%)	0.0%	0.0%	0.0% (<0.1%)
Euro 1	0.1%	0.1%	0.0% (-0.1%)	0.0%	0.0%	0.0% (<0.1%)	0.0%	0.0%	0.0% (<0.1%)	0.0%	0.0%	0.0% (<0.1%)
Euro 2	2.2%	2.2%	0.0% (-2.2%)	1.0%	1.0%	0.1% (-0.9%)	1.0%	1.0%	0.0% (-1.0%)	0.4%	0.4%	0.0% (-0.4%)
Euro 3	11.1%	11.0%	44.4% (+33.4%)	5.3%	5.3%	12.5% (+7.2%)	5.9%	6.0%	26.8% (+20.8%)	2.4%	2.4%	6.3% (+3.9%)
Euro 4	19.8%	19.7%	42.5% (+22.8%)	19.6%	19.5%	26.4% (+6.9%)	14.9%	15.2%	13.8% (-1.4%)	12.4%	12.7%	16.0% (+3.3%)
Euro 5	33.8%	33.8%	6.7% (-27.1%)	41.6%	41.5%	53.0% (+11.5%)	29.1%	29.6%	7.3% (-22.4%)	30.1%	30.9%	35.8% (+4.9%)
Euro 6	31.4%	31.5%	5.2% (-26.3%)	32.6%	32.7%	8.0% (-24.7%)	47.7%	21.9%	23.9% (+1.9%)	54.7%	19.0%	14.9% (-4.2%)
Euro 6c	0.0%	0.0%	0.0% (<0.1%)	-	0.0%	0.0% (<0.1%)	0.0%	24.8%	27.0% (+2.2%)	-	34.6%	27.0% (-7.6%)
Euro 6d	-	-	-	-	0.0%	0.0% (<0.1%)	-	-	-	-	0.0%	0.0% (<0.1%)

* Numbers in brackets represent variance from EFT v9.0. Percentages may not add up to exactly 100% due to rounding. EFT version 8.0.1 does not contain Euro Class information for taxis for areas outside of Inner London. ** Pre-Euro 1 category includes vehicles with failed catalysts.

Table 7. Euro Class Split Comparisons Between EFT v8.0.1, 9.0 and ANPR, 2017 and 2019: Petrol Hybrid Cars

Euro Standard	Full Hybrid Petrol Cars 2017 EFT 8.0.1	Full Hybrid Petrol Cars 2017 EFT v9.0	Full Hybrid Petrol Cars 2017 ANPR Data*	Plug-in Hybrid Petrol Cars 2017 EFT v8.0.1	Plug-in Hybrid Petrol Cars 2017 EFT v9.0	Plug-in Hybrid Petrol Cars 2017 ANPR Data*	Full Hybrid Petrol Cars 2019 EFT v8.0.1	Full Hybrid Petrol Cars 2019 EFT v9.0	Full Hybrid Petrol Cars 2019 ANPR Data*	Plug-in Hybrid Petrol Cars 2019 EFT v8.0.1	Plug-in Hybrid Petrol Cars 2019 EFT v9.0	Plug-in Hybrid Petrol Cars 2019 ANPR Data*
Pre-Euro 1**	1.1%	1.1%	1.2% (+0.2%)	1.1%	1.1%	1.2% (+0.2%)	1.1%	1.1%	1.2% (+0.1%)	1.1%	1.1%	1.2% (+0.2%)
Euro 1	-	-	-	-	-	0.0% (<0.1%)	-	-	0.0% (<0.1%)	-	-	-
Euro 2	-	-	-	-	-	0.0% (<0.1%)	-	-	0.0% (<0.1%)	-	-	-
Euro 3	0.4%	0.4%	12.2% (+11.8%)	-	-	0.0% (<0.1%)	0.1%	0.1%	4.1% (+4.0%)	-	-	-
Euro 4	9.3%	9.0%	12.2% (+3.2%)	-	-	0.0% (<0.1%)	4.0%	4.0%	6.9% (+3.0%)	-	-	-
Euro 5	28.2%	28.0%	41.9% (+13.8%)	31.1%	9.5%	55.6% (+46.1%)	14.7%	14.9%	20.7% (+5.8%)	17.9%	4.7%	23.3% (+18.6%)
Euro 6	61.1%	31.9%	16.8% (-15.1%)	67.8%	63.2%	30.5% (-32.7%)	80.1%	17.2%	14.4% (-2.8%)	81.0%	32.4%	25.9% (-6.5%)
Euro 6c	-	29.7%	15.7% (-14.0%)	-	26.2%	12.7% (-13.6%)	-	62.8%	52.6% (-10.1%)	-	61.9%	49.5% (-12.4%)

* Numbers in brackets represent variance from EFT v9.0. Percentages may not add up to exactly 100% due to rounding. ** Pre-Euro 1 category includes vehicles with failed catalysts.

Table 8. Euro Class Split Comparisons Between EFT v8.0.1, 9.0 and ANPR, 2017 and 2019: Diesel Hybrid Cars and Taxis

Euro Standard	Diesel Hybrid Cars 2017 EFT 8.0.1	Diesel Hybrid Cars 2017 EFT v9.0	Diesel Hybrid Cars 2017 ANPR Data*	Taxis 2017 EFT v8.0.1	Taxis 2017 EFT v9.0	Taxis 2017 ANPR Data*	Diesel Hybrid Cars 2019 EFT v8.0.1	Diesel Hybrid Cars 2019 EFT v9.0	Diesel Hybrid Cars 2019 ANPR Data*	Taxis 2019 EFT v8.0.1	Taxis 2019 EFT v9.0	Taxis 2019 ANPR Data*
Pre-Euro 1	-	-	-	-	0.0%	0.0% (<0.1%)	-	-	-	-	0.0%	0.0% (<0.1%)
Euro 1	-	-	-	-	0.0%	0.0% (<0.1%)	-	-	-	-	0.0%	0.0% (<0.1%)
Euro 2	-	-	-	-	1.0%	0.0% (-1.0%)	-	-	-	-	0.4%	0.0% (-0.4%)
Euro 3	-	-	-	-	5.3%	26.7% (+21.4%)	-	-	-	-	2.4%	18.5% (+16.1%)
Euro 4	-	-	-	-	19.5%	40.4% (+20.8%)	-	-	-	-	12.7%	37.0% (+24.3%)
Euro 5**	14.2%	14.2%	56.0% (+41.9%)	-	41.5%	29.8% (-11.7%)	4.8%	4.9%	45.9% (+41.0%)	-	30.9%	33.9% (+3.0%)
Euro 6	85.8%	37.2%	19.1% (-18.1%)	-	32.7%	3.2% (-29.5%)	95.2%	11.3%	6.4% (-4.9%)	-	19.0%	3.8% (-15.2%)
Euro 6c	-	48.7%	24.9% (-23.7%)	-	0.0%	0.0% (0.0%)	-	83.8%	47.7% (-36.1%)	-	34.6%	6.9% (-27.7%)
Euro 6d	-	0.0%	0.0% (<0.1%)	-	0.0%	0.0% (0.0%)	-	0.0%	0.0% (<0.1%)	-	0.0%	0.0% (<0.1%)

* Numbers in brackets represent variance from EFT v9.0. Percentages may not add up to exactly 100% due to rounding. ** Euro 5 diesel hybrid cars category includes vehicles with failed catalysts.

Table 9. Euro Class Split Comparisons Between EFT v8.0.1, 9.0 and ANPR, 2017 and 2019: Heavy-Goods Vehicles

Euro Standard	Rigid HGVs			Articulated HGVs			Rigid HGVs			Articulated HGVs		
	2017 EFT 8.0.1	2017 EFT v9.0	2017 ANPR Data*	2017 EFT v8.0.1	2017 EFT v9.0	2017 ANPR Data*	2019 EFT v8.0.1	2019 EFT v9.0	2019 ANPR Data*	2019 EFT v8.0.1	2019 EFT v9.0	2019 ANPR Data*
Pre-Euro I	0.0%	0.0%	0.0% (<0.1%)	0.0%	0.0%	0.0% (<0.1%)	0.0%	0.0%	0.0% (<0.1%)	0.0%	0.0%	0.0% (<0.1%)
Euro I	0.0%	0.0%	0.0% (<0.1%)	0.0%	0.0%	0.0% (<0.1%)	0.0%	0.0%	0.0% (<0.1%)	0.0%	0.0%	0.0% (<0.1%)
Euro II	1.4%	1.4%	0.1% (-1.3%)	0.2%	0.2%	0.5% (+0.3%)	0.6%	0.5%	0.0% (-0.5%)	0.0%	0.0%	0.3% (+0.3%)
Euro III	8.8%	8.5%	12.1% (+3.6%)	1.8%	1.9%	1.9% (<0.1%)	4.4%	4.1%	4.9% (+0.8%)	0.6%	0.7%	1.5% (+0.8%)
Euro IV	8.2%	7.9%	17.9% (+10.0%)	2.8%	2.9%	11.3% (+8.4%)	4.7%	4.4%	9.5% (+5.1%)	1.1%	1.2%	0.9% (-0.3%)
Euro V EGR	6.7%	6.4%	8.9% (+2.5%)	5.9%	6.1%	10.9% (+4.8%)	4.9%	4.6%	6.6% (+2.1%)	3.1%	3.3%	3.2% (-0.1%)
Euro V SCR	20.0%	19.2%	26.7% (+7.5%)	17.7%	18.3%	32.7% (+14.4%)	14.6%	13.7%	19.9% (+6.2%)	9.3%	9.8%	9.5% (-0.3%)
Euro VI	54.8%	56.7%	34.3% (-22.4%)	71.6%	70.6%	42.7% (-27.8%)	70.9%	72.7%	59.1% (-13.5%)	85.8%	85.0%	84.7% (-0.3%)

* Numbers in brackets represent variance from EFT v9.0. Percentages may not add up to exactly 100% due to rounding. ** Pre-Euro I category includes vehicles with failed catalysts.

Table 10. Euro Class Split Comparisons Between EFT v8.0.1, 9.0 and ANPR, 2017 and 2019: Buses and Coaches

Euro Standard	Buses and Coaches			Buses and Coaches		
	2017 EFT v8.0.1	2017 EFT v9.0	2017 ANPR Data*	2019 EFT v8.0.1	2019 EFT v9.0	2019 ANPR Data*
Pre-Euro I	0.0%	0.0%	0.0% (<0.1%)	0.0%	0.0%	0.0% (<0.1%)
Euro I	0.0%	0.0%	0.0% (<0.1%)	0.0%	0.0%	0.0% (<0.1%)
Euro II	3.3%	3.3%	0.0% (-3.3%)	1.6%	1.6%	0.0% (-1.6%)
Euro III	13.2%	13.1%	14.7% (+1.6%)	7.6%	7.5%	2.8% (-4.8%)
Euro IV	10.5%	10.4%	28.6% (+18.2%)	7.2%	7.1%	19.8% (+12.7%)
Euro V EGR	8.2%	8.2%	12.1% (+3.9%)	6.4%	6.3%	11.5% (+5.2%)
Euro V SCR	24.7%	24.6%	36.3% (+11.8%)	19.2%	18.9%	34.6% (+15.6%)
Euro VI	40.1%	40.4%	8.2% (-32.2%)	58.0%	58.6%	31.3% (-27.2%)

* Numbers in brackets represent variance from EFT v9.0. Percentages may not add up to exactly 100% due to rounding. ** Pre-Euro I category includes vehicles with failed catalysts.

Impact of Euro Class Breakdown on Emissions

4.15 To assess the potential impact of variations in the Euro Class breakdown on the resultant road vehicle emissions, NO_x emission rates were calculated using the two version of the EFT for an arbitrary road link of 10,000 vehicles AADT and a speed of 40 km/h. The 'Detailed Option 3' traffic format was used, which requires percentages of petrol cars, diesel cars, black cab taxis (EFT version 9.0 only), LGVs, rigid HGVs, articulated HGVs, buses/coaches, and motorcycles to be specified. To enable the effect only of changes in Euro Class breakdown to be assessed the default EFT fleet proportions for the relevant year were used in all calculations. Since it is not possible to input taxis as a separate vehicle class in EFT version 8.0.1 the taxis were grouped with diesel cars in the version 8.0.1 runs, as the surveyed taxis were all diesel fuelled.

4.16 NO_x emissions calculated using Euro Class breakdowns derived from the different data sources are presented in Table 11 and Table 12. For the EFT default Euro Class calculations, the default Euro standard proportions are applied, whilst for the ANPR runs the Euro split is derived from the ANPR observations.

4.17 Comparing the NO_x emissions in Table 11 and Table 12 it can be seen that the use of Euro Class breakdown derived from ANPR observations results in higher emission rates than using the EFT default breakdowns. This would be expected as the previous discussion of ANPR data suggested an older vehicle fleet (i.e. greater proportions of earlier Euro standards) across the majority of vehicle types than the EFT figures. This is consistent for both the 2017 and 2019 data.

4.18 The use of EFT version 9.0 results in slightly higher NO_x emission rates compared to EFT version 8.0.1; this is consistent with the observations from the Basic Fleet Split analysis (see para 3.2).

Table 11. Calculated NO_x Emissions (g/km/s) Using Standard EFT Euro Class Assumptions

Year	Road Type	Traffic Flow	Fleet Split	Speed (kph)	EFT V8.0.1	EFT V9
2017	Rural (not London)	10000	See Table 1 [a]	40	0.05812	0.05828
2019	Rural (not London)	10000	See Table 2 [b]	40	0.04889	0.04921

[a] Fleet split taken from Table 1, columns EFT v8.0.1 and EFT v9.0. [b] Fleet split taken from Table 2, columns EFT v8.0.1 and EFT v9.0.

Table 12. Calculated NO_x Emissions (g/km/s) Using ANPR Euro Class Breakdown

Year	Road Type	Traffic Flow	Fleet Split	Speed (kph)	EFT V8.0.1	EFT V9
2017	Rural (not London)	10000	See Table 1 [a]	40	0.06715	0.06750
2019	Rural (not London)	10000	See Table 2 [b]	40	0.05366	0.05373

[a] Fleet split taken from Table 1, columns EFT v8.0.1 and EFT v9.0. [b] Fleet split taken from Table 2, columns EFT v8.0.1 and EFT v9.0.

Combined Impact of Basic Fleet and Euro Class Breakdowns on Emissions

4.19 Table 13 presents the total NO_x emissions considering the combined effect of both basic fleet split and Euro Class breakdown derived from the ANPR surveys.

4.20 Comparing the calculated emissions in Table 13 with those presented in Table 4, calculated applying the local basic fleet split only, it can be seen that the combined effect of using the local basic fleet split and Euro Class breakdown results in higher emissions than the use of the local basic fleet split alone. This would be expected since the analysis of the ANPR data indicated that the local fleet comprises larger proportions of older vehicles than the default assumptions contained in the EFT.

4.21 Comparing the calculated emissions in Table 13 with those presented in Table 11, calculated using the EFT default basic fleet split and default Euro Class breakdown, it can be seen that the combined effect of using the local basic fleet split and local Euro Class breakdown results in lower emissions than the use of the default EFT assumptions. This is because the effect of the local ANPR basic fleet split in reducing emissions relative to the EFT default assumptions outweighs the effect of local ANPR Euro Class breakdown in increasing emissions relative to the EFT default assumptions. It would appear that the vehicle emission rates are more strongly influenced by the *proportion* of HGVs within the vehicle fleet than the Euro standard makeup of the vehicle fleet.

4.22 In 2017, the total NO_x emission rate calculated using EFT version 9.0 and the application of ANPR basic fleet and Euro Class figures is 0.04530 g/km/s. This is approximately 8% lower than the emission rate calculated using the EFT default figures (0.04921 g/km/s).

Table 13. Calculated NO_x Emissions (g/km/s) Using ANPR Basic Fleet and Euro Class Breakdowns

Year	Road Type	Traffic Flow	Fleet Split	Speed (kph)	EFT V8.0.1	EFT V9
2017	Rural (not London)	10000	See Table 1 [a]	40	0.05678	0.05717
2019	Rural (not London)	10000	See Table 2 [b]	40	0.04505	0.04530

[a] Fleet split taken from Table 1, column Local 2017 ANPR data. [b] Fleet split taken from Table 2, column Local 2019 ANPR data

5. Road Type

5.1 The analyses in sections 3 and 4 have been undertaken relative to the EFT's rural road vehicle fleet, however as shown, there are intrinsic differences in the EFSAC ANPR data and the EFT's rural fleet e.g. relative split between petrol and diesel cars, proportion of electric vehicles. In this section, the 2019 ANPR data are compared against the vehicle fleet for rural, urban and outer London roads, in terms of both the Basic Fleet Split and the breakdown between Euro Classes.

5.2 The purpose of the comparison is to ascertain whether the vehicle fleet operating on the roads through the EFSAC can be considered to be most like the national average for rural, urban or outer London roads[7]. The conclusions of the analysis will be used to inform the projection of the vehicle fleet that will be expected to use the roads in EFSAC in future years, and in turn, will inform any appropriate mitigation measures. Note that the analysis is undertaken using the current version of the EFT only, v9.0, as this is the tool that will used in the upcoming air quality modelling study. The EFT v9.0 provides the ability to project the Euro class distribution for future years, however it does not project the proportion of vehicles in terms of the basic fleet split.

Basic Fleet Split

5.3 Table 14, Table 15 and Table 16 present a comparison of the 2019 ANPR derived fleet with the EFT v9.0 rural, urban and outer London Basic Fleet Splits, respectively. The comparison is undertaken with the HDV percentage defined in EFT v9.0 to equal the 2019 ANPR percentage (2.0%), therefore there is no difference for rigid HGV, articulated HGV, buses and coaches, and it is presented as <0.1%.

5.4 The greatest difference between the 2019 ANPR fleet and the EFT rural (not London) fleet is the relative proportions of petrol and diesel cars (+8.6% and -10.8% respectively). There is also a slightly greater proportion of diesel LGVs in the 2019 ANPR data (+1.7%). There are more petrol hybrid and electric cars present in the 2019 ANPR fleet than in the EFT's rural fleet, though (to a lesser extent) fewer hybrid diesel cars.

5.5 The difference between the relative proportions of petrol and diesel cars in the 2019 ANPR fleet and the EFT urban (not London) fleet is smaller relative to the EFT rural fleet (+2.9% and -5.7% respectively). There is also a greater proportion of diesel LGVs in the 2019 ANPR data (+3.0%). Similarly, there are more petrol hybrid and electric cars present in the 2019 ANPR fleet than in the EFT's urban fleet, though (to a lesser extent) fewer hybrid diesel cars.

5.6 Whilst there are no black cab taxis included in the EFT's rural or urban fleets, 0.5% of the 2019 ANPR fleet was found to comprise of these vehicles, presumably because of the location of the EFSAC relative to London. This is in addition to the greater proportion of diesel LGVs in the 2019 ANPR fleet.

5.7 The 2019 ANPR fleet shows a similar proportion of the fleet as petrol cars compared to the outer London fleet, with the lower proportion of diesel cars and black cab taxis (-4.8% and -1.6% respectively) largely off-set by the greater proportion of diesel LGVs (+6.9%). There are more petrol hybrid cars present in the 2019 ANPR fleet than in the EFT's outer London fleet, and (as with the EFT rural and urban fleets), fewer hybrid diesel cars. The proportion of electric vehicles is marginally less in the 2019 ANPR fleet than in outer London fleet.

5.8 The proportion of motorcycles in the 2019 ANPR fleet was found to be less than 0.1%, and is thus smaller than the proportion present in the EFT's rural, urban and outer London fleets (-0.9%, -1.1%, -1.5% respectively).

[7] Other road types have been excluded from the comparison, as they are not considered to be appropriate in this case (namely, motorways, inner London and

Table 14. Basic Vehicle Split Comparisons Between EFT 9.0 Rural Fleet and 2019 ANPR

Vehicle Type	Proportion of Vehicle Fleet in 2019* EFT v9.0 (Rural – not London)	Local 2019 ANPR Data*	Difference of ANPR 2019 from EFT v9.0 Rural fleet
Petrol Car	35.2%	43.8%	+8.6%
Diesel Car	42.3%	31.5%	-10.8%
Taxi (black cab)	0.0%	0.5%	+0.5%
Petrol LGV	0.4%	0.2%	-0.2%
Diesel LGV	16.3%	18.0%	+1.7%
Rigid HGV	1.6%	1.6%	<0.1%
Articulated HGV	0.2%	0.2%	<0.1%
Bus and coach	0.2%	0.2%	<0.1%
Motorcycle	0.9%	0.0%	-0.9%
Hybrid Car (Petrol)	1.7%	2.4%	+0.7%
Plug-In Hybrid Car (Petrol)	0.7%	1.2%	+0.5%
Hybrid Car (Diesel)	0.4%	0.1%	-0.4%
Electric Car	0.0%	0.3%	+0.3%
Electric LGV	0.0%	0.0%	<0.1%

Note: Percentages may not add up to exactly 100% due to rounding.

Table 15. Basic Vehicle Split Comparisons Between EFT 9.0 Urban Fleet and 2019 ANPR

Vehicle Type	Proportion of Vehicle Fleet in 2019* EFT v9.0 (Urban – not London)	Local 2019 ANPR Data*	Difference of ANPR 2019 from EFT v9.0 Urban fleet
Petrol Car	40.9%	43.8%	+2.9%
Diesel Car	37.2%	31.5%	-5.7%
Taxi (black cab)	0.0%	0.5%	+0.5%
Petrol LGV	0.4%	0.2%	-0.2%
Diesel LGV	15.0%	18.0%	+3.0%
Rigid HGV	1.6%	1.6%	<0.1%
Articulated HGV	0.2%	0.2%	<0.1%
Bus and coach	0.2%	0.2%	<0.1%
Motorcycle	1.1%	0.0%	-1.1%
Hybrid Car (Petrol)	2.0%	2.4%	+0.4%
Plug-In Hybrid Car (Petrol)	0.8%	1.2%	+0.4%
Hybrid Car (Diesel)	0.4%	0.1%	-0.3%
Electric Car	0.2%	0.3%	+0.1%
Electric LGV	0.1%	<0.1%	<0.1%

Note: Percentages may not add up to exactly 100% due to rounding.

Table 16. Basic Vehicle Split Comparisons Between EFT 9.0 Outer London Fleet and 2019 ANPR

	Proportion of Vehicle Fleet in 2019*		
Vehicle Type	EFT v9.0 (Outer London)	Local 2019 ANPR Data*	Difference of ANPR 2019 from EFT v9.0 Outer London fleet
Petrol Car	43.3%	43.8%	+0.5%
Diesel Car	36.3%	31.5%	-4.8%
Taxi (black cab)	2.1%	0.5%	-1.6%
Petrol LGV	0.2%	0.2%	<0.1%
Diesel LGV	11.1%	18.0%	+6.9%
Rigid HGV	1.6%	1.6%	<0.1%
Articulated HGV	0.2%	0.2%	<0.1%
Bus and coach	0.2%	0.2%	<0.1%
Motorcycle	1.5%	0.0%	-1.5%
Hybrid Car (Petrol)	2.0%	2.4%	+0.4%
Plug-In Hybrid Car (Petrol)	0.3%	1.2%	+0.9%
Hybrid Car (Diesel)	0.6%	0.1%	-0.5%
Electric Car	0.4%	0.3%	<0.1%
Electric LGV	0.2%	0.0%	-0.2%

Note: Percentages may not add up to exactly 100% due to rounding.

Vehicle Euro Class Breakdown

5.9 A further comparison regarding the proportion of Euro standards by vehicle type has been undertaken between the EFT's average fleets and the 2019 ANPR fleet. The distribution of Euro standards within the EFT are set as a national UK average outside of London, and so are the same for both rural and urban fleets.

5.10 With regard to petrol cars in the 2019 ANPR fleet (Table 17), there is a greater proportion of higher Euro standards (Euro 4 onwards), and a smaller proportion of lower Euro standards (up to and including Euro 3) relative to the outer London EFT fleet. The differences are within ±3.5% for all Euro standards. The distribution of Euro standards in the 2019 ANPR fleet relative to the EFT UK average fleet (all road types outside of London) is more variable (±6.8%), with a greater prevalence of Euro 3 and Euro 4 cars.

5.11 There is a greater proportion of Euro 6 diesel cars (Table 17) in the 2019 ANPR fleet, and a smaller proportion of lower Euro standards (up to and including Euro 5) relative to the outer London EFT fleet. The differences are up to approximately ±10% across the Euro standards. The distribution of Euro standards in the 2019 ANPR fleet relative to the EFT UK average fleet (both rural and urban roads) is less variable (±4.2%), although with a greater prevalence of Euro 3 and Euro 4 cars.

5.12 For petrol LGVs (Table 18), the variance in proportions of Euro standards present in the 2019 ANPR fleet is up to ±22.4% relative to the EFT rural/urban fleet, and up to ±17.8% relative to the EFT outer London fleet. The 2019 ANPR fleet has a greater proportion of Euro 6 petrol LGVs than both of the EFT fleets (>10% compared to outer London). However, there is a much smaller proportion of Euro 5 and a greater proportion of Euro 3 petrol LGVs than both of the EFT fleets presented (-15.7% to +17.8% compared to outer London, and -22.4% to +20.8% compared to rural/urban).

5.13 With regard to diesel LGVs (Table 18), the 2019 ANPR fleet is similar to the outer London EFT fleet (±1.7%). The 2019 ANPR fleet is overall older than the EFT rural/urban fleet, with a greater proportion of Euro 3-5 diesel LGVs, and an equivalent lesser proportion of Euro 6.

5.14 The full and plug-in hybrid petrol car 2019 ANPR fleet is older than both the rural/urban and outer London EFT fleets, with a greater proportion of Euro 3-5 petrol hybrid cars, and a smaller proportion of Euro 6 petrol hybrid cars (Table 19). A similar trend is seen for diesel hybrid cars (Table 20).

5.15 With regard to taxis (Table 20), the 2019 ANPR fleet is overall older than the EFT fleets. The outer London EFT fleet assumes almost a third of taxis are Zero Emission Capable (ZEC), with emissions estimated to be equivalent to a Euro 6 petrol LGV. This type of vehicle has not (as yet) been disaggregated in the 2019 ANPR dataset.

5.16 The 2019 ANPR rigid HGV fleet (Table 21) is overall older than both the rural/urban and the outer London EFT fleets, showing greater proportions of Euro III, IV, V EGR and V SCR and a smaller proportion of Euro VI vehicles.

5.17 The 2019 ANPR articulated HGV fleet (Table 21) is very similar to the rural/urban fleet with regards to Euro standards (±0.8%), whereas it has a greater proportion of Euro VI articulated HGVs compared to the outer London EFT fleet.

5.18 Overall the 2019 ANPR bus and coach fleet (Table 22) is older than the rural/urban and outer London EFT fleets, with a much smaller proportion of vehicles of Euro VI standard (-27.2% relative to rural/urban EFT fleet and -20.0% relative to outer London EFT fleet).

Epping Forest SAC ‘road type’

5.19 The analysis of the 2019 ANPR data and the EFT’s Basic Fleet Split for rural, urban and outer London roads suggests that the vehicle fleet using the roads through the EFSAC is most similar to the outer London fleet, as defined in EFT v9.0 for 2019.

5.20 Taking into account the greater prevalence of diesel LGVs in the 2019 ANPR data, the outer London EFT fleet shows a similar split between petrol and diesel LDVs, whereas the rural EFT fleet does not allow for any electric vehicles, and has the greatest difference in petrol/diesel split for cars when compared to the 2019 ANPR data.

5.21 In terms of Euro Class split, the 2019 ANPR data shows that the car and LGV fleet using the EFSAC is broadly newer than that in the EFT outer London fleet, but older than the EFT UK average outside of London. The hybrid vehicles, taxis, rigid HGV and bus and coach fleets using the EFSAC roads are in general older than both of the EFT fleets considered here. The articulated HGVs using the EFSAC road are newer than those in the EFT outer London fleet, but overall very similar in terms of Euro Class split to the EFT national fleet.

Table 17. Euro Class Split Comparisons Between EFT v9.0 and 2019 ANPR: Petrol and Diesel Cars

Euro Standard	Petrol cars					Diesel cars				
	2019 EFT v9.0		2019 ANPR Data	Difference of ANPR 2019 from EFT v9.0		2019 EFT v9.0		2019 ANPR Data	Difference of ANPR 2019 from EFT v9.0	
	Rural & Urban	Outer London		Rural & Urban	Outer London	Rural & Urban	Outer London		Rural & Urban	Outer London
Pre-Euro 1**	1.2%	1.9%	1.2%	<0.1%	-0.7%	-	-	-	<0.1%	<0.1%
Euro 1	-	0.4%	-	<0.1%	-0.4%	-	0.2%	-	<0.1%	-0.2%
Euro 2	0.2%	3.3%	-	-0.2%	-3.3%	0.1%	0.8%	-	<0.1%	-0.8%
Euro 3	4.5%	11.9%	9.4%	+5.0%	-2.5%	2.3%	9.0%	4.4%	+2.1%	-4.6%
Euro 4	15.1%	21.2%	21.9%	+6.8%	+0.7%	12.4%	26.7%	16.6%	+4.2%	-10.1%
Euro 5	27.9%	22.1%	24.4%	-3.5%	+2.3%	32.9%	34.5%	32.2%	-0.7%	-2.3%
Euro 6	16.6%	12.7%	14.0%	-2.7%	+1.3%	18.2%	7.8%	16.3%	-2.0%	+8.5%
Euro 6c	34.6%	26.4%	29.0%	-5.5%	+2.6%	34.1%	20.9%	30.4%	-3.7%	+9.5%
Euro 6d	-	-	-	-	-	-	-	-	<0.1%	<0.1%

Note: Percentages may not add up to exactly 100% due to rounding.

** Pre-Euro 1 category includes vehicles with failed catalysts.

Table 18. Euro Class Split Comparisons Between EFT v9.0 and 2019 ANPR: Petrol and Diesel LGVs

Euro Standard	Petrol LGV					Diesel LGV				
	2019 EFT v9.0		2019 ANPR Data	Difference of ANPR 2019 from EFT v9.0		2019 EFT v9.0		2019 ANPR Data	Difference of ANPR 2019 from EFT v9.0	
	Rural & Urban	Outer London		Rural & Urban	Outer London	Rural & Urban	Outer London		Rural & Urban	Outer London
Pre-Euro 1**	1.4%	12.8%	1.2%	-0.1%	-11.5%	-	-	-	<0.1%	<0.1%
Euro 1	-	-	-	<0.1%	<0.1%	-	-	-	<0.1%	<0.1%
Euro 2	1.0%	3.2%	-	-1.0%	-3.2%	0.4%	-	-	-0.4%	<0.1%
Euro 3	6.0%	9.0%	26.8%	+20.8%	+17.8%	2.4%	5.4%	6.3%	+3.9%	+0.9%
Euro 4	15.2%	22.6%	13.8%	-1.4%	-8.8%	12.7%	17.7%	16.0%	+3.3%	-1.7%
Euro 5	29.6%	23.0%	7.3%	-22.4%	-15.7%	30.9%	35.9%	35.8%	+4.9%	-0.1%
Euro 6	21.9%	13.8%	23.9%	+1.9%	+10.1%	19.0%	13.8%	14.9%	-4.2%	+1.0%
Euro 6c	24.8%	15.6%	27.0%	+2.2%	+11.4%	34.6%	27.2%	27.0%	-7.6%	-0.2%
Euro 6d	-	-	-	-	-	-	-	-	<0.1%	<0.1%

Note: Percentages may not add up to exactly 100% due to rounding. EFT version 8.0.1 does not contain Euro Class information for taxis for areas outside of Inner London.

** Pre-Euro 1 category includes vehicles with failed catalysts.

Table 19. Euro Class Split Comparisons Between EFT v9.0 and 2019 ANPR: Petrol Hybrid Cars

Euro Standard	Full Hybrid Petrol Cars					Plug-in Hybrid Petrol Cars				
	2019 EFT v9.0		2019 ANPR Data	Difference of ANPR 2019 from EFT v9.0		2019 EFT v9.0		2019 ANPR Data	Difference of ANPR 2019 from EFT v9.0	
	Rural & Urban	Outer London		Rural & Urban	Outer London	Rural & Urban	Outer London		Rural & Urban	Outer London
Pre-Euro 1**	1.1%	1.1%	1.2%	+0.1%	+0.1%	1.1%	0.9%	1.2%	+0.2%	+0.3%
Euro 1	-	-	-	<0.1%	<0.1%	-	-	-	-	-
Euro 2	-	-	-	<0.1%	<0.1%	-	-	-	-	-
Euro 3	0.1%	0.2%	4.1%	+4.0%	+3.9%	-	-	-	-	-
Euro 4	4.0%	5.4%	6.9%	+3.0%	+1.6%	-	-	-	-	-
Euro 5	14.9%	19.4%	20.7%	+5.8%	+1.3%	4.7%	7.2%	23.3%	+18.6%	+16.1%
Euro 6	17.2%	15.9%	14.4%	-2.8%	-1.5%	32.4%	31.6%	25.9%	-6.5%	-5.7%
Euro 6c	62.8%	58.1%	52.6%	-10.1%	-5.4%	61.9%	60.3%	49.5%	-12.4%	-10.8%

Note: Percentages may not add up to exactly 100% due to rounding.

** Pre-Euro 1 category includes vehicles with failed catalysts.

Table 20. Euro Class Split Comparisons Between EFT v9.0 and 2019 ANPR: Diesel Hybrid Cars and Taxis

Euro Standard	Diesel Hybrid Cars					Taxis				
	2019 EFT v9.0		2019 ANPR Data	Difference of ANPR 2019 from EFT v9.0		2019 EFT v9.0		2019 ANPR Data	Difference of ANPR 2019 from EFT v9.0	
	Rural & Urban	Outer London		Rural & Urban	Outer London	Rural & Urban	Outer London		Rural & Urban	Outer London
Pre-Euro 1	-	-	-	-	-	-	-	-	<0.1%	<0.1%
Euro 1	-	-	-	-	-	-	-	-	<0.1%	<0.1%
Euro 2	-	-	-	-	-	0.4%	-	-	-0.4%	<0.1%
Euro 3	-	-	-	-	-	2.4%	6.1%	18.5%	+16.1%	+12.4%
Euro 4	-	-	-	-	-	12.7%	25.6%	37.0%	+24.3%	+11.4%
Euro 5**	4.9%	5.7%	45.9%	+41.0%	+40.2%	30.9%	19.2%	33.9%	+3.0%	+14.7%
Euro 6	11.3%	25.6%	6.4%	-4.9%	-19.2%	19.0%	18.3%	3.8%	-15.2%	-14.5%
Euro 6c	83.8%	68.6%	47.7%	-36.1%	-21.0%	34.6%	-	6.9%	-27.7%	+6.9%
Euro 6d	-	-	-	<0.1%	<0.1%	-	-	-	<0.1%	<0.1%
ZEC***	n/a	n/a	n/a	n/a	n/a	-	30.8%	-	<0.1%	-30.8%

Note: Percentages may not add up to exactly 100% due to rounding.

** Euro 5 diesel hybrid cars category includes vehicles with failed catalysts.

*** Zero Emission Capable ZEC. In EFT v9.0, emissions for Diesel LGV N1 III are used to represent vehicles assigned as Taxis both inside and outside of London, and emissions for Euro 6 Petrol LGV N1 III are used to represent vehicles assigned as ZEC Taxis both inside and outside of London

Table 21. Euro Class Split Comparisons Between EFT v9.0 and 2019 ANPR: Heavy Goods Vehicles

Euro Standard	Rigid HGV					Articulated HGV				
	2019 EFT v9.0		2019 ANPR Data	Difference of ANPR 2019 from EFT v9.0		2019 EFT v9.0		2019 ANPR Data	Difference of ANPR 2019 from EFT v9.0	
	Rural & Urban	Outer London		Rural & Urban	Outer London	Rural & Urban	Outer London		Rural & Urban	Outer London
Pre-Euro I	-	-	-	<0.1%	<0.1%	-	-	-	<0.1%	<0.1%
Euro I	-	0.1%	-	<0.1%	-0.1%	-	-	-	<0.1%	<0.1%
Euro II	0.5%	0.7%	-	-0.5%	-0.7%	-	0.5%	0.3%	+0.3%	-0.2%
Euro III	4.1%	2.8%	4.9%	+0.8%	+2.1%	0.7%	1.8%	1.5%	+0.8%	-0.3%
Euro IV	4.4%	6.4%	9.5%	+5.1%	+3.1%	1.2%	8.4%	0.9%	-0.3%	-7.5%
Euro V EGR	4.6%	4.9%	6.6%	+2.1%	+1.7%	3.3%	5.1%	3.2%	-0.1%	-2.0%
Euro V SCR	13.7%	14.7%	19.9%	+6.2%	+5.2%	9.8%	15.4%	9.5%	-0.3%	-5.9%
Euro VI	72.7%	70.3%	59.1%	-13.5%	-11.2%	85.0%	68.9%	84.7%	-0.3%	+15.8%

Note: Percentages may not add up to exactly 100% due to rounding.

** Pre-Euro I category includes vehicles with failed catalysts.

Table 22. Euro Class Split Comparisons Between EFT v9.0 and 2019 ANPR: Buses and Coaches

Euro Standard	Buses & Coaches				
	2019 EFT v9.0		2019 ANPR Data	Difference of ANPR 2019 from EFT v9.0	
	Rural & Urban	Outer London		Rural & Urban	Outer London
Pre-Euro I	-	-	-	<0.1%	<0.1%
Euro I	-	-	-	<0.1%	<0.1%
Euro II	1.6%	0.2%	-	-1.6%	-0.2%
Euro III	7.5%	1.3%	2.8%	-4.8%	+1.5%
Euro IV	7.1%	3.6%	19.8%	+12.7%	+16.2%
Euro V EGR	6.3%	10.9%	11.5%	+5.2%	+0.6%
Euro V SCR	18.9%	32.7%	34.6%	+15.6%	+1.9%
Euro VI	58.6%	51.3%	31.3%	-27.2%	-20.0%

Note: Percentages may not add up to exactly 100% due to rounding.

** Pre-Euro I category includes vehicles with failed catalysts.

6. Concluding Remarks and Recommendations

6.1 This Technical Note has been prepared by AECOM on behalf of Epping Forest District Council (EFDC) to provide a comparison between the local vehicle fleet captured using Automatic Number Plate Recognition (ANPR) and the default vehicle fleets inherent within two versions of Defra's Emissions Factors Toolkit (EFT), for the years 2017 and 2019.

6.2 The analyses have established the variability between both the ANPR datasets and the EFT, and between the EFT versions themselves (version 8.0.1 and version 9.0), and the implications these may have on the resultant emissions calculations.

6.3 It has been demonstrated that the use of the newer EFT, version 9.0, tends to produce slightly higher road NO_x emissions in the scenarios tested as compared to EFT v8.0.1, which was used in the 2019 HRA air quality modelling. This was consistent for both 2017 and 2019 ANPR fleet data.

6.4 The basic fleet split derived from the ANPR data shows a lower percentage of heavy-duty vehicles in the local fleet than would be anticipated using the EFT default fleet split for rural roads. The HDV proportions from the ANPR survey data were between 2% and 2.5% whereas the 2019 HRA used 6-9% depending on the road link. Using the locally-derived vehicle fleet split therefore results in lower total NO_x emissions than was modelled in the 2019 HRA.

6.5 Analysis of the ANPR data has revealed that the local vehicle fleet is generally older than the national default assumptions inherent within the EFT for rural/urban roads. Vehicles of earlier Euro standards are typically more prevalent in the local vehicle fleet for both 2017 and 2019 than the EFT default projections. This pattern is common across all vehicle categories. The 2019 local LDV fleet is in general newer than the EFT's outer London LDV fleet.

6.6 Application of the locally-derived Euro Class breakdown produces higher total NO_x emissions than using EFT default proportions for urban/rural roads; however, when the combined effect of the local basic fleet split and Euro Class breakdown is taken into account the calculated road NO_x emissions are lower than using EFT defaults for rural roads. It is therefore apparent that the difference in the basic fleet split between the ANPR survey data and the EFT has a greater influence on emissions than Euro Class breakdown.

6.7 For 2017, road NO_x emissions calculated using EFT version 9.0 are as follows:

- Using the default fleet split and Euro Class breakdown (as was used for the 2019 HRA assessment): 0.05812 g/km/s
- Using the locally-derived fleet split and Euro Class breakdown (best estimate of accrual): 0.05678 g/km/s
- **This represents approximately a 1.9% reduction in road NO_x emission rate when the local ANPR data are applied.**

6.8 For 2019, road NO_x emissions calculated using EFT version 9.0 are as follows:

- Using the default fleet split and Euro Class breakdown (which would be used if ANPR data were not available): 0.04921 g/km/s
- Using the locally-derived fleet split and Euro Class breakdown (best estimate of accrual): 0.04530 g/km/s
- **This represents approximately a 7.9% reduction in road NO_x emission rate when the local ANPR data are applied.**

6.9 The percentage reduction in NO_x emission rate using the locally-derived fleet split and Euro Class breakdown is greater in 2019 than 2017. There are a number of reasons for this, including the higher proportion of petrol-fuelled cars in the 2019 local vehicle fleet, the lower proportion of heavy-duty vehicles in the fleet, and the penetration of newer vehicles into the vehicle fleet (i.e. more Euro 6 / Euro VI vehicles).

6.10 As the ANPR data has shown the local vehicle fleet operating in the EFSAC to be different from those defined in the EFT in terms of both basic fleet split and Euro class split, it is recommended that the 2017 ANPR data is used to derive the vehicle fleet for the updated 2017 baseline air quality modelling scenario. This scenario will be undertaken with the purpose of calculating appropriate verification factors to account for model bias.

6.11 Consideration of the local vehicle fleet compared with the EFT's outer London fleet has been limited to consider only the basic vehicle fleet and the Euro class splits for 2019. The analysis indicates that, in terms of the basic fleet split, the local EFSAC vehicle fleet is most like that defined in the EFT for outer London.

6.12 Whilst the EFT v9.0 provides the ability to project the Euro class distribution for future years, it does not project the proportion of vehicles in terms of the basic fleet split. Therefore, it is recommended that the EFT outer London fleet is used to inform the projection of the fleet that will be expected to use the roads in EFSAC in future years, and in turn, will inform any appropriate mitigation measures.

Appendix A

2019 HRA modelling heavy duty vehicle (HDV) percentage

For the purpose of an air quality assessment, and when using Defra's EFT, heavy duty vehicles (HDV) include vehicles over 3.5 tonnes and so include rigid and articulated HGVs, buses and coaches.

For the 2019 HRA, HDV percentages were derived from ATC data, with vehicles classified according to the table below[8]. HDVs were considered to include vehicles in classes 4-10. This gave percentages relative to total traffic flow varying between 6% to 9% across the roads within EFSAC.

The 2017 and 2019 ANPR data classifies HDVs as buses and coaches, plus HGVs greater than 3.5 tonnes. The average HDV percentage across the EFSAC roads is calculated to be 2.5% from the 2017 ANPR data and 2.0% from the 2019 ANPR data. These percentages are in-line with HDV proportions as a percentage of Annual Average Traffic Data (AADT) flow as measured at DfT count points in the vicinity of the EFSAC. These data are presented in Appendix B.

Further scrutiny of the ANPR HDV data and the HDV percentages derived from the ATC data indicates that the latter most likely included some LGVs less than or equal to 3.5 tonnes as classes 4 and 5 in the table below were included in the HDV category; the vehicle classes used in the ATC were misaligned relative to the EFT vehicle classes.

<table>
<tr><th>CLASS</th><th>ABBREV.</th><th>DESCRIPTION</th><th>LENGTH</th><th>COBA</th><th>AQMA</th><th>MANUAL</th></tr>
<tr><td>1</td><td>MC</td><td>Motorcycle</td><td rowspan="2">SHORT
Up to 5.5m</td><td>N/A</td><td>MC</td><td>MC</td></tr>
<tr><td>2</td><td>SV</td><td>Cars, taxis, 4WD, vans</td><td rowspan="2">CAR & LGV</td><td rowspan="2">CAR</td><td rowspan="2">CAR & LGV1</td></tr>
<tr><td>3</td><td>SVT</td><td>Class 2 plus trailer</td><td rowspan="4">MEDIUM
5.5m to 14.5m</td></tr>
<tr><td>4</td><td>TB2</td><td>2 axle truck / bus</td><td>OGV1 & PSV</td><td rowspan="2">LGV & MGV</td><td>LGV2 & PSV</td></tr>
<tr><td>5</td><td>TB3</td><td>3 axle truck / bus</td><td>OGV1</td><td>MGV & PSV</td></tr>
<tr><td>6</td><td>T4</td><td>4 axle truck</td><td rowspan="5">OGV2</td><td>HGV RIGID</td><td>HGV1</td></tr>
<tr><td>7</td><td>ART3</td><td>3 axle articulated</td><td rowspan="4">LONG
11.5m to 19.0m</td><td rowspan="4">HGV ARTIC</td><td rowspan="4">HGV2</td></tr>
<tr><td>8</td><td>ART4</td><td>4 axle articulated</td></tr>
<tr><td>9</td><td>ART5</td><td>5 axle articulated</td></tr>
<tr><td>10</td><td>ART6</td><td>6+ axle articulated</td></tr>
</table>

[8] The ANPR Survey states that: "Vehicles recorded by the ATC are placed into one of ten classes based on axle spacing and pattern. This scheme is based on the AustRoad94 algorithm and modified for UK traffic, referred to as ARX. The table aligns the ARX classifications with the AQMA (air quality management standard) and the Essex 9-class, as used in the manual junction counts undertaken by Essex Highways."

Appendix B

DfT count data – Annual Average Daily Traffic Flows in the vicinity of EFSAC

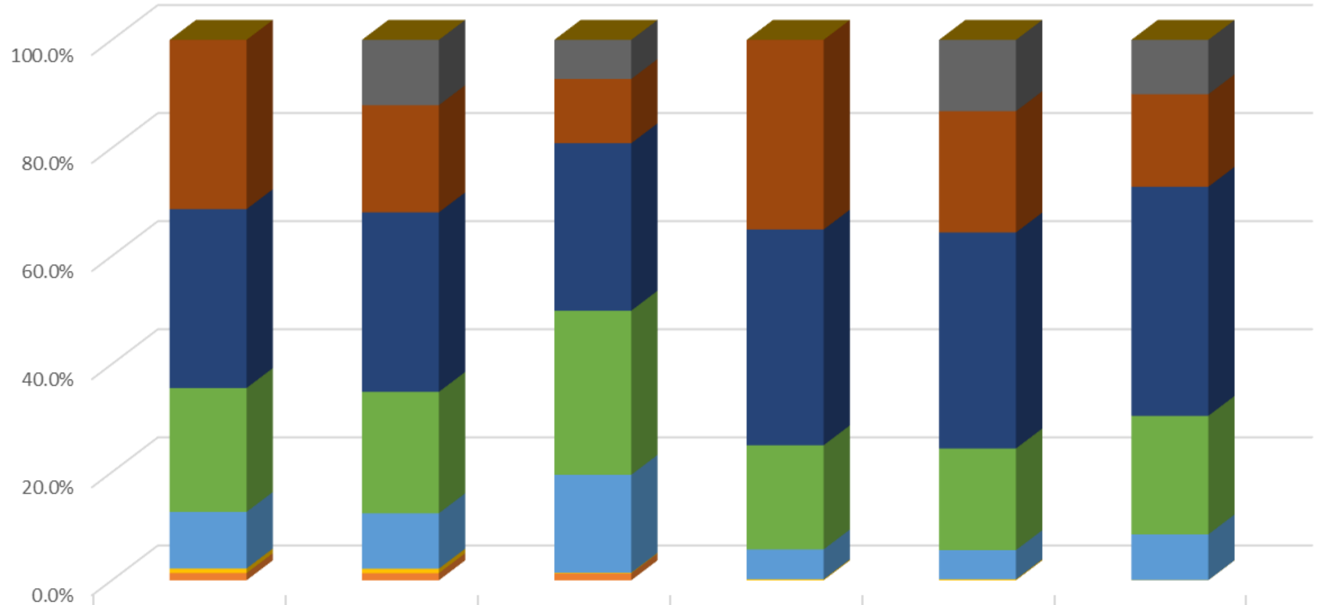
https://roadtraffic.dft.gov.uk/#6/55.254/-6.053/basemap-regions-countpoints

count point id	year	local authority name	road name	start junction road name	end junction road name	estimation method detailed	buses and coaches	all HGVs	all motor vehicles	HGVs+ buses+coaches	%HDV
58084	2016	Essex	A121	A104	A121 Honey Lane roundabout	Manual count	88	562	22497	650	2.9%
58084	2011	Essex	A121	A104	A121 Honey Lane roundabout	Manual count	116	681	20375	797	3.9%
58084	2010	Essex	A121	A104	A121 Honey Lane roundabout	Manual count	137	559	22242	696	3.1%
58084	2009	Essex	A121	A104	A121 Honey Lane roundabout	Manual count	104	548	22536	652	2.9%
58084	2008	Essex	A121	A104	A121 Honey Lane roundabout	Manual count	116	614	22730	730	3.2%
58084	2004	Essex	A121	A104	A121 Honey Lane roundabout	Manual count	163	812	20646	975	4.7%
58084	2000	Essex	A121	A104	A121 Honey Lane roundabout	Manual count	135	653	18139	788	4.3%
930090	2009	Essex	B172			Manual count	10	104	7800	114	1.5%
930090	2008	Essex	B172			Manual count	12	114	7066	126	1.8%
930090	2007	Essex	B172			Manual count	28	171	7217	199	2.8%
930090	2006	Essex	B172			Manual count	10	165	7341	175	2.4%
930090	2005	Essex	B172			Manual count	25	123	7138	148	2.1%
930090	2004	Essex	B172			Manual count	11	214	8872	225	2.5%
930090	2003	Essex	B172			Manual count	22	209	7187	231	3.2%
16638	2017	Essex	A121	Baldwin's Hill	A104	Manual count	81	534	17908	615	3.4%
16638	2013	Essex	A121	Baldwin's Hill	A104	Manual count	119	428	17794	547	3.1%
16638	2011	Essex	A121	Baldwin's Hill	A104	Manual count	159	443	18577	602	3.2%

count point id	year	local authority name	road name	start junction road name	end junction road name	estimation method detailed	buses and coaches	all HGVs	all motor vehicles	HGVs+ buses+coaches	%HDV
16638	2009	Essex	A121	Baldwin's Hill	A104	Manual count	127	470	18580	597	3.2%
16638	2007	Essex	A121	Baldwin's Hill	A104	Manual count	155	491	18178	646	3.6%
16638	2003	Essex	A121	Baldwin's Hill	A104	Manual count	167	602	16591	769	4.6%
940922	2009	Essex	B1393			Manual count	70	427	18925	497	2.6%
940922	2008	Essex	B1393			Manual count	68	537	19064	605	3.2%
940922	2006	Essex	B1393			Manual count	65	516	19341	581	3.0%
940922	2005	Essex	B1393			Manual count	116	400	18564	516	2.8%
940922	2004	Essex	B1393			Manual count	99	585	17882	684	3.8%
940922	2003	Essex	B1393			Manual count	141	618	19689	759	3.9%
940922	2002	Essex	B1393			Manual count	99	642	21768	741	3.4%
940922	2001	Essex	B1393			Manual count	115	578	20319	693	3.4%
940922	2000	Essex	B1393			Manual count	130	429	20760	559	2.7%
6198	2018	Essex	A104	A1069	A121	Manual count	33	170	14579	203	1.4%
6198	2014	Essex	A104	A1069	A121	Manual count	37	234	13658	271	2.0%
6198	2010	Essex	A104	A1069	A121	Manual count	40	192	17464	232	1.3%
6198	2007	Essex	A104	A1069	A121	Manual count	94	324	18776	418	2.2%
6198	2005	Essex	A104	A1069	A121	Manual count	61	293	16044	354	2.2%
6198	2004	Essex	A104	A1069	A121	Manual count	66	351	15016	417	2.8%
6198	2002	Essex	A104	A1069	A121	Manual count	44	447	15145	491	3.2%
6198	2000	Essex	A104	A1069	A121	Manual count	30	289	15908	319	2.0%

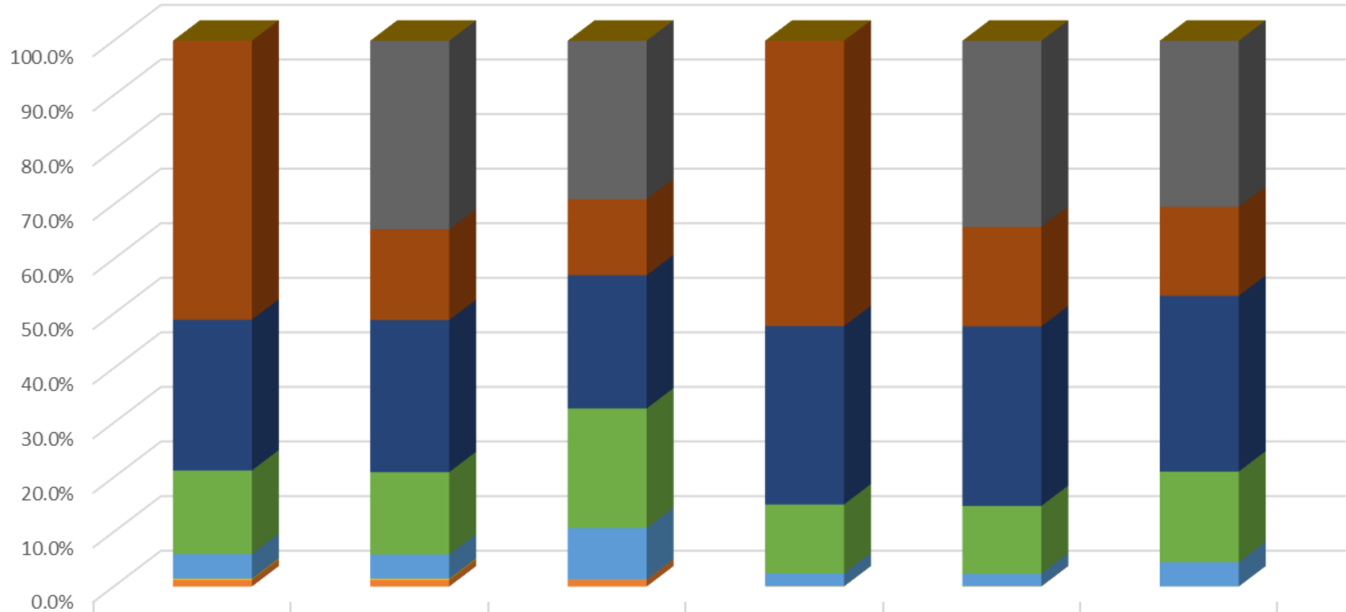
Appendix C

Figure 3. Comparison of Euro Class Breakdown for Conventional Petrol and Diesel Cars, 2017



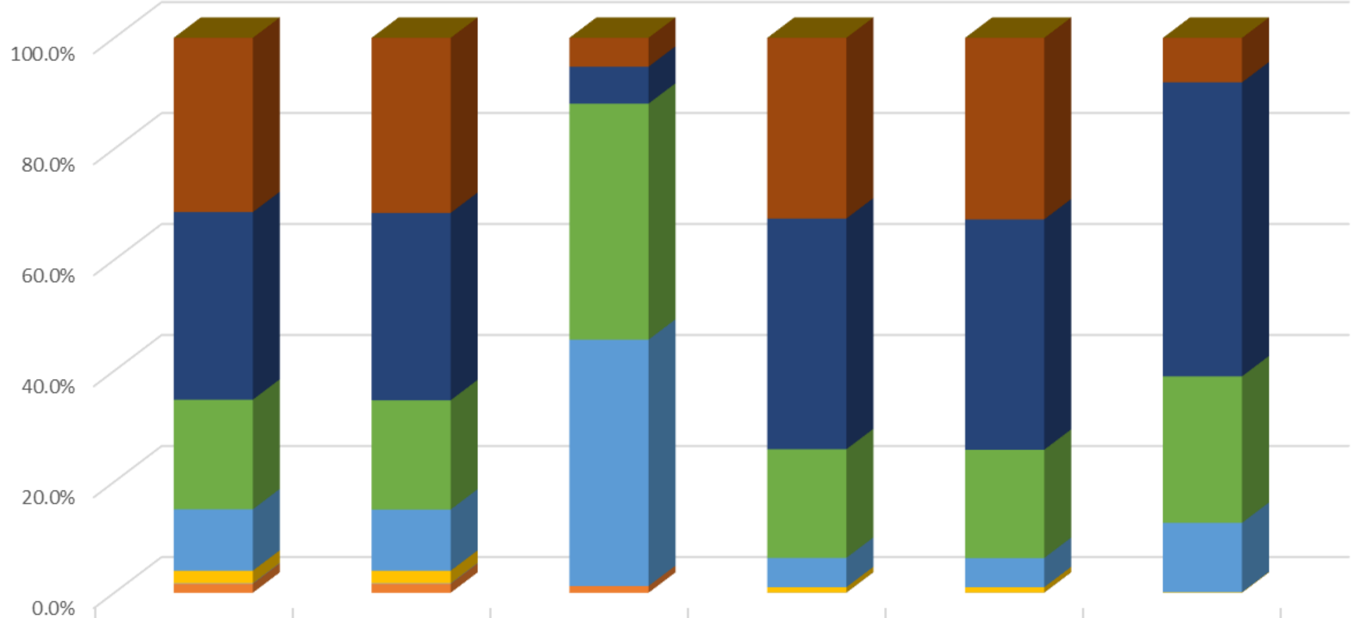
	EFT v8.0.1 Petrol Car	EFT v9.0 Petrol Car	ANPR 2017 Petrol Car	EFT v8.0.1 Diesel Car	EFT v9.0 Diesel Car	ANPR 2017 Diesel Car
Euro 6d	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Euro 6c	0.0%	12.1%	7.2%	0.0%	13.2%	10.1%
Euro 6	31.3%	19.8%	11.9%	35.1%	22.4%	17.1%
Euro 5	33.1%	33.2%	31.0%	39.9%	40.0%	42.4%
Euro 4	22.9%	22.5%	30.4%	19.3%	18.8%	21.9%
Euro 3	10.5%	10.3%	18.1%	5.5%	5.4%	8.5%
Euro 2	0.8%	0.8%	0.1%	0.2%	0.2%	0.0%
Euro 1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Pre-Euro 1	1.3%	1.3%	1.3%	0.0%	0.0%	0.0%

Figure 4. Comparison of Euro Class Breakdown for Conventional Petrol and Diesel Cars, 2019



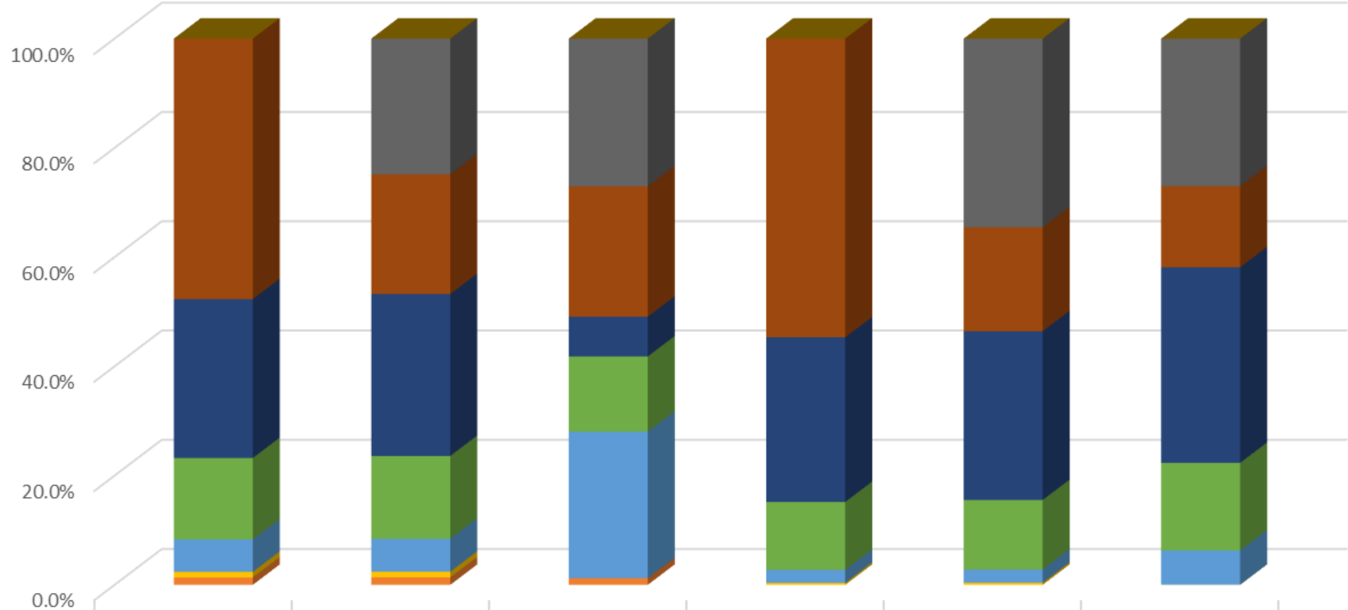
	EFT v8.0.1 Petrol Car	EFT v9.0 Petrol Car	ANPR 2019 Petrol Car	EFT v8.0.1 Diesel Car	EFT v9.0 Diesel Car	ANPR 2019 Diesel Car
Euro 6d	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Euro 6c	0.0%	34.6%	29.0%	0.0%	34.1%	30.4%
Euro 6	51.1%	16.6%	14.0%	52.3%	18.2%	16.3%
Euro 5	27.6%	27.9%	24.4%	32.7%	32.9%	32.2%
Euro 4	15.3%	15.1%	21.9%	12.6%	12.4%	16.6%
Euro 3	4.5%	4.5%	9.4%	2.4%	2.3%	4.4%
Euro 2	0.2%	0.2%	0.0%	0.1%	0.1%	0.0%
Euro 1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Pre-Euro 1	1.2%	1.2%	1.2%	0.0%	0.0%	0.0%

Figure 5. Comparison of Euro Class Breakdown for Conventional Petrol and Diesel LGVs, 2017



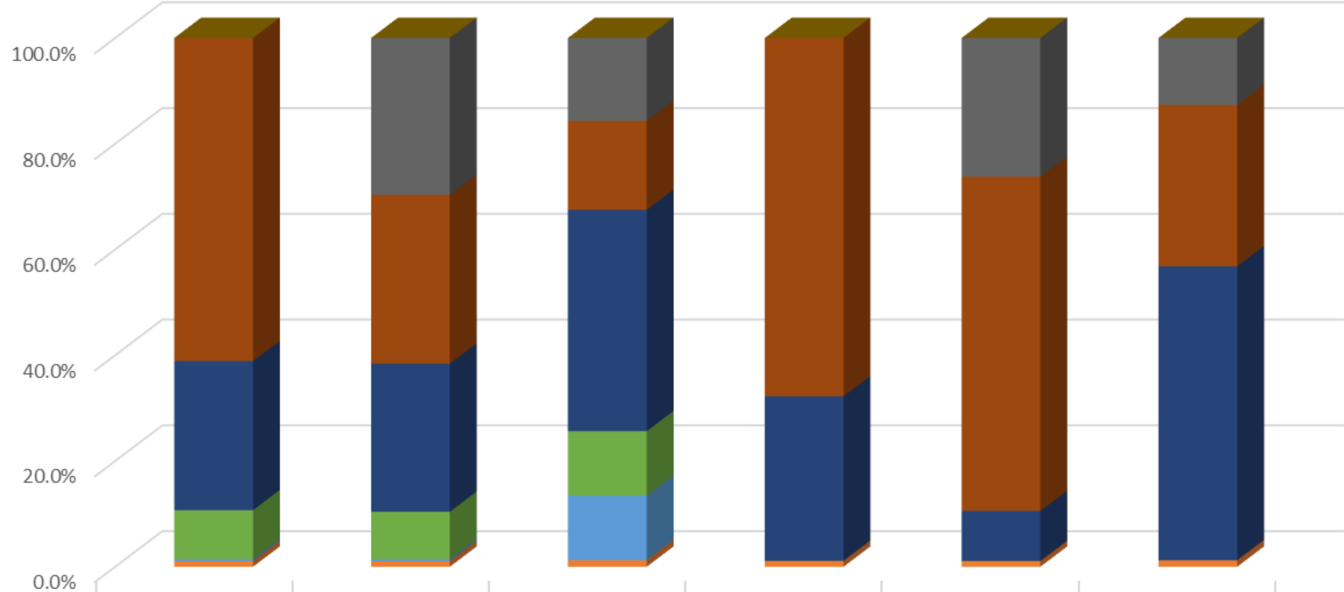
	EFT v8.0.1 Petrol LGV	EFT v9.0 Petrol LGV	ANPR 2017 Petrol LGV	EFT v8.0.1 Diesel LGV	EFT v9.0 Diesel LGV	ANPR 2017 Diesel LGV
Euro 6d	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Euro 6c	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Euro 6	31.4%	31.5%	5.2%	32.6%	32.7%	8.0%
Euro 5	33.8%	33.8%	6.7%	41.6%	41.5%	53.0%
Euro 4	19.8%	19.7%	42.5%	19.6%	19.5%	26.4%
Euro 3	11.1%	11.0%	44.4%	5.3%	5.3%	12.5%
Euro 2	2.2%	2.2%	0.0%	1.0%	1.0%	0.1%
Euro 1	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
Pre-Euro 1	1.6%	1.6%	1.2%	0.0%	0.0%	0.0%

Figure 6. Comparison of Euro Class Breakdown for Conventional Petrol and Diesel LGVs, 2019



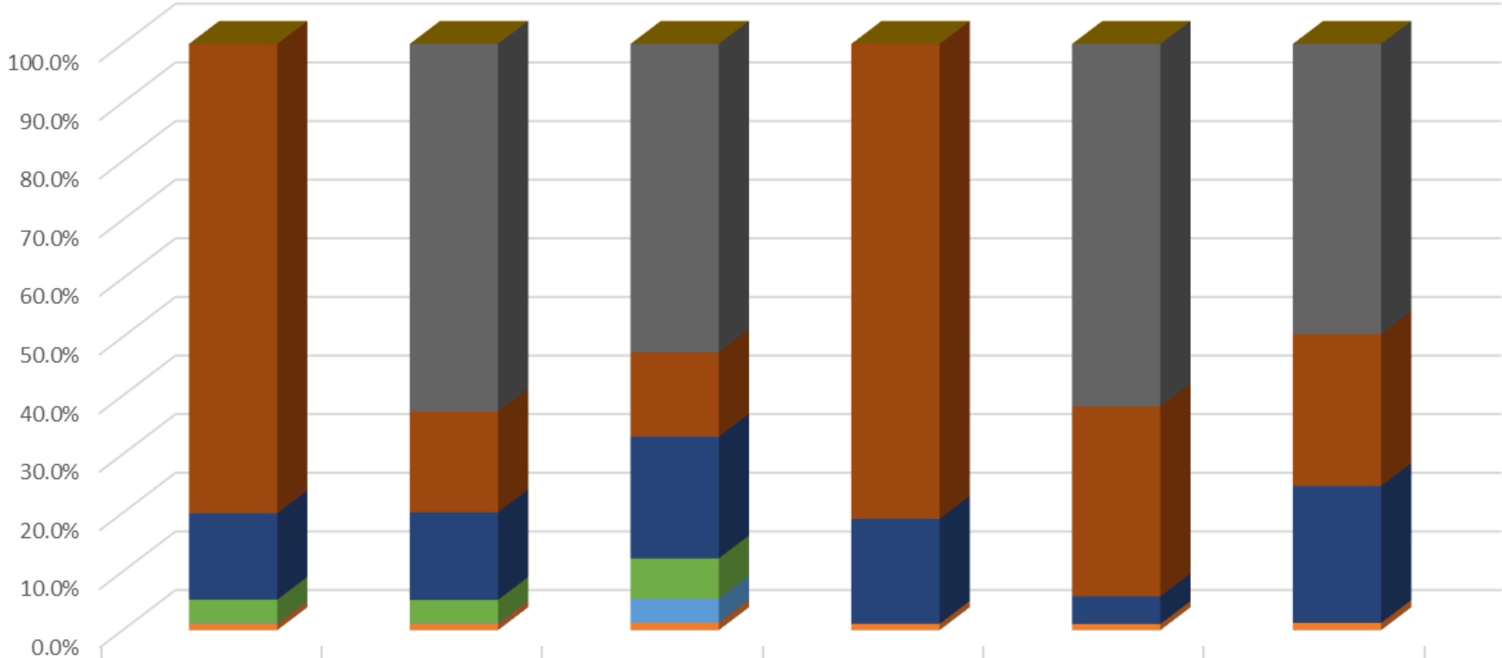
	EFT v8.0.1 Petrol LGV	EFT v9.0 Petrol LGV	ANPR 2019 Petrol LGV	EFT v8.0.1 Diesel LGV	EFT v9.0 Diesel LGV	ANPR 2019 Diesel LGV
Euro 6d	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Euro 6c	0.0%	24.8%	27.0%	0.0%	34.6%	27.0%
Euro 6	47.7%	21.9%	23.9%	54.7%	19.0%	14.9%
Euro 5	29.1%	29.6%	7.3%	30.1%	30.9%	35.8%
Euro 4	14.9%	15.2%	13.8%	12.4%	12.7%	16.0%
Euro 3	5.9%	6.0%	26.8%	2.4%	2.4%	6.3%
Euro 2	1.0%	1.0%	0.0%	0.4%	0.4%	0.0%
Euro 1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Pre-Euro 1	1.4%	1.4%	1.2%	0.0%	0.0%	0.0%

Figure 7. Comparison of Euro Class Breakdown for Full Hybrid and Plug-in Hybrid Petrol Cars, 2017



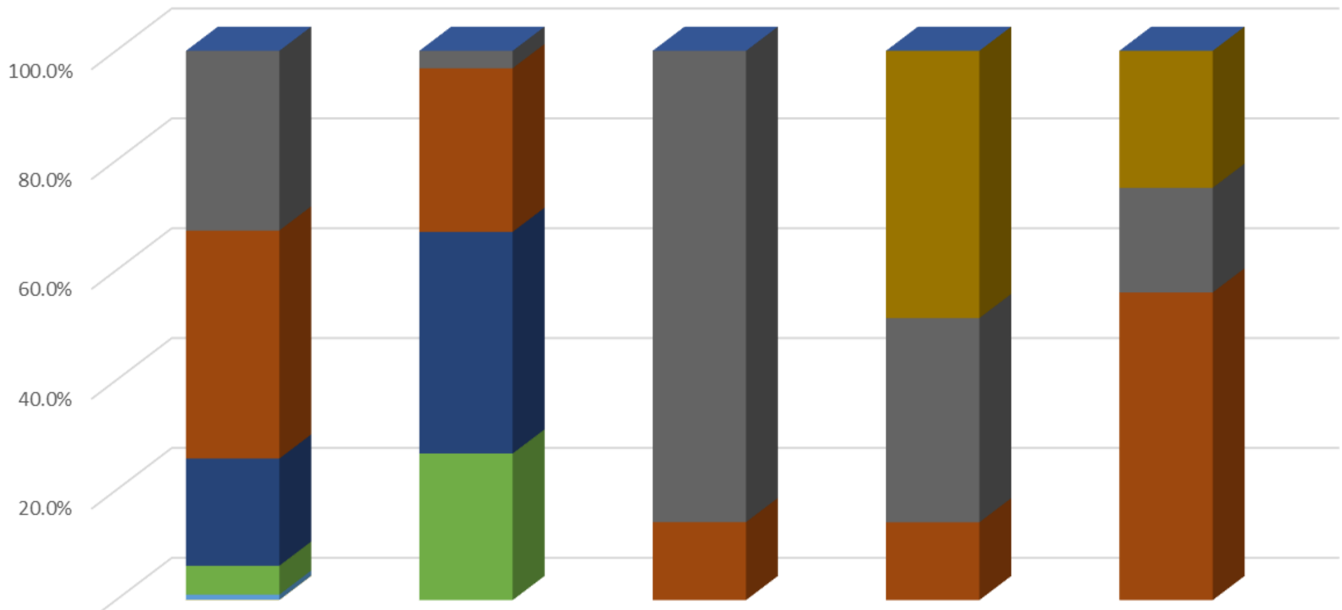
	EFT v8.0.1 Hybrid Car Petrol	EFT v9.0 Hybrid Car Petrol	ANPR 2017 Hybrid Car Petrol	EFT v8.0.1 Plug-In Hybrid Car (Petrol)	EFT v9.0 Plug-In Hybrid Car (Petrol)	ANPR 2017 Plug-In Hybrid Car (Petrol)
Euro 6d	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Euro 6c	0.0%	29.7%	15.7%	0.0%	26.2%	12.7%
Euro 6	61.1%	31.9%	16.8%	67.8%	63.2%	30.5%
Euro 5	28.2%	28.0%	41.9%	31.1%	9.5%	55.6%
Euro 4	9.3%	9.0%	12.2%	0.0%	0.0%	0.0%
Euro 3	0.4%	0.4%	12.2%	0.0%	0.0%	0.0%
Euro 2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Euro 1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Pre-Euro 1	1.1%	1.1%	1.2%	1.1%	1.1%	1.2%

Figure 8. Comparison of Euro Class Breakdown for Full Hybrid and Plug-in Hybrid Petrol Cars, 2019



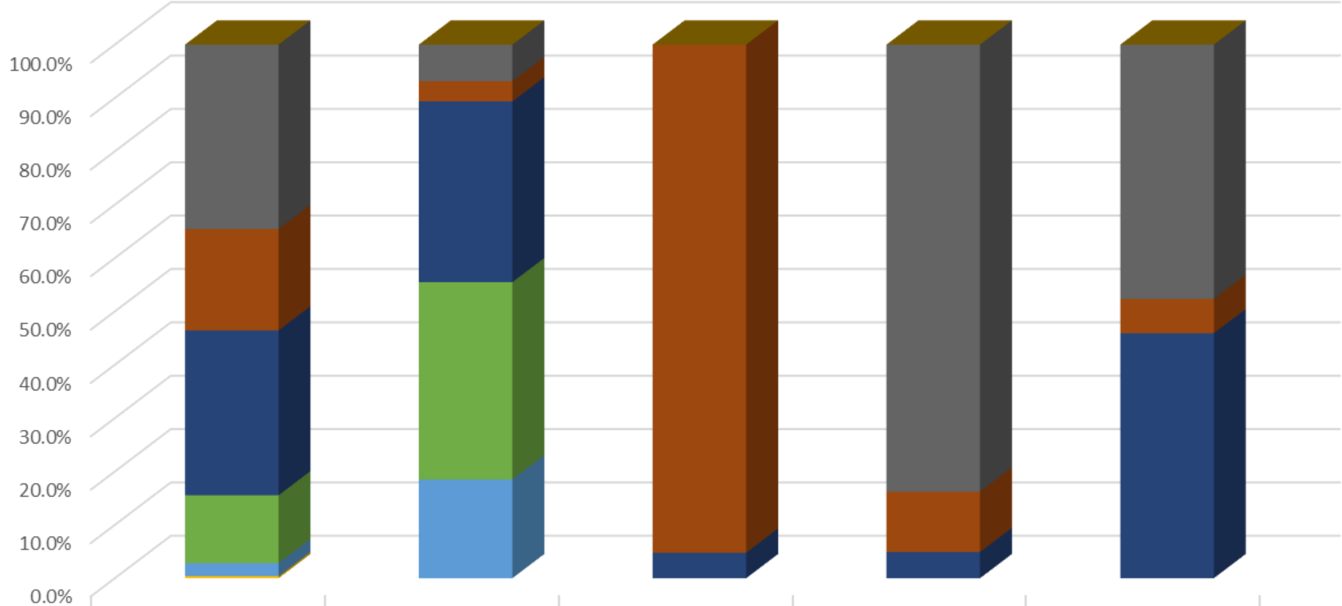
	EFT v8.0.1 Hybrid Car Petrol	EFT v9.0 Hybrid Car Petrol	ANPR 2019 Hybrid Car Petrol	EFT v8.0.1 Plug-In Hybrid Car (Petrol)	EFT v9.0 Plug-In Hybrid Car (Petrol)	ANPR 2019 Plug-In Hybrid Car (Petrol)
Euro 6d	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Euro 6c	0.0%	62.8%	52.6%	0.0%	61.9%	49.5%
Euro 6	80.1%	17.2%	14.4%	81.0%	32.4%	25.9%
Euro 5	14.7%	14.9%	20.7%	17.9%	4.7%	23.3%
Euro 4	4.0%	4.0%	6.9%	0.0%	0.0%	0.0%
Euro 3	0.1%	0.1%	4.1%	0.0%	0.0%	0.0%
Euro 2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Euro 1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Pre-Euro 1	1.1%	1.1%	1.2%	1.1%	1.1%	1.2%

Figure 9. Comparison of Euro Class Breakdown for Taxis and Diesel Hybrid Cars, 2017



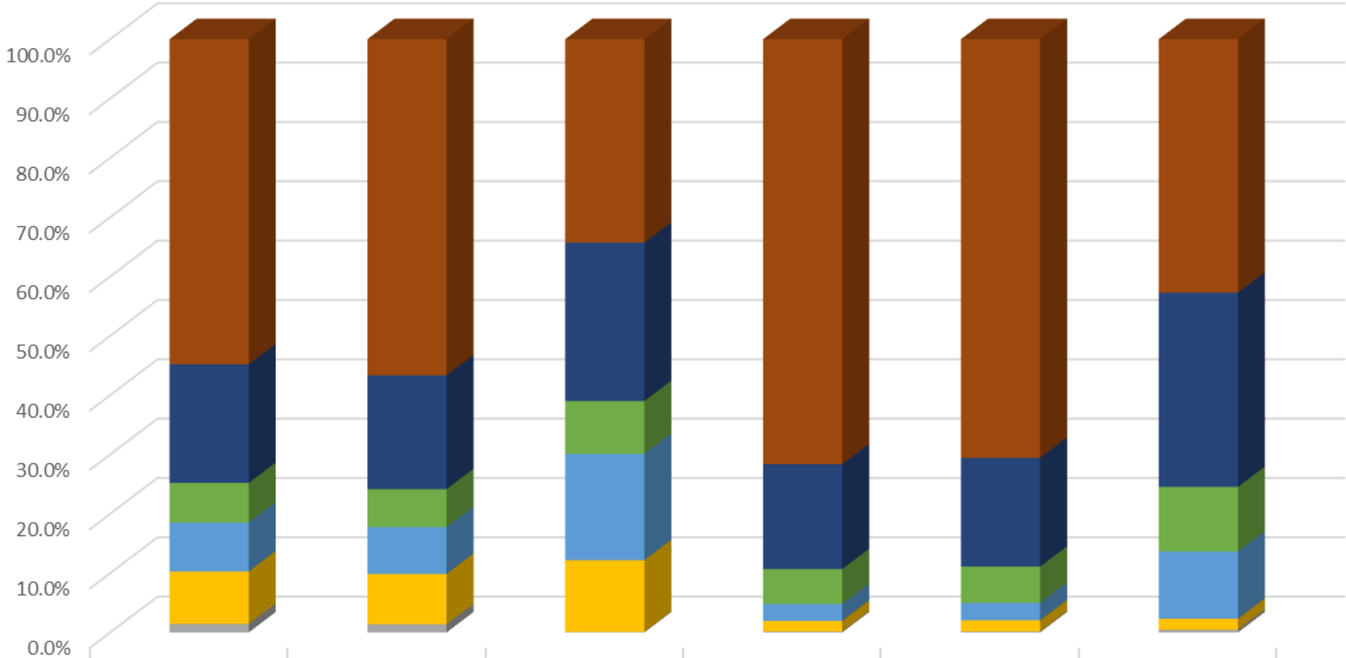
	EFT v9.0 Taxi (black cab)	ANPR 2017 Taxi (black cab)	EFT v8.0.1 Hybrid Car (Diesel)	EFT v9.0 Hybrid Car (Diesel)	ANPR 2017 Hybrid Car (Diesel)
Euro 6d	0.0%	0.0%	0.0%	0.0%	0.0%
Euro 6c	0.0%	0.0%	0.0%	48.7%	24.9%
Euro 6	32.7%	3.2%	85.8%	37.2%	19.1%
Euro 5	41.5%	29.8%	14.2%	14.2%	56.0%
Euro 4	19.5%	40.4%	0.0%	0.0%	0.0%
Euro 3	5.3%	26.7%	0.0%	0.0%	0.0%
Euro 2	1.0%	0.0%	0.0%	0.0%	0.0%
Euro 1	0.0%	0.0%	0.0%	0.0%	0.0%
Pre-Euro 1	0.0%	0.0%	0.0%	0.0%	0.0%

Figure 10. Comparison of Euro Class Breakdown for Taxis and Diesel Hybrid Cars, 2019



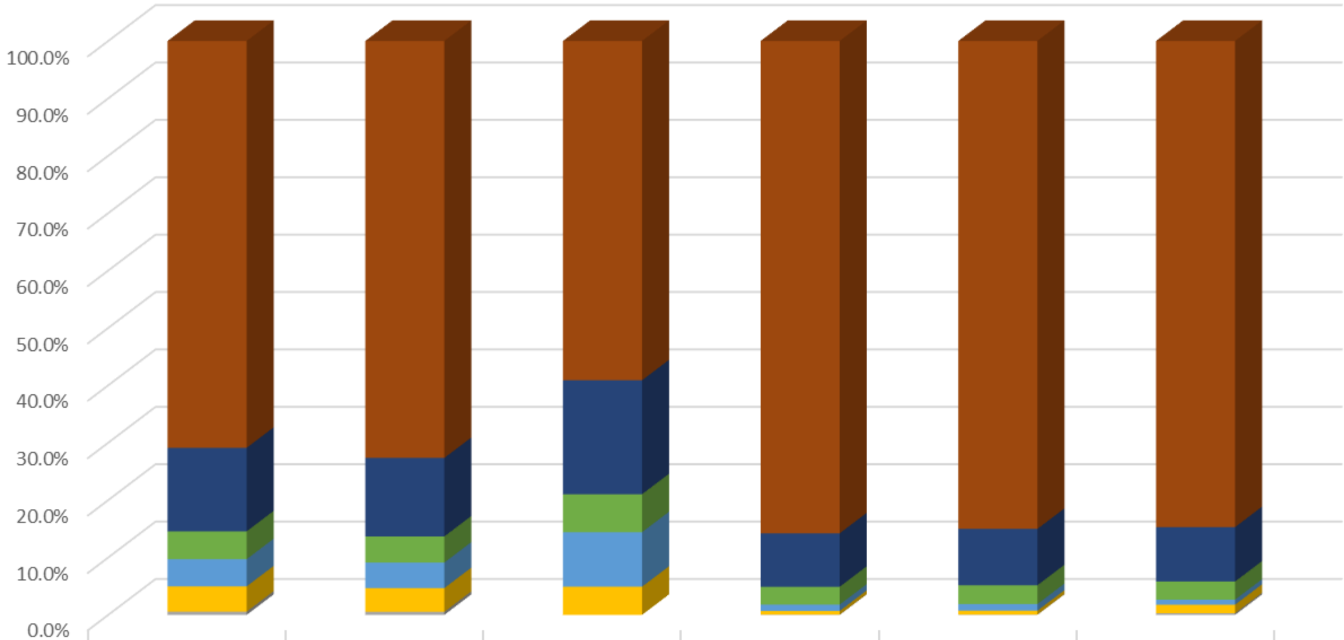
	EFT v9.0 Taxi (black cab)	ANPR 2019 Taxi (black cab)	EFT v8.0.1 Hybrid Car (Diesel)	EFT v9.0 Hybrid Car (Diesel)	ANPR 2019 Hybrid Car (Diesel)
Euro 6d	0.0%	0.0%	0.0%	0.0%	0.0%
Euro 6c	34.6%	6.9%	0.0%	83.8%	47.7%
Euro 6	19.0%	3.8%	95.2%	11.3%	6.4%
Euro 5	30.9%	33.9%	4.8%	4.9%	45.9%
Euro 4	12.7%	37.0%	0.0%	0.0%	0.0%
Euro 3	2.4%	18.5%	0.0%	0.0%	0.0%
Euro 2	0.4%	0.0%	0.0%	0.0%	0.0%
Euro 1	0.0%	0.0%	0.0%	0.0%	0.0%
Pre-Euro 1	0.0%	0.0%	0.0%	0.0%	0.0%

Figure 11. Comparison of Euro Class Breakdown for Rigid and Articulated HGVs, 2017



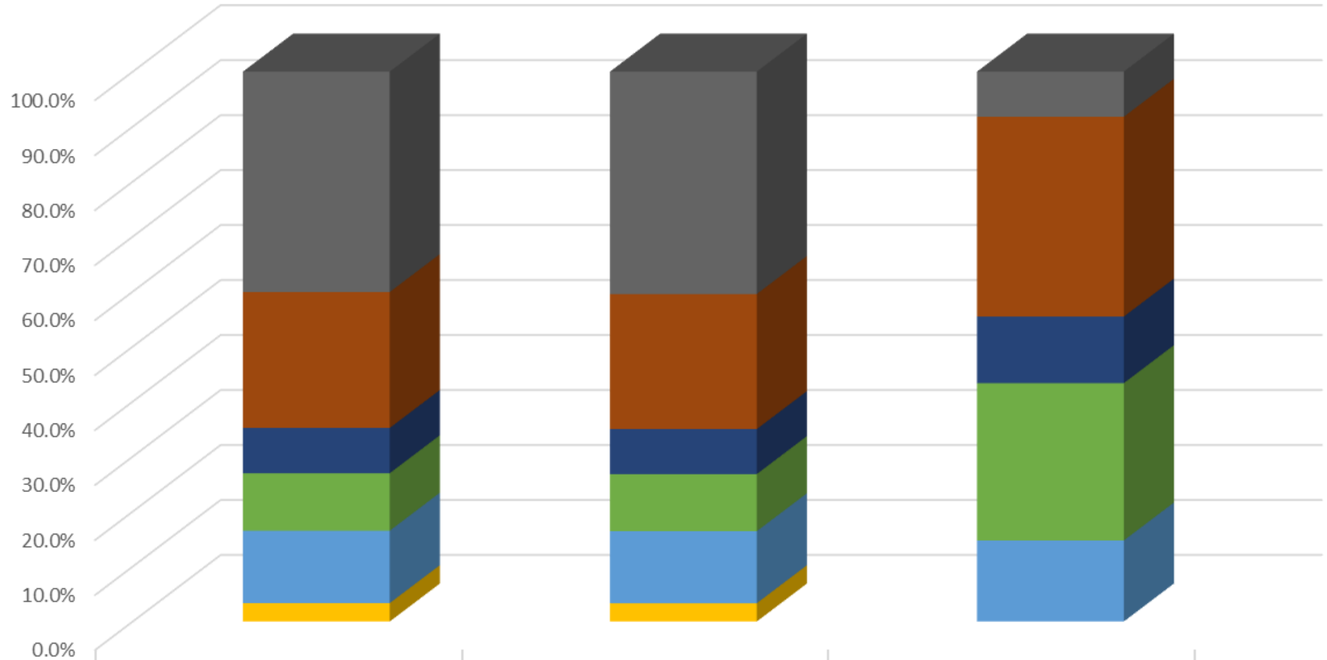
	EFT v8.0.1 Rigid HGV	EFT v9.0 Rigid HGV	ANPR 2017 Rigid HGV	EFT v8.0.1 Articulated HGV	EFT v9.0 Articulated HGV	ANPR 2017 Articulated HGV
Euro VI	54.8%	56.7%	34.3%	71.6%	70.6%	42.7%
Euro V SCR	20.0%	19.2%	26.7%	17.7%	18.3%	32.7%
Euro V EGR	6.7%	6.4%	8.9%	5.9%	6.1%	10.9%
Euro IV	8.2%	7.9%	17.9%	2.8%	2.9%	11.3%
Euro III	8.8%	8.5%	12.1%	1.8%	1.9%	1.9%
Euro II	1.4%	1.4%	0.1%	0.2%	0.2%	0.5%
Euro I	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Pre-Euro I	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Figure 12. Comparison of Euro Class Breakdown for Rigid and Articulated HGVs, 2019



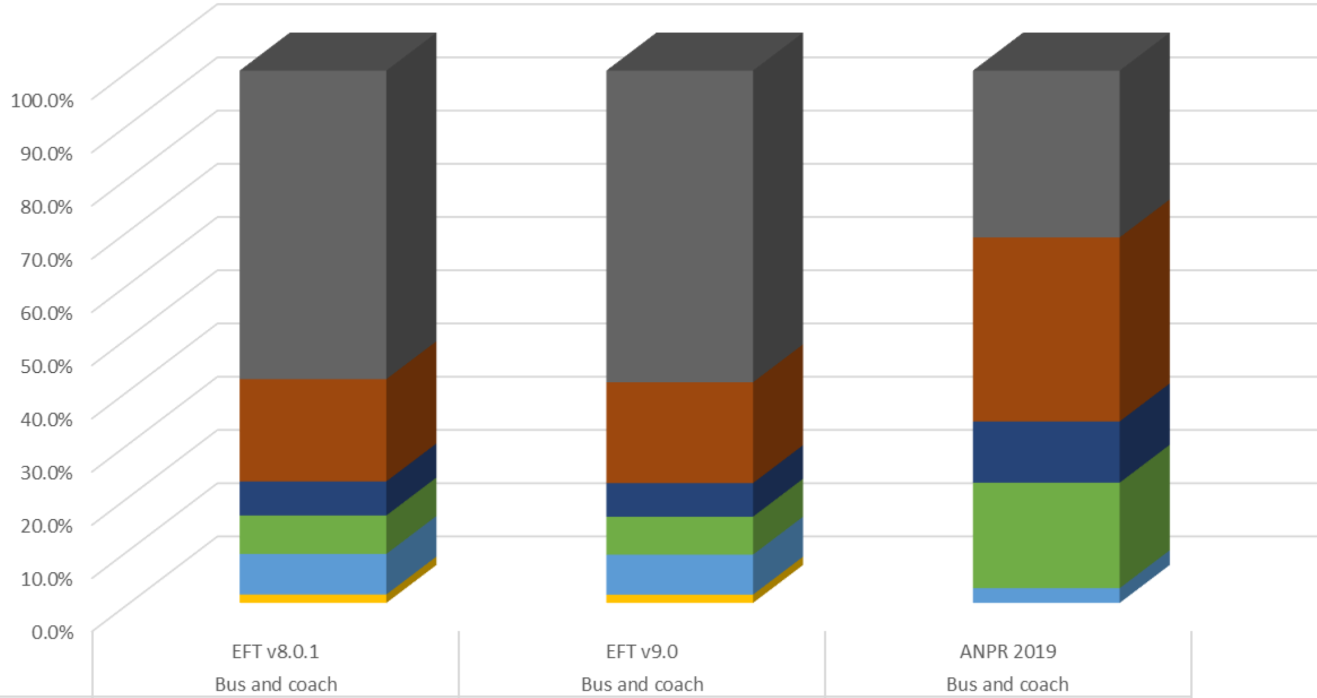
	EFT v8.0.1 Rigid HGV	EFT v9.0 Rigid HGV	ANPR 2019 Rigid HGV	EFT v8.0.1 Articulated HGV	EFT v9.0 Articulated HGV	ANPR 2019 Articulated HGV
Euro VI	70.9%	72.7%	59.1%	85.8%	85.0%	84.7%
Euro V SCR	14.6%	13.7%	19.9%	9.3%	9.8%	9.5%
Euro V EGR	4.9%	4.6%	6.6%	3.1%	3.3%	3.2%
Euro IV	4.7%	4.4%	9.5%	1.1%	1.2%	0.9%
Euro III	4.4%	4.1%	4.9%	0.6%	0.7%	1.5%
Euro II	0.6%	0.5%	0.0%	0.0%	0.0%	0.3%
Euro I	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Pre-Euro I	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Figure 13. Comparison of Euro Class Breakdown for Buses and Coaches, 2017



	EFT v8.0.1 Bus and coach	EFT v9.0 Bus and coach	ANPR 2017 Bus and coach
Euro VI	40.1%	40.4%	8.2%
Euro V SCR	24.7%	24.6%	36.3%
Euro V EGR	8.2%	8.2%	12.1%
Euro IV	10.5%	10.4%	28.6%
Euro III	13.2%	13.1%	14.7%
Euro II	3.3%	3.3%	0.0%
Euro I	0.0%	0.0%	0.0%
Pre-Euro I	0.0%	0.0%	0.0%

Figure 14. Comparison of Euro Class Breakdown for Buses and Coaches, 2019



	EFT v8.0.1 Bus and coach	EFT v9.0 Bus and coach	ANPR 2019 Bus and coach
Euro VI	58.0%	58.6%	31.3%
Euro V SCR	19.2%	18.9%	34.6%
Euro V EGR	6.4%	6.3%	11.5%
Euro IV	7.2%	7.1%	19.8%
Euro III	7.6%	7.5%	2.8%
Euro II	1.6%	1.6%	0.0%
Euro I	0.0%	0.0%	0.0%
Pre-Euro I	0.0%	0.0%	0.0%

Appendix E – Use of ANPR Data to Inform the Projected Vehicle Fleet in EFSAC

Epping Forest Special Area of Conservation

Use of ANPR data to inform the projected vehicle fleet in EFSAC
Technical Note

Epping Forest District Council

17 March 2020

Quality information

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1. Introduction

1.1 This Technical Note has been prepared by AECOM on behalf of Epping Forest District Council (EFDC) to explain how the 2019 Automatic Number Plate Recognition (ANPR) from the Epping Forest Special Area of Conservation (EFSAC), and Defra's Emission Factors Toolkit (EFT) have been used to inform the projection of the vehicle fleet to future years.

1.2 A separate Technical Note, 'Comparing 2017 and 2019 ANPR Vehicle Composition with EFT National Default Fleets', has been issued, presenting an analysis of the variability between the 2017 and 2019 ANPR datasets and between the EFT versions (version 8.0.1 and version 9.0), together with the implications that these may have on the resultant emissions calculations. The latest version of the EFT (v9.0) will be used for all further work.

1.3 The basic fleet split derived from the ANPR data showed a lower percentage of heavy-duty vehicles (HDV) in the local fleet than would be anticipated using the EFT default fleet split for rural roads. The HDV proportions from the ANPR survey data were between 2% and 2.5% whereas the 2019 HRA used 6-9% depending on the road link. Using the locally-derived vehicle fleet split therefore results in lower total NO_x emissions than was modelled in the 2019 HRA.

1.4 Analysis of the ANPR data revealed that the local vehicle fleet in EFSAC is generally older than the national default assumptions inherent within the EFT for rural/urban roads across all vehicle categories.

1.5 The EFSAC local vehicle fleet, as informed by the 2019 ANPR data, was also compared with the EFT's outer London fleet due to the proximity of the EFSAC to outer London. The 2019 local light duty vehicle (LDV) fleet was found to be newer than the EFT's outer London LDV fleet. In terms of the basic fleet split, the local vehicle fleet was found to be most like that defined in the EFT for outer London.

1.6 It was concluded that the ANPR data showed the local vehicle fleet operating in the EFSAC to be different from those defined in the EFT in terms of both basic fleet split and Euro class split. Therefore, it was recommended that the 2017 ANPR data be used to derive the vehicle fleet for the updated 2017 baseline air quality modelling scenario, and that 2019 ANPR data be used to inform the future local vehicle fleet in EFSAC.

1.7 For air quality modelling for future years, the EFT v9.0 provides the ability to project the Euro class distribution for future years, however it does not project the proportion of vehicles in terms of the basic fleet split. It was therefore recommended that the EFT outer London fleet be used to inform the projection of the fleet that will be expected to use the roads in EFSAC in future years, and in turn, inform any appropriate mitigation measures.

1.8 This Technical Note outlines the rationale and the methodology used to project the vehicle fleet that, based on current expectations, is likely to operate on the roads within Epping Forest SAC in future years.

2. Background and Overview

Emission Factor Toolkit (EFT)

2.1 EFT Version 9.0 was released in May 2019, refining and updating the basic fleet assumptions with the latest DfT data. Version 9.0 was also released with the inclusion of a new Advanced Fleet Option 'Fleet Projection Tool' that allows users to project their user defined Euro fleet information from a Base Year (e.g. a local Euro fleet derived from ANPR surveys) to a future Projection Year.

2.2 The vehicle fleet applied in the 2017 baseline model for the 2019 HRA modelling was previously taken from the EFT v8.0.1 for 'Rural' roads, due to the rural nature of the area. One of the limitations of this approach is that both versions of the EFT assume that there are no electric cars or LGVs using rural roads, which effectively increases the emissions rates applied.

ANPR Surveys

2.3 An ANPR survey was conducted on 23 February 2017, a neutral day and at a time where there were no school holidays, in line with best practice, to capture the local fleet composition of traffic travelling within the EFSAC. The dataset contains approximately 39,000 unique vehicles and a total of 259,000 observations / movements. This data represents a single day of trips observed.

2.4 A further ANPR survey was undertaken for three days (15 to 17 October 2019) at eight different locations within the Epping Forest SAC in order to capture the majority of vehicles passing through the SAC. The survey dates were considered to be neutral days and at a time where there were no school holidays, in line with best practice. The 2019 dataset contains approximately 55,000 unique vehicles and a total of 160,000 observations / movements.

2.5 Of the two ANPR surveys, the percentage of successful DVLA matches was higher for 2019 (97.5% of 56,681 registration plates) than for 2017 (81.8% of 47,998 registration plates).

Data Analysis

2.6 The ANPR survey data were analysed to extract the equivalent Basic Fleet Split and Euro emissions standards information for comparison with the EFT versions. The DVLA match data was processed to assign each matched vehicle to the equivalent EFT vehicle category. This was done based on type approval category[1], fuel type and gross vehicle weight. Where insufficient information was provided in the DVLA data to assign vehicles to an appropriate EFT category, other data fields were used to try to infill the gaps (e.g. vehicle wheel plan, number of axles, vehicle body shape). Euro emissions standards were also extracted from the DVLA data. Where Euro standard information was missing, infilling was carried out using vehicle registration date and vehicle type to assign an appropriate Euro standard.

2.7 An anonymised vehicle identifier was used to cross-reference the DVLA match data against the ANPR observation data so that the number of observations of each individual vehicle could be quantified. The use of total vehicle observations as opposed to individual vehicle counts is considered to better represent vehicle-kilometres travelled and also gives more weight to those vehicles that travel more frequently and / or greater distance. All subsequent analyses concerning the ANPR data has therefore been carried out on total vehicle observations rather than unique vehicles.

2.8 Similar local vehicle fleets were identified for both 2017 and 2019 ANPR data, as shown in Table 1. This provides confidence in the data collection methodology and validity of the data as representative of the fleet using the roads through EFSAC. An evolution of the vehicle fleet from diesel cars to petrol, hybrid and electric cars can be observed.

[1] https://www.vehicle-certification-agency.gov.uk/vehicletype/definition-of-vehicle-categories.asp

Table 1. Basic Vehicle Split Comparisons Between 2017and 2019 ANPR fleets

	Proportion of Vehicle Fleet		
Vehicle Type	**Local 2017 ANPR Data***	**Local 2019 ANPR Data***	**% Change in vehicle fleet from 2017 to 2019**
Petrol Car	40.1%	43.8%	+3.7%
Diesel Car	36.0%	31.5%	-4.5%
Taxi (black cab)	0.7%	0.5%	-0.2%
Petrol LGV	0.1%	0.2%	+0.1%
Diesel LGV	18.2%	18.0%	-0.2%
Rigid HGV	2.0%	1.6%	-0.4%
Articulated HGV	0.3%	0.2%	-0.1%
Bus and coach	0.2%	0.2%	<0.1%
Motorcycle	0.1%	<0.1%	-0.1%
Hybrid Car (Petrol)	1.4%	2.4%	1.0%
Plug-In Hybrid Car (Petrol)	0.7%	1.2%	0.5%
Hybrid Car (Diesel)	0.1%	0.1%	<0.1%
Electric Car	0.1%	0.3%	0.2%
Electric LGV	<0.1%	<0.1%	<0.1%

* Percentages may not add up to exactly 100% due to rounding.

2.9 The analysis of the 2019 ANPR data and the EFT's Basic Fleet Split for rural, urban and outer London roads indicated that the vehicle fleet using the roads through the EFSAC is most similar to the outer London fleet, as defined in EFT v9.0 for 2019. Taking into account the greater prevalence of diesel LGVs in the 2019 ANPR data, as shown in Table 2, the outer London EFT fleet shows a similar split between petrol and diesel LDVs. The rural EFT fleet, however, does not allow for any electric vehicles, and has the greatest difference in petrol/diesel split for cars when compared to the 2019 ANPR data.

2.10 In terms of Euro Class split, the 2019 ANPR data shows that the car and LGV EFSAC fleet is for the main part newer than that in the EFT outer London fleet, but older than the EFT UK average outside of London. The hybrid vehicles, taxis, rigid HGV and bus and coach fleets using the EFSAC roads are in general older than both of the EFT fleets considered. The articulated HGVs using the EFSAC roads are newer than those in the EFT outer London fleet, but overall very similar in terms of Euro Class split to the EFT national fleet.

2.11 For air quality modelling for future years, the EFT v9.0 provides the ability to project the Euro class distribution for future years, however it does not project the proportion of vehicles in terms of the basic fleet split. This report outlines how the EFT is used to inform the projection of the fleet that is expected to use the roads in EFSAC in future years, and in turn, will inform any appropriate mitigation measures.

Table 2. Basic Vehicle Split Comparisons Between EFT 9.0 Outer London Fleet and 2019 ANPR

	Proportion of Vehicle Fleet in 2019*		
Vehicle Type	EFT v9.0 (Outer London)	Local 2019 ANPR Data*	Difference of ANPR 2019 from EFT v9.0 Outer London fleet
Petrol Car	43.3%	43.8%	+0.5%
Diesel Car	36.3%	31.5%	-4.8%
Taxi (black cab)	2.1%	0.5%	-1.6%
Petrol LGV	0.2%	0.2%	<0.1%
Diesel LGV	11.1%	18.0%	+6.9%
Rigid HGV	1.6%	1.6%	<0.1%
Articulated HGV	0.2%	0.2%	<0.1%
Bus and coach	0.2%	0.2%	<0.1%
Motorcycle	1.5%	<0.1%	-1.5%
Hybrid Car (Petrol)	2.0%	2.4%	+0.4%
Plug-In Hybrid Car (Petrol)	0.3%	1.2%	+0.9%
Hybrid Car (Diesel)	0.6%	0.1%	-0.5%
Electric Car	0.4%	0.3%	<0.1%
Electric LGV	0.2%	<0.1%	-0.2%

Note: Percentages may not add up to exactly 100% due to rounding.

3. Methodology

Euro standards

3.1 The 2019 ANPR data have formed the basis upon which the future EFSAC vehicle fleet will be developed. The EFT v9.0 includes a 'Fleet Projection Tool'. There are two options when using this tool[2]:

***Option 1** assumes that the local fleet will follow the same profile as the national fleet, and that the difference between the two fleets is due to the local fleet being either "ahead" or "behind" the national fleet in terms of Euro class uptake. Therefore, the assumption is that the "gap" observed (in terms of number of years ahead or behind) between local and national fleets in the baseline year will remain the same in the Projection Year – i.e. if ANPR data show that the local fleet composition is currently cleaner than the national fleet composition (i.e. a higher proportion of newer Euro class vehicles in the fleet), the EFT will assume that this will remain the case in the Projection Year; and that the local fleet will remain "ahead" of the national fleet.*

***Option 2** assumes that the local fleet composition will gradually shift and converge towards the national fleet composition and mirror it at a specific point in time (referred to as the "Convergence Year" hereafter) – assuming the convergence will occur a number of years after the Projection Year, and no later than 2030 (the latest year of assessment currently available in the EFT). Whilst similar to Option 1 in terms of first determining the gap between local and national fleets, the EFT then considers that this gap will eventually close towards the Convergence Year.*

3.2 Option 1 has been selected for the projection of the EFSAC vehicle fleet so as to allow the vehicle fleet to evolve in future years, in line with national estimates, but recognising that the local vehicle fleet was overall 'older' than the national fleet in both 2017 and 2019.

Basic Fleet Split

3.3 EFT v9.0 does not provide a means of projecting the Basic Fleet Split to future years. Therefore the proportion of the EFSAC fleet derived from the 2019 ANPR data will be maintained for all HDV, LGV and motorcycles for all future scenarios.

3.4 However, the composition of the car fleet (petrol-diesel split, alternative technologies) is projected to change for future emissions scenarios. This is undertaken by following the change in car fleet relative to the outer London vehicle fleet. Outer London was selected based on the proximity of EFSAC to London, and the previous comparisons of the ANPR data identified similarities between the EFSAC ANPR data and the EFT 9.0 default outer London fleet. The EFT utilises bespoke vehicle fleet information and projections for London provided by Transport for London (TfL) in early 2018, taking account of the Mayor's announcement to bring the Ultra-Low Emission Zone (ULEZ) forward to 2019[2].

[2] Defra 'Emissions Factors Toolkit v9 User Guide', May 2019. Available at: https://laqm.defra.gov.uk/documents/EFTv9-user-guide-v1.0.pdf

4. Future EFSAC Vehicle Fleet

'End of Plan' vehicle fleet

4.1 Scenarios 3- 5 are to be modelled for the end of the Local Plan, 2033. Defra's EFT provides information up to and including 2030, therefore the 'end of plan' vehicle fleets and emission factors are based upon 2030 information, with no change in vehicle fleet projected from 2030 to 2033.

4.2 Table 3 shows the EFT v9.0 basic fleet split for outer London compared to the projected end of plan fleet within the EFSAC. In line with the methodology described above, the proportion of the fleet present as LGV, HDV (rigid, artic, buses/coaches), and motorcycles remains unchanged from the 2019 ANPR fleet (Table 2). An increase in the proportion of hybrid and electric cars is predicted, relative to conventional petrol and diesel cars. The uptake in these alternative fuelled cars has been projected at the same rate as that predicted in outer London in the EFT v9.0. Based upon the previous analysis of the ANPR and EFT vehicle fleets, this is considered to be the most realistic approach. Furthermore, the approach used to project the vehicle fleet to future years is consistent with Joint Air Quality Unit (JAQU) guidance for assessing the efficacy of Clean Air Zones (CAZ).

4.3 Option 1 of the Fleet Projection Tool in EFT v9.0 is used to project the euro standard distribution of vehicles to future years from the 2019 ANPR data. As such, the EFSAC fleet remains 'older', and therefore more polluting, than the EFT default vehicle fleets in the same year.

4.4 Table 4 to Table 9 show the EFT v9.0 Euro class split for outer London compared to the projected end of plan fleet within the EFSAC. Overall, there is a greater proportion of the fleet present at lower Euro standards for conventional and hybrid petrol cars, diesel LGV, taxis, buses and coaches within the EFSAC fleet than the outer London fleet. Conversely, there is a greater proportion of the fleet present at higher Euro standards for conventional and hybrid diesel cars, petrol LGVs and artic HGVs.

Table 3. Basic Vehicle Split Comparisons Between EFT 9.0 Outer London 2030 Fleet and Projected 'End of Plan' Fleet

	Proportion of Vehicle Fleet *		
Vehicle Type	**EFT v9.0 2030 (Outer London)**	**Projected 'End of Plan' Fleet**	**Difference of Projected Fleet from EFT v9.0 2030 (Outer London)**
Petrol Car	36.7%	39.5%	+2.8%
Diesel Car	28.9%	26.0%	-2.9%
Taxi (black cab)	2.0%	0.5%	-1.5%
Petrol LGV	0.2%	0.2%	<0.1%
Diesel LGV	11.1%	18.0%	+6.9%
Rigid HGV	2.8%	1.6%	-1.2%
Articulated HGV	1.1%	0.2%	-0.9%
Bus and coach	1.9%	0.2%	-1.7%
Motorcycle	1.4%	<0.1%	-1.4%
Hybrid Car (Petrol)	4.0%	5.4%	+1.4%
Plug-In Hybrid Car (Petrol)	4.2%	4.2%	<0.1%
Hybrid Car (Diesel)	2.6%	2.2%	-0.4%
Electric Car	1.9%	1.9%	<0.1%
Electric LGV	1.2%	<0.1%	-1.2%

Note: Percentages may not add up to exactly 100% due to rounding.

Table 4. Euro Class Split Comparisons Between EFT v9.0 Outer London 2030 and EFSAC 'End of Plan': Petrol and Diesel Cars

Euro Standard	Petrol cars			Diesel cars		
	2030 EFT v9.0	EFSAC 'End of Plan'	Difference of EFSAC 'End of Plan' from EFT v9.0	2030 EFT v9.0	EFSAC 'End of Plan'	Difference of EFSAC 'End of Plan' from EFT v9.0
Pre-Euro 1	-		-	-	-	-
Euro 1	-	-	-	-	-	-
Euro 2	-	-	-	-	-	-
Euro 3	-	-	-	-	-	-
Euro 4	0.6%	0.3%	-0.3%	0.4%	0.1%	-0.3%
Euro 5	1.4%	2.2%	+0.8%	3.6%	1.9%	-1.6%
Euro 6	2.2%	3.3%	+1.1%	3.3%	3.0%	-0.3%
Euro 6c	95.8%	94.2%	-1.6%	12.0%	11.0%	-1.0%
Euro 6d	-	-	-	80.8%	84.0%	+3.2%

Note: Percentages may not add up to exactly 100% due to rounding.

Table 5. Euro Class Split Comparisons Between EFT v9.0 Outer London 2030 and EFSAC 'End of Plan': Petrol and Diesel LGVs

Euro Standard	Petrol LGVs			Diesel LGVs		
	2030 EFT v9.0	EFSAC 'End of Plan'	Difference of EFSAC 'End of Plan' from EFT v9.0	2030 EFT v9.0	EFSAC 'End of Plan'	Difference of EFSAC 'End of Plan' from EFT v9.0
Pre-Euro 1	-	-	-	-	-	-
Euro 1	-	-	-	-	-	-
Euro 2	-	-	-	-	-	-
Euro 3	-	-	-	-	-	-
Euro 4	0.3%	-	-0.3%	-	0.3%	+0.3%
Euro 5	2.7%	1.1%	-1.6%	0.9%	5.9%	+4.9%
Euro 6	0.5%	0.9%	+0.4%	2.2%	3.4%	+1.3%
Euro 6c	96.5%	98.0%	+1.6%	8.3%	10.4%	+2.1%
Euro 6d	-	-	-	88.6%	80.0%	-8.6%

Note: Percentages may not add up to exactly 100% due to rounding.

Table 6. Euro Class Split Comparisons Between EFT v9.0 Outer London 2030 and EFSAC 'End of Plan': Petrol Hybrid Cars

Euro Standard	Full Hybrid Petrol Cars			Plug-In Hybrid Cars		
	2030 EFT v9.0	EFSAC 'End of Plan'	Difference of EFSAC 'End of Plan' from EFT v9.0	2030 EFT v9.0	EFSAC 'End of Plan'	Difference of EFSAC 'End of Plan' from EFT v9.0
Pre-Euro 1	-	-	-	-	-	-
Euro 1	-	-	-	-	-	-
Euro 2	-	-	-	-	-	-
Euro 3	-	-	-	-	-	-
Euro 4	-	-	-	-	-	-
Euro 5	0.5%	0.6%	<0.1%	0.0%	0.1%	+0.1%
Euro 6	1.1%	2.4%	+1.3%	0.3%	0.9%	+0.6%
Euro 6c	98.3%	97.0%	-1.3%	99.6%	98.9%	-0.7%

Note: Percentages may not add up to exactly 100% due to rounding.

Table 7. Euro Class Split Comparisons Between EFT v9.0 Outer London 2030 and EFSAC 'End of Plan': Diesel Hybrid Cars and Taxis

Euro Standard	Diesel Hybrid Cars			Taxis		
	2030 EFT v9.0	EFSAC 'End of Plan'	Difference of EFSAC 'End of Plan' from EFT v9.0	2030 EFT v9.0	EFSAC 'End of Plan'	Difference of EFSAC 'End of Plan' from EFT v9.0
Pre-Euro 1	-	-	-	-	-	-
Euro 1	-	-	-	-	-	-
Euro 2	-	-	-	-	-	-
Euro 3	-	-	-	-	-	-
Euro 4	-	-	-	-	-	-
Euro 5	0.1%	0.3%	+0.3%	1.1%	4.1%	+2.9%
Euro 6	3.4%	1.4%	-2.0%	11.4%	7.2%	-4.3%
Euro 6c	12.5%	12.0%	-0.5%	-	17.2%	+17.2%
Euro 6d	84.1%	86.3%	+2.2%	-	69.5%	+69.5%
Zero Emission Capable				87.4%	-	-87.4%

Note: Percentages may not add up to exactly 100% due to rounding.

Table 8. Euro Class Split Comparisons Between EFT v9.0 Outer London 2030 and EFSAC 'End of Plan': Rigid and Artic HGVs

Euro Standard	Rigid HGVs			Artic HGVs		
	2030 EFT v9.0	EFSAC 'End of Plan'	Difference of EFSAC 'End of Plan' from EFT v9.0	2030 EFT v9.0	EFSAC 'End of Plan'	Difference of EFSAC 'End of Plan' from EFT v9.0
Pre-Euro I	-	-	-	-	-	-
Euro I	-	-	-	-	-	-
Euro II	-	-	-	-	-	-
Euro III	-	-	-	-	-	-
Euro IV	-	0.2%	+0.2%	-	-	-
Euro V EGR	0.3%	0.3%	<0.1%	0.4%	-	-0.4%
Euro V SCR	1.0%	0.9%	-0.1%	1.3%	-	-1.3%
Euro VI	98.7%	98.6%	-0.1%	98.2%	99.9%	+1.7%

Note: Percentages may not add up to exactly 100% due to rounding.

Table 9. Euro Class Split Comparisons Between EFT v9.0 Outer London 2030 and EFSAC 'End of Plan': Buses and Coaches

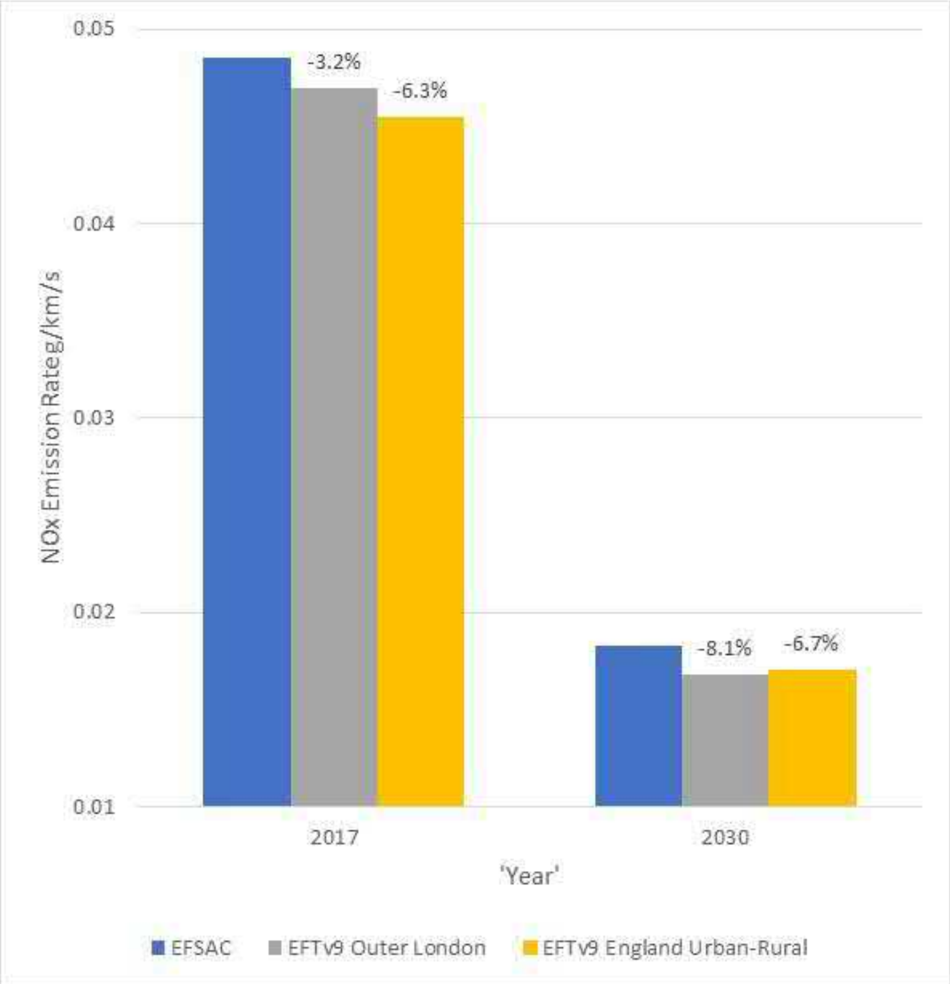
Euro Standard	Buses and Coaches		
	2030 EFT v9.0	EFSAC 'End of Plan'	Difference of EFSAC 'End of Plan' from EFT v9.0
Pre-Euro I	-	-	-
Euro I	-	-	-
Euro II	-	-	-
Euro III	-	-	-
Euro IV	-	1.8%	+1.8%
Euro V EGR	0.2%	1.9%	+1.7%
Euro V SCR	0.7%	5.8%	+5.1%
Euro VI	99.1%	90.4%	-8.6%

Note: Percentages may not add up to exactly 100% due to rounding.

4.5 Figure 1 shows the emission rates for a road within the EFSAC, applying the EFSAC-specific Euro standard split, and the EFT's default outer London and urban/rural Euro standard splits. Higher emission rates can be seen for the EFSAC compared to the EFT.

4.6 For 2017, the outer London, Urban / Rural fleet emission rates are 3.2% and 6.3% lower than the 2017 EFSAC emission rate, respectively. For the 'end of plan' year (2030), the outer London, Urban / Rural fleet emission rates are 8.1% and 6.7% lower than the EFSAC 'end of plan' emission rate, respectively.

Figure 1. Comparison of emission rates for a road within EFSAC for different road types



Note: Percentage changes are shown relative to the EFSAC fleet for the same 'year'

'Interim Year' vehicle fleet

4.7 Scenario 6 is to be modelled for an interim year between the adoption and end of the Local Plan. Following the review of temporal scales, the year of assessment has been revised to 2024. Therefore the 'interim year' vehicle fleet and emission factors are based upon 2024 information.

4.8 Table 10 shows the EFT v9.0 basic fleet split for outer London in 2024 compared to the projected 'interim year' fleet within the EFSAC. As for the end of year fleet, and in line with the methodology described above, the proportion of the fleet present as LGV, HDV (rigid, artic, buses/coaches), and motorcycles remains unchanged from the 2019 ANPR fleet (Table 2). An increase in the proportion of hybrid and electric cars is predicted, relative to conventional petrol and diesel cars. The uptake in these alternative fuelled cars has been projected at the same rate as that predicted in outer London in the EFT v9.0.

Table 10. Basic Vehicle Split Comparisons Between EFT 9.0 Outer London 2024 Fleet and Projected 'End of Plan' Fleet

Vehicle Type	Proportion of Vehicle Fleet *		
	EFT v9.0 2024 (Outer London)	Projected 'Interim Year' Fleet	Difference of Projected Fleet from EFT v9.0 2024 (Outer London)
Petrol Car	38.5%	41.0%	+2.5%
Diesel Car	33.3%	30.2%	-3.1%
Taxi (black cab)	2.0%	0.5%	-1.5%
Petrol LGV	0.2%	0.2%	<0.1%
Diesel LGV	11.0%	18.0%	+7.0%
Rigid HGV	2.9%	1.6%	-1.3%
Articulated HGV	1.1%	0.2%	-0.9%
Bus and coach	1.9%	0.2%	-1.7%
Motorcycle	1.4%	<0.1%	-1.4%
Hybrid Car (Petrol)	3.1%	4.5%	+1.4%
Plug-In Hybrid Car (Petrol)	1.4%	1.4%	<0.1%
Hybrid Car (Diesel)	1.7%	1.2%	-0.5%
Electric Car	1.0%	1.2%	+0.2%
Electric LGV	0.5%	<0.1%	-0.5%

Note: Percentages may not add up to exactly 100% due to rounding.

4.9 Again, Option 1 of the Fleet Projection Tool in EFT v9.0 is used to project the euro standard distribution of vehicles to future years from the 2019 ANPR data. As such, the EFSAC fleet remains 'older', and therefore more polluting, than the EFT default vehicle fleets in the same year.

4.10 Table 11 to Table 16 show the EFT v9.0 Euro class split for outer London in 2024 compared to the projected 'interim year' fleet within the EFSAC. Overall, there is a greater proportion of the fleet present at higher Euro standards for conventional diesel cars and artic HGVs only.

Table 11. Euro Class Split Comparisons Between EFT v9.0 Outer London 2024 and EFSAC 'Interim Year': Petrol and Diesel Cars

Euro Standard	Petrol cars			Diesel cars		
	2024 EFT v9.0	EFSAC 'Interim Year'	Difference of EFSAC 'Interim Year' from EFT v9.0	2024 EFT v9.0	EFSAC 'Interim Year'	Difference of EFSAC 'Interim Year' from EFT v9.0
Pre-Euro 1	-		-	-	-	-
Euro 1	-	-	-	-	-	-
Euro 2	-	-	-	0.4%	-	-0.4%
Euro 3	1.8%	0.9%	-0.9%	0.9%	0.3%	-0.6%
Euro 4	5.4%	5.7%	+0.3%	11.0%	2.9%	-8.1%
Euro 5	15.9%	16.3%	+0.4%	20.9%	17.5%	-3.4%
Euro 6	9.9%	12.0%	+2.1%	6.4%	13.3%	+6.8%
Euro 6c	67.1%	65.1%	-2.0%	19.4%	25.5%	+6.1%
Euro 6d	-	-	-	41.0%	39.9%	-1.1%

Note: Percentages may not add up to exactly 100% due to rounding.

Table 12. Euro Class Split Comparisons Between EFT v9.0 Outer London 2024 and EFSAC 'Interim Year': Petrol and Diesel LGVs

Euro Standard	Petrol LGVs			Diesel LGVs		
	2024 EFT v9.0	EFSAC 'Interim Year'	Difference of EFSAC 'Interim Year' from EFT v9.0	2024 EFT v9.0	EFSAC 'Interim Year'	Difference of EFSAC 'Interim Year' from EFT v9.0
Pre-Euro 1	-	-	-	-	-	-
Euro 1	-	-	-	-	-	-
Euro 2	-	-	-	-	-	-
Euro 3	1.4%	5.3%	+3.9%	1.0%	0.8%	-0.2%
Euro 4	7.1%	2.3%	-4.8%	2.3%	3.8%	+1.5%
Euro 5	17.1%	21.8%	+4.7%	17.2%	23.2%	+5.9%
Euro 6	6.1%	12.7%	+6.6%	8.2%	11.5%	+3.3%
Euro 6c	68.4%	58.0%	-10.4%	20.6%	25.8%	+5.2%
Euro 6d	-	-	-	50.7%	35.0%	-15.8%

Note: Percentages may not add up to exactly 100% due to rounding.

Table 13. Euro Class Split Comparisons Between EFT v9.0 Outer London 2024 and EFSAC 'Interim Year': Petrol Hybrid Cars

Euro Standard	Full Hybrid Petrol Cars			Plug-In Hybrid Cars		
	2024 EFT v9.0	EFSAC 'Interim Year'	Difference of EFSAC 'Interim Year' from EFT v9.0	2024 EFT v9.0	EFSAC 'Interim Year'	Difference of EFSAC 'Interim Year' from EFT v9.0
Pre-Euro 1	-	-	-	-	-	-
Euro 1	-	-	-	-	-	-
Euro 2	-	-	-	-	-	-
Euro 3	-	0.2%	+0.2%	-	-	-
Euro 4	0.8%	0.7%	-0.1%	-	-	-
Euro 5	6.0%	5.5%	-0.5%	0.9%	2.3%	+1.4%
Euro 6	6.2%	8.7%	+2.4%	5.3%	10.1%	+4.9%
Euro 6c	87.0%	85.0%	-2.0%	93.8%	87.6%	-6.2%

Note: Percentages may not add up to exactly 100% due to rounding.

Table 14. Euro Class Split Comparisons Between EFT v9.0 Outer London 2024 and EFSAC 'Interim Year': Diesel Hybrid Cars and Taxis

Euro Standard	Diesel Hybrid Cars			Taxis		
	2024 EFT v9.0	EFSAC 'Interim Year'	Difference of EFSAC 'Interim Year' from EFT v9.0	2024 EFT v9.0	EFSAC 'Interim Year'	Difference of EFSAC 'Interim Year' from EFT v9.0
Pre-Euro 1	-	-	-	-	-	-
Euro 1	-	-	-	-	-	-
Euro 2	-	-	-	-	-	-
Euro 3	-	-	-	-	3.8%	+3.8%
Euro 4	-	-	-	6.2%	13.5%	+7.3%
Euro 5	0.9%	2.3%	+1.4%	10.8%	17.7%	+6.8%
Euro 6	9.5%	6.5%	-3.0%	14.9%	17.8%	+2.9%
Euro 6c	28.8%	50.2%	+21.4%	-	47.2%	+47.2%
Euro 6d	60.8%	41.0%	-19.7%	-	-	-
Zero Emission Capable				68.1%	-	-68.1%

Note: Percentages may not add up to exactly 100% due to rounding.

Table 15. Euro Class Split Comparisons Between EFT v9.0 Outer London 2024 and EFSAC 'Interim Year': Rigid and Artic HGVs

Euro Standard	Rigid HGVs			Artic HGVs		
	2024 EFT v9.0	EFSAC 'Interim Year'	Difference of EFSAC 'Interim Year' from EFT v9.0	2024 EFT v9.0	EFSAC 'Interim Year'	Difference of EFSAC 'Interim Year' from EFT v9.0
Pre-Euro I	-	-	-	-	-	-
Euro I	-	-	-	-	-	-
Euro II	0.1%	-	-0.1%	-	-	-
Euro III	0.6%	0.5%	-0.1%	0.5%	0.1%	-0.4%
Euro IV	2.1%	2.2%	<0.1%	1.8%	0.1%	-1.7%
Euro V EGR	0.9%	2.2%	+1.3%	1.9%	0.4%	-1.5%
Euro V SCR	2.7%	6.6%	+3.9%	5.6%	1.1%	-4.6%
Euro VI	93.5%	88.6%	-5.0%	90.2%	98.4%	+8.2%

Note: Percentages may not add up to exactly 100% due to rounding.

Table 16. Euro Class Split Comparisons Between EFT v9.0 Outer London 2024 and EFSAC 'Interim Year': Buses and Coaches

Euro Standard	Buses and Coaches		
	2024 EFT v9.0	EFSAC 'Interim Year'	Difference of EFSAC 'Interim Year' from EFT v9.0
Pre-Euro I	-	-	-
Euro I	-	-	-
Euro II	-	-	-
Euro III	0.5%	-	-0.5%
Euro IV	0.6%	7.9%	+7.3%
Euro V EGR	1.7%	6.6%	+4.8%
Euro V SCR	5.2%	19.7%	+14.5%
Euro VI	92.0%	65.9%	-26.2%

Note: Percentages may not add up to exactly 100% due to rounding.

Sensitivity Tests

4.11 As presented above, and in the ANPR Technical Note ('Comparing 2017 and 2019 ANPR Vehicle Composition with EFT National Default Fleets', February 2020), the use of the EFSAC ANPR vehicle fleet is shown to estimate increased emissions when compared against the EFT v9.0 average rural, urban and outer London average fleets.

4.12 There has previously been reason to consider the EFT future emission predictions with caution, for example with regard to Euro 6 vehicles not performing as expected[3]. Since then, various changes have been made to improve the EFT, including the use of the COPERT emission factors[4], and more recently the update to version 9.0 of the tool[5].

4.13 Recent research has been undertaken which shows that EFT v9.0 is now corresponding with decreasing measured concentrations of NOx and NO_2 in the UK[6]. Moreover, the research suggests that EFT v9.0 future fleet predictions may overestimate future emissions of NOx from road traffic:

[3] Carslaw et al., 'Trends in NOx and NO_2 emissions and ambient measurements in the UK.' Prepared for Defra (version 3rd March 2011, available at: https://uk-air.defra.gov.uk/assets/documents/reports/cat05/1103041401_110303_Draft_NOx_NO2_trends_report.pdf
[4] https://copert.emisia.com/
[5] https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html
[6] 'Performance of Defra's Emission Factor Toolkit 2013 - 2019', Air Quality Consultants, February 2020. Available at: https://www.aqconsultants.co.uk/CMSPages/GetFile.aspx?guid=7fba769d-f1df-49c4-a2e7-f3dd6f316ec1

'*…on balance, the EFT is unlikely to over-state the rate at which NOx emissions decline in the future at an 'average' site in the UK. In practice, the balance of evidence suggests that NOx concentrations are most likely to decline more quickly in the future, on average, than predicted by the EFT. This does not mean that there will be no locations where the EFT over-states the rate of decline, but the most likely situation at most locations appears to be that the EFT will under-predict the rate at which NOx emissions fall in the near future.*'

4.14 This research suggests that the future EFSAC vehicle fleets presented in this report provide an appropriately conservative fleet composition for use in the EFSAC model studies. As the future fleets are based upon recorded ANPR data and projected using information within the EFT v9.0 for the closest 'year' of assessment, without any reduction in the difference between the local and national fleets, the assumptions are considered to already include a level of caution. Following the recent evidence that suggests that the EFT standard fleets are likely to underpredict improvements in emissions, and the EFSAC projections give rise to higher emissions than the standard EFT fleets, the EFSAC fleet scenarios build in adequate caution whilst also remaining realistic. Therefore, the ANPR projections are considered to be cautious enough to not require an additional sensitivity test.

Appendix F – EFSAC fleet mix by road and year with/without mitigation

2017

Link	% Petrol Car	% Diesel Car	% Taxi (black cab)	% LGV	% Rigid HGV	% Artic HGV	% Bus and Coach	% Motorcycle	% Full Hybrid Petrol Cars	% Plug-In Hybrid Petrol Cars	% Full Hybrid Diesel Cars	% Battery EV Cars	% Battery EV LGV
J01_01	44.8	34.2	0.8	16.2	1.7	0.2	0.2	0.1	1.3	0.5	<0.1	0.1	<0.1
J01_02	38.3	36.2	0.7	21.2	1.3	<0.1	0.2	0.1	1.4	0.5	0.1	0.1	<0.1
J01_03	42.2	36.9	0.3	15.1	2.7	0.4	0.2	0.1	1.5	0.5	0.1	0.1	<0.1
J01_04	42.2	36.6	1.3	15.5	1.3	0.2	0.1	0.1	1.9	0.7	0.1	0.1	<0.1
J01_05	35.1	37.8	0.4	21.0	2.8	0.5	0.2	0.1	1.4	0.5	0.1	0.1	<0.1
J33_01	43.1	31.7	0.5	21.2	1.4	0.1	0.1	<0.1	1.3	0.5	<0.1	0.2	<0.1
J33_02	35.1	37.8	0.4	21.0	2.8	0.5	0.2	0.1	1.4	0.5	0.1	0.1	<0.1
J33_03	36.7	41.7	0.6	17.3	0.5	<0.1	0.1	<0.1	2.1	0.8	0.1	0.1	<0.1
J33_04	35.1	37.8	0.4	21.0	2.8	0.5	0.2	0.1	1.4	0.5	0.1	0.1	<0.1
J35_01	36.5	40.9	0.5	17.7	0.7	<0.1	0.2	0.1	2.3	0.9	0.1	0.1	<0.1
J35_02	44.1	37.8	0.7	14.1	0.7	<0.1	0.2	<0.1	1.7	0.6	<0.1	<0.1	<0.1
J35_03	44.1	37.8	0.7	14.1	0.7	<0.1	0.2	<0.1	1.7	0.6	<0.1	<0.1	<0.1
J36_01	42.2	36.6	1.3	15.5	1.3	0.2	0.1	0.1	1.9	0.7	0.1	0.1	<0.1
J36_02	45.7	39.5	0.3	10.8	0.4	<0.1	0.2	0.4	1.9	0.7	0.1	0.1	<0.1
J36_03	41.2	35.9	1.0	17.5	1.4	0.1	0.2	<0.1	1.8	0.7	0.1	0.1	<0.1
J36_04	44.1	37.8	0.7	14.1	0.7	<0.1	0.2	<0.1	1.7	0.6	<0.1	<0.1	<0.1

2024 without mitigation

Link	% Petrol Car	% Diesel Car	% Taxi (black cab)	% LGV	% Rigid HGV	% Artic HGV	% Bus and Coach	% Motorcycle	% Full Hybrid Petrol Cars	% Plug-In Hybrid Petrol Cars	% Full Hybrid Diesel Cars	% Battery EV Cars	% Battery EV LGV
J01_01	43.8	29.1	0.7	16.5	1.7	0.2	0.1	<0.1	4.3	1.4	1.2	0.9	<0.1
J01_02	36.4	28.9	0.4	24.2	1.9	0.1	0.2	<0.1	4.6	1.4	1.1	0.9	<0.1
J01_03	42.0	31.1	0.3	16.6	1.9	0.4	0.2	<0.1	4.0	1.4	1.2	0.9	<0.1
J01_04	43.4	28.9	0.7	16.8	1.5	0.1	0.1	0.1	4.8	1.5	1.2	1.0	<0.1
J01_05	36.8	31.4	0.3	21.1	2.1	0.5	0.2	0.1	4.2	1.3	1.1	0.9	<0.1
J33_01	36.8	31.4	0.3	21.1	2.1	0.5	0.2	0.1	4.2	1.3	1.1	0.9	<0.1
J33_02	36.8	31.4	0.3	21.1	2.1	0.5	0.2	0.1	4.2	1.3	1.1	0.9	<0.1
J33_03	36.8	31.4	0.3	21.1	2.1	0.5	0.2	0.1	4.2	1.3	1.1	0.9	<0.1
J33_04	36.8	31.4	0.3	21.1	2.1	0.5	0.2	0.1	4.2	1.3	1.1	0.9	<0.1
J35_01	40.2	31.2	0.4	18.8	0.6	<0.1	0.1	<0.1	5.0	1.5	1.2	0.9	<0.1
J35_02	40.2	31.2	0.4	18.8	0.6	<0.1	0.1	<0.1	5.0	1.5	1.2	0.9	<0.1
J35_03	40.2	31.2	0.4	18.8	0.6	<0.1	0.1	<0.1	5.0	1.5	1.2	0.9	<0.1
J36_01	43.4	28.9	0.7	16.8	1.5	0.1	0.1	0.1	4.8	1.5	1.2	1.0	<0.1
J36_02	45.3	31.0	0.2	13.7	0.8	<0.1	0.2	<0.1	5.1	1.5	1.2	1.0	<0.1
J36_03	42.8	29.3	0.7	16.8	1.1	0.1	0.1	<0.1	5.2	1.5	1.2	1.0	<0.1
J36_04	40.2	31.2	0.4	18.8	0.6	<0.1	0.1	<0.1	5.0	1.5	1.2	0.9	<0.1

2024 with 10% shift of petrol cars to electric cars

Link	% Petrol Car	% Diesel Car	% Taxi (black cab)	% LGV	% Rigid HGV	% Artic HGV	% Bus and Coach	% Motorcycle	% Full Hybrid Petrol Cars	% Plug-In Hybrid Petrol Cars	% Full Hybrid Diesel Cars	% Battery EV Cars	% Battery EV LGV
J01_01	39.4	29.1	0.7	16.5	1.7	0.2	0.1	<0.1	4.3	1.4	1.2	5.3	<0.1
J01_02	32.8	28.9	0.4	24.2	1.9	0.1	0.2	<0.1	4.6	1.4	1.1	4.6	<0.1
J01_03	37.8	31.1	0.3	16.6	1.9	0.4	0.2	<0.1	4.0	1.4	1.2	5.1	<0.1
J01_04	39.0	28.9	0.7	16.8	1.5	0.1	0.1	0.1	4.8	1.5	1.2	5.4	<0.1
J01_05	33.1	31.4	0.3	21.1	2.1	0.5	0.2	0.1	4.2	1.3	1.1	4.6	<0.1
J33_01	33.1	31.4	0.3	21.1	2.1	0.5	0.2	0.1	4.2	1.3	1.1	4.6	<0.1
J33_02	33.1	31.4	0.3	21.1	2.1	0.5	0.2	0.1	4.2	1.3	1.1	4.6	<0.1
J33_03	33.1	31.4	0.3	21.1	2.1	0.5	0.2	0.1	4.2	1.3	1.1	4.6	<0.1
J33_04	33.1	31.4	0.3	21.1	2.1	0.5	0.2	0.1	4.2	1.3	1.1	4.6	<0.1
J35_01	36.2	31.2	0.4	18.8	0.6	<0.1	0.1	<0.1	5.0	1.5	1.2	4.9	<0.1
J35_02	36.2	31.2	0.4	18.8	0.6	<0.1	0.1	<0.1	5.0	1.5	1.2	4.9	<0.1
J35_03	36.2	31.2	0.4	18.8	0.6	<0.1	0.1	<0.1	5.0	1.5	1.2	4.9	<0.1
J36_01	39.0	28.9	0.7	16.8	1.5	0.1	0.1	0.1	4.8	1.5	1.2	5.4	<0.1
J36_02	40.8	31.0	0.2	13.7	0.8	<0.1	0.2	<0.1	5.1	1.5	1.2	5.5	<0.1
J36_03	38.5	29.3	0.7	16.8	1.1	0.1	0.1	<0.1	5.2	1.5	1.2	5.3	<0.1
J36_04	36.2	31.2	0.4	18.8	0.6	<0.1	0.1	<0.1	5.0	1.5	1.2	4.9	<0.1

2033 without mitigation

Link	% Petrol Car	% Diesel Car	% Taxi (black cab)	% LGV	% Rigid HGV	% Artic HGV	% Bus and Coach	% Motorcycle	% Full Hybrid Petrol Cars	% Plug-In Hybrid Petrol Cars	% Full Hybrid Diesel Cars	% Battery EV Cars	% Battery EV LGV
J01_01	42.2	24.9	0.7	16.5	1.7	0.2	0.1	<0.1	5.2	4.3	2.2	2.0	<0.1
J01_02	35.0	25.0	0.4	24.2	1.9	0.1	0.2	<0.1	5.4	4.0	2.0	1.8	<0.1
J01_03	40.4	26.9	0.3	16.6	1.9	0.4	0.2	<0.1	5.0	4.2	2.2	1.9	<0.1
J01_04	41.8	24.6	0.7	16.8	1.5	0.1	0.1	0.1	5.7	4.3	2.2	2.0	<0.1
J01_05	35.3	27.4	0.3	21.1	2.1	0.5	0.2	0.1	5.0	4.0	2.1	1.9	<0.1
J33_01	35.3	27.4	0.3	21.1	2.1	0.5	0.2	0.1	5.0	4.0	2.1	1.9	<0.1
J33_02	35.3	27.4	0.3	21.1	2.1	0.5	0.2	0.1	5.0	4.0	2.1	1.9	<0.1
J33_03	35.3	27.4	0.3	21.1	2.1	0.5	0.2	0.1	5.0	4.0	2.1	1.9	<0.1
J33_04	35.3	27.4	0.3	21.1	2.1	0.5	0.2	0.1	5.0	4.0	2.1	1.9	<0.1
J35_01	38.6	27.0	0.4	18.8	0.6	<0.1	0.1	<0.1	6.0	4.3	2.2	1.9	<0.1
J35_02	38.6	27.0	0.4	18.8	0.6	<0.1	0.1	<0.1	6.0	4.3	2.2	1.9	<0.1
J35_03	38.6	27.0	0.4	18.8	0.6	<0.1	0.1	<0.1	6.0	4.3	2.2	1.9	<0.1
J36_01	41.8	24.6	0.7	16.8	1.5	0.1	0.1	0.1	5.7	4.3	2.2	2.0	<0.1
J36_02	43.6	26.5	0.2	13.7	0.8	<0.1	0.2	<0.1	6.1	4.6	2.3	2.0	<0.1
J36_03	41.2	25.1	0.7	16.8	1.1	0.1	0.1	<0.1	6.1	4.4	2.2	2.1	<0.1
J36_04	38.6	27.0	0.4	18.8	0.6	<0.1	0.1	<0.1	6.0	4.3	2.2	1.9	<0.1

2033 with 30% shift of petrol cars to electric cars

Link	% Petrol Car	% Diesel Car	% Taxi (black cab)	% LGV	% Rigid HGV	% Artic HGV	% Bus and Coach	% Motorcycle	% Full Hybrid Petrol Cars	% Plug-In Hybrid Petrol Cars	% Full Hybrid Diesel Cars	% Battery EV Cars	% Battery EV LGV
J01_01	29.5	24.9	0.7	16.5	1.7	0.2	0.1	<0.1	5.2	4.3	2.2	14.6	<0.1
J01_02	24.5	25.0	0.4	24.2	1.9	0.1	0.2	<0.1	5.4	4.0	2.0	12.3	<0.1
J01_03	28.3	26.9	0.3	16.6	1.9	0.4	0.2	<0.1	5.0	4.2	2.2	14.0	<0.1
J01_04	29.3	24.6	0.7	16.8	1.5	0.1	0.1	0.1	5.7	4.3	2.2	14.6	<0.1
J01_05	24.7	27.4	0.3	21.1	2.1	0.5	0.2	0.1	5.0	4.0	2.1	12.5	<0.1
J33_01	24.7	27.4	0.3	21.1	2.1	0.5	0.2	0.1	5.0	4.0	2.1	12.5	<0.1
J33_02	24.7	27.4	0.3	21.1	2.1	0.5	0.2	0.1	5.0	4.0	2.1	12.5	<0.1
J33_03	24.7	27.4	0.3	21.1	2.1	0.5	0.2	0.1	5.0	4.0	2.1	12.5	<0.1
J33_04	24.7	27.4	0.3	21.1	2.1	0.5	0.2	0.1	5.0	4.0	2.1	12.5	<0.1
J35_01	27.0	27.0	0.4	18.8	0.6	<0.1	0.1	<0.1	6.0	4.3	2.2	13.5	<0.1
J35_02	27.0	27.0	0.4	18.8	0.6	<0.1	0.1	<0.1	6.0	4.3	2.2	13.5	<0.1
J35_03	27.0	27.0	0.4	18.8	0.6	<0.1	0.1	<0.1	6.0	4.3	2.2	13.5	<0.1
J36_01	29.3	24.6	0.7	16.8	1.5	0.1	0.1	0.1	5.7	4.3	2.2	14.6	<0.1
J36_02	30.6	26.5	0.2	13.7	0.8	<0.1	0.2	<0.1	6.1	4.6	2.3	15.1	<0.1
J36_03	28.9	25.1	0.7	16.8	1.1	0.1	0.1	<0.1	6.1	4.4	2.2	14.4	<0.1
J36_04	27.0	27.0	0.4	18.8	0.6	<0.1	0.1	<0.1	6.0	4.3	2.2	13.5	<0.1

Appendix G – EFSAC Euro Class Split used in EFSAC air quality modelling

Petrol and Diesel Cars

Euro Standard	Petrol cars					Diesel cars				
	2017 ANPR Data*	EFSAC 'Interim Year'	EFSAC 'End of Plan'	EFSAC CAZ 'Interim Year'	EFSAC CAZ 'End of Plan'	2017 ANPR Data*	EFSAC 'Interim Year'	EFSAC 'End of Plan'	EFSAC CAZ 'Interim Year'	EFSAC CAZ 'End of Plan'
Pre-Euro 1	1.3%	-	-	-	-	-	-	-	-	-
Euro 1	-	-	-	-	-	-	-	-	-	-
Euro 2	0.1%	-	-	<0.1%	-	-	-	-	<0.1%	-
Euro 3	18.1%	0.9%	-	0.2%	-	8.5%	0.3%	-	0.1%	-
Euro 4	30.4%	5.7%	0.3%	6.7%	0.6%	21.9%	2.9%	0.1%	2.0%	-
Euro 5	31.0%	16.3%	2.2%	13.7%	1.4%	42.4%	17.5%	1.9%	3.2%	1.0%
Euro 6	11.9%	12.0%	3.3%	10.2%	2.2%	17.1%	13.3%	3.0%	11.8%	1.1%
Euro 6c	7.2%	65.1%	94.2%	69.2%	95.8%	10.1%	25.5%	11.0%	36.8%	6.5%
Euro 6d	-	-	-	-	-	-	39.9%	84.0%	46.1%	91.4%

Note: Percentages may not add up to exactly 100% due to rounding.

Petrol and Diesel LGVs

Euro Standard	Petrol LGVs					Diesel LGVs				
	2017 ANPR Data*	EFSAC 'Interim Year'	EFSAC 'End of Plan'	EFSAC CAZ 'Interim Year'	EFSAC CAZ 'End of Plan'	2017 ANPR Data*	EFSAC 'Interim Year'	EFSAC 'End of Plan'	EFSAC CAZ 'Interim Year'	EFSAC CAZ 'End of Plan'
Pre-Euro 1	1.2%	-	-	-	-	-	-	-	-	-
Euro 1	-	-	-	-	-	-	-	-	-	-
Euro 2	-	-	-	<0.1%	-	0.1%	-	-	-	-
Euro 3	44.4%	5.3%	-	0.4%	-	12.5%	0.8%	-	0.1%	-
Euro 4	42.5%	2.3%	-	8.9%	0.3%	26.4%	3.8%	0.3%	1.5%	-
Euro 5	6.7%	21.8%	1.1%	17.4%	2.7%	53.0%	23.2%	5.9%	7.6%	0.9%
Euro 6	5.2%	12.7%	0.9%	6.0%	0.5%	8.0%	11.5%	3.4%	9.4%	2.2%
Euro 6c	-	58.0%	98.0%	67.2%	96.5%	-	25.8%	10.4%	23.5%	8.3%
Euro 6d	-	-	-	-	-	-	35.0%	80.0%	57.9%	88.6%

Note: Percentages may not add up to exactly 100% due to rounding.

Petrol Hybrid Cars

Euro Standard	Full Hybrid Petrol Cars					Plug-In Hybrid Cars				
	2017 ANPR Data*	EFSAC 'Interim Year'	EFSAC 'End of Plan'	EFSAC CAZ 'Interim Year'	EFSAC CAZ 'End of Plan'	2017 ANPR Data*	EFSAC 'Interim Year'	EFSAC 'End of Plan'	EFSAC CAZ 'Interim Year'	EFSAC CAZ 'End of Plan'
Pre-Euro 1	1.2%	-	-	-	-	1.2%	-	-	-	-
Euro 1	-	-	-	-	-	-	-	-	-	-
Euro 2	-	-	-	-	-	-	-	-	-	-
Euro 3	12.2%	0.2%	-	<0.1%	-	-	-	-	-	-
Euro 4	12.2%	0.7%	-	0.8%	<0.1%	-	-	-	-	-
Euro 5	41.9%	5.5%	0.6%	6.0%	0.5%	55.6%	2.3%	0.1%	0.9%	<0.1%
Euro 6	16.8%	8.7%	2.4%	6.2%	1.1%	30.5%	10.1%	0.9%	5.3%	0.3%
Euro 6c	15.7%	85.0%	97.0%	87.0%	98.3%	12.7%	87.6%	98.9%	93.8%	99.6%

Note: Percentages may not add up to exactly 100% due to rounding.

Diesel Hybrid Cars and Taxis

Euro Standard	Diesel Hybrid Cars 2017 ANPR Data*	Diesel Hybrid Cars EFSAC 'Interim Year'	Diesel Hybrid Cars EFSAC 'End of Plan'	Diesel Hybrid Cars EFSAC CAZ 'Interim Year'	Diesel Hybrid Cars EFSAC CAZ 'End of Plan'	Taxis 2017 ANPR Data*	Taxis EFSAC 'Interim Year'	Taxis EFSAC 'End of Plan'	Taxis EFSAC CAZ 'Interim Year'	Taxis EFSAC CAZ 'End of Plan'
Pre-Euro 1	-	-	-	-	-	-	-	-	-	-
Euro 1	-	-	-	-	-	-	-	-	-	-
Euro 2	-	-	-	-	-	-	-	-	-	-
Euro 3	-	-	-	-	-	26.7%	3.8%	-	-	-
Euro 4	-	-	-	-	-	40.4%	13.5%	-	6.2%	-
Euro 5	56.0%	2.3%	0.3%	0.9%	0.1%	29.8%	17.7%	4.1%	10.8%	1.1%
Euro 6	19.1%	6.5%	1.4%	12.4%	1.1%	3.2%	17.8%	7.2%	14.9%	11.4%
Euro 6c	24.9%	50.2%	12.0%	38.5%	6.6%	-	47.2%	17.2%	-	-
Euro 6d	-	41.0%	86.3%	48.2%	92.2%	-	-	69.5%	-	-
ZEC	-	-	-	-	-	-	-	-	68.1%	87.4%

Note: Percentages may not add up to exactly 100% due to rounding.

Rigid and Artic HGVs

Euro Standard	Rigid HGVs 2017 ANPR Data*	Rigid HGVs EFSAC 'Interim Year'	Rigid HGVs EFSAC 'End of Plan'	Rigid HGVs EFSAC CAZ 'Interim Year'	Rigid HGVs EFSAC CAZ 'End of Plan'	Artic HGVs 2017 ANPR Data*	Artic HGVs EFSAC 'Interim Year'	Artic HGVs EFSAC 'End of Plan'	Artic HGVs EFSAC CAZ 'Interim Year'	Artic HGVs EFSAC CAZ 'End of Plan'
Pre-Euro I	-	-	-	-	-	-	-	-	-	-
Euro I	-	-	-	-	-	-	-	-	-	-
Euro II	0.1%	-	-	-	-	0.5%	-	-	0.0%	-
Euro III	12.1%	0.5%	-	<0.1%	-	1.9%	0.1%	-	0.0%	-
Euro IV	17.9%	2.2%	0.2%	0.1%	-	11.3%	0.1%	-	0.1%	-
Euro V EGR	8.9%	2.2%	0.3%	0.4%	0.2%	10.9%	0.4%	-	0.1%	-
Euro V SCR	26.7%	6.6%	0.9%	1.1%	0.7%	32.7%	1.1%	-	0.2%	-
Euro VI	34.3%	88.6%	98.6%	98.4%	99.0%	42.7%	98.4%	100.0%	99.6%	100.0%

Note: Percentages may not add up to exactly 100% due to rounding.

Buses and Coaches

Euro Standard	Buses and Coaches				
	2017 ANPR Data*	EFSAC 'Interim Year'	EFSAC 'End of Plan'	EFSAC CAZ 'Interim Year'	EFSAC CAZ 'End of Plan'
Pre-Euro I	-	-	-	-	-
Euro I	-	-	-	-	-
Euro II	-	-	-	-	-
Euro III	14.7%	-	-	<0.1%	-
Euro IV	28.6%	7.9%	1.8%	<0.1%	-
Euro V EGR	12.1%	6.6%	1.9%	0.3%	-
Euro V SCR	36.3%	19.7%	5.8%	0.8%	-
Euro VI	8.2%	65.9%	90.4%	98.9%	100.0%

Note: Percentages may not add up to exactly 100% due to rounding.

Appendix E Air Quality Modelling Results

See separate Excel Workbook

Appendix F Right Turn Ban Modelling Technical Note

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Project name:
Epping Forest Local Plan HRA

To:
Epping Forest District Council

Project ref:

CC:
Next PLC

From:
Dr James Riley, Technical Director
Dr Helen Venfield, Principal Air Quality Scientist

Date:
11 January 2021

Memo

Subject: Air Quality Implications of Proposed A121 to Forest Side Right Turn Ban

Introduction

In 2020 AECOM undertook traffic-related air quality modelling of Epping Forest SAC, to identify the effects of growth in the Epping Forest Local Plan ‘in combination’ with all other traffic growth expected on the modelled road network through the SAC to 2033. That analysis concluded that no adverse effect on the integrity of the SAC would arise provided the following mitigation measures were implemented: introduction of a Clean Air Zone from 2025, initiatives to shift ownership of petrol cars to electric vehicles from plan adoption to achieve a 30% conversion of petrol cars to ULEVs by 2033, and some specific localised additional measures such as veteran tree management plans.

With these measures in place the Local Plan modelling identified that the vast majority of the SAC will experience either a negligible ‘in combination’ NOx, ammonia or nitrogen dose, or a net reduction (i.e. improvement) in ammonia and nitrogen deposition compared to the 2033 baseline. A total of 12% of the SAC would experience a net reduction in ammonia concentrations compared to the 2033 baseline and 5% would experience a net reduction in nitrogen deposition rates compared to the 2033 baseline.

Although a conclusion of no adverse effect on integrity was reached, the AECOM report also identified that there is an opportunity for the Council to explore additional possible solutions that may address residual issues and further reinforce a conclusion of no adverse effect on integrity. One of these consisted of introducing a ‘no right turn’ ban at the junction between Honey Lane and Forest Side. In December 2020 AECOM were asked to specifically model the implications of such a Right Turn Ban.

Two alternative bans were modelled: a total ban, and a partial ban that would apply only during the AM and PM peak hour periods (AM – 0700-1000h; PM – 1600-1900h). The same modelling methodology was used as described in the ‘*Air Quality Assessment Modelling Methodology for 2020 Habitat Regulations Assessment Technical Note*’ (August 2020) to model concentrations of nitrogen oxides and ammonia, and subsequently nitrogen deposition in the SAC.

The change in road traffic flow data relative to the mitigated scenario described above, scenario 4.5ULEZev, was provided by Jacobs, and is shown in Table 1. For the total right hand ban (RHB), the data were provided as Annual Average Daily Traffic (AADT), and this change in flow was split across the four time periods according to Table 2 (as in HRA) – these flows are also presented in Table 1. For the peak hour only RHB, changes in traffic were provided separately for the AM and PM peak periods. The equivalent change in AADT is presented in Table 1 for comparison.

Table 1: Change in road traffic flows relative to mitigated scenario, 4.5ULEZev

Link	Scenario 4.5ULEZev 2033 w LP & mitigation AADT (24h)	Scenario 4.5ULEZev-RHB AADT (24h)	RHB AM (3h)	RHB IP (6h)	RHB PM (3h)	RHB OP (12h)	Scenario 4.5ULEZev-RHBampm AADT (24h)	RHBampm AM (3h)	RHBampm PM (3h)
J01_01	24,083	-	-	-	-	-	-	-	-
J01_02	9,419	-	-	-	-	-	-	-	-
J01_03	22,839	-	-	-	-	-	-	-	-
J01_04	18,102	+474	+95	+180	+100	+104	+252	+137	+115
J01_05	29,152	+383	+77	+146	+80	+84	+194	+105	+89
J33_01	2,425	-	-	-	-	-	-	-	-
J33_02	29,109	-	-	-	-	-	-	-	-
J33_03	2,702	-934	-187	-355	-196	-205	-476	-260	-216
J33_04	29,459	-	-	-	-	-	-	-	-
J35_01	1,484	-233	-47	-89	-49	-51	-119	-65	-54
J35_02	3,749	-188	-38	-71	-39	-41	-104	-57	-47
J35_03	2,304	+46	+9	+17	+10	+10	+15	+8	+7
J36_01	18,109	-	-	-	-	-	-	-	-
J36_02	3,077	-	-	-	-	-	-	-	-
J36_03	18,781	-38	-8	-14	-8	-8	-22	-12	-10
J36_04	3,822	-151	-30	-57	-32	-33	-83	-45	-38

Table 2: Time periods and distribution of AADT in air quality modelling

Period	Time	Duration	Traffic Flow (% of AADT)
AM peak	0700-1000h	3 hours	20%
Inter-peak	1000-1600h	6 hours	38%
PM peak	1600-1900h	3 hours	21%
Off-peak	1900-0700h	12 hours	22%

The core analysis of relevance is whether either right turn ban would materially affect the results of the Local Plan modelling for the mitigated scenario. In other words:

- would there be an increase in the size of any areas forecast to receive a greater than imperceptible 'in combination' pollutant dose, compared to the Local Plan 2033 mitigated scenario?
- would any forecast doses get materially worse compared to the 2033 mitigated scenario (e.g. would a 'small' residual dose in the Local Plan mitigated scenario become a 'medium' residual dose due to either right turn ban, or would an 'imperceptible' residual dose become a 'small' residual dose)? and
- would any new areas of SAC become subject to a greater than imperceptible 'in combination' pollutant dose compared to the Local Plan mitigated scenario?

This Technical Note presents the results of the comparative analysis. The data are presented as isopleth (contour) maps since this is visually the easiest way to compare model outputs and identify whether any new issues are caused, or existing issues exacerbated. Each pollutant is discussed in turn.

Comparisons are only made with the 2033 model scenarios, rather than the 2024 scenarios, because any Right Turn Ban would not be introduced until after 2024.

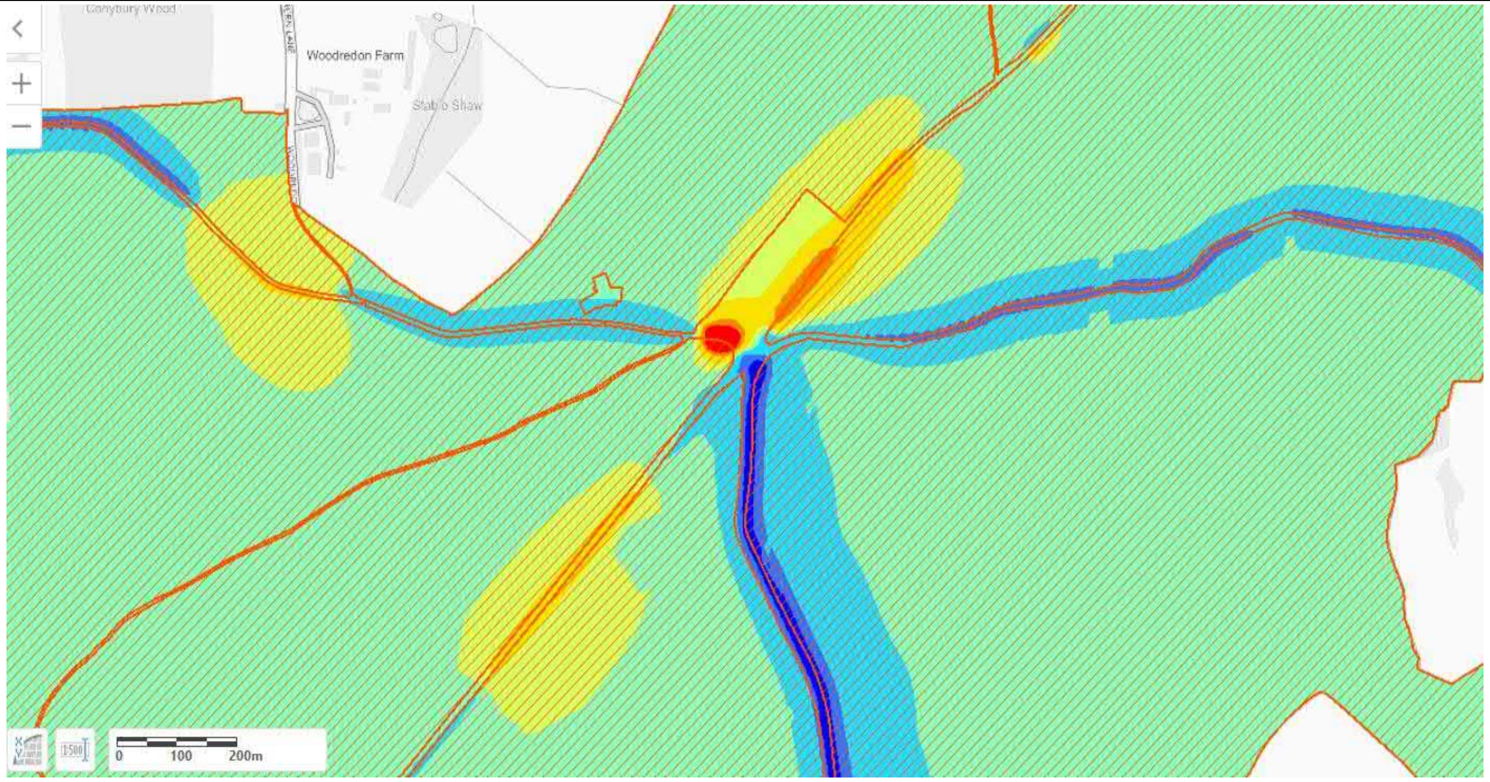
Nitrogen

Total right turn ban (RTB)

Isopleths depicting the results are presented overleaf. The following conclusions can be drawn by comparing the Local Plan mitigated scenario and the total RTB scenario:

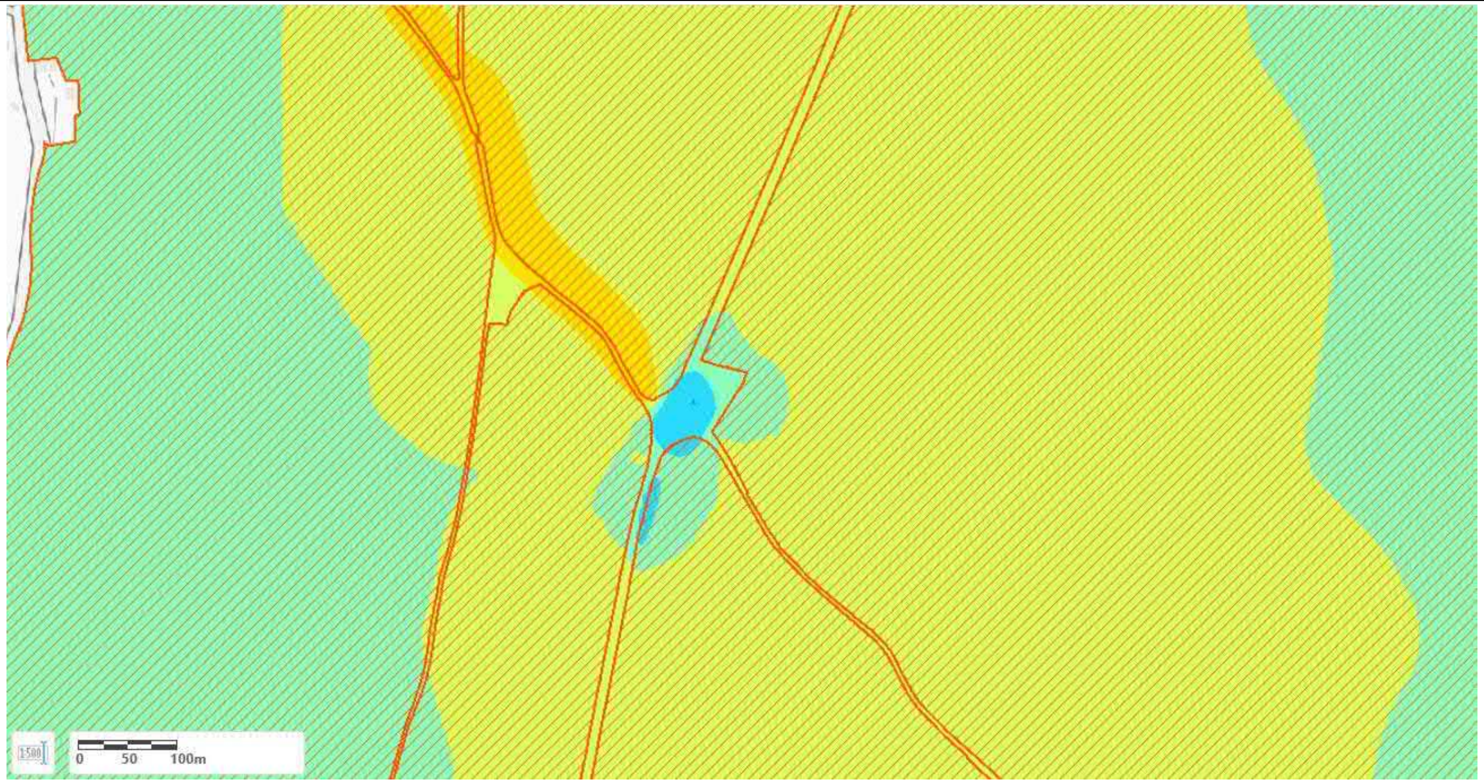
1. The lime green area in the vicinity of the restaurant and petrol station west of Epping Road increases in size, but this denotes an ‘imperceptible’ dose in any event so is not an issue.
2. The area subject to a dark yellow (small) dose increases in this same location but only west of the B1393 (Epping Road), and thus only in the carriageway and at the restaurant/petrol station
3. The red (‘large’) dose at ‘Wake Arms Pits’ remains as it did in the original Local Plan mitigated scenario, but the extent does not increase
4. South of Woodredon Farm there is now a small (yellow) dose which appears within c. 10m of the road for a c. 250m stretch. This may require further locationally-specific mitigation such as mulching and/or veteran tree management plans (although no veteran trees are actually shown on mapping) but these are already part of the mitigation strategy in any event
5. A similar 350m long area of ‘small’ dose appears very close to the A104 south of Wake Arms Roundabout and this may also trigger some localised need for veteran tree management although on mapping only 1 tree appears to lie within the zone.
6. At Robin Hood Roundabout the lime green area increases but this denotes an ‘imperceptible’ dose in any event. Most notably, the deep orange (medium dose) along the western arm that was visible in the original mitigated scenario disappears.

Wake Arms Roundabout - Local Plan 2033 Mitigated Scenario (Nitrogen)



Wake Arms Roundabout - Local Plan 2033 Mitigated Scenario plus Total Right Turn Ban (Nitrogen)

Robin Hood Roundabout - Local Plan 2033 Mitigated Scenario (Nitrogen)



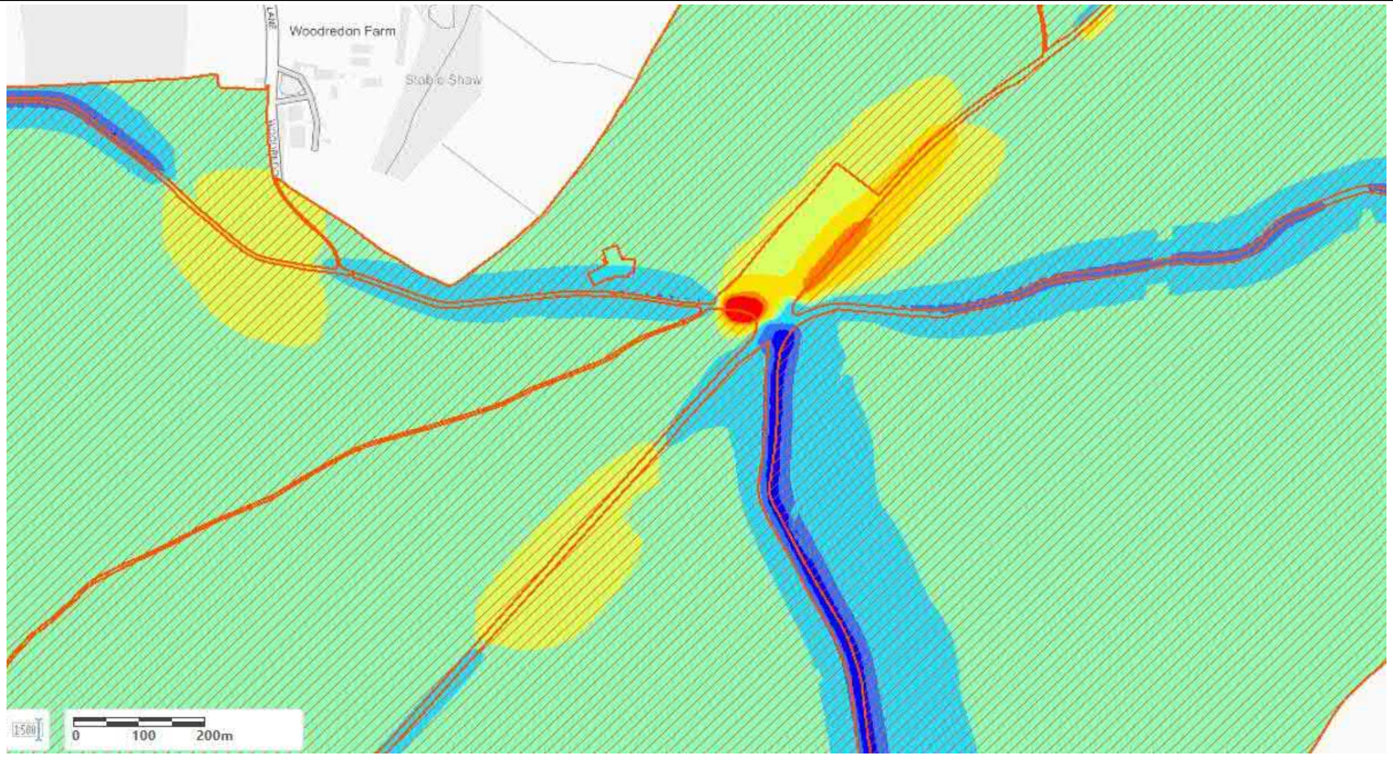
Robin Hood Roundabout - Local Plan 2033 Mitigated Scenario plus Total Right Turn Ban (Nitrogen)

Partial RTB

Isopleths depicting the results are presented overleaf. The following conclusions can be drawn by comparing the Local Plan mitigated scenario and the partial RTB scenario:

1. The results at Wake Arms are very similar to a full RTB except that the two new areas of 'small' nitrogen dose that appear under a full RTB (south of Woodredon Farm and on the A104 South of Wake Arms Roundabout) do not occur. Only imperceptible doses arise in these locations.
2. At Robin Hood Roundabout the lime green area increases but this denotes an 'imperceptible' dose in any event. The patches of deep orange (medium dose) along the western arm that were visible in the original mitigated scenario reduce greatly, although very small areas are still visible.

Wake Arms Roundabout - Local Plan 2033 Mitigated Scenario (Nitrogen)



Wake Arms Roundabout - Local Plan 2033 Mitigated Scenario plus AM/PM Peak Right Turn Ban (Nitrogen)

Robin Hood Roundabout - Local Plan 2033 Mitigated Scenario (Nitrogen)

Robin Hood Roundabout - Local Plan 2033 Mitigated Scenario plus AM/PM Peak Right Turn Ban (Nitrogen)

Ammonia

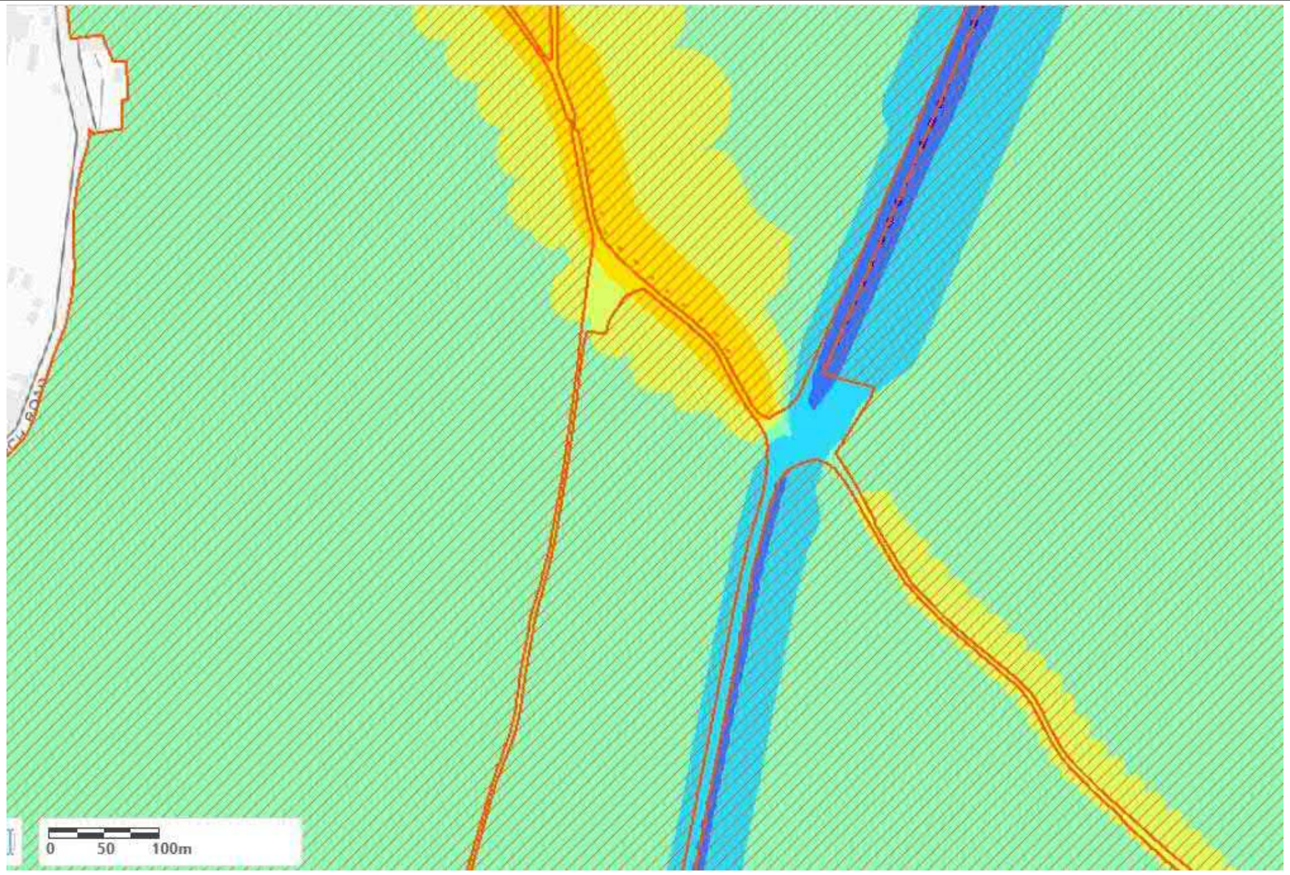
Total RTB

Isopleths depicting the results are presented overleaf. The following conclusions can be drawn by comparing the Local Plan mitigated scenario and the total RTB scenario:

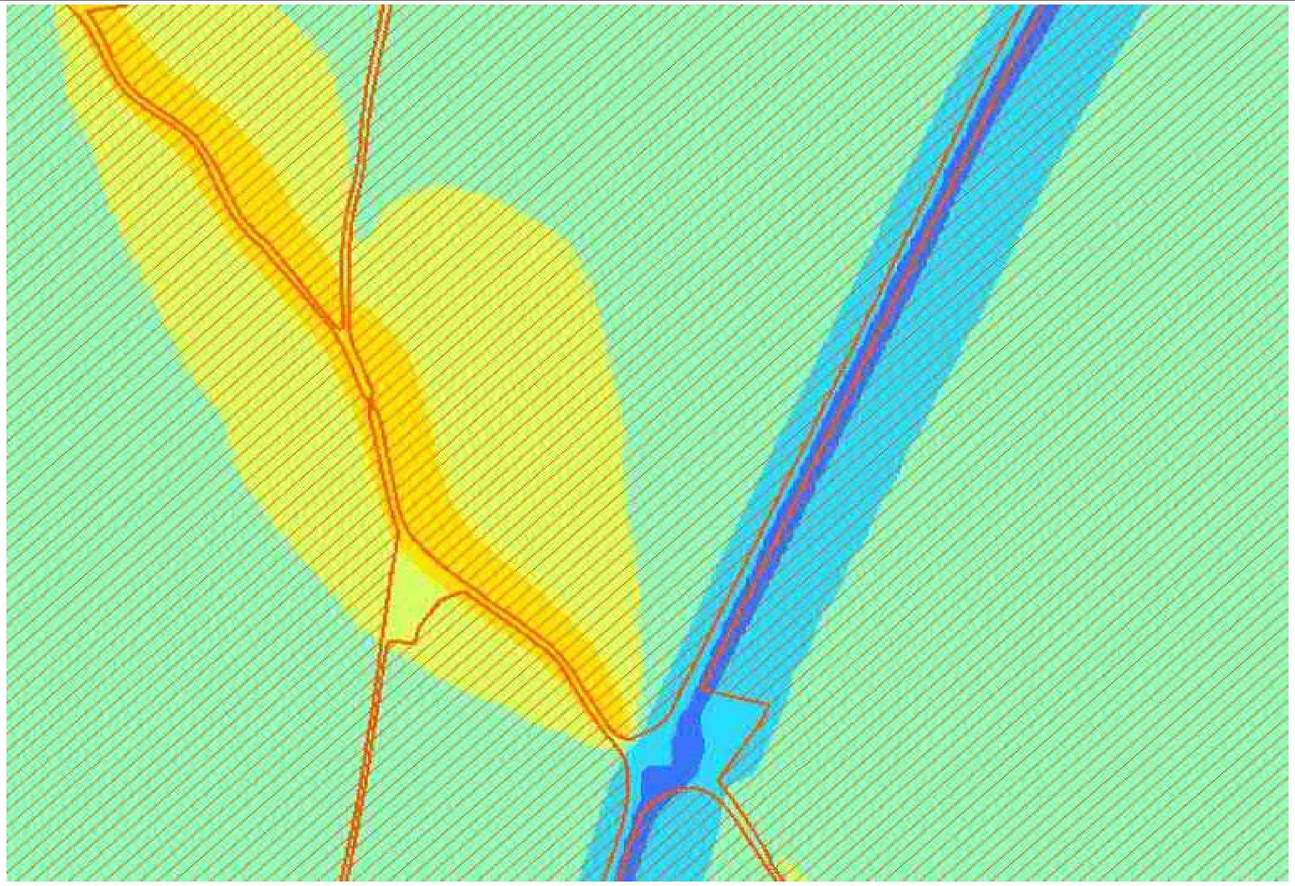
1. Much of the area around Wake Arms Roundabout would continue to experience a net reduction in ammonia compared to the 2033 baseline (areas of blue and green), although the extent of that reduction would be less than with no RTB at all (evidenced by an increase in the amount of green compared to the original Local Plan mitigated scenario and a reduction in the amount of dark blue). The single location of net increase in ammonia at Wake Arms pits remains very similar to the original 2033 Local Plan mitigated scenario.
2. Unlike for nitrogen deposition, there remains a forecast net reduction in ammonia compared to the 2033 baseline south of Woodredon Farm, and on the A104 south of Wake Arms Roundabout.
3. Much of the area around Wake Arms Roundabout would continue to experience a net reduction in ammonia compared to the 2033 baseline (areas of blue and green), although the extent of that reduction would be less than with no RTB at all (evidenced by an increase in the amount of green compared to the original Local Plan mitigated scenario and a reduction in the amount of dark blue). Most notably, the deep orange (medium dose) along the western arm that was visible in the original mitigated scenario disappears.

Wake Arms Roundabout - Local Plan 2033 Mitigated Scenario (Ammonia)

Wake Arms Roundabout - Local Plan 2033 Mitigated Scenario plus Total Right Turn Ban (Ammonia)



Robin Hood Roundabout - Local Plan 2033 Mitigated Scenario (Ammonia)



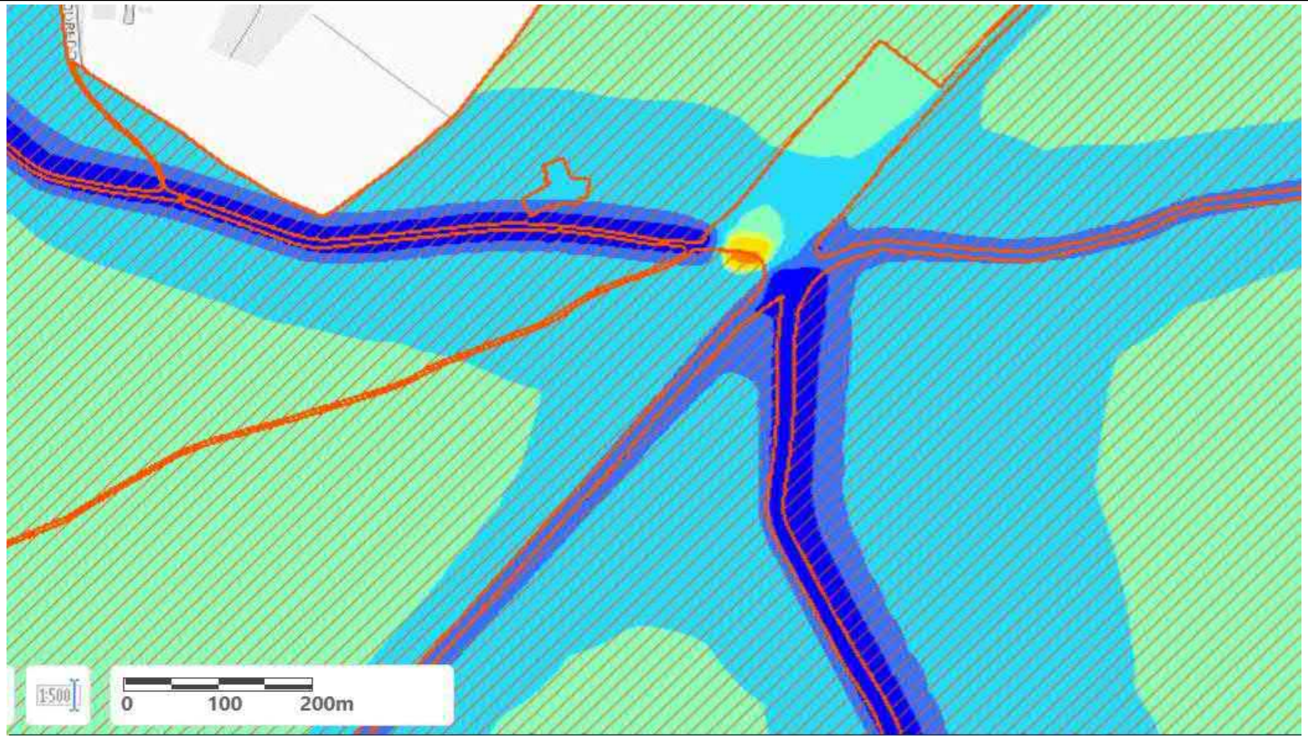
Robin Hood Roundabout - Local Plan 2033 Mitigated Scenario plus Total Right Turn Ban (Ammonia)

Partial RTB

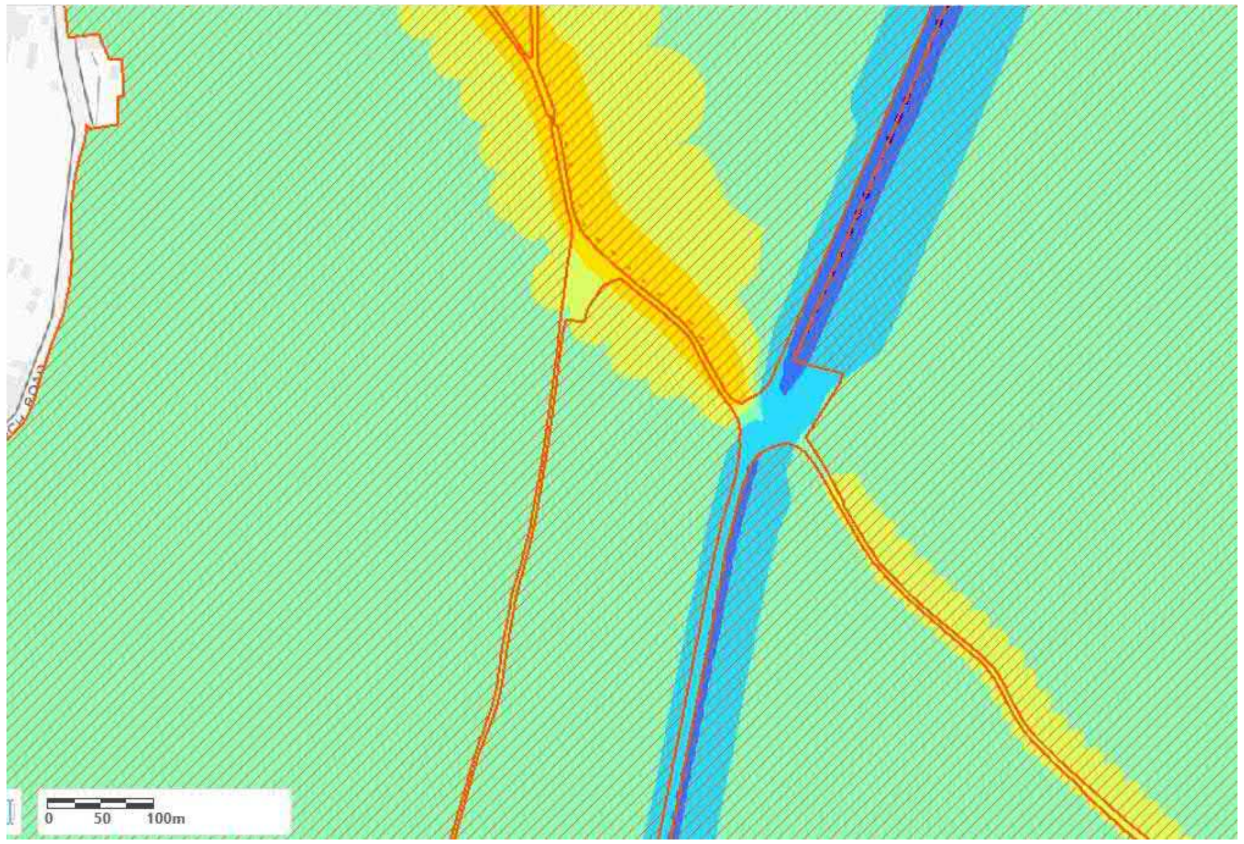
Isopleths depicting the results are presented overleaf. The following conclusions can be drawn by comparing the Local Plan mitigated scenario and the partial RTB scenario:

4. At Wake Arms Roundabout the result is similar to a full RTB
5. At Robin Hood Roundabout the result is very similar indeed to a full RTB

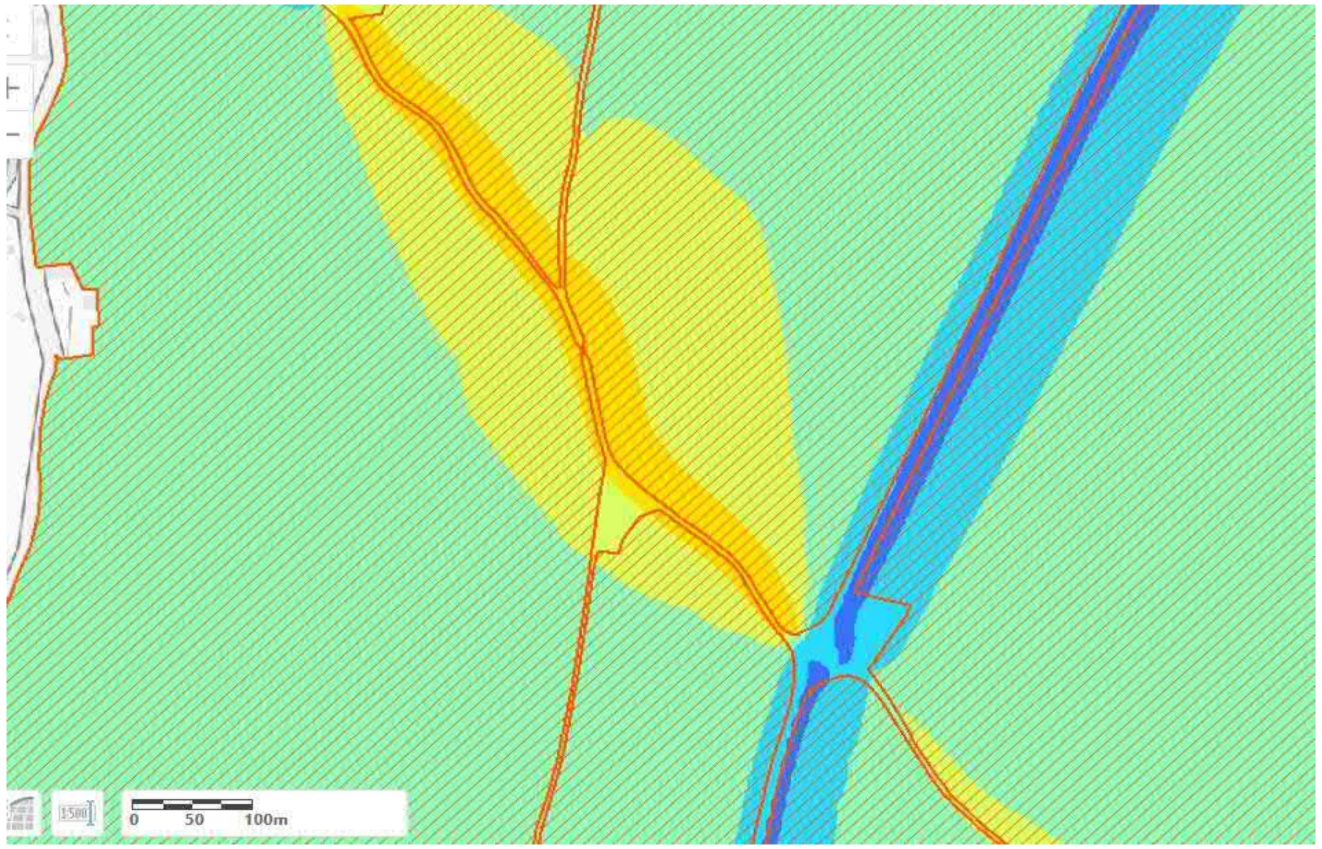
Wake Arms Roundabout - Local Plan 2033 Mitigated Scenario (Ammonia)



Wake Arms Roundabout - Local Plan 2033 Mitigated Scenario plus AM/PM Peak Right Turn Ban (Ammonia)



Robin Hood Roundabout - Local Plan 2033 Mitigated Scenario (Ammonia)



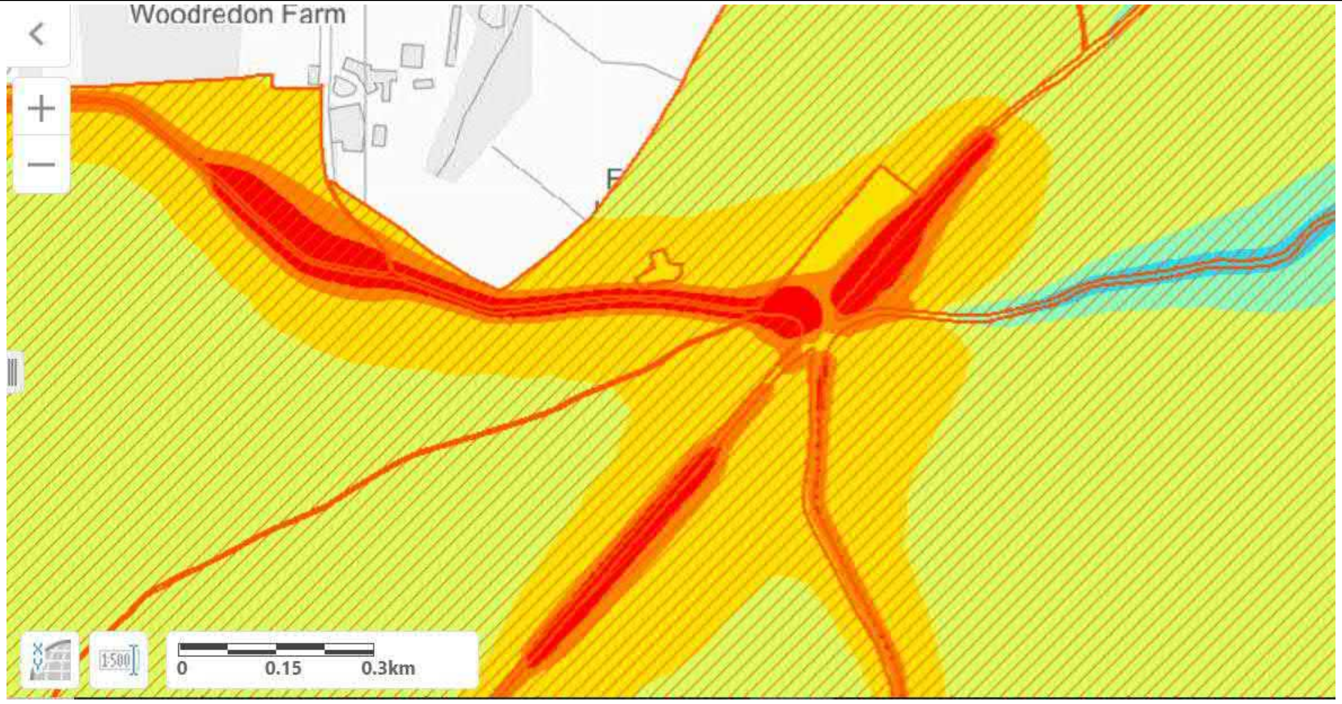
Robin Hood Roundabout - Local Plan 2033 Mitigated Scenario plus AM/PM Peak Right Turn Ban (Ammonia)

Oxides of Nitrogen (NOx)

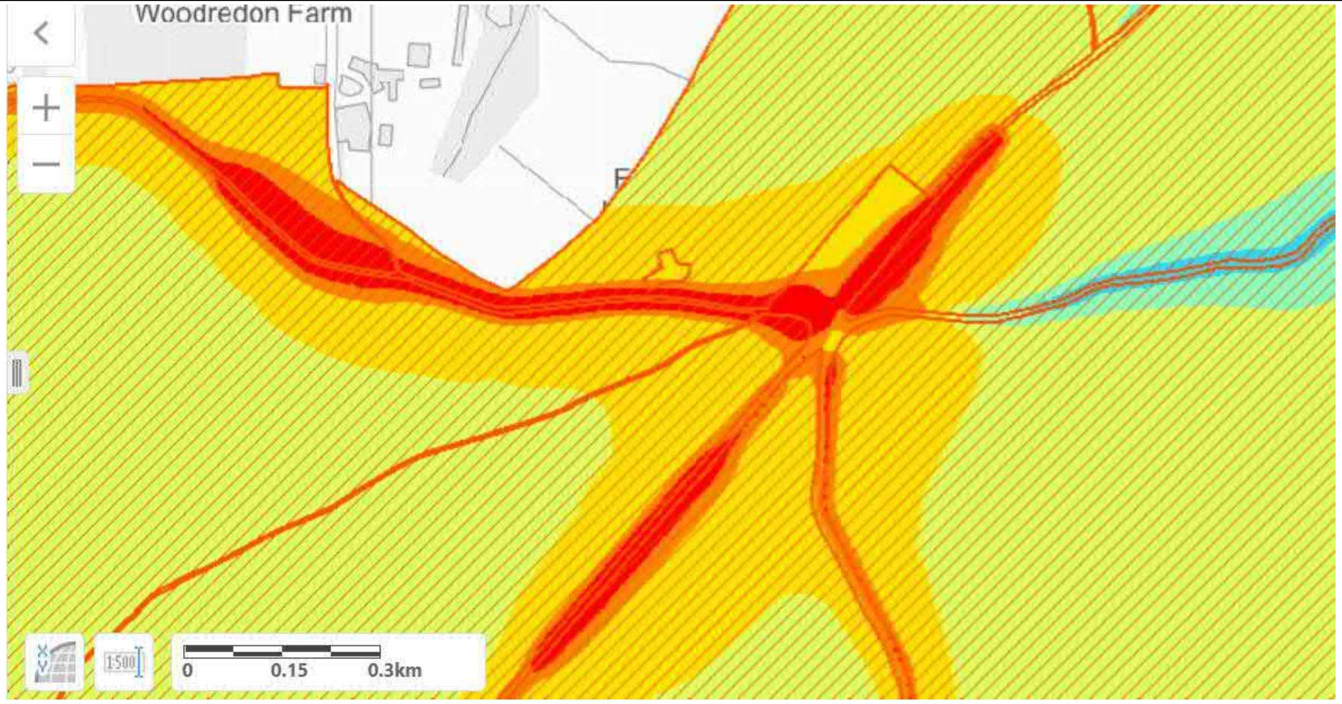
Total RTB

Isopleths depicting the results are presented overleaf. The following conclusions can be drawn by comparing the Local Plan mitigated scenario and the total RTB scenario:

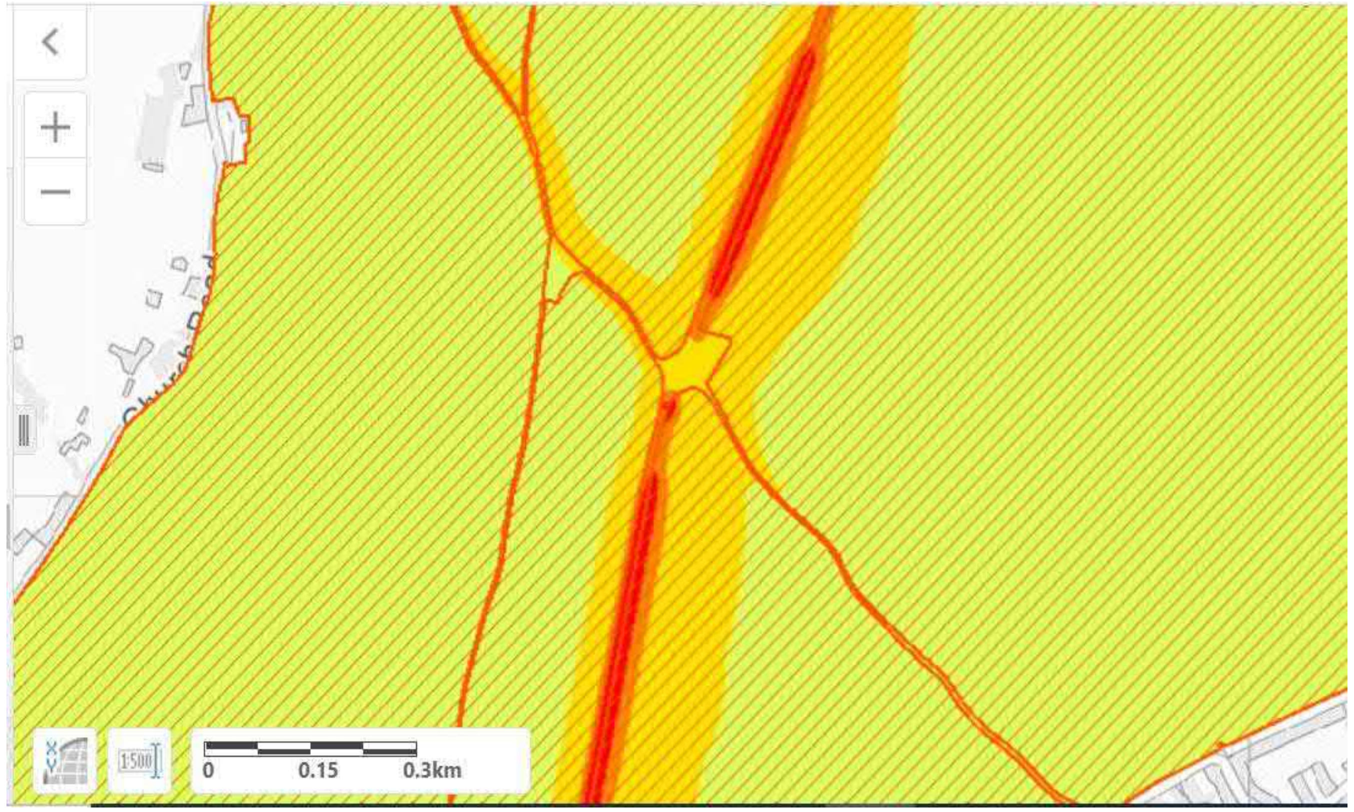
1. Very little difference is observed. The main difference is that there is a slight increase in the total area at Wake Arms Roundabout subject to a ‘large’ residual NOx dose compared to the 2033 mitigated scenario. However, this area is located entirely within the carriageway rather than within the SAC.



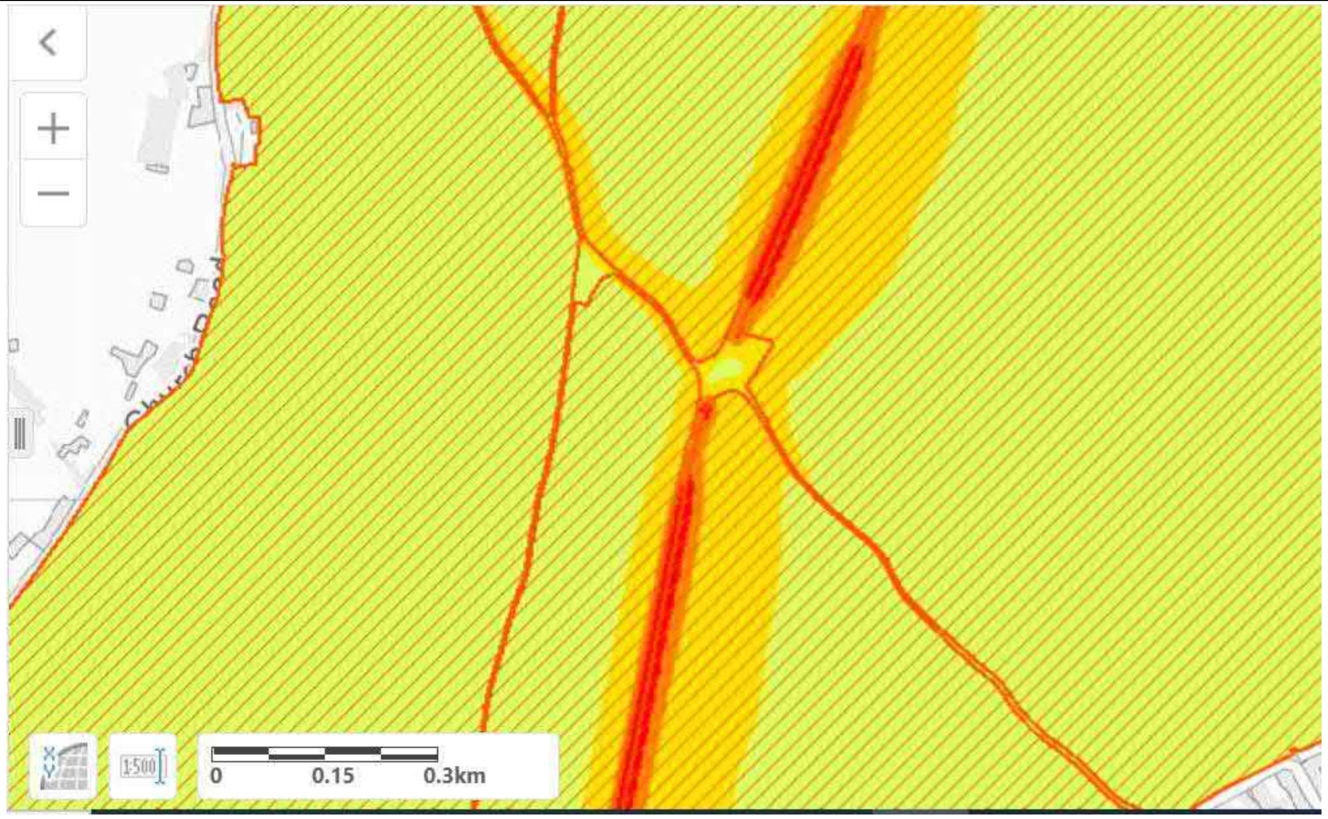
Wake Arms Roundabout - Local Plan 2033 Mitigated Scenario (NOx)



Wake Arms Roundabout - Local Plan 2033 Mitigated Scenario plus Total Right Turn Ban (NOx)



Robin Hood Roundabout - Local Plan 2033 Mitigated Scenario (NOx)

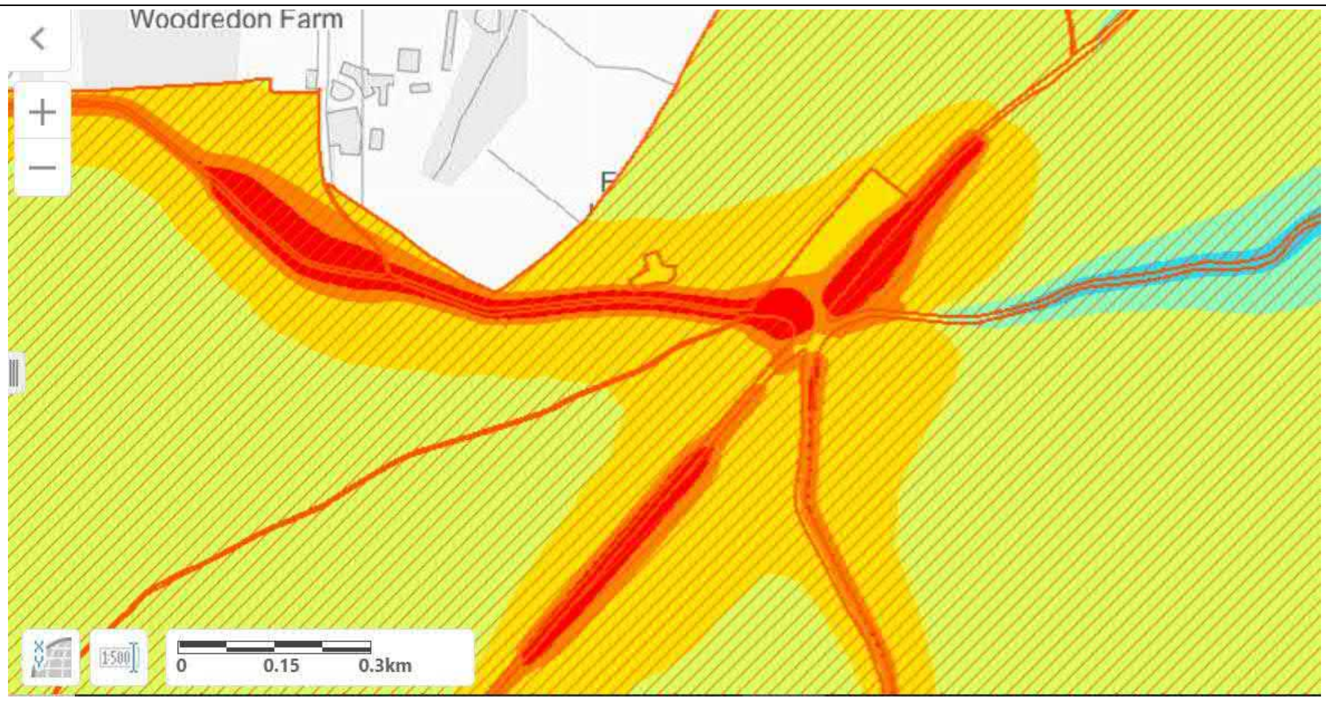


Robin Hood Roundabout - Local Plan 2033 Mitigated Scenario plus Total Right Turn Ban (NOx)

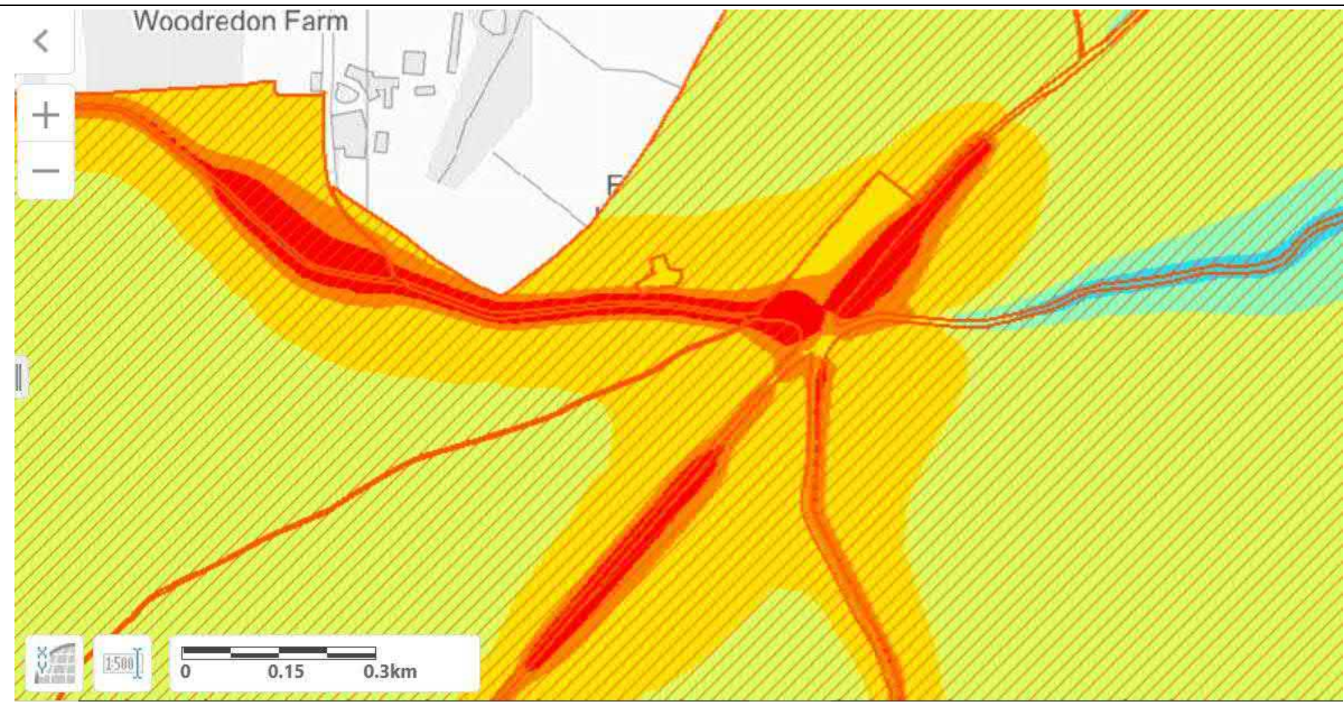
Partial RTB

Isopleths depicting the results are presented overleaf. The following conclusions can be drawn by comparing the Local Plan mitigated scenario and the partial RTB scenario:

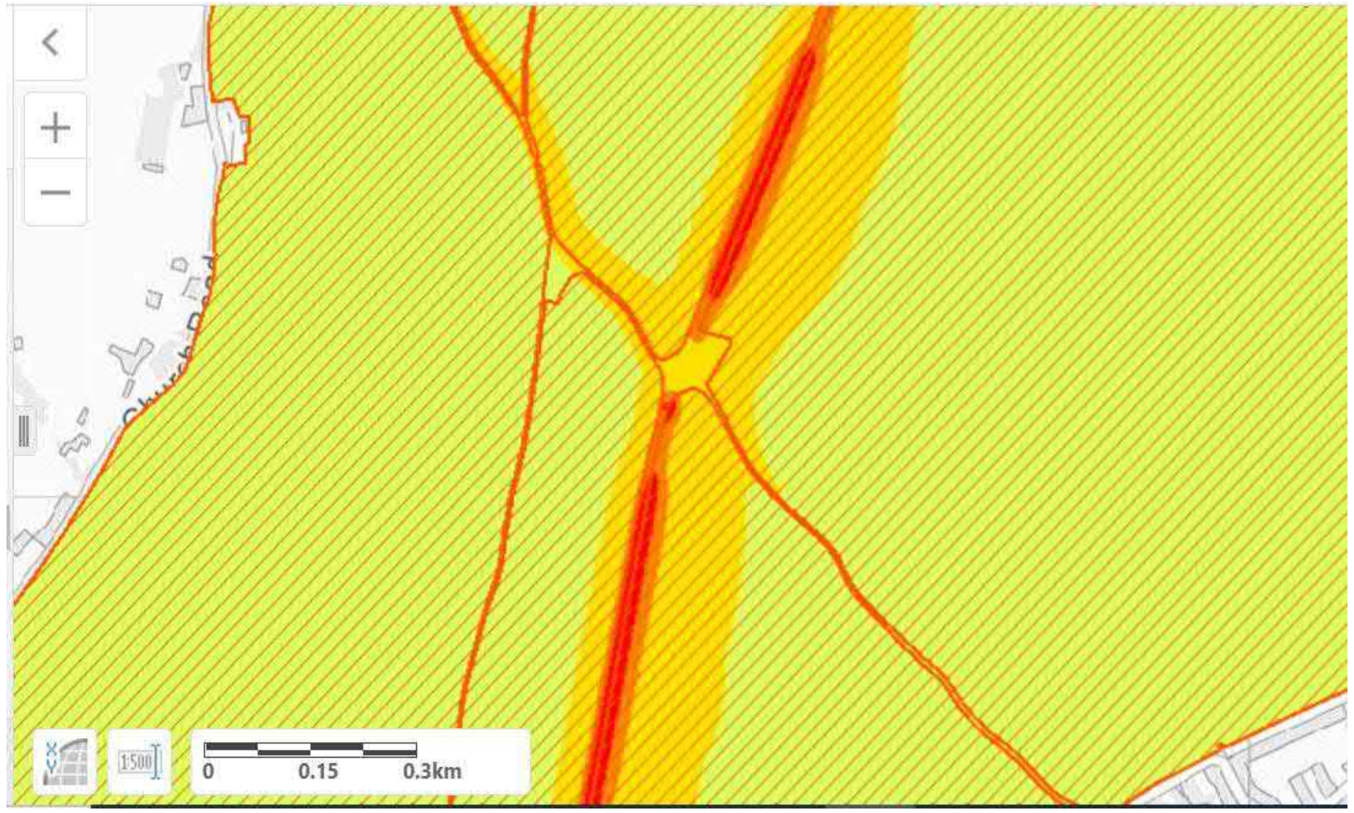
1. At Wake Arms Roundabout the result is similar to a full RTB
2. At Robin Hood Roundabout the result is very similar to a full RTB



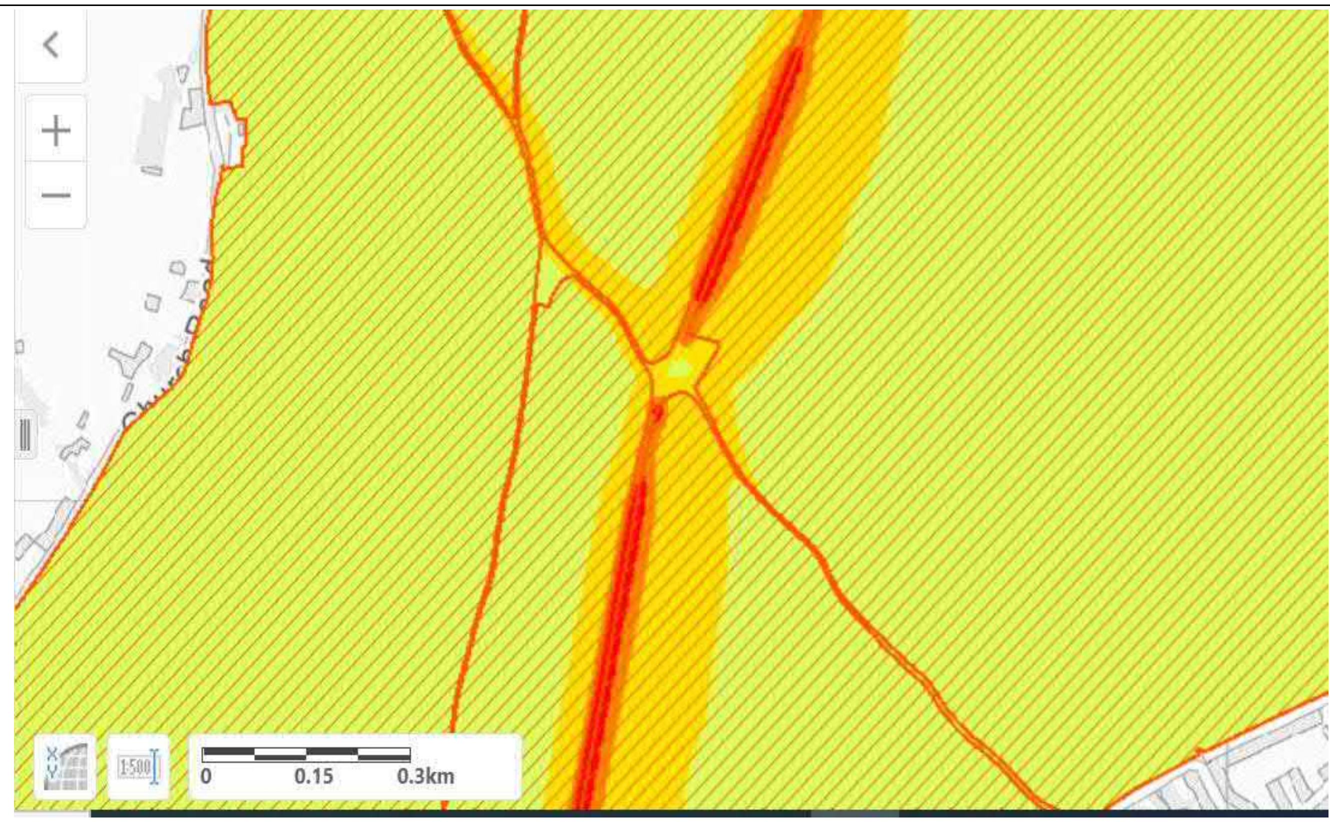
Wake Arms Roundabout - Local Plan 2033 Mitigated Scenario (NOx)



Wake Arms Roundabout - Local Plan 2033 Mitigated Scenario plus Partial Right Turn Ban (NOx)



Robin Hood Roundabout - Local Plan 2033 Mitigated Scenario (NOx)



Robin Hood Roundabout - Local Plan 2033 Mitigated Scenario plus Partial Right Turn Ban (NOx)

Conclusion

Both a full and partial Right Turn Ban would appear beneficial in that they both reduce the orange (medium) nitrogen and ammonia dose areas west of Robin Hood Roundabout without materially increasing the extent or location of yellow (small), orange (medium) or red (large) dose areas around Wake Arms Roundabout.

On balance, it is considered that a partial (AM/PM peak hour) Right Turn Ban is the overall best solution as it minimises the areas of 'orange' (medium) nitrogen dose around Robin Hood Roundabout but doesn't introduce new areas of 'yellow' (small) nitrogen dose around Wake Arms Roundabout that would not otherwise arise in the Local Plan mitigated scenario.

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