Test Valley Borough Council - Air Quality Modelling

Test Valley Borough Council - Regulation 18 Stage 2

Test Valley Borough Council

Project number: 60701122

January 2024

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Quality information

Prepared by	Checked by	Verified by	Approved by
Sage Boyman Graduate Air Quality Consultant Vasilis Kazakos Air Quality Graduate Consultant	Julian Mann Senior Air Quality Consultant	Anna Savage Technical Director – Air Quality	Dr James Riley Technical Director (Ecology)

Revision History

Revision	Revision date	Details	Authorized	Name	Position
V1	15/12/2023	Draft	AS	Anna Savage	Technical Director
V2	09/01/2024	Final	AS	Anna Savage	Technical Director

Distribution List

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Prepared for:

Test Valley Borough Council

Prepared by:

Sage Boyman
Graduate Air Quality Consultant
M: 07551405003
E: sage.boyman@aecom.com

AECOM Limited
Royal Court, Basil Close
Chesterfield
Derbyshire S41 7SL
United Kingdom

T: +44 (1246) 209221
aecom.com

Figures

Tables

1. Introduction

1.1 Test Valley Borough Council (TVBC) is preparing a Draft Local Plan 2040 which represents a full review of the adopted Local Plan. Once the Local Plan has been through a number of statutory stages of preparation, it will be examined and if found to be sound, it can be adopted. Upon adoption it will replace the current Test Valley Revised Local Plan 2011-2029. The Council has commissioned AECOM Limited to conduct an air quality assessment to inform the Habitats Regulations Assessment (HRA) of the Regulation 18 Stage 2 preparation of the Local Plan 2040 and to form part of the evidence base. It should be noted that due to the design of the traffic model, the end period traffic data for the southern model region used in this assessment is valid for 2041, rather than 2040.

1.2 The work presented in this report is to be used to inform the Appropriate Assessment of the HRA. It focuses on the impact of traffic related emissions due to planned development during the Local Plan period on sensitive ecosystems within the Salisbury Plain, New Forest, Mottisfont Bats, Emer Bog and Solent Maritime Special Areas of Conservation (SACs). The SACs are mainly designated for forest and heathland, in which there are habitats that are sensitive to nitrogen and acid deposition due to several reasons, such as soil acidification and toxicity to species (Natural England, 2018). More specifically, in terms of nitrogen sensitive habitats, Salisbury Plain SAC contains European dry heaths and other grassland habitats; the New Forest SAC contains wet and dry heaths, meadows, and beech forests; Mottisfont Bats SAC contains broadleaved deciduous woodland; Emer Bog contains transition mires and quaking bogs; and Solent Maritime contains salt meadows, coastal dunes, mudflats and sandflats.

1.3 This assessment considers the following four key pollutants shown to affect sensitive ecosystems: ammonia (NH_3), oxides of nitrogen (NO_X), total nitrogen deposition and total acid deposition. All pollutants are considered at receptor points, within transects, up to 200m of the roadside, within each of the five SACs considered in the assessment.

1.4 The main aims of this study are to:

- Identify potentially sensitive ecological receptor locations within the SACs within 200m of roads that are expected to be affected by the Local Plan 2040;
- Predict annual mean NO_x and NH_3 concentrations and nitrogen and acid deposition rates for the following scenarios at selected ecological receptors;
  - Baseline year (2019): represents air quality in a recent past year (2019);
  - Future Baseline (2041): uses the traffic data from the ‘current baseline’ in 2019, but applies future assessment year vehicle emission factors and background pollutant concentrations to allow for the ‘in combination’ assessment required for the HRA;
  - 2041 ‘Do Minimum’ (DM) Reference Case: future assessment year, which does not include the influence of planned development from the Local Plan 2040, but does allow for strategic planned development in neighbouring local authorities;
  - 2041 ‘Do Something’ Scenario 1 (DS1) (Growth Option 1): future assessment year, which includes the influence of planned development from the Test Valley Borough Council Local Plan 2040, using the growth option 1 scenario from the Transport Assessment and from strategic planned development in neighbouring local authorities.
  - 2041 ‘Do Something’ Scenario 2 (DS2) (Growth Option 2): future assessment year, which includes the influence of planned development from the Test Valley Borough Council Local Plan 2040, using the growth option 2 scenario from the Transport Assessment and from strategic planned development in neighbouring local authorities.
- Determine if there are any exceedances of NO_x and NH_3 critical levels, and nitrogen and acid deposition critical loads within the five SACs.

1.5 The results and implications of the modelling outputs are presented in the accompanying report ‘Habitats Regulations Assessment (HRA) of the Test Valley Local Plan Review’. More detail on the Transport Assessment and associated modelling are available separately.

2. Policy Context

Clean Air Strategy

2.1 In 2019, the UK government released its Clean Air Strategy 2019 (Defra, 2019) as part of its 25 Year Environment Plan (Defra, 2018). These documents include targets to reduce emissions of ammonia from farming activities, and nitrogen oxides from combustion processes, and thus reduce the deposition of nitrogen to sensitive ecosystems.

Environment Act

2.2 The Environment Act 2021 (HM Government, 2021) amends the Environment Act 1995 (HM Government, 1995). On 9th November 2021, the Act received Royal Assent after being first introduced to Parliament in January 2020 to address environmental protection and the delivery of the Government's 25 Year Environment Plan. It includes provisions to establish a set of statutory environmental principles to ensure environmental governance through an environmental watchdog, the Office for Environmental Protection (OEP).

2.3 The Secretary of State must publish a review report every five years (as a minimum and with yearly updates to Parliament). The 25 Year Environment Plan has been adopted as the first Environmental Improvement Plan (EIP) of the Environment Act 2021, with long-term legally binding targets being finalised by Defra[1]. The EIP 2023 was published in January 2023 (updated February 2023), building on the 25 Year Environment Plan, and setting out how the delivery of environmental goals will be coordinated with landowners, communities and businesses.

Habitats Regulations Assessment

2.4 While the UK is no longer a member of the EU, a requirement for HRA will continue as set out in the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019.

2.5 The HRA process applies the 'Precautionary Principle'[2] to European sites[3]. Plans and projects can only be permitted having ascertained that there will be no adverse effect on the integrity of the European site(s) in question. To ascertain whether or not site integrity will be affected, an Appropriate Assessment should be undertaken of the Plan or project in question.

2.6 Following evidence gathering, the first stage of any Habitats Regulations Assessment is the screening for Likely Significant Effects (LSEs), a high-level assessment to decide whether the Appropriate Assessment is required. Where it is determined that a conclusion of 'no Likely Significant Effects' cannot be drawn, the analysis proceeds to the Appropriate Assessment.

Other Guidance documents

2.7 Best practice and advice / guidance contained within documents from Natural England (Natural England, 2018), the Institute of Air Quality Management (IAQM) (IAQM, 2020), the Chartered Institute of Ecology and Environmental Management (CIEEM) (CIEEM, 2021) and National Highways (Design Manual for Roads and Bridges DMRB LA105) (DMRB, 2019) have been used to determine the methodology applied, and in the accompanying ecological interpretation of the results.

Critical Levels

2.8 Annual mean critical levels of NO_x and NH_3 are summarised in Table 1. These are concentrations above which adverse effects on ecosystems may occur based on present knowledge. The critical level for NO_x is taken from the EU Ambient Air Quality Directive 2008/50/EU (EU Directives, 2008) which has also

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[1] https://www.gov.uk/government/news/update-on-progress-on-environmental-targets

[2] The Precautionary Principle, which is referenced in Article 191 of the Treaty on the Functioning of the European Union, has been defined by the United Nations Educational, Scientific and Cultural Organisation (UNESCO, 2005) as: *"When human activities may lead to morally unacceptable harm* [to the environment] *that is scientifically plausible but uncertain, actions shall be taken to avoid or diminish that harm. The judgement of plausibility should be grounded in scientific analysis".*

[3] https://www.gov.uk/guidance/habitats-regulations-assessments-protecting-a-european-site - "*A European site is protected by the Conservation of Habitats and Species Regulations 2017 as amended (known as the Habitats Regulations)*". These include Special Areas of Conservation (SACs), Special Protection Areas (SPAs), and Ramsar sites (wetlands of international importance).

been set as the Air Quality Strategy objective for the protection of vegetation and ecosystems, and has been incorporated into English legislation.

2.9 The EU Directive (EU Directives, 2008) states that the sampling point to determine compliance should be sited more than 20 km away from agglomerations or more than 5 km away from other built-up areas, industrial installations or motorways or major roads with traffic counts of more than 50,000 vehicles per day, which means that a sampling point must be sited in such a way that is representative of an area of at least 1,000 km^2. Applying the critical level for NO_x to designated nature conservation sites that are located close to busy roads is therefore precautionary.

2.10 The critical levels for NH_3 have not been incorporated into legislation and are a recommendation made by the United Nations Economic Commission for Europe (UNECE) Executive Body for the Convention on Long-Range Transboundary Air Pollution (CLRTAP) (UNECE, 2013).

Table 1: Annual Mean Critical Levels (NO_x and NH_3)

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

3. Methodology

3.1 The District Plan will significantly increase the population and employment opportunities within the District, which may result in more commuter journeys being undertaken within 200m of sensitive heathland. Therefore, LSEs cannot be excluded, and five European sites are screened in for Appropriate Assessment regarding this impact pathway. This is in accordance with Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations (Natural England, 2018).

3.2 As such, the air quality modelling methodology and analyses presented in this report have been undertaken to inform the HRA for the Salisbury Plain, New Forest, Mottisfont Bats, Emer Bog and Solent Maritime SACs. These SACs have been considered in the assessment as they contain habitats and species that are sensitive to N deposition, with more information provided in the introduction section.

3.3 The following sections outline the methodology used to model air quality in the five SACs as listed above, affected by changes to traffic associated with the Test Valley Local Plan 2040. The following sources of information and data have been used to form the basis of the air quality assessment:

- Department for Environment, Food and Rural Affairs' (Defra) Air Quality Background Concentration Maps based on a 2018 base year (Defra, 2020a);
- Defra's Vehicle Emission Factors (Defra, 2020b);
- Driver Vehicle Licencing Agency (DVLA) statistics on licensed road-using cars and light goods vehicles dataset for 2022 (DVLA, 2022);
- Department for Transport's (DfT) Transport Decarbonisation Plan of future vehicle fleet projections (DfT, 2022);
- Emission rates as published in the Calculator for Road Emissions of Ammonia (CREAM) tool (Air Quality Consultants, 2020);
- 1x1 km modelled nitrogen and acid deposition data and ammonia background concentrations from the Air Pollution Information System (APIS, 2022);
- Traffic count and speed data used to inform the Transport Assessment for 2019 and 2041.

3.4 The modelling assessment was conducted following methodology within Defra's Local Air Quality Management Technical Guidance (LAQM.TG(22) (Defra, 2022), and guidance contained within documents from Natural England (Natural England, 2018), the Institute of Air Quality Management (IAQM) (IAQM, 2020) and the Chartered Institute of Ecology and Environmental Management (CIEEM) (CIEEM, 2021).

Pollutants of Interest

3.5 The pollutants of interest with regard to sensitive ecosystems for which critical levels and critical loads exist, and which are included in the air quality modelling and assessment of impacts on the five SACs listed above, are NO_x, NH_3, and nitrogen and acid deposition. Modelling of these pollutants is undertaken to assess the air quality impacts of planned development in the Local Plan on the SACs alone, and 'in combination' with existing plans within surrounding authorities.

3.6 Whilst emissions of NO_x from road vehicles are regulated according to Euro standards, emissions of NH_3 are not. This means that emissions of NH_3 from individual vehicle types are highly uncertain, particularly as measurements are rarely made (as this is not required for regulatory purposes). The uncertainty associated with the predicted nitrogen deposition rates from NH_3 is also greater than for NO_2, with the NH_3 derived nitrogen deposition rates representing an upper estimate.

3.7 There is currently no tool publicly available for the assessment of road traffic emissions of NH_3 from National Highways, Defra, Natural England, or other nature conservation bodies. However, there is evidence that exclusion of NH_3 from assessments leads to an underestimate of deposited nitrogen (Air Quality Consultants, 2020).

3.8 The methodology used to model NH_3 concentrations from road traffic, using ADMS Roads, and the subsequent contribution to nitrogen deposition within the SACs (described below), is considered the most appropriate that is available at this time. The methodology has been applied by AECOM in several Appropriate Assessments to inform HRA including that for Tunbridge Wells Borough Council, Epping Forest, Wealden and Mid Sussex District Councils.

Nitrogen Oxides

3.9 Detailed dispersion modelling of road traffic emissions of NO_x has been undertaken using the latest version of ADMS Roads (currently v5), combined with the latest version – at the time of assessment – of Defra's Emissions Factor Toolkit (EFT v11). Defra released an update to the EFT (version 12) in December 2023 after the modelling had been carried out, and has therefore not been used in this assessment. The subsequent contribution of emitted NO_x to nitrogen deposition within the SAC has also been assessed.

3.10 Future fleet predictions were updated in EFT v11 (November 2021) for the fleet operating outside of London. However, the UK government's policy to ban the sale of new petrol and diesel cars and vans by 2035 (recently postponed from 2030) are not accounted for in the fleet information within the current version of the EFT. As such, a more up-to-date fleet projection for the future year fleet has been used, in line with recent DfT policy, which is discussed in more detail below in the "Modelled Vehicle Fleet" subsection. This takes account of the fact that a significant shift in the constitution of the UK vehicle fleet will arise during the 2030s.

3.11 As the latest year for which emission factors are available in EFT v11 is 2030, AECOM has used 2030 information for any later modelled years. This therefore offers a precautionary approach for Local Plan modelling as it would not account for any improvements in vehicle emission factors in the latter part of the plan period (even though such improvements are likely with the introduction of Euro 7 from c.2025 or the ban on the sale of new petrol and diesel cars and vans from 2035, recently postponed from 2030).

Ammonia

3.12 In February 2020, Air Quality Consultants developed and published the Calculator for Road Emissions of Ammonia (CREAM) tool, '*in order to allow tentative predictions regarding trends in traffic-related ammonia emissions over time*'. The tool is based upon remotely sensed pollutant measurements, published real-world fuel consumption data, and ambient measurements of ammonia recorded in Ashdown Forest (2014-2016).

3.13 The report that was published alongside 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*."

3.14 The CREAM tool currently uses vehicle fleet information from Defra's EFT v9 which has now been superseded. AECOM has therefore applied the ammonia emission factors, as derived by Air Quality Consultants and in the current version of CREAM, with the average vehicle fleet on rural roads from EFT v11 to estimate emissions in the SAC.

3.15 The latest version of ADMS Roads has been employed to model the dispersion of emissions of NH_3 from road traffic, consistent with the approach for modelling emissions of NO_x.

Traffic Data

3.16 The traffic data used for this assessment is based on the modelling undertaken for the Transport Assessment for two growth scenarios. The growth scenarios provide two different combinations of sites to enable comparison of impacts between sites and have both been assessed in this report.

3.17 The existing Local Plan mandates the construction of a minimum of 5,292 new homes from 2020 to 2029. As per the Draft Local Plan 2040, the borough requires 11,000 homes between 2020 and 2040, averaging approximately 550 homes annually. This housing requirement is divided between the

Northern and Southern Housing Market Areas of Test Valley. The Northern area is allocated 57% of the total (6,720 homes, or 313 annually), while the Southern area is allocated 43% (4,730 homes, or 237 annually). The numbers in Table 2 and Table 3 present the additional housing and employment requirements in addition to committed development for the two growth scenarios in more detail.

Table 2: Growth Scenarios 1 and 2 – Residential Sites

Site Name	Growth Option 1 (dwellings)	Growth Option 2 **(dwellings)**
Land east of Ludgershall	350	350
Land south of bypass	110	110
Land at Finkley Down Farm	900	0
Land at Manor Farm	800	800
Land at Bere Hill Farm	600	400
Land at Ganger Farm South	340	80
Land N King Edward Park St James Park Wheelhouse Park	44	44
Land south of A342 and east of Shoddesden Lane	0	1,150
Land south of Forest Lane	270	0
Brentry Nursery Jermyns Lane	0	250
Halterworth	0	1,150
Land at Bere Hill and Bayliffs Bottom	792	792
Packridge Farm and land south of Hoe Lane	150	0
Penton Corner	0	210
Land south of London Road	90	90
Velmore Farm / Castle Lane	1,070	0

Table 3: Growth Scenarios 1 and 2 – Employment Sites

Site Name	Growth Option 1 (m^2)	Growth Option 2 **(m^2)**
Land adj to Abbey Park	19,588	19,588
Land west of Ordnance Lane Weyhill	22,000	0
Land at Manor Farm (as part of residential-led mixed use development)	5,000	5,000
Kennels Farm	14,000	14,000
South side of Botley Road	3,200	0
Land at Upton Lane	29,500	29,500
Land at Harroway House	0	46,450
Upton Triangle	0	16,000
Land at Test Valley Business Park	0	12,000
Land south of Thruxton Aerodrome, north of A303	63,177	0
Velmore Farm / Castle Lane	5,700	0

3.18 The traffic data were provided for a series of road links within 200m of the Salisbury Plain, New Forest, Mottisfont Bats, Emer Bog and Solent Maritime SACs. These links were chosen as they are located on the busiest roads in the area that are expected to experience the greatest increase in flows over the Local Plan period. As such, these are the roads where an air quality effect due to additional traffic growth is most likely to be observed. The modelled road links in each of the SACs are shown in Figures 1 to 5.

3.19 Traffic data were provided for each of the road links, in the form of 24-hour Annual Average Daily Traffic (AADT) flows, with percentage heavy duty vehicle (HDV) flows and average speed for four scenarios – 2019 baseline (also used for the future baseline), future year ‘Do Minimum’ (or ‘Reference Case’), and two future year ‘Do Something’ Scenarios (Growth Options 1 and 2). A summary of the traffic data used in the air quality assessment is given in Annex A.1.

Modelled Vehicle Fleet

3.20 For the baseline modelling of the SAC, the nominal EFT v11 “Basic Split” rural fleet for the 2019 year was used, as this aligns well with the 2019 base year traffic data and 2019 meteorological data.

3.21 For the future year (2041) modelling, an approach has been taken to determine the vehicle fleet used in the modelling to apply a more up-to-date projection than that published in the EFT v11 in relation to the uptake of hybrid and zero emission / battery electric vehicles. A current vehicle fleet representative of the local area was determined, which was then projected forward to the future year (2041) following the methodology below.

3.22 The current (2022) fleet composition, from which the 2041 fleet projection is based, is derived from the most up-to-date available full-year dataset (2022) of registered light-duty vehicles (LDV) from DVLA (DVLA, 2022). A high-level review of the fleet characteristics for Test Valley Borough Council, neighbouring districts, and the South East and South West regions of England, revealed a high level of similarity in the fleet at local and regional levels. Additionally, given the presence of relatively long-distance motorways and A-roads/trunk roads within TVBC and the surrounding area, this is likely to give rise to a vehicle fleet that is characteristic of the wider south-east and south-west regions. Given this similarity, and to incorporate a dataset with a greater number of overall vehicles, it was decided to use the fleet characteristics at the combined South East and South West regional level as the starting point for the fleet projections.

3.23 Light Duty Vehicles (LDVs), which are mainly cars and light goods vehicles (LGVs), comprise the majority of vehicles in the overall fleet (approximately 95%), and therefore this dataset will give a robust and accurate starting point for future fleet projections. Heavy Duty Vehicles (HDVs) made up of buses, coaches and Heavy Goods Vehicles- HGVs), which comprise the remaining ~5% of the fleet, have been apportioned based on the EFT basic split for 2041. The exact LDV/HDV split varies according to the provided traffic data and depends on the road link, and the fleet breakdown for each road link takes this split into account.

3.24 Transport projections out to 2050 of UK’s intended decarbonisation of the fleet and alignment with Net Zero became available from the DfT’s Transport Decarbonisation Plan (TDP) (DfT, 2022). These projections are based on high and low ambition for rates of decarbonisation for every year up to 2050. These projections were adjusted to determine the breakdown of individual fuel types in line with the EFT v11.

3.25 To take a more cautious approach, the lower ambition “Decarbonising Transport Upper” projection was used to project the 2022-based current fleet out to the future year of 2041, by using the calculated year-on-year car, LGV and HDV growth rates for each vehicle fuel type. This projection was deemed to represent a more cautiously realistic scenario than either the EFT v11 or TDP baseline projections.

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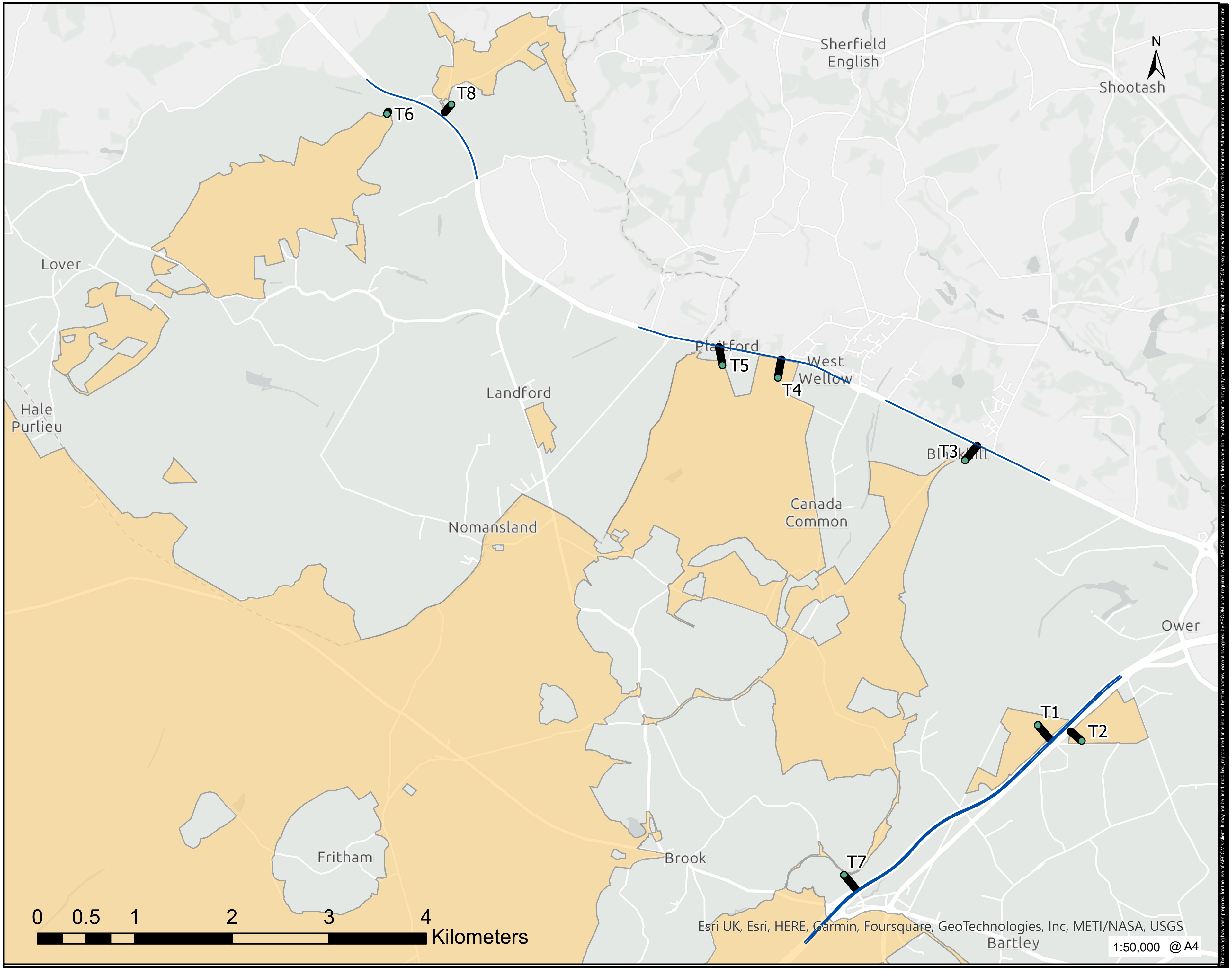

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AECOM Limited
Midpoint
Alencon Link
Basingstoke, RG21 7PP, United Kingdom
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LEGEND

- Road Links
- Transects
- SAC New Forest

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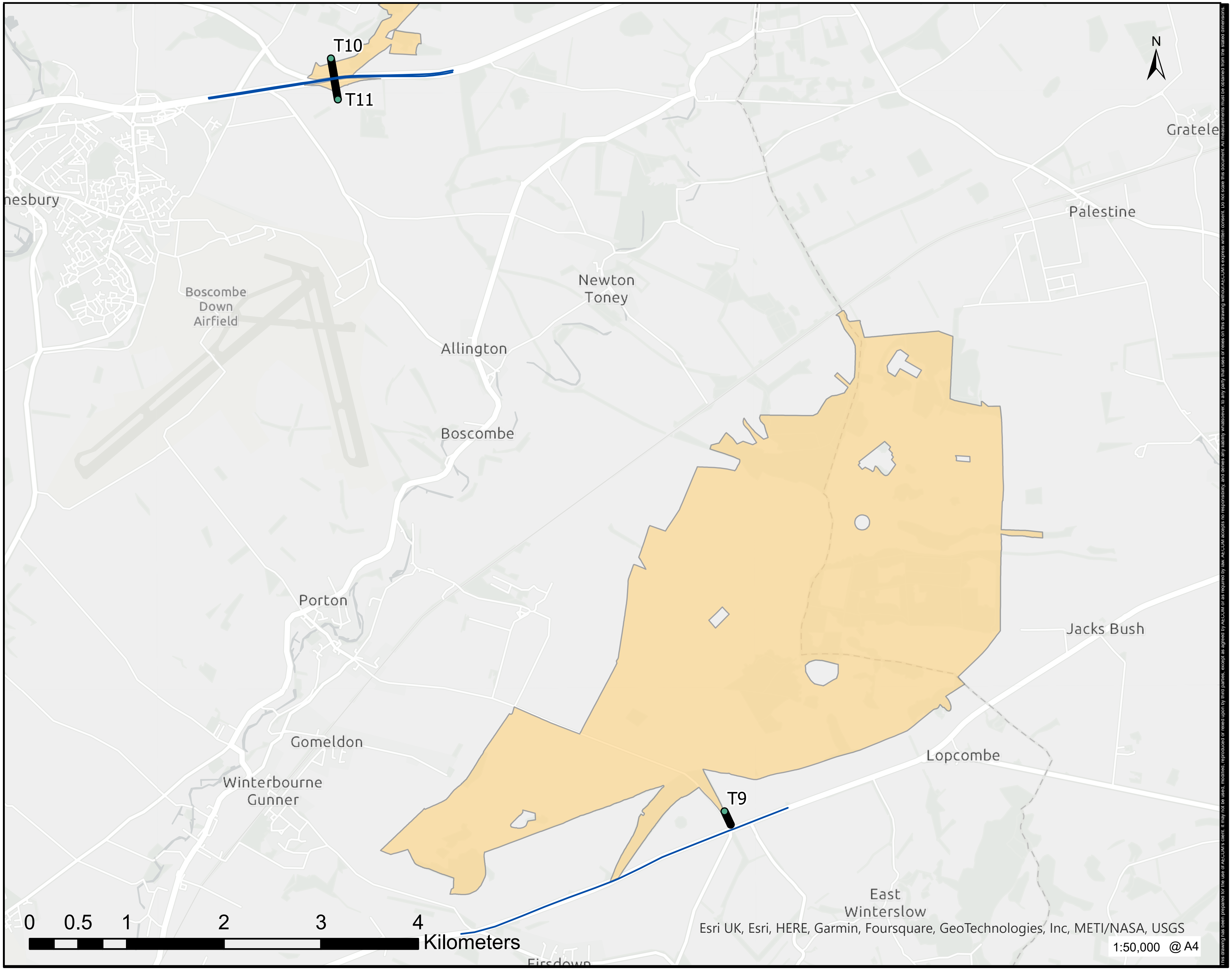
SHEET TITLE

Modelled Road Network and Ecological Receptor Transects

SHEET NUMBER

Figure 1

Revision: Rev No. Drawn: VK Checked: JM Approved: AS Date: 11/12/2023



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LEGEND
- Road Links
- Transects
- SAC Salisbury Plain

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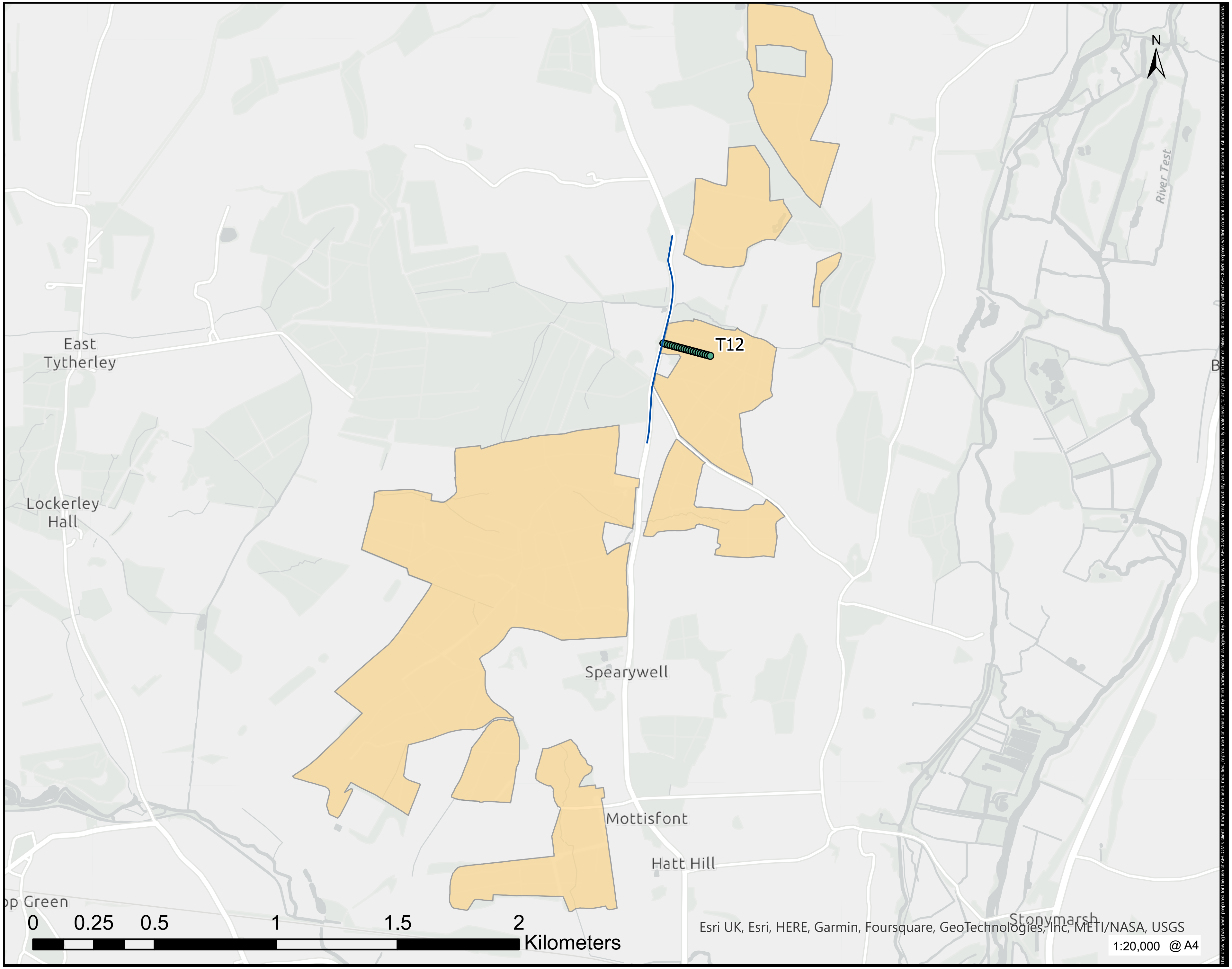
SHEET TITLE
Modelled Road Network and Ecological Receptor Transects

SHEET NUMBER
Figure 2

Revision: Rev No. Drawn: VK Checked: JM Approved: AS Date: 11/12/2023



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LEGEND

Road Links
Transects
SAC Mottisfont Bats

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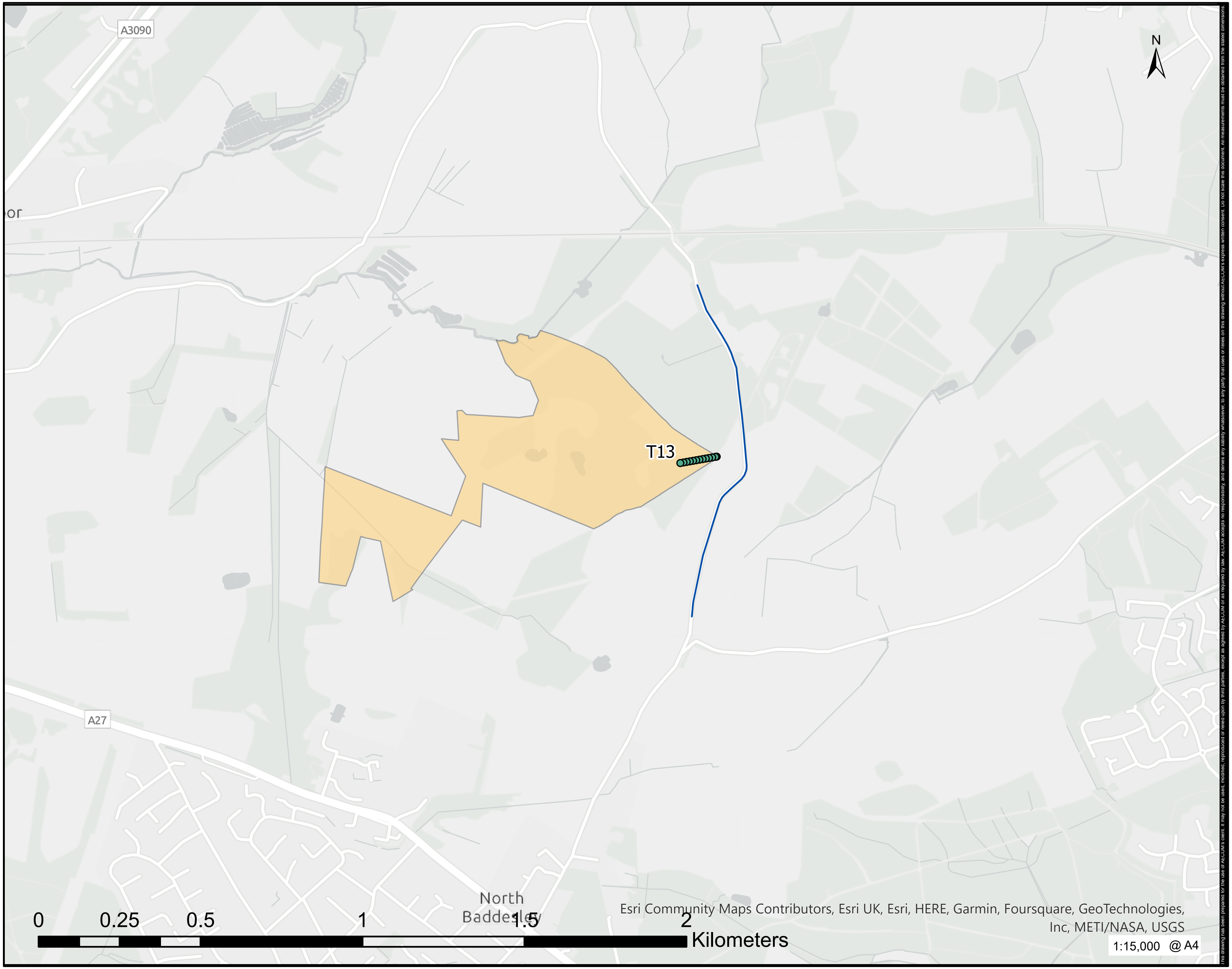
SHEET TITLE

Modelled Road Network and Ecological Receptor Transects

SHEET NUMBER

Figure 3



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LEGEND

- Road Links
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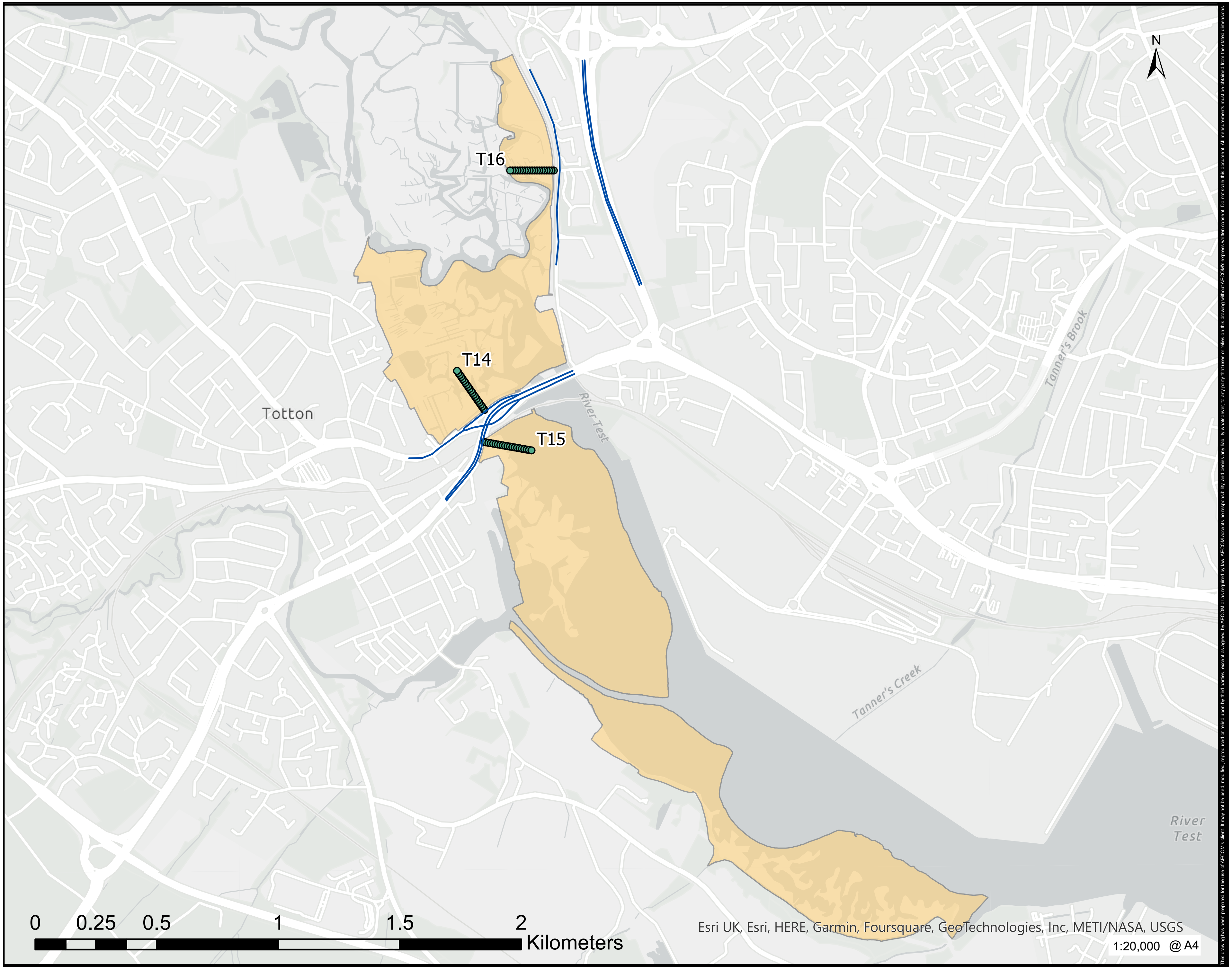
SHEET TITLE

Modelled Road Network and Ecological Receptor Transects

SHEET NUMBER

Figure 4

Revision: Rev No. Drawn: VK Checked: JM Approved: AS Date: 11/12/2023



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LEGEND

- Road Links
- Transects
- SAC Solent Maritime

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Modelled Road Network and Ecological Receptor Transects

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Figure 5

Receptors

3.26 Pollutant concentrations and deposition rates have been predicted along defined transects within the SAC within 200m of affected roads, in accordance with National Highways guidance for ecological assessments (LA105) (DMRB, 2019) and Natural England guidance (Natural England, 2018). The greatest impacts from changes in road traffic emissions will be observed and modelled closest to the roadside. Consideration of the road network within 200m of the SAC is therefore considered robust as background concentrations utilised in the assessment will account for all other sources that are not defined explicitly in the model.

3.27 The locations of the ecological transects relevant to this project were agreed with TVBC and other stakeholders. The transects are situated at key locations where the greatest impacts upon each of the five SACs assessed are likely to occur. The locations are presented in Figures 1 to 5 and further details are presented in Annex A.2.

3.28 For each SAC, the receptors are situated at the closest point to the road within the SAC, and spaced every 10m within the transects, up to 200m from the roadside. All receptors are modelled at ground level (0m height).

3.29 The greatest impacts will generally occur where both the greatest change in traffic flows is expected and the SAC habitats lies closest to the road. This information has been used to select transect locations. The usual approach is to place a transect on a modelled link (sometimes having a transect either side of the road to account for differences in the dispersion of emissions due to meteorology), with each link being defined as a stretch of road between changes in emissions i.e. where there are changes in traffic flows and/or speeds.

3.30 The modelled transects presented in Figure 1 to Figure 5 provide good coverage of the SACs, match well to previously modelled transects, and avoid modelling in areas where there is only woodland within 200m of the road. This is based on confirmation from Natural England that woodland is not an SAC interest feature, only a Site of Special Scientific Interest (SSSI) interest feature.

Model Setup

3.31 As detailed above, road traffic emissions of NO_x were derived using the latest version of Defra's Emissions Factor Toolkit (EFT v11) at the time of assessment, and associated guidance and tools (Defra, 2022). For the base year (2019), the nominal EFT "Basic Split" rural vehicle fleet for 2019 was used, whereas for all the future year (2041) scenarios, the 2041 projected fleet as described in the methodology above was used with the default 2030 EFT emission factors. Road traffic emissions of NH_3 were derived using emission rates CREAM V1A (Air Quality Consultants, 2020) combined with the EFT v11 vehicle fleet for the relevant year, using the same vehicle fleet methodology as described above for NO_X.

3.32 Detailed dispersion modelling was undertaken using the current version of ADMS-Roads (v5.0) to model concentrations of NO_x and NH_3 using the parameters in Table 4 for the following scenarios:

- 2019 Baseline – 2019 AADT, 2019 emission factors and 2019 "Basic Split" fleet, and 2019 background concentrations;
- 2041 Future Baseline – 2019 AADT, 2030 emission factors (latest available year), 2039 projected vehicle fleet, and 2030 background concentrations (the latest projected year available from Defra);
- 2041 Do Minimum (Reference Case) – 2041 AADT without Local Plan but with all committed development, 2030 emission factors, 2041 projected vehicle fleet, and 2030 background concentrations;
- 2041 Do Something 1– 2041 AADT with Local Plan using growth scenario 1, 2030 emission factors, 2041 projected vehicle fleet, and 2030 background concentrations; and
- 2041 Do Something 2– 2041 AADT with Local Plan using growth scenario 2, 2030 emission factors, 2041 projected vehicle fleet, and 2030 background concentrations.

3.33 A baseline year was modelled to provide a means of model verification – for this assessment, 2019 traffic data were provided for the modelled baseline. To support the assessment of the potential impact of the planned development in the Local Plan scenarios, a 'future baseline' and future year 'do minimum' scenario were modelled. The 'do minimum' scenario includes the influence of development in neighbouring local authorities, whereas the 'future baseline' does not.

3.34 The future baseline is a hypothetical scenario as it applies improvements in vehicle emissions standards to the baseline vehicle fleet without allowing for any traffic growth. However, such an approach enables the 'in combination' effect of development and traffic growth to be seen unobscured by improvements in emissions technology / performance.

3.35 The difference between the 'do something' and the 'do minimum' scenarios provides the impact of the planned development within the Local Plan, alone. The difference between the 'do something' and the 'future baseline' scenarios provides a thorough and precautionary assessment of the impact of the planned development within the Local Plan 'in combination', as the 'future baseline' accounts for no future growth.

Table 4: General ADMS-Roads Model Conditions

Variables	ADMS-Roads Model Input
Surface roughness at source	0.5m
Surface roughness at Meteorological Site	0.2m
Minimum Monin-Obukhov length for stable conditions	30m
Terrain types	Flat
Receptor location	x, y coordinates determined by GIS, z = 0m for ecological receptors.
Emissions	NO_x – Defra's EFT v11 NH_3 – CREAM V1A
Meteorological data	1 year (2019) hourly sequential data from Boscombe Down meteorological station.
Receptors	Ecological transects
Model output	Long-term (annual) mean NO_x and NH_3 concentrations.

Plume Depletion

3.36 Plume depletion due to dry deposition onto vegetation was taken into account in the model. This was enabled by using the ADMS-Roads 'Dry Deposition' module, applying the 'grassland' deposition rates presented in the Air Quality Technical Advisory Group (AQTAG) deposition velocities that are cited in 2020 IAQM guidance (IAQM, 2020), as shown in Table 5.

3.37 The deposition velocity for NO_2 was applied to raw modelled NO_x. This assumes that 100% of NO_x is emitted as NO_2, and therefore represents an optimistic depletion of NO_x from the atmosphere.

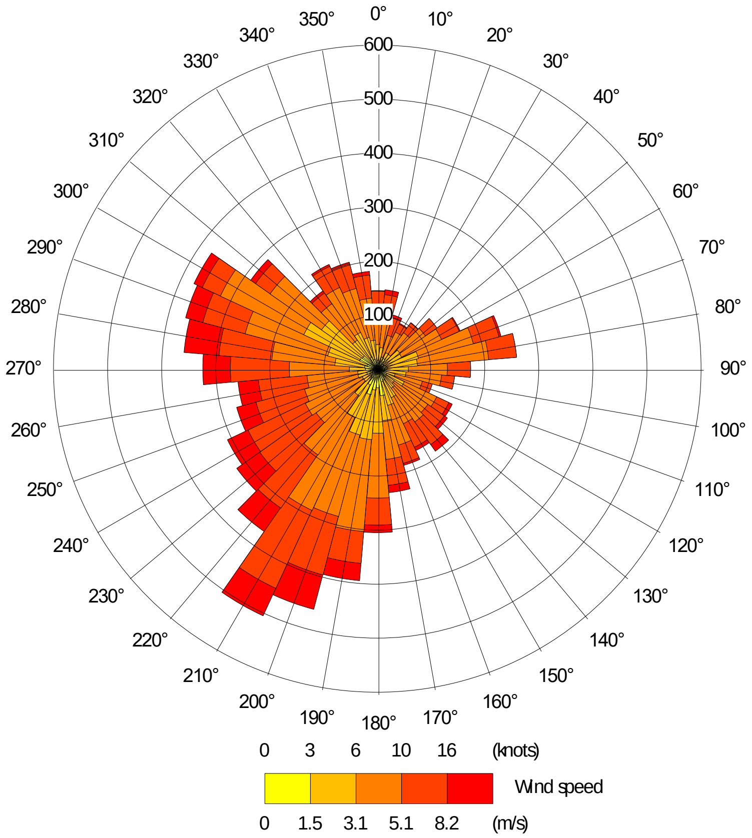
Table 5: Nitrogen Deposition Velocities and Conversion Rates

Pollutant	Habitat	Nitrogen deposition conversion rates	Deposition velocity
NO_2	Grassland / short vegetation	1 µg/m^3 NO_2 = 0.14 kgN/ha/yr	0.0015 m/s
NH_3	Grassland / short vegetation	1 µg/m^3 NH_3 = 5.2 kgN/ha/yr	0.020 m/s

Meteorological Data

3.38 One year (2019) of hourly sequential observation data from Boscombe Down meteorological station has been used in this assessment to correspond with the baseline traffic data and emission factors. The station is located in a rural setting approximately 2 km south of the A303 near Amesbury, along which two of the sixteen transects considered in the study are located, and experiences meteorological conditions that are representative of those experienced within the overall air quality study area. Figure 6 shows that the dominant direction of wind was from the south-west, as is typical for the UK.

Figure 6: Wind Rose, Boscombe Down Meteorological Data, 2019



Background Data

3.39 Background concentrations of nitrogen dioxide (NO_2) and NO_x for 2019 and 2030 were sourced from Defra's 2018-based 1x1km background maps in the study area (Defra, 2020a).

3.40 Contributions from explicitly modelled source sectors were removed from the NO_2 and NO_x background concentrations, as outlined in Table 6, in accordance with Defra guidance (Defra, 2022). The data presented in Table 6 show that the concentrations are predicted to decrease between 2019 and 2030.

3.41 The NH_3 background concentrations from APIS are presented in Table 7.

Table 6: Defra Mapped Background Pollutant Concentrations

Transects	Road Name	Grid Square (X, Y)	Annual Mean Concentrations (µg/m³)			
			2019 NO_2	2019 NO_x	2030 NO_2	2030 NO_x
T1	M27	431500, 115500	10.4	13.7	7.4	9.5
T2	M27	431500, 115500	10.4	13.7	7.4	9.5
T3	A36	430500, 118500	9.0	11.8	6.8	8.7
T4	A36	428500, 119500	8.4	10.9	6.4	8.1
T5	A36	427500, 119500	8.2	10.6	6.2	7.9
T6	A36	424500, 121500	7.4	9.6	5.7	7.2
T7	M27	429500, 113500	10.4	13.7	7.1	9.1
T8	A36	425500, 121500	7.8	10.0	6.0	7.6
T9	A30	422500, 134500	8.0	10.3	6.0	7.6
T10	A303	418500, 142500	8.0	10.4	6.0	7.6
T11	A303	418500, 142500	8.0	10.4	6.0	7.6
T12	B3084	431500, 128500	7.9	10.3	6.0	7.7
T13	Pound Lane	440500, 121500	10.9	14.5	8.1	10.5
T14	A35, A36	436500, 113500	16.6	23.1	12.0	16.2
T15	A35, A36	436500, 113500	16.6	23.1	12.0	16.2
T16	M271, Test Lane	436500, 114500	13.6	18.6	10.2	13.6

Note: Sectors removed as emissions included in detailed dispersion modelling: Motorway (in of 1x1km grid square) and Trunk A road (in of 1x1km grid square)

Ecological Data

3.42 APIS provides 'a searchable database and information on pollutants and their impacts on habitats and species'. For each of the five SACs assessed, data for the appropriate habitat have been applied for each receptor along each transect in the study. Data applicable to forest habitat was used for transects T1 to T8 in the New Forest SAC, and also for the Mottisfont Bats and Emer Bog SACs, while that pertaining to short vegetation or grassland was used for the transects in the Salisbury Plain and Solent Maritime SACs. This includes critical loads of nitrogen and the average nitrogen and acid deposition rates to the habitat, as presented in Table 7.

3.43 Background concentrations of ammonia were also sourced from 5x5 km modelled maps available from APIS, whereas background concentrations of NO_x and NO_2 were sourced from Defra's latest 1x1 km maps, thereby accounting for all sources that are not explicitly defined in the model.

3.44 While gorse scrub and other shrubs are likely to be present within the SACs assessed, they are not of significance to heathland integrity in dense stands. The deposition velocity to short vegetation is applicable where such shrubs are interspersed as part of the heathland matrix.

3.45 In order to create a robust and scientifically agreed projection for background nitrogen deposition trends in the UK, even allowing for growth, the Joint Nature Conservation Committee (JNCC) commissioned the Nitrogen Futures project, which reported in 2020 (JNCC, 2020). The JNCC Nitrogen Futures project investigated whether a net improvement in nitrogen deposition (including expected development over the same period) was expected to occur to 2030 under a range of scenarios ranging from the most cautious scenario (Business As Usual, BAU, reflecting simply existing emission reduction commitments /measures already in place) to much more ambitious scenarios that would require varying amounts of additional, currently uncommitted, measures from the UK government and devolved administrations.

3.46 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* NO_x*)']. This is estimated to achieve the UK Government's Clean Air Strategy (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, including the most cautious (2030 BAU). For the BAU scenario nitrogen deposition was forecast to decrease between 2017 and 2030 from 277.1 kt N to 239.5 kt N (i.e. a reduction of 37.6 kt N).

3.47 Background nitrogen deposition at Ashdown Forest was specifically discussed in Annex 5 of the report as a case study. The report predicted a 1-2 kgN/ha/yr reduction in background nitrogen deposition to low growing vegetation (i.e. the heathland interest feature) at the SAC between 2016 and 2030, depending on scenario, and noted that *'The emission reductions predicted between the 2017 and 2030 baseline scenarios cover a range of sectors, including road transport, and so improvements are predicted to occur over the whole site, including the worst-affected roadside locations'*. This was the case under all modelled scenarios.

3.48 In summary, the Nitrogen Futures study forecast a minimum rate of improvement in background nitrogen of 0.07 kgN/ha/yr at Ashdown Forest, with other forecasts indicating a greater rate of reduction. In line with the forecast for Ashdown Forest, and therefore taking a precautionary approach, this study applies a projected decrease in background nitrogen of 0.07 kgN/ha/yr. The corresponding decrease is also reflected in the total average acid deposition rate for nitrogen in the future scenarios (reduction of 0.065 keq/ha/yr N.).

3.49 Over the 20-year period, this equates to a reduction in the APIS background nitrogen deposition rate presented in Table 7 (3-year average, 2019-21) of 1.47 kg N/ha/yr for the 2041 model scenarios. This decrease is also reflected in the total average acid deposition rate for nitrogen in the 2041 scenarios (reduction of 0.105 keq/ha/yr N).

3.50 No other changes to the APIS data have been made from those presented (3-year average, 2019-21) for any modelled scenario.

3.51 Not to make *any* allowance for improvements in emission factors or background concentrations would result in increased emissions and hence concentrations over the plan period as an increased number of vehicles is expected on the roads. This is not expected to occur as can be seen from previous long-term trends in the UK, which show slowing of improvements over extended periods, not worsening. Historical records (e.g., Defra monitoring trends) show that as increased vehicles enter the fleet that these increases are offset by the improvements in the emissions of the newer vehicles and the removal of older vehicles.

3.52 In 2018 the Court of Justice of the European Union (CJEU) ruled in cases C-293/17 and C-294/17 (often dubbed the Dutch Nitrogen cases). One aspect of that ruling concerned the extent to which autonomous measures (i.e., improvements in baseline nitrogen deposition that are not attributable to the Local Plan) can be taken into account in appropriate assessment, the CJEU ruled that it <u>*was*</u> legally compliant to take such autonomous measures into account provided the benefits were not 'uncertain' (paragraphs 130&132). Note that previous case law on the interpretation of the Habitats Directive has clarified that 'certain' does not mean absolute certainty but '*where no <u>reasonable</u> scientific doubt remains*'[4] [emphasis added].

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

- When it comes to forecasting the NO_x emissions of additional traffic, it would overestimate those emissions to assume that by 2041 the emission factors will be no different to those in 2019; to make such an assumption would be to fail to take account of the expected continued uptake of Euro 6 compliant vehicles between 2019 and 2041 and would assume (putting it simply) that no motorists would replace their cars during the entire plan period. For example,

[4] Case C-239/04 Commission v Portugal [2006] ECR 10183, para. 24; Holohan et al vs. An Bord Pleanála (C-461/17), para. 33

the latest (Euro 6/VI) emissions standard only became mandatory in 2014 (for heavy duty vehicles) and 2015 (for cars) and the effects will not therefore be visible in the data available from APIS because relatively few people will have been driving vehicles compliant with that standard as early as 2019. Far more drivers can be expected to be using Euro 6 compliant vehicles by the end of the Local Plan period.

- The vehicle emission factors within the air quality modelling tools available only project out to 2030. While the fuel technology is projected out to 2041 following the DfT decarbonisation pathway, as described earlier, the breakdown of euro classifications published in the EFT extends to 2030, and so the 2041 assessment year does not recognise continued uptake of more stringent emissions standards. Therefore, the results are likely to be cautious in terms of emissions related to vehicle age.

Table 7: APIS Data for Ecological Transects for 2019-2021

Transect	Av. N Dep kgN/ha/yr$	Critical Load N Dep kgN/ha/yr	Total Av. Acid Dep keq/ha/yr N$	Critical Load N Acid Dep keq/ha/yr MaxCLMinN-MaxCLMaxN	Background NH_3 (µg/m^3)*
T1	23.58	5 - 10	1.73	0.357-2.918	1.25
T2	23.58	5 - 10	1.73	0.357-2.918	1.25
T3	24.43	5 - 10	1.78	0.357-2.918	1.37
T4	24.75	5 - 10	1.79	0.357-2.918	1.47
T5	24.77	5 - 10	1.79	0.357-2.918	1.49
T6	25.38	5 - 10	1.83	0.357-2.918	1.48
T7	23.03	5 - 10	1.68	0.357-2.918	1.17
T8	25.34	5 - 10	1.83	0.357-2.918	1.50
T9	16.07	5 - 15	1.15	0.892-5.052	1.57
T10	15.67	5 - 15	1.12	0.892-5.052	1.55
T11	15.67	5 - 15	1.12	0.892-5.052	1.55
T12	25.93	10 - 15	1.89	0.357-8.707	1.43
T13	25.70	5 - 15	1.94	0.321-0.598	1.29
T14	25.70	5 - 15	1.94	0.321-0.606	1.34
T15	13.76	5 - 10	1.05	1.071-5.071	1.34
T16	13.76	5 - 10	1.05	1.071-5.071	1.36

Note:
$ Average nitrogen deposition rate (kgN/ha/yr) projected to decrease by 1.47 kgN/ha/yr from base year to future year (i.e. 0.07 x 21 years = 1.47 kgN/ha/yr). This results in a corresponding decrease in acid deposition of 0.10 keq/ha/yr N.
* Average 2019NH_3 background concentration applied in modelling assessment = 1.40 µg/m^3

Verification

3.54 Model verification is the process by which the performance of the model is assessed to identify any discrepancies between modelled and measured concentrations at air quality monitoring sites within the study area.

3.55 There are no appropriately located local air quality monitoring stations within the model domain with which to make a comparison between modelled and measured concentrations. Therefore, verification factors have been used based upon professional judgement and experience of similar projects. Verification factors of 1.5 for NO_X and 1.0 for NH_3 have been applied based on previous verification and validation of the EFT and CREAM tools.

Deposition velocities

3.56 Deposited nitrogen from road traffic derived NH_3 and NO_2 was estimated using the deposition velocities presented in Table 5. The conversion rates were applied to the final modelled NO_2 and NH_3 concentrations from road traffic, to provide kgN/ha/year. All of the transects across all five SACs were modelled and analysed as heathland / grassland i.e. ‘short vegetation’ was used at all locations. As some transects were in forest habitat, this would give a conservative approach to plume depletion as a result of dry deposition at these locations.

4. References

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5. Annexes

Traffic Data

Link	2019 Base AADT	2019 Base HDV %	2019 Base Speed (km/h)	2041 DM AADT	2041 DM HDV %	2041 DM Speed (kph)	2041 DS1 AADT	2041 DS1 HDV %	2041 DS1 Speed (kph)	2041 DS2 AADT	2041 DS2 HDV %	2041 DS2 Speed (kph)
Pound Lane (south of Green Lane)	1,346	0.0	52	5,342	0.0	52	6,150	0.0	52	5,399	0.0	52
B3084	2,495	5.1	86	6,571	3.8	86	6,952	4.4	92	7,031	4.3	92
Test Lane	1,646	0.4	75	6,363	5.8	75	6,991	6.7	79	7,494	6.5	79
M271 junction NB	28,242	7.1	109	30,247	5.0	109	29,864	5.0	109	30,073	4.9	109
M271 junction SB	27,414	8.6	94	33,547	6.8	94	32,661	6.5	109	33,079	6.4	109
A35 Totton Bypass EB	16,327	8.1	71	22,361	6.0	71	22,430	4.7	80	22,362	4.8	80
A35 Totton Bypass WB	17,102	10.5	74	24,973	8.1	74	24,890	6.6	80	24,904	6.6	80
A35 Redbridge Causeway EB	20,575	6.3	63	28,738	5.3	63	28,900	4.1	80	28,649	4.3	80
A35 Redbridge Causeway WB	22,395	8.0	70	32,253	6.8	70	32,156	5.7	80	32,150	5.7	80
A36	13,846	4.1	40	16,887	5.8	40	17,149	6.3	40	17,089	6.3	40
A36 NB	6,827	3.7	40	7,543	7.4	40	7,588	8.9	40	7,597	8.6	40
A36 SB	7,019	4.5	40	9,344	4.6	40	9,561	4.3	40	9,492	4.5	40
Eling Hill	1,552	0.0	39	2,813	0.0	39	2,764	0.0	39	2,748	0.0	39
Marchwood Road/ Bury Road	11,302	6.9	58	12,769	7.9	58	12,722	8.1	63	12,730	8.1	63
Gover Road (Access Roads)	991	1.2	37	1,900	1.3	37	2,115	2.5	39	2,014	2.9	39
A303 W	23,842	10.0	93	22,484	15.4	93	24,727	10.9	93	25,067	10.7	93
A303 E EB	19,542	7.0	93	21,312	6.4	93	21,338	6.8	93	21,331	6.8	93
A303 E WB	22,955	7.2	93	26,986	6.3	93	26,959	6.8	93	26,944	6.8	93
A30	11,748	9.4	72	15,707	8.0	72	15,595	8.4	72	15,602	8.4	72
A36 W	14,755	13.7	68	16,774	12.2	68	16,856	7.1	68	16,801	7.1	68
A36 E	13,584	14.3	70	14,598	14.9	70	14,416	6.4	70	14,449	6.4	70

Link	2019 Base AADT	2019 Base HDV %	2019 Base Speed (km/h)	2041 DM AADT	2041 DM HDV %	2041 DM Speed (kph)	2041 DS1 AADT	2041 DS1 HDV %	2041 DS1 Speed (kph)	2041 DS2 AADT	2041 DS2 HDV %	2041 DS2 Speed (kph)
M27 EB	36,877	8.7	105	47,935	8.3	105	48,175	8.1	109	48,225	8.0	109
M27 WB	40,372	6.7	109	49,171	7.1	109	49,017	7.2	109	49,134	7.1	109

Modelled Ecological Receptor Locations

Transect 1	X co-ordinate (m)	Y co-ordinate (m)	Transect 2	X co-ordinate (m)	Y co-ordinate (m)
T1_21m	431156	115307	T2_51.5m	431378	115379
T1_30m	431150	115314	T2_60m	431384	115373
T1_40m	431144	115322	T2_70m	431392	115367
T1_50m	431137	115330	T2_80m	431400	115360
T1_60m	431131	115337	T2_90m	431407	115354
T1_70m	431124	115345	T2_100m	431415	115347
T1_80m	431118	115353	T2_110m	431423	115341
T1_90m	431111	115360	T2_120m	431430	115335
T1_100m	431105	115368	T2_130m	431438	115328
T1_110m	431099	115375	T2_140m	431446	115322
T1_120m	431092	115383	T2_150m	431453	115315
T1_130m	431086	115391	T2_160m	431461	115309
T1_140m	431079	115398	T2_170m	431469	115302
T1_150m	431073	115406	T2_180m	431476	115296
T1_160m	431066	115414	T2_190m	431484	115290
T1_170m	431060	115421	T2_200m	431492	115283
T1_180m	431054	115429			
T1_190m	431047	115437			
T1_200m	431041	115444			

Transect 3	X co-ordinate (m)	Y co-ordinate (m)	Transect 4	X co-ordinate (m)	Y co-ordinate (m)
T3_5.75m	430416	118319	T4_5.25m	428399	119208
T3_10m	430414	118316	T4_10m	428399	119208
T3_20m	430407	118308	T4_20m	428397	119198
T3_30m	430401	118300	T4_30m	428395	119188
T3_40m	430394	118293	T4_40m	428394	119178
T3_50m	430388	118285	T4_50m	428392	119168
T3_60m	430381	118277	T4_60m	428390	119159
T3_70m	430375	118270	T4_70m	428388	119149
T3_80m	430369	118262	T4_80m	428387	119139
T3_90m	430362	118254	T4_90m	428385	119129
T3_100m	430356	118247	T4_100m	428383	119119
T3_110m	430349	118239	T4_110m	428382	119109
T3_120m	430343	118231	T4_120m	428380	119100
T3_130m	430336	118224	T4_130m	428378	119090
T3_140m	430330	118216	T4_140m	428376	119080

T3_150m	430324	118208	T4_150m	428375	119070
T3_160m	430317	118201	T4_160m	428373	119060
T3_170m	430311	118193	T4_170m	428371	119050
T3_180m	430304	118185	T4_180m	428369	119040
T3_190m	430298	118178	T4_190m	428368	119031
T3_200m	430291	118170	T4_200m	428366	119021

Transect 5	X co-ordinate (m)	Y co-ordinate (m)	Transect 6	X co-ordinate (m)	Y co-ordinate (m)
T5_3.75m	427761	119336	T6_173.5m	424355	121760
T5_10m	427761	119336	T6_180m	424352	121754
T5_20m	427763	119326	T6_190m	424348	121745
T5_30m	427765	119317	T6_200m	424344	121736
T5_40m	427766	119307			
T5_50m	427768	119297			
T5_60m	427770	119287			
T5_70m	427772	119277			
T5_80m	427773	119267			
T5_90m	427775	119258			
T5_100m	427777	119248			
T5_110m	427779	119238			
T5_120m	427780	119228			
T5_130m	427782	119218			
T5_140m	427784	119208			
T5_150m	427786	119198			
T5_160m	427787	119189			
T5_170m	427789	119179			
T5_180m	427791	119169			
T5_190m	427793	119159			
T5_200m	427794	119149			

Transect 7	X co-ordinate (m)	Y co-ordinate (m)	Transect 8Ea	X co-ordinate (m)	Y co-ordinate (m)
T7_15.5m	429165	113761	T8_44.5m	424938	121752
T7_20m	429162	113765	T8_50m	424941	121756
T7_30m	429156	113772	T8_60m	424948	121764
T7_40m	429150	113780	T8_70m	424954	121772
T7_50m	429143	113788	T8_80m	424961	121779
T7_60m	429137	113795	T8_90m	424967	121787
T7_70m	429130	113803	T8_100m	424974	121794
T7_80m	429124	113811	T8_110m	424980	121802

T7_90m	429117	113818	T8_120m	424986	121810
T7_100m	429111	113826	T8_130m	424993	121817
T7_110m	429105	113834	T8_140m	424999	121825
T7_120m	429098	113841	T8_150m	425006	121833
T7_130m	429092	113849			
T7_140m	429085	113857			
T7_150m	429079	113864			
T7_160m	429072	113872			
T7_170m	429066	113880			
T7_180m	429060	113887			
T7_190m	429053	113895			
T7_200m	429047	113903			

Transect 9	X co-ordinate (m)	Y co-ordinate (m)	Transect 10	X co-ordinate (m)	Y co-ordinate (m)
T9_49m	422947	134742	T10_5.25m	418866	142437
T9_50m	422946	134743	T10_10m	418866	142441
T9_60m	422942	134752	T10_20m	418864	142451
T9_70m	422938	134761	T10_30m	418862	142461
T9_80m	422934	134770	T10_40m	418860	142471
T9_90m	422929	134779	T10_50m	418859	142481
T9_100m	422925	134788	T10_60m	418857	142491
T9_110m	422921	134797	T10_70m	418855	142500
T9_120m	422917	134806	T10_80m	418853	142510
T9_130m	422913	134815	T10_90m	418852	142520
T9_140m	422908	134824	T10_100m	418850	142530
T9_150m	422904	134833	T10_110m	418848	142540
T9_160m	422900	134842	T10_120m	418847	142550
T9_170m	422896	134851	T10_130m	418845	142559
T9_180m	422891	134860	T10_140m	418843	142569
T9_190m	422887	134869	T10_150m	418841	142579
T9_200m	422883	134878	T10_160m	418840	142589
			T10_170m	418838	142599
			T10_180m	418836	142609
			T10_190m	418834	142619
			T10_200m	418833	142628

Transect 11	X co-ordinate (m)	Y co-ordinate (m)	Transect 12	X co-ordinate (m)	Y co-ordinate (m)
T11_0.25m	418869	142403	T12_0.35m	431751	128800
T11_10m	418871	142394	T12_10m	431760	128797

T11_20m	418873	142384	T12_20m	431770	128794
T11_30m	418874	142374	T12_30m	431780	128792
T11_40m	418876	142364	T12_40m	431789	128789
T11_50m	418878	142354	T12_50m	431799	128787
T11_60m	418879	142345	T12_60m	431809	128784
T11_70m	418881	142335	T12_70m	431818	128781
T11_80m	418883	142325	T12_80m	431828	128779
T11_90m	418885	142315	T12_90m	431838	128776
T11_100m	418886	142305	T12_100m	431847	128774
T11_110m	418888	142295	T12_110m	431857	128771
T11_120m	418890	142285	T12_120m	431867	128769
T11_130m	418892	142276	T12_130m	431876	128766
T11_140m	418893	142266	T12_140m	431886	128763
T11_150m	418895	142256	T12_150m	431896	128761
T11_160m	418897	142246	T12_160m	431905	128758
T11_170m	418899	142236	T12_170m	431915	128756
T11_180m	418900	142226	T12_180m	431925	128753
T11_190m	418902	142216	T12_190m	431934	128750
T11_200m	418904	142207	T12_200m	431944	128748

Transect 13	X co-ordinate (m)	Y co-ordinate (m)	Transect 14	X co-ordinate (m)	Y co-ordinate (m)
T13_85.95m	440172	121453	T14_3.55m	436675	113528
T13_90m	440168	121452	T14_10m	436671	113534
T13_100m	440158	121450	T14_20m	436665	113542
T13_110m	440149	121449	T14_30m	436660	113550
T13_120m	440139	121447	T14_40m	436654	113558
T13_130m	440129	121445	T14_50m	436648	113566
T13_140m	440119	121444	T14_60m	436642	113575
T13_150m	440109	121442	T14_70m	436637	113583
T13_160m	440099	121440	T14_80m	436631	113591
T13_170m	440090	121438	T14_90m	436625	113599
T13_180m	440080	121437	T14_100m	436619	113607
T13_190m	440070	121435	T14_110m	436614	113616
T13_200m	440060	121433	T14_120m	436608	113624
			T14_130m	436602	113632
			T14_140m	436596	113640
			T14_150m	436591	113648
			T14_160m	436585	113656
			T14_170m	436579	113665

Transect 15	X co-ordinate (m)	Y co-ordinate (m)	Transect 16	X co-ordinate (m)	Y co-ordinate (m)
			T14_180m	436574	113673
			T14_190m	436568	113681
			T14_200m	436562	113689
T15_2.85m	436674	113396	T16_20.5m	436960	114514
T15_10m	436681	113395	T16_30m	436951	114514
T15_20m	436691	113393	T16_40m	436941	114514
T15_30m	436701	113391	T16_50m	436931	114514
T15_40m	436711	113390	T16_60m	436921	114514
T15_50m	436721	113388	T16_70m	436911	114514
T15_60m	436731	113386	T16_80m	436901	114514
T15_70m	436741	113384	T16_90m	436891	114514
T15_80m	436750	113383	T16_100m	436881	114514
T15_90m	436760	113381	T16_110m	436871	114514
T15_100m	436770	113379	T16_120m	436861	114514
T15_110m	436780	113377	T16_130m	436851	114514
T15_120m	436790	113376	T16_140m	436841	114514
T15_130m	436800	113374	T16_150m	436831	114514
T15_140m	436809	113372	T16_160m	436821	114514
T15_150m	436819	113371	T16_170m	436811	114514
T15_160m	436829	113369	T16_180m	436801	114514
T15_170m	436839	113367	T16_190m	436791	114514
T15_180m	436849	113365	T16_200m	436781	114514
T15_190m	436859	113364			
T15_200m	436869	113362			

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