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CONSULTANTS

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Ecological Sites, Eastleigh Borough Council

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Experts in air quality
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Contents

Tables

Figures

1 Introduction

1.1 This report describes the potential air quality impacts associated with the Eastleigh Borough Local Plan on the following European protected ecological sites:

- River Itchen Special Area of Conservation (SAC);
- the Solent Maritime SAC; and
- the Solent and Southampton Water Special Protection Area (SPA) and Ramsar site.

1.2 This assessment has been carried out by Air Quality Consultants Ltd. On behalf of Eastleigh Borough Council. A summary of the professional experience of the staff contributing to this assessment is provided in Appendix A1. The results of the assessment will feed into the Habitats Regulation Assessment being prepared for the Eastleigh Borough Local Plan by Urban Edge Consulting.

1.3 This assessment considers the potential for adverse impacts on the European ecological sites that may occur as a result of the increase in emissions on roads with the borough, due to all the development (completed, permitted and new allocations) outlined in the 2016 – 2036 Eastleigh Borough Local Plan.

1.4 The River Itchen SAC has been designated due to the presence of the Southern Damselfly and also for its aquatic habitats, fish and otters. Eastleigh Borough Council is particularly concerned with how the increase in road emissions will impact on the Southern Damselfly population. The Solent Maritime SAC and Solent and Southampton Water SPA and Ramsar site have been designated for their coastal and wetland habitats and migratory birds.

1.5 A single future assessment year of 2036 has been considered within this report for a worst-case combination of two Local Plan scenarios (DS2_DPC_2036 and DS3_DPP_2036).

1.6 A sensitivity test has also been carried out which involves assuming much higher NOx emissions from certain vehicles than have been published by Defra, using AQC's Calculator Using Realistic Emissions for Diesels (CURED v3A) tool (AQC, 2017b). This is to address the potential under-performance of emissions control technology on modern diesel vehicles.

1.7 The main pollutants of concern related to traffic emissions, and the potential for adverse effects on the designated ecological sites, are nitrogen oxides (NO_x), nutrient nitrogen deposition, acid nitrogen deposition and ammonia.

1.8 The ecologists for the project have advised that for the River Itchen SAC the appropriate habitat type to reference is Rich Fens. According to the Air Pollution Information System website (APIS) (APIS, 2018), this habitat type is not sensitive to acidity. For the Solent Maritime SAC, the only feature sensitive to acidity is the Whorl Snail, the ecologists have confirmed that there are no Whorl Snails present within the study area. In relation to the Solent and Southampton Water SPA and Ramsar site, the ecologists have confirmed that there are no breeding terns (sensitive to acidity) in the vicinity of Eastleigh. Acid nitrogen deposition has thus not been considered further.

2 Policy Context and Assessment Criteria

Relevant Policies

2.1 The “Habitats Directive” (European Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora, 1992) requires member states to introduce a range of measures for the protection of habitats and species. The Regulations (The Conservation of Habitats and Species Regulations 2010 Statutory Instrument 490, 2010), transpose the Directive into law in England and Wales. They require the Secretary of State to provide the European Commission with a list of sites which are important for the habitats or species listed in the Directive. The Commission then designates worthy sites as Special Areas of Conservation (SACs). The Regulations also require the compilation and maintenance of a register of European sites, to include SACs and Special Protection Areas (SPAs), with the latter classified under the “Birds Directive” (Directive 2009/147/EC of the European Parliament and of the Council, 2009). These sites form a network termed “Natura 2000”.

2.2 The Regulations primarily provide measures for the protection of European Sites and European Protected Species, but also require local planning authorities to encourage the management of other features that are of major importance for wild flora and fauna.

2.3 In addition to SACs and SPAs, some internationally important UK sites are designated under the Ramsar Convention. Originally intended to protect waterfowl habitat, the Convention has broadened its scope to cover all aspects of wetland conservation. Planning policy requires that Ramsar Sites are treated in an equivalent manner to European sites.

2.4 The Habitats Directive (as implemented by the Regulations) requires the competent authority, which in this case will be the planning authority, to firstly evaluate whether the development is likely to give rise to a significant effect on the European site. Where this is the case, it has to carry out an Appropriate Assessment in order to determine whether the development will adversely affect the integrity of the site.

Assessment Criteria

2.5 Critical levels and critical loads are the ambient concentrations and deposition fluxes below which significant harmful effects to sensitive ecosystems are unlikely to occur. Typically, the potential for exceedances of the critical levels and critical loads is considered in the context of the level of protection afforded to the ecological site as a whole. For example, the level of protection afforded to an internationally-designated site (such as a Ramsar, SAC or SPA) is significantly greater than that afforded to a local nature reserve; reflecting the relative sensitivity of the sites as well as their perceived ecological value. The critical levels relevant to this assessment are set out in Table 1, while the critical loads are provided in Table 2.

Table 1: Vegetation and Ecosystem Critical Levels [a]

Pollutant	Time Period	Critical Level
Nitrogen Oxides (expressed as NO_2)	Annual Mean [b]	30 µg/m^3
	24-Hour Mean	75 µg/m^3
Ammonia	Annual Mean	3 µg/m^3 [c]

[a] The critical levels are defined by the World Health Organisation (WHO, 2000). Ammonia critical level is defined by the Convention on Long-Range Transboundary Air Pollution (CLRTAP).

[b] Away from major sources (see Paragraph 2.6), this critical level is set as an objective (Defra, 2007) and a limit value (The European Parliament and the Council of the European Union, 2008).

[c] The ammonia critical level has only been applied to habitats within the River Itchen and Solent and Southampton Water SPA and Ramsar.

Table 2: Vegetation and Ecosystem Critical Loads

Habitat Type [a]	Nutrient Nitrogen (kgN/ha/yr) [b]
River Itchen SAC	
Rich Fens	15
Solent Maritime SAC	
Salicornia and other Annuals Colonizing mud and sand. **Spartina Swards.** **Atlantic Salt Meadows**	20
Solent and Southampton Water SPA and Ramsar	
Coastal Saltmarsh	20

[a] The European Nature Information System. (European Environment Agency, 2018). The habitat types used in the assessment have been advised by the ecologists for the project.

[b] Critical loads for nutrient nitrogen taken from (APIS, 2013).

2.6 Objectives for the protection of vegetation and ecosystems have been set by the UK Government and have the same numerical values as the critical levels that have been used in this assessment. The objectives, however, only apply a) more than 20 km from an agglomeration (about 250,000 people), and b) more than 5 km from Part A industrial sources, motorways and built up areas of more than 5,000 people[1]. The objectives will therefore not strictly apply as Eastleigh has a population of over 5,000 people and the M27 and M3 run either through or close to the designated ecological sites.

Descriptors for Air Quality Impacts and Assessment of Significance

2.7 The Environment Agency's Air Emissions Risk Assessment guidance (Environment Agency, 2016) discounts as insignificant any impact on a national or European designated ecological site from an

[1] The same concentrations, with the same constraints, have also been set as Limit Values by the European Commission.

individual permit[2] application if the change in annual mean concentration or deposition flux is <1% of a long-term (e.g. annual mean) or 10% of a short-term (e.g. 24-hour mean) environmental standard. This is the case regardless of the existing or predicted future baseline level (i.e. whether or not the critical level or critical load is currently exceeded). The Environment Agency does not suggest that impacts will necessarily be significant above these criteria, merely that there is a potential for significant impacts to occur that should be considered using alternative means. When issuing permits to operate, the Environment Agency also suggests that there is no need for additional assessment if it can be demonstrated that the predicted concentration or flux (with the proposed operation in place) is less than the critical level or critical load.

2.8 Despite their origin, these criteria are commonly used as screening criteria when assessing all manner of development schemes, including those that generate road traffic. Because many interested parties are familiar with these screening criteria, they have been used here as one of the ways to present the results. It is not within the scope of this section to appraise whether or not the Environment Agency screening criteria provide an appropriate level of assessment, or protection, with respect to traffic-related impacts from a Local Plan.

2 The Environment Agency issues permits to operate industrial processes in England and Wales and its guidance was developed for this purpose.

3 Assessment Approach

Existing Conditions

3.1 Background concentrations across the study area have been defined using the national pollution maps published by Defra (2018c). These cover the whole country on a 1x1 km grid. 2015 has been used as the base year, with 2036 as the future year. Since the background maps only predict up to 2030, the values for 2030 have been used for 2036. Background concentrations are expected to decrease in future years; using the values for 2030 for the assessment year of 2036 will thus provide a conservative assessment. Background nitrogen deposition fluxes and ammonia concentrations across the ecological areas have been provided by the Centre for Ecology and Hydrology and cover the country on a 5x5 km grid. The latest available year of 2014 has been used as the base year, and factored forward to 2036 (see Appendix A2 for further information).

Road Traffic Impacts

3.2 Pollutant concentrations have been modelled over a gridded area covering the designated ecological areas. Concentrations have also been modelled at six diffusion tube locations within the Eastleigh Borough, in order to verify the modelled results (see Appendix A2 for verification method). The diffusion tubes are operated by Eastleigh Borough Council and prepared and analysed by Gradko Environmental, using the 20% TEA in water method.

3.3 Predictions of all pollutants (where relevant) have been carried out for a current base year (2015), and a future assessment year of 2036. Predictions for 2036 have been made for three scenarios:

- 2036 with zero traffic growth. This assumes that traffic volumes in 2036 are identical to those in 2015 (but that the vehicle fleet composition – and thus emissions per vehicle – and background concentrations change in line with national projections);
- 2036 Without Local Plan. This assumes that traffic volumes will increase between 2015 and 2036, taking account of national and regional projections but excluding growth associated with the Local Plan itself; and
- 2036 With Local Plan. This adds the additional traffic associated with the Local Plan to the 2036 without Local Plan data.

3.4 The results for these scenarios have been compared against one-another to show the impacts of the Local Plan on its own 'in isolation' and 'in combination' with other predicted traffic growth[3]. This has been done as follows:

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[3] The Habitats Regulations requires the competent authority to assess whether a plan or project is likely to have a significant effect on a European Site either alone or in combination with other plans and projects. There is currently no guidance on how to complete an 'in combination' assessment, however, the methodology adopted for

- the impacts of the Local Plan in isolation have been determined by comparing the 2036 With Local Plan results against the 2036 Without Local Plan results; and
- the impacts of the Local Plan in combination with other traffic growth have been determined by comparing the 2036 With Local Plan results against the 2036 with zero traffic growth results.

3.5 This means that, for both sets of comparisons (both 'in isolation' and 'in combination'), the With Local Plan results are the same, what is varied is the baseline against which these results are compared.

3.6 In addition to this set of predictions, a sensitivity test has been carried out for nitrogen dioxide and NOx. This involves assuming much higher NOx emissions from certain vehicles than have been used by Defra, using AQC's Calculator Using Realistic Emissions for Diesels (CURED v3A) tool (AQC, 2017b). This is to address the potential under-performance of emissions control technology on modern diesel vehicles (AQC, 2016b). There are thus two scenarios for the future year: a base scenario ('official'), using Defra's 'official' emission forecasts, using the Emission Factor Toolkit (EFT) v8.0.1; and a sensitivity test, using AQC's CURED v3A tool, which allows for the greater real-world emissions from diesel vehicles.

3.7 Nitrogen deposition fluxes have been derived from the predicted concentrations of nitrogen dioxide, and ammonia concentrations. Details of the method for calculating nitrogen deposition fluxes are provided in Appendix A2.

3.8 Concentrations have been predicted using the ADMS-Roads dispersion model. Traffic data for the assessment have been provided by Systra on behalf of Eastleigh Borough Council. Details of the traffic data, model inputs, assumptions and the verification are provided in Appendix A2, together with the method used to derive base and future year background concentrations. Where assumptions have been made, a realistic worst-case approach has been adopted.

3.9 For each of the modelled scenarios the maximum predicted concentrations and deposition fluxes within the assessed ecological areas have been presented in the results tables. Where the predicted changes are above the relevant screening criteria, figures showing the areas of exceedance are provided in Appendix A3. Transects showing the change in nitrogen deposition with distance from the road have also been provided in Appendix A4.

Uncertainty in Road Traffic Modelling Predictions

3.10 There are many components that contribute to the uncertainty of modelling predictions. The road traffic emissions dispersion model used in this assessment is dependent upon the traffic data that

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this assessment considers the effects of all changes in traffic that are expected to occur between the current 2015 baseline and each of the 2036 Do-Something scenarios, which is considered a robust approach.

have been input, which will have inherent uncertainties associated with them. There are then additional uncertainties, as models are required to simplify real-world conditions into a series of algorithms.

3.11 An important stage in the process is model verification, which involves comparing the model output with measured concentrations (see Appendix A2). Because the model has been verified and adjusted, there can be reasonable confidence in the prediction of base year (2015) concentrations.

3.12 Predicting pollutant concentrations in a future year will always be subject to greater uncertainty. For obvious reasons, the model cannot be verified in the future, and it is necessary to rely on a series of projections provided by DfT and Defra as to what will happen to traffic volumes, background pollutant concentrations and vehicle emissions.

3.13 European type approval ('Euro') standards for vehicle emissions apply to all new vehicles manufactured for sale in Europe. These standards have, over many years, become progressively more stringent and this is one of the factors that has driven reductions in both predicted and measured pollutant concentrations over time.

3.14 Historically, the emissions tests used for type approval were carried out within laboratories and were quite simplistic. They were thus insufficiently representative of emissions when driving in the real world. For a time, this resulted in a discrepancy, whereby nitrogen oxides emissions from new diesel vehicles reduced over time when measured within the laboratory, but did not fall in the real world. This, in turn, led to a discrepancy between models (which predicted improvements in nitrogen dioxide concentrations over time) and measurements (which very often showed no improvements year-on-year).

3.15 Recognition of these discrepancies has led to changes to the type approval process. Vehicles are now tested using a more complex laboratory drive cycle and also through 'Real Driving Emissions' (RDE) testing, which involves driving on real roads while measuring exhaust emissions. For Heavy Duty Vehicles (HDVs), the new testing regime has worked very well and NOx emissions from the latest vehicles (Euro VI[4]) are now very low when compared with those from older models (ICCT, 2017).

3.16 For Light Duty Vehicles (LDVs), while the latest (Euro 6) emission standard has been in place since 2015, the new type-approval testing regime only came into force in 2017. Despite this delay, earlier work by AQC (2016) showed that Euro 6 diesel cars manufactured prior to 2017 tend to emit significantly less NOx than previous (Euro 5 and earlier) models. Given the changes to the testing regime, it is reasonable to expect that diesel cars and vans registered for type approval since 2017 will, on average, generate even lower NOx emissions.

4 Euro VI refers to HDVs while Euro 6 refers to LDVs.

3.17 As well as reviewing information on the emissions from modern diesel vehicles in the real world (AQC, 2016), AQC has also reviewed the assumptions contained within Defra's latest Emission Factor Toolkit (EFT) (v8.0.1) (AQC, 2018a). One point of note is that the EFT makes a range of assumptions, which appear to be very conservative, regarding the continued use of diesel cars into the future and the relatively slow uptake of non-conventional (e.g. electric) vehicles (AQC, 2018a). Thus, despite previous versions of Defra's EFT being over-optimistic regarding future-year predictions, it is not unreasonable to consider that EFT v8.0.1 might under-state the scale of reductions over coming years (i.e. over-predict future-year traffic emissions).

3.18 Overall, it is considered that, for assessment years prior to 2020, the EFT provides a robust method of calculating emissions. While there is still some uncertainty regarding any predictions of what will occur in the future, there are no obvious reasons to expect predictions made using the EFT to under-predict concentrations in the future up to and including 2019.

3.19 For assessment years beyond 2020, EFT v8.0.1 makes additional assumptions regarding the expected performance of diesel cars and vans registered for type approval beyond this date, reflecting further planned changes to the type approval testing. While there is currently no reason to disbelieve these assumptions, it is sensible to consider the possibility that this future-year technology might be less effective than has been assumed. A sensitivity test has thus been carried out using AQC's CURED v3A model (AQC, 2017b), which assumes that this, post-2020, technology does not deliver any benefits. Further details of CURED v3A are provided in a supporting report prepared by AQC (2018a). CURED v3A is considered to provide a worst-case assessment.

3.20 Much less research has been carried out into ammonia emissions from vehicles than into NOx emissions and so all projections are more tenuous. A large part of the problem is that, while NOx emissions from new vehicle models are regulated by European legislation, ammonia emissions are not. Furthermore, Selective Catalytic Reduction (SCR) technology, which is often used to help achieve the NOx emissions standards, has the potential to be a source of ammonia. The way in which the NOx emissions standards are implemented for light-duty diesel vehicles is set to become more stringent by 2020 and it is not unreasonable to assume that vehicle manufacturers will meet this challenge with more emphasis on SCR technology and, potentially, with higher dosing rates of the reagents which can give rise to ammonia emissions. While this is, largely, speculation, it does not seem unreasonable to conclude that ammonia emissions per vehicle may increase in the future. This effect is not taken into account within the Calculation of Emissions from Road Transport (COPERT) model (V5.0.1067), which is produced by the European Environment Agency and is expected to be used by the majority of European member states for reporting to the European Commission. The COPERT model predicts that, while NOx emissions from newly-manufactured diesel cars will fall between 2016 and 2020, there will be no associated change in ammonia emissions. On the other hand, Defra's predictions, which were made earlier, suggest that ammonia emissions from road traffic will reduce into the future (Defra, 2012).

3.21 As explained in Appendix A2, bridges, such as Highbridge Road, Bishopstoke Road and the M27 across the River Itchen, and the M27 across the River Hamble, have not been modelled as elevated roads. This is likely to have resulted in the degree of pollutant dispersion in these areas being under-predicted, with a resultant over-prediction in concentrations. This is potentially significant, since the sections of both the River Itchen and Solent Maritime SACs where maximum concentrations are predicted are both adjacent to bridges. The result is that the assessment will be worst-case for these areas.

4 Baseline Conditions

National Background Maps for NO_x and nitrogen dioxide

4.1 Estimated background concentrations of NO_x and nitrogen dioxide have been determined for 2015 and the future year of 2036 using Defra's background maps (Defra, 2018c). The background concentrations are set out in Table 3 and have been derived as described in Appendix A2. The NO_x background concentrations range from well below to above the critical level.

Table 3: Estimated Annual Mean Background Pollutant Concentrations in 2015 and 2036 (µg/m^3)

Year	NOx	NO_2 [a]
2015	12.0 – **67.6**	9.0 – 37.8
2036 [b]	7.8 – **62.2**	6.0 – 35.0
2036 Sensitivity Test [c]	*8.4 – **62.7***	*6.5 – 35.2*
Critical Level	**30**	**-**

The range of values is for the different 1x1 km grid squares covering the study area.

a Nitrogen dioxide backgrounds have been used to convert the NO_x model outputs into road nitrogen dioxide for the purposes of calculating the nutrient-nitrogen deposition.

b In line with Defra's forecasts.

c Assuming higher emissions from future diesel cars and vans as described in Paragraph A2.8 in Appendix A2.

National Background Ammonia Map

4.2 Background ammonia concentrations in the study area have been taken from the UK Deposition Data website operated by the Centre for Ecology and Hydrology (Centre for Ecology and Hydrology, 2018) for 2014 (the latest available year) and factored forwards to the future year of 2036. The 2036 values have been derived by projecting forward the 2014 values following the methodology described in Appendix A2. The ammonia background concentrations are all below the critical level.

Table 4: Estimated Background Ammonia Concentrations in 2014 and 2036 (µg/m^3) [a]

Year	Ammonia
2014	0.70 – 2.24
2036	0.75 – 2.43
Critical Level	**3**

a 2014 is the latest available year for concentrations of ammonia.

Background Deposition

4.3 Background nitrogen deposition fluxes to the study area have been taken from the UK Deposition Data website operated by the Centre for Ecology and Hydrology (Centre for Ecology and Hydrology, 2018) for 2014 (the latest available year) and factored forwards to the future year of 2036, as described in Appendix A2. The range in critical loads assessed against is 15 - 20 (see Table 2), and therefore background nutrient-nitrogen deposition rates are likely to be above the critical load at some locations in all modelled scenarios.

Table 5: Estimated Annual Mean Background Nitrogen Deposition

Site	Nutrient Nitrogen Deposition (kgN/ha/yr)
2014 [a]	12.5 – 18.1
2036 [b]	10.7 – 15.7
2036 Sensitivity Test [c]	*11.1 – 16.2*
Critical Load	**15 - 20**

[a] 2014 is the latest available year for concentrations of ammonia that contribute to then nutrient deposition.

[b] Based on Defra's forecasts for the NOx background used to uplift the oxidised nitrogen component.

[c] Assuming higher emissions from modern diesel vehicles in the NOx background for uplifting the oxidised nitrogen component as described in Appendix A2.

Baseline Model Results

4.4 Baseline concentrations of nitrogen oxides at the locations within the study area with the highest predicted concentration in 2015 and 2036 (Without Local Plan) are set out in Table 6. The maxima within the River Itchen SAC and the Solent Maritime SAC were predicted immediately adjacent to roads and are not necessarily representative of large areas. Furthermore, as explained in Paragraph 3.21, the predictions at these worst-case locations are likely to be conservative. Annual mean nitrogen oxides concentrations exceed the objective at worst-case locations within each of the designated sites in 2015 and in 2036 without the Local Plan.

Table 6: Maximum Annual Mean Nitrogen Oxides Concentrations (μg/m^3) [a]

Designated Site	2015	2036 Without Local Plan [b]	*2036 Without Local Plan Sensitivity Test* [c]
River Itchen	**231.3**	**99.5**	***150.0***
Solent Maritime [d]	**243.1**	**83.0**	***123.9***
Solent and Southampton Water	**65.8**	24.6	***32.0***
Critical Level	**30**		

[a] Exceedances of the objective are shown in bold.

[b] In line with Defra's forecasts.

c Assuming higher emissions from future diesel cars and vans as described in Paragraph A2.8 in Appendix A2.

d Within the Solent Maritime designated site the highest concentrations are predicted where the M27 crosses the SAC. The concentration presented is the highest concentration predicted that is not within the modelled road edge.

4.5 No background 24-hour mean nitrogen oxides concentrations are available therefore baseline 24-hour mean concentrations have not been calculated. The worst-case assumption, that the critical level is already exceeded, has been made.

4.6 Baseline predicted nutrient nitrogen deposition rates within the ecological areas with the highest concentration in 2015 and 2036 (Without Local Plan) are set out in Table 7. As for NOx, the maxima within the River Itchen SAC and the Solent Maritime SAC were predicted immediately adjacent to roads and are not necessarily representative of large areas. Furthermore, as explained in Paragraph 3.21, the predictions at these worst-case locations are likely to be conservative. Nutrient nitrogen deposition exceeds the critical load at worst-case locations within the River Itchen SAC and the Solent Maritime SAC in 2015 and in 2036 without the Local Plan, but remains below the critical load within the Solent and Southampton Water SPA and Ramsar site.

Table 7: Maximum Modelled Baseline Nutrient Nitrogen Deposition Rates (kgN/ha/yr)

Maximum Concentration	Designated Site [a]		
	River Itchen	Solent Maritime [b]	Solent and Southampton Water
2015	**44.9**	**48.2**	19.5
2036 Without Local Plan	**43.1**	**52.6**	16.6
2036 Without Local Plan Sensitivity Test	**45.8**	**55.6**	17.5
Critical Load	**15**	**20**	**20**

a Exceedances of the critical load are shown in bold.

b Within the Solent Maritime designated site the highest concentrations are predicted where the M27 crosses the SAC. The concentration presented is the highest concentration predicted that is not within the modelled road.

4.7 The highest predicted baseline total ammonia concentrations within the ecological areas in 2015 and 2036 (Without Local Plan) are set out in Table 7. As for NOx, the maxima within the River Itchen SAC and the Solent Maritime SAC were predicted immediately adjacent to roads and are not necessarily representative of large areas. Furthermore, as explained in Paragraph 3.21, the predictions at these worst-case locations are likely to be conservative. Total ammonia concentrations exceed the critical level at locations within the River Itchen SAC in 2036 without the Local Plan, but remain below the critical load within the Solent Maritime SAC and Solent and Southampton Water SPA and Ramsar site, and at all designated sites in 2015.

Table 8: Maximum Modelled Baseline Ammonia (µg/m^3)

Maximum Concentration	Designated Site [a]		
	River Itchen	Solent Maritime [b]	Solent and Southampton Water
2015	2.9	2.9	1.2
2036 Without Local Plan	**3.6**	3.0	1.6
Critical Load	**3**		

a Exceedances of the critical load are shown in bold.

b Within the Solent Maritime designated site the highest concentrations are predicted where the M27 crosses the SAC. The concentration presented is the highest concentration predicted that is not within the modelled road.

5 Screening Assessment

Impacts of the Local Plan In Isolation

5.1 The maximum changes in predicted concentrations of nitrogen oxides in 2036 caused by the Local Plan in isolation (i.e. comparing the With Local Plan results against the Without Local Plan results) are set out in Table 9. The maximum changes in rates of nutrient nitrogen deposition in 2036 caused by the Local Plan in isolation are set out in Table 10. For both pollutants, the maximum changes within the River Itchen SAC and the Solent Maritime SAC were predicted immediately adjacent to roads and are not necessarily representative of large areas. Furthermore, as explained in Paragraph 3.21, the predictions at these worst-case locations are likely to be conservative.

Table 9: Maximum Changes in Nitrogen Oxides caused by the Local Plan In Isolation

Pollutant	'Official' Prediction [a]		*Worst-case Sensitivity Test* [b]	
	Change (μg/m³)	% of Critical Level	*Change (μg/m³)*	*% of Critical Level*
Annual Mean NOx	River Itchen			
	4.7	**15.7**	***7.1***	***23.5***
	Solent Maritime			
	0.9	**2.9**	***1.3***	***4.2***
	Solent and Southampton Water			
	0.1	0.2	*0.1*	*0.3*
Screening Criterion	0.3 μg/m³ (1%)			
Max 24hr-Mean NOx	River Itchen			
	25.3	**33.7**	**36.6**	**48.8**
	Solent Maritime			
	3.4	4.6	5.0	6.6
	Solent and Southampton Water			
	0.6	0.7	0.9	1.2
Screening Criterion	7.5 μg/m³ (10%)			

[a] In line with Defra's forecasts.

[b] Assuming higher emissions from future diesel cars and vans as described in Paragraph A2.8 in Appendix A2.

Table 10: Maximum Changes in Nitrogen Deposition caused by the Local Plan Alone

Pollutant	'Official' Prediction [a]		*Worst-case Sensitivity Test* [b]		Screening Criterion
	Deposition Rate (kg-N/ha/yr)	% of Critical Load	*Deposition Rate (kg-N/ha/yr)*	*% of Critical Load*	
Annual Mean Nutrient Nitrogen (kgN/ha/yr)	River Itchen				
	2.2	**14.5**	***2.3***	***15.6***	**0.15 kg-N/ha/yr (1%)**
	Solent Maritime				
	0.4	**1.8**	***0.4***	***1.9***	**0.2 kg-N/ha/yr (1%)**
	Solent and Southampton Water				
	0.01	0.1	*0.02*	*0.1*	**0.2 kg-N/ha/yr (1%)**

[a] In line with Defra's forecasts.

[b] Assuming higher emissions from future diesel cars and vans as described in Paragraph A2.8 in Appendix A2.

5.2 In both model scenarios, the change in annual mean nitrogen oxides concentrations is greater than 1% of the critical level at the worst-case locations within the River Itchen SAC and Solent Maritime SAC, but is below the critical level within the Solent and Southampton Water SPA and Ramsar site. The potential for significant impacts cannot be discounted within the River Itchen SAC and Solent Maritime SAC and further assessment should be carried out. The change in 24-hour mean nitrogen oxides concentrations is greater than 10% of the critical level at the worst-case location within the River Itchen SAC, but is below the critical level within the Solent Maritime SAC and the Solent and Southampton Water SPA and Ramsar site. The potential for significant impacts cannot be discounted within the River Itchen SAC and further assessment should be carried out.

5.3 Changes in nutrient nitrogen deposition rates are predicted to be above the '1% of the critical loads' screening criterion within the River Itchen SAC and Solent Maritime SAC, but are below the screening criterion within the Solent and Southampton Water SPA and Ramsar site. The potential for significant impacts cannot be discounted within the River Itchen SAC and Solent Maritime SAC and further assessment should be carried out.

5.4 The maximum changes in predicted concentrations of ammonia in 2036 caused by the Local Plan in isolation are set out in Table 11. As above, the maximum changes within the River Itchen SAC and the Solent Maritime SAC were predicted immediately adjacent to roads and are not necessarily representative of large areas. Furthermore, as explained in Paragraph 3.21, the predictions at these worst-case locations are likely to be conservative.

Table 11: Maximum Changes in Ammonia Concentrations caused by the Local Plan Alone

Pollutant	Change (μg/m³)	% of Critical Level
Ammonia	River Itchen	
	0.2	**5.6**
	Solent Maritime	
	0.03	1.0
	Solent and Southampton Water	
	0.001	0.02
Screening Criterion	0.03 μg/m³ (1%)	

5.5 Changes in ammonia are predicted to be above the screening criterion within the River Itchen SAC, but are below the screening criterion within the Solent Maritime SAC and the Solent and Southampton Water SPA and Ramsar site. The potential for significant impacts cannot be discounted within the River Itchen SAC and further assessment should be carried out.

Impacts In Combination with Other Predicted Traffic Growth

5.6 The maximum changes in predicted concentrations of nitrogen oxides in 2036 caused by the Local Plan in combination with other predicted traffic growth (i.e. comparing the With Local Plan results against those for the zero growth scenario) are set out in Table 9. The maximum changes in rates of nutrient nitrogen deposition in 2036 caused by the Local Plan in combination with other traffic growth are set out in Table 10. As noted previously, the maximum changes within the River Itchen SAC and the Solent Maritime SAC were predicted immediately adjacent to roads and are not necessarily representative of large areas.

Table 12: Maximum Changes in Nitrogen Oxides caused by the Local Plan In Combination with other Predicted Traffic Growth

Pollutant	'Official' Prediction [a]		*Worst-case Sensitivity Test* [b]	
	Change (μg/m³)	% of Critical Level	*Change (μg/m³)*	*% of Critical Level*
Annual Mean NOx	River Itchen			
	20.3	67.6	*32.3*	*107.7*
	Solent Maritime			
	33.3	111.0	*49.5*	*165.0*
	Solent and Southampton Water			
	2.4	8.1	*3.8*	*12.6*
Screening Criterion	0.3 μg/m³ (1%)			
Max 24hr-Mean NOx	River Itchen			
	93.4	124.5	*141.5*	*188.7*
	Solent Maritime			
	140.8	187.7	*208.0*	*277.3*
	Solent and Southampton Water			
	21.2	28.2	*32.7*	*43.5*
Screening Criterion	7.5 μg/m³ (10%)			

a In line with Defra's forecasts.

b Assuming higher emissions from future diesel cars and vans as described in Paragraph A2.8 in Appendix A2.

Table 13: Maximum Changes in Nitrogen Deposition caused by the Local Plan In Combination with other Predicted Traffic Growth

Pollutant	'Official' Prediction [a]		*Worst-case Sensitivity Test* [b]		Screening Criterion
	Deposition Rate (kg-N/ha/yr)	% of Critical Load	*Deposition Rate (kg-N/ha/yr)*	*% of Critical Load*	
Annual Mean Nutrient Nitrogen (kgN/ha/yr)	River Itchen				
	6.7	44.8	*7.1*	*47.5*	0.15 kg-N/ha/yr (1%)
	Solent Maritime				
	14.0	70.1	*14.5*	*72.6*	0.2 kg-N/ha/yr (1%)
	Solent and Southampton Water				
	0.63	3.2	*0.72*	*3.6*	0.2 kg-N/ha/yr (1%)

a In line with Defra's forecasts.

b Assuming higher emissions from future diesel cars and vans as described in Paragraph A2.8 in Appendix A2.

5.7 In both model scenarios, the change in annual mean nitrogen oxides concentrations is greater than 1% of the critical level at the worst-case locations within all three designated sites. The potential for significant impacts cannot be discounted and further assessment should be carried out. The change in 24-hour mean nitrogen oxides concentrations is greater than 10% of the critical level at the worst-case locations within all three designated sites. The potential for significant impacts cannot be discounted and further assessment should be carried out.

5.8 Changes in nutrient nitrogen deposition rates are predicted to be above the '1% of the critical loads' screening criterion at the worst-case locations within all three designated sites. The potential for significant impacts cannot discounted and further assessment is required.

5.9 The maximum changes in predicted concentrations of ammonia in 2036 caused by the Local Plan in combination with other predicted traffic growth are set out in Table 11.

Table 14: Maximum Changes in Ammonia Concentrations caused by the Local Plan In Combination with other Predicted Traffic Growth

Pollutant	Change (µg/m^3)	% of Critical Level
Ammonia	River Itchen	
	0.5	17.2
	Solent Maritime	
	1.1	37.7
	Solent and Southampton Water	
	0.04	1.4
Screening Criterion	0.03 µg/m^3 (1%)	

5.10 Changes in ammonia are predicted to be above the screening criterion at the worst-case locations within all three designated sites. The potential for significant impacts cannot be discounted and further assessment is required.

6 Further Assessment

Impacts of the Local Plan In Isolation

Annual Mean Nitrogen Oxides

6.1 The maximum total concentrations of nitrogen oxides anywhere within the River Itchen SAC and Solent Maritime SAC under the Without Local Plan and With Local Plan scenarios are set out in Table 15. As noted previously, these maxima were all predicted immediately adjacent to roads and are not necessarily representative of large areas. Furthermore, as explained in Paragraph 3.21, the predictions at these worst-case locations are likely to be conservative.

6.2 Contours of the areas where changes in the annual mean nitrogen oxides concentrations (comparing the With Local Plan results against the Without Local Plan results) are greater than 1% of the critical level screening criterion and the total nitrogen oxides concentrations (with the Local Plan) are above the critical level (30 µg/m^3) are shown in Appendix A3.

6.3 There are predicted to be changes above the screening criterion of 1 % in the northern section of the River Itchen SAC, up to approximately 300 m from the roadside. Total annual mean NO_x concentrations within this area, however, are below the critical level of 30 µg/m^3. In the southern section of the River Itchen SAC, there are predicted to be changes above the screening criterion of 1 %; within some of these areas the total annual mean NO_x concentrations are also above the critical level of 30 µg/m^3 (for small areas up to approximately 30 m from the roadside). These changes are shown in Figure A3.1.

6.4 There are predicted to be changes above the screening criterion of 1 % within the Solent Maritime SAC, up to approximately 30 m from the M27 and approximately 10 m from the A27. Within this area the total annual mean NO_x concentrations are above the critical level of 30 µg/m^3 (see Figure A3.2).

6.5 There are predicted to be no changes above the screening criterion of 1 % within the Solent and Southampton Water SPA and Ramsar.

Sensitivity Test

6.6 The results from the sensitivity test are similar to those using the 'official' predictions, although the areas affected are larger, and there are also exceedances of the critical level (30 µg/m^3) within the northern section of the River Itchen SAC (see Figure A3.3 and Figure A3.4).

Table 15: Maximum Annual Mean Nitrogen Oxides Concentrations anywhere within River Itchen and Solent Maritime Without and With the Local Plan (µg/m^3) [a]

Designated Site	2015	2036 Without Local Plan [b]	2036 With Local Plan [b]	*Worst-case Sensitivity Test [c]*	
				2036 Without Local Plan	*2036 With Local Plan*
River Itchen	**231.3**	**99.5**	**99.3**	***150.0***	***149.6***
Solent Maritime [d]	**243.1**	**83.0**	**82.8**	***123.9***	***123.4***
Critical Level	**30**				

[a] Exceedances of the critical level are shown in bold.

[b] In line with Defra's forecasts.

[c] Assuming higher emissions from future diesel cars and vans as described in Paragraph A2.8 in Appendix A2.

[d] Within the Solent Maritime designated site the highest concentrations are predicted where the M27 crosses the SAC. The concentration presented is the highest concentration that is predicted not within the modelled road edge.

24-hour Mean Nitrogen Oxides

6.7 Contours of the area where changes in the 24-hour mean nitrogen oxides concentrations (comparing the With and Without Local Plan results) are greater than 10% of the critical level screening criterion are shown in Appendix A3.

6.8 There are predicted to be changes above the screening criterion of 10 % in the northern section of the River Itchen SAC, up to approximately 70 m from the roadside. There are no other locations where the predicted changes are above the screening criterion (Figure A3.5).

6.9 No background 24-hour mean NOx concentrations are available, therefore 24-hour mean concentrations have not been calculated. The worst-case assumption has been made that the 24-hour mean NOx critical level is already exceeded at locations close to the roadside.

Sensitivity Test

6.10 There is an additional area in the southern section of the River Itchen SAC, up to approximately 60 m from the roadside, where the predicted changes are above the screening criterion of 10 % (Figure A3.6).

Nutrient Nitrogen Deposition

6.11 The maximum nutrient nitrogen deposition rates anywhere within the River Itchen SAC and Solent Maritime SAC under the Without Local Plan and With Local Plan scenarios are set out in Table 16. As noted previously, these maxima were all predicted immediately adjacent to roads and are not necessarily representative of large areas. Furthermore, as explained in Paragraph 3.21, the predictions at these worst-case locations are likely to be conservative.

6.12 Contours of the areas where changes in the nutrient nitrogen deposition rates (when comparing the With Local Plan results against the Without Local Plan results) are greater than 1% of the critical load and the total nutrient nitrogen deposition rates (with the Local Plan) are above the critical load are shown in Appendix A3.

6.13 There are predicted to be changes above the screening criterion of 1 % in the northern and southern sections of the River Itchen SAC, up to approximately 100 m from the roadside (Figure A3.7 and Figure A3.8), where there are also predicted to be exceedances of the critical load of 15 kgN/ha/yr. There are also predicted to be changes above the screening criterion of 1 % in the Solent Maritime SAC, up to approximately 25 m from the roadside (Figure A3.9), where there are also predicted to be exceedances of the critical load of 20 kgN/ha/yr.

Sensitivity Test

6.14 The results from the sensitivity test are similar to those using the 'official' predictions, although the areas affected are larger (see Figure A3.10, Figure A3.11 and Figure A3.12).

Table 16: Maximum Nutrient Nitrogen Deposition Rates anywhere within River Itchen and Solent Maritime Without and With the Local Plan (kg-N/ha/yr) [a]

Maximum Concentration	Designated Site	
	River Itchen	Solent Maritime [b]
2015	**44.9**	**48.2**
2036 Without Local Plan [c]	**43.1**	**52.6**
2036 With Local Plan [c]	**43.1**	**53.0**
2036 Without Local Plan Sensitivity Test [d]	***45.8***	***55.6***
2036 With Local Plan Sensitivity Test [d]	***45.9***	***55.9***
Critical Load	**15**	**20**

a Exceedances of the critical load are shown in bold.

b Within the Solent Maritime designated site the highest concentrations are predicted where the M27 crosses the SAC. The concentration presented is the highest concentration that is predicted not within the modelled road edge.

c In line with Defra's forecasts.

d Assuming higher emissions from future diesel cars and vans as described in Paragraph A2.8 in Appendix A2.

6.15 Due to concerns regarding how the increase in road emissions will impact on the Southern Damselfly population in the River Itchen SAC, transects showing the change in nitrogen deposition with distance from Highbridge Road, Bishopstoke Road and the M27 have been provided in Appendix A4. These show that nitrogen deposition decreases rapidly with distance from the road.

Annual Mean Ammonia

6.16 The maximum annual mean ammonia concentrations anywhere within the River Itchen SAC under the Without Local Plan and With Local Plan scenarios are set out in Table 17. Contours of the area where changes in the annual mean ammonia concentrations (when comparing the With Local Plan results against those Without the Local Plan) are greater than 1% of the critical level screening criterion and the total ammonia concentrations (with the Local Plan) are above the critical level (3 µg/m^3) are shown in Appendix A3.

6.17 There are predicted to be changes above the screening criterion of 1 % in the River Itchen SAC, up to approximately 35 m from the roadside. There are also areas where total ammonia concentrations are predicted to be above the critical level of 3 µg/m^3, but the two areas do not coincide (Figure A3.13).

6.18 There are predicted to be no changes above the screening criterion of 1 % within the Solent Maritime SAC or the Solent and Southampton Water SPA and Ramsar.

Table 17: Maximum Annual Mean Ammonia Concentrations anywhere within River Itchen Without and With the Local Plan (µg/m^3) [a]

Designated Site	2015	2036 Without Local Plan	2036 With Local Plan
River Itchen	2.9	**3.6**	**6.0**
Critical Level	**3**		

[a] Exceedances of the critical level are shown in bold.

Impacts In Combination with Other Predicted Traffic Growth

Annual Mean Nitrogen Oxides

6.19 The maximum total concentrations of nitrogen oxides anywhere within each of the designated sites under the Zero Traffic Growth and With Local Plan scenarios are set out in Table 18. The With Local Plan results are the same as those presented previously (see Table 15), but the Zero Traffic Growth results are specific to the 'in combination' assessment. As noted previously, the maxima within the River Itchen SAC and the Solent Maritime SAC were predicted immediately adjacent to roads and are not necessarily representative of large areas. Furthermore, as explained in Paragraph 3.21, the predictions at these worst-case locations are likely to be conservative.

6.20 Contours of the areas where changes in the annual mean nitrogen oxides concentrations (comparing the With Local Plan results against the zero growth results) are greater than 1% of the critical level screening criterion and the total nitrogen oxides concentrations (with the Local Plan) are above the critical level (30 µg/m^3) are shown in Appendix A3.

6.21 There are predicted to be changes above the screening criterion of 1 % across the majority of the River Itchen SAC. Total annual mean NO_x concentrations within these areas, however, are below the critical level of 30 µg/m^3, except for the southern section of the River Itchen SAC where total annual mean NO_x concentrations are above the critical level of 30 µg/m^3 (up to approximately 140 m from the roadside). These changes are shown in Figure A3.14.

6.22 There are predicted to be changes above the screening criterion of 1 % across the majority of the Solent Maritime SAC and much of the Solent and Southampton Water SPA and Ramsar site. Total annual mean NO_x concentrations are above the critical level of 30 µg/m^3 up to approximately 95 m from the M27 and 10 m from the A27 (see Figure A3.15).

Sensitivity Test

6.23 The results from the sensitivity test are similar to those using the 'official' predictions, although the areas affected are larger, in addition there are also exceedances of the critical level (30 µg/m^3) within the northern section of the River Itchen SAC (see Figure A3.16). Total annual mean NO_x concentrations are above the critical level of 30 µg/m^3 up to approximately 350 m from the M27 and 120 m of the A27 (Figure A3.17).

Table 18: Maximum Annual Mean Nitrogen Oxides Concentrations anywhere within River Itchen, Solent Maritime, or Solent and Southampton under Zero Growth and With the Local Plan Scenarios (µg/m^3) [a]

Designated Site	2015	2036 Zero Traffic Growth [b]	2036 With Local Plan [b]	*Worst-case Sensitivity Test* [c]	
				2036 Zero Traffic Growth	*2036 With Local Plan*
River Itchen	**231.3**	**79.1**	**99.3**	***117.3***	***149.6***
Solent Maritime [d]	**243.1**	**66.7**	**82.8**	***97.8***	***123.4***
Solent and Southampton Water	**65.8**	24.2	25.9	***31.3***	***33.9***
Critical Level	30				

[a] Exceedances of the critical level are shown in bold.

[b] In line with Defra's forecasts.

[c] Assuming higher emissions from future diesel cars and vans as described in Paragraph A2.8 in Appendix A2.

[d] Within the Solent Maritime designated site the highest concentrations are predicted where the M27 crosses the SAC. The concentration presented is the highest concentration that is predicted not within the modelled road edge.

24-hour Mean Nitrogen Oxides

6.24 Contours of the areas where changes in the 24-hour mean nitrogen oxides concentrations (comparing the With Local Plan results against the zero growth results) are greater than 10% of the critical level screening criterion are shown in Appendix A3.

6.25 There are predicted to be changes above the screening criterion of 10 % across a large part the River Itchen SAC (Figure A3.18) as well as the Solent Maritime SAC and Solent and Southampton Water SPA and Ramsar site (Figure A3.19).

6.26 No background 24-hour mean NOx concentrations are available, therefore 24-hour mean concentrations have not been calculated. The worst-case assumption has been made that they already exceed the 24-hour mean NOx critical level at locations close to the roadside.

Sensitivity Test

6.27 The results from the sensitivity test are similar to those using the 'official' predictions, although the areas affected are larger (Figure A3.20 and Figure A3.21).

Nutrient Nitrogen Deposition

6.28 The maximum nutrient nitrogen deposition rates anywhere within each of the designated sites under the Zero Traffic Growth and With Local Plan scenarios are set out in Table 19. The With Local Plan results are the same as those presented previously, but the Zero Traffic Growth results are specific to the 'in combination' assessment. As noted previously, the maxima within the River Itchen SAC and the Solent Maritime SAC were predicted immediately adjacent to roads and are not necessarily representative of large areas. Furthermore, as explained in Paragraph 3.21, the predictions at these worst-case locations are likely to be conservative.

6.29 Contours of the areas where changes in the nutrient nitrogen deposition rates (comparing the With Local Plan results against the zero growth results) are greater than 1% of the critical load screening criterion and the total nutrient nitrogen deposition rates (with the Local Plan) are above the critical loads are shown in Appendix A3.

6.30 There are predicted to be changes above the screening criterion of 1 % in several sections of the River Itchen SAC, up to approximately 1 km from the roadside (Figure A3.22). Total nitrogen deposition concentrations are also predicted to be above 15 kgN/ha/hr within some of these locations. There are predicted to be changes above the screening criterion of 1 % within the Solent Maritime SAC and Solent and Southampton Water SPA and Ramsar site up to approximately 750 m from the M27 and up to approximately 130 m from the A27 (Figure A3.23). Total nitrogen deposition concentrations are predicted to be only above 20 kgN/ha/yr up to approximately 60 m from the M27.

Sensitivity Test

6.31 There are predicted to be changes above the screening criterion of 1 % in similar locations to those using the 'official' predictions, although the areas affected are larger (Figure A3.24 and Figure A3.25).

Table 19: Maximum Nutrient Nitrogen Deposition Rates anywhere within River Itchen, Solent Maritime, or Solent and Southampton under Zero Growth and With the Local Plan Scenarios (kgN/ha/yr) [a]

Maximum Concentration	Designated Site		
	River Itchen	Solent Maritime [b]	Solent and Southampton Water
2015	**44.9**	**48.2**	*19.5*
2036 Zero Traffic Growth [c]	**36.4**	**39.0**	*16.0*
2036 With Local Plan [c]	**43.1**	**53.0**	*16.6*
2036 Zero Traffic Growth *Sensitivity Test* [d]	***38.7***	***41.4***	*16.8*
***2036 With Local Plan Sensitivity Test* [d]**	***45.9***	***55.9***	*17.5*
Critical Load	**15**	**20**	

[a] Exceedances of the critical load are shown in bold.

[b] Within the Solent Maritime designated site the highest concentrations are predicted where the M27 crosses the SAC. The concentration presented is the highest concentration that is predicted not within the modelled road edge.

[c] In line with Defra's forecasts.

[d] Assuming higher emissions from future diesel cars and vans as described in Paragraph A2.8 in Appendix A2.

6.32 Transects showing the change in nitrogen deposition with distance from Highbridge Road, Bishopstoke Road and the M27 have been provided in Appendix A4. These show that nitrogen deposition decreases rapidly with distance from the road.

Annual Mean Ammonia

6.33 The maximum annual mean ammonia concentrations anywhere within each of the designated sites under the Zero Traffic Growth and With Local Plan scenarios are set out in Table 20. The With Local Plan results are the same as those presented previously, but the Zero Traffic Growth results are specific to the 'in combination' assessment. As noted previously, the maxima within the River Itchen SAC and the Solent Maritime SAC were predicted immediately adjacent to roads and are not necessarily representative of large areas. Furthermore, as explained in Paragraph 3.21, the predictions at these worst-case locations are likely to be conservative.

6.34 Contours of the areas where changes in the annual mean ammonia concentrations comparing the With Local Plan results against the zero growth results) are greater than 1% of the critical level screening criterion and the total ammonia concentrations (with the Local Plan) are above the critical level (3 $\mu g/m^3$) are shown in Appendix A3.

6.35 There are predicted to be changes above the screening criterion of 1 % in the River Itchen SAC, up to approximately 220 m from the roadside. Total ammonia concentrations are predicted to be above the critical level of 3 µg/m^3 in the southern section of the River Itchen SAC (Figure A3.26).

6.36 There are predicted to be changes above the screening criterion of 1 % within the Solent Maritime SAC and the Solent and Southampton Water SPA and Ramsar site up to approximately 310 m from the M27 and up to approximately 40 m from the A27. Total ammonia concentrations are predicted to be above the critical level of 3 µg/m^3 up to approximately 25 m from the M27 (Figure A3.26).

Table 20: Maximum Annual Mean Ammonia Concentrations anywhere within River Itchen, Solent Maritime, or Solent and Southampton under Zero Growth and With the Local Plan Scenarios (µg/m^3) [a]

Designated Site	2015	2036 Zero Traffic Growth	2036 With Local Plan
River Itchen	2.9	**4.9**	**6.0**
Solent Maritime [b]	2.9	**4.0**	**4.8**
Solent and Southampton Water	1.2	1.9	2.0
Critical Level	**3**		

[a] Exceedances of the critical level are shown in bold.

[b] Within the Solent Maritime designated site the highest concentrations are predicted where the M27 crosses the SAC. The concentration presented is the highest concentration that is predicted not within the modelled road edge.

7 Summary

7.1 The potential air quality impacts associated with the Eastleigh Borough Local Plan on the River Itchen SAC, the Solent Maritime SAC and the Solent and Southampton Water SPA and Ramsar site have been assessed.

Impacts of the Local Plan In Isolation

7.2 There are predicted to be changes in annual mean NOx concentrations above the screening criterion of 1 % in the River Itchen SAC and the Solent Maritime SAC. Total annual mean NO_x concentrations within these areas are above the critical level of 30 µg/m^3. There are predicted to be no changes above the screening criterion within the Solent and Southampton Water SPA and Ramsar site.

7.3 There are predicted to be changes in 24-hour mean NOx concentrations above the screening criterion of 10 % in the River Itchen SAC. There are no other locations where the predicted changes in 24-hour mean NOx concentrations are above the screening criterion.

7.4 There are predicted to be changes in nutrient nitrogen deposition rates above the screening criterion of 1 % in the River Itchen SAC and the Solent Maritime SAC. Total nutrient nitrogen deposition rates within these areas are above the critical loads of 15 kgN/ha/yr and 20 kgN/ha/yr respectively. There are predicted to be no changes above the screening criterion within the Solent and Southampton Water SPA and Ramsar site.

7.5 There are predicted to be changes in annual mean ammonia concentrations above the screening criterion of 1 % in the River Itchen SAC. Total ammonia concentrations are predicted to be below the critical level of 3 µg/m^3. There are no other locations where the predicted changes in annual mean ammonia concentrations are above the screening criterion.

Impacts In Combination With other Predicted Traffic Growth

7.6 There are predicted to be changes in annual mean NOx concentrations above the screening criterion of 1 % in all three designated sites. Total annual mean NO_x concentrations within the River Itchen SAC and the Solent Maritime SAC are above the critical level of 30 µg/m^3.

7.7 There are predicted to be changes in 24-hour mean NOx concentrations above the screening criterion of 10 % in all three designated sites.

7.8 There are predicted to be changes in nutrient nitrogen deposition rates above the screening criterion of 1 % in all three designated sites. Total nutrient nitrogen deposition rates within the River Itchen SAC and the Solent Maritime SAC are above the critical loads of 15 kgN/ha/yr and 20 kgN/ha/yr respectively.

7.9 There are predicted to be changes in annual mean ammonia concentrations above the screening criterion of 1 % in all three designated sites. Total ammonia concentrations are predicted to be above the critical level of 3 µg/m^3 within the River Itchen SAC and the Solent Maritime SAC.

Conclusions

7.10 The assessment has shown that the potential for the Eastleigh Borough Local Plan in isolation to have significant impacts on the River Itchen SAC close to Highbridge Road, Bishopstoke Road and the M27, and on the Solent Maritime SAC close to the M27 and A27, cannot be discounted purely by reference to the critical levels and critical loads and to the 1% and 10% screening criteria. Similarly, the potential for the Eastleigh Borough Local Plan in combination with other predicted traffic growth to have significant impacts on the above sites, as well as on the Solent and Southampton Water SPA and Ramsar site close to the M27, cannot be discounted. It is thus necessary to consider the effects that these air quality impacts might have on the specific ecosystems of interest.

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9 Glossary

AADT	Annual Average Daily Traffic
ADMS-Roads	Atmospheric Dispersion Modelling System model for Roads
APIS	Air Pollution Information System
AQC	Air Quality Consultants
CURED	Calculator Using Realistic Emissions for Diesels
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
EFT	Emission Factor Toolkit
Exceedance	A period of time when the concentration of a pollutant is greater than the appropriate air quality objective. This applies to specified locations with relevant exposure
HDV	Heavy Duty Vehicles (> 3.5 tonnes)
ICCT	International Council on Clean Transportation
LAQM	Local Air Quality Management
LDV	Light Duty Vehicles (<3.5 tonnes)
µg/m^3	Microgrammes per cubic metre
NO	Nitric oxide
NO_2	Nitrogen dioxide
NOx	Nitrogen oxides (taken to be NO_2 + NO)
NPPF	National Planning Policy Framework
Objectives	A nationally defined set of health-based concentrations for nine pollutants, seven of which are incorporated in Regulations, setting out the extent to which the standards should be achieved by a defined date. There are also vegetation-based objectives for sulphur dioxide and nitrogen oxides
RDE	Real Driving Emissions
SAC	Special Area of Conservation
SPA	Special Protection Area
Standards	A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal

TEA	Triethanolamine – used to absorb nitrogen dioxide

10 Appendices

A1 Professional Experience

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

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

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

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

Dr Imogen Heard, BSc (Hons) MSc PhD MInstPhys

Dr Heard is a Senior Consultant with AQC, having joined the company in 2013. Prior to joining she worked as a scientist in the Atmospheric Dispersion and Air Quality area at the UK Met Office for four years, modelling the dispersion of a range of pollutants over varying spatial and temporal scales. She now works in the field of air quality assessment and has been involved in numerous development projects including road schemes, energy from waste facilities, urban extensions and energy centres. These have included the use of ADMS-5 and ADMS-Roads dispersion models to study the impacts of a variety of pollutants, including nitrogen dioxide, PM_{10} and $PM_{2.5}$, and the preparation of air quality assessment reports and air quality chapters for Environmental Statements. She also has experience in undertaking construction dust risk assessments and Air Quality Neutral assessments, as well as in preparing local authority reports.

Full CVs are available at www.aqconsultants.co.uk.

A2 Modelling Methodology

Model Inputs

A2.1 Predictions have been carried out using the ADMS-Roads dispersion model (v4.1). The model requires the user to provide various input data, including emissions from each section of road and the road characteristics (including road width, where applicable). All of the roads entered into the model have been assumed to have no elevation above the surrounding ground level, even when the road in question is on a bridge.

A2.2 Traffic emissions of NOx have been calculated based on vehicle flow, composition and speed data using the EFT (Version 8.0.1) published by Defra (2018b).

A2.3 The two most commonly-used sources of ammonia emissions data in Europe come from the Computer Programme to calculate Emissions from Road Transport (COPERT) (Emisia, 2018) model and from the Netherlands Organisation for Applied Scientific Research (TNO). TNO has collated comprehensive evidence (TNO, 2015) which shows that the emissions factors used in COPERT are likely to be incorrect and should not, therefore, be used. Unfortunately, TNO’s own testing for ammonia has recently encountered some instrument problems and their latest data are thus subject to question (Norbert Ligterink, TNO, pers. comm). Ammonia is thought to be released both from 3-way catalytic converters in older vehicles and also, increasingly, from selective catalytic reduction devices fitted to newer diesel cars, vans, lorries, and buses. Ammonia is thus a bi-product of technology which is intended to reduce emission of NOx, but it is nevertheless reasonable to consider that the factors which drive higher NOx emissions (traffic volume, vehicle type, speed, and gradient) may also give rise to higher ammonia emissions.

A2.4 Work carried out by Wealden District Council (within Ashdown Forest in East Sussex) (Wealden District Council, 2018) has involved detailed roadside ammonia measurements which have been used to derive approximate, UK-specific, ammonia emissions factors for road traffic, which scale from 2015 NOx emissions in the EFT. These data have been updated to reflect the NOx emissions in EFT version 8.0.1, with the result being that, in order to predict traffic related ammonia emissions (in g/km/s), 2015-specific NOx emissions (in g/km/s) have been multiplied by a factor of 0.022. While the resultant estimates will be approximate, they are considered to be the best available estimate at the current time.

A2.5 COPERT does not predict any appreciable change in traffic-related ammonia emissions over time but, as noted above, this model is not considered to be robust for ammonia. Recent issues with TNO’s measurements make it very difficult to determine how ammonia emissions from traffic might change in the future, but it is the opinion of AQC, as well as of others in the field (e.g. Norbert Ligterink, TNO, pers. comm) that emissions per vehicle are likely to increase in the future. Unfortunately, there is currently no robust way to predict by how much emissions of ammonia per vehicle might change by 2036 and, because of this, ammonia emissions per vehicle are not predicted to change over time.

A2.6 Hourly sequential meteorological data from Middle Wallop for 2015 have been used in the model. The Middle Wallop meteorological monitoring station is located at the Army Aviation Centre, approximately 20 km to the northwest of the proposed development site. It is deemed to be the nearest monitoring station representative of meteorological conditions in the vicinity of the proposed development site; both the development site and the Middle Wallop meteorological monitoring station are located in the south of England where they will be influenced by the effects of inland meteorology over flat-lying topography.

A2.7 AADT flows, diurnal flow profiles, speeds, and vehicle fleet composition data for all major roads within the Eastleigh borough have been provided by Systra, who have undertaken the transport assessment work. Traffic speeds have been estimated based on professional judgement, taking account of the road layout, speed limits and the proximity to a junction. Diurnal flow profiles for the traffic have been derived from the national diurnal profiles published by DfT (2017b).

Sensitivity Test for Nitrogen Oxides and Nitrogen Dioxide

A2.8 As explained in Section 3, AQC has carried out a detailed analysis which showed that, whereas previous standards had had limited on-road success in reducing nitrogen oxides emissions from diesel vehicles, the 'Euro VI' and 'Euro 6' standards are delivering real on-road improvements (AQC, 2016). Defra's EFT v8.0.1 takes account of these observed improvements, but also makes additional assumptions regarding the performance of diesel cars and vans that will be produced in the future. In particular, it assumes that diesel cars and vans registered for type approval after 2020 will, on average, emit significantly less NOx than earlier models. A sensitivity test has been carried out using AQC's CURED v3A model (AQC, 2017b), which assumes that this post-2020 technology does not deliver any benefits (as a worst-case assumption). Further details of CURED v3A are provided in the supporting report prepared by AQC (2018a).

Background Concentrations and Deposition Fluxes

Background NO_2 and NOx Concentrations

A2.9 The background NOx and nitrogen dioxide concentrations across the study area have been defined using the national pollution maps published by Defra (2018b). These cover the whole country on a 1x1 km grid and are published for each year from 2013 until 2030. The background maps for 2015 have been calibrated against concurrent measurements from national monitoring sites. The calibration factor calculated has also been applied to future year backgrounds. This has resulted in slightly higher predicted concentrations for the future assessment year than those derived from the Defra maps.

Background NO_2 and NOx Concentrations for Sensitivity Test

A2.10 The road-traffic components of nitrogen oxides and nitrogen dioxide in the background maps have been uplifted in order to derive future year background nitrogen dioxide and nitrogen oxides concentrations for use in the sensitivity test. Details of the approach are provided in the report prepared by AQC (2018b).

Background Ammonia Concentrations and Nitrogen Deposition Fluxes

A2.11 Background ammonia concentrations and nitrogen deposition fluxes have been taken from the UK Deposition Data website operated by the Centre for Ecology and Hydrology (Centre for Ecology and Hydrology, 2018) for 2014 (the latest available year). In order to predict background ammonia concentrations in 2036, it would have been preferable to calculate source-specific emissions in 2015 and use detailed process information to model year-by-year changes in emissions from each source individually. Such an approach would, however, require resources well beyond the scope of this study. A best estimate has been calculated by multiplying existing annual mean background concentrations by the expected change in national ammonia emissions between 2015 and 2030 (which is the latest year for which Defra provides these predictions). Given other sources of uncertainty, this approach is considered to be appropriate. Defra has calculated the UK total NH_3 emissions in 2015 to be 272.11 kt, and in 2030 to be 294.33 kt (Defra, 2012). The 2015 background NH_3 concentrations have thus been multiplied by 294.33 / 272.11. This clearly over-simplifies what is likely to happen (for example, changes in the emissions of acidic gases over this period will change the behaviour of NH_3) but it nevertheless provides a useful estimate.

A2.12 Nitrogen deposition is influenced, amongst other factors, by concentrations of NOx and ammonia, however, the relationship between these emissions and nitrogen deposition is non-linear due to the changes to the chemical processing of NOx species in the atmosphere. Future concentrations of NOx are expected to fall, albeit not as rapidly as historically predicted. On the other hand, ammonia levels are predicted to increase into the future, primarily due to changes in agricultural processes (Defra, 2012). Background deposition rates have been factored forward by individually considering both the oxidised and reduced nitrogen deposition components, with the total background nitrogen deposition rate taken as the sum. In order to factor the oxidised nitrogen deposition component, Defra's maps of ambient background NOx concentrations in 2015 and 2030[3] for all 1 x 1 km grid squares covering the receptors have been obtained. The ratio of the assessment year (2036) prediction to the 2015 prediction at each square has then been calculated. On average, the predictions for 2036 are 75% respectively of those in 2015. The 2015 background fluxes have thus been multiplied by 0.75 to estimate 2036 values. For the sensitivity tests, the predictions for 2036 have been factored by 0.81. The reduced nitrogen deposition component has been adjusted following the approach given Paragraph A2.11.

Model Verification

A2.13 In order to ensure that ADMS-Roads accurately predicts local concentrations, it is necessary to verify the model against local measurements.

Background Concentrations

A2.14 Background concentrations of nitrogen dioxide for the verification sites have been derived from the national maps, having been calculated using the same approach as described in Paragraph 0. The background concentrations for the verification sites are presented in Table A2.1.

Table A2.1: Background Concentrations used in the Verification for 2015 (µg/m^3)

Site	NOx	NO_2
BR	22.0	15.8
BR2	22.0	15.8
MS	26.9	18.9
SRAN	26.5	18.6
SR1	26.5	18.6
WA	25.6	18.1
Objectives	**-**	**40**

Nitrogen Dioxide

A2.15 Most nitrogen dioxide (NO_2) is produced in the atmosphere by reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions of nitrogen oxides (NOx = NO + NO_2). The model has been run to predict the annual mean NOx concentrations during 2015 at six diffusion tube monitoring sites within the Eastleigh borough. Concentrations have been modelled at the heights of the monitors.

A2.16 The model output of road-NOx (i.e. the component of total NOx coming from road traffic) has been compared with the 'measured' road-NOx. Measured road-NOx has been calculated from the measured NO_2 concentrations and the predicted background NO_2 concentration using the NOx from NO_2 calculator (Version 6.1) available on the Defra LAQM Support website (Defra, 2018b).

A2.17 An adjustment factor has been determined as the slope of the best-fit line between the 'measured' road contribution and the model derived road contribution, forced through zero (Figure A2.1). The calculated adjustment factor of 2.098 has been applied to the modelled road-NOx concentration for each receptor to provide adjusted modelled road-NOx concentrations.

A2.18 The total nitrogen dioxide concentrations have then been determined by combining the adjusted modelled road-NOx concentrations with the predicted background NO_2 concentration within the

NOx to NO_2 calculator. Figure A2.2 compares final adjusted modelled total NO_2 at each of the monitoring sites to measured total NO_2, and shows a close agreement.

A2.19 The results imply that the model has under predicted the road-NOx contribution. This is a common experience with this and most other road traffic emissions dispersion models.

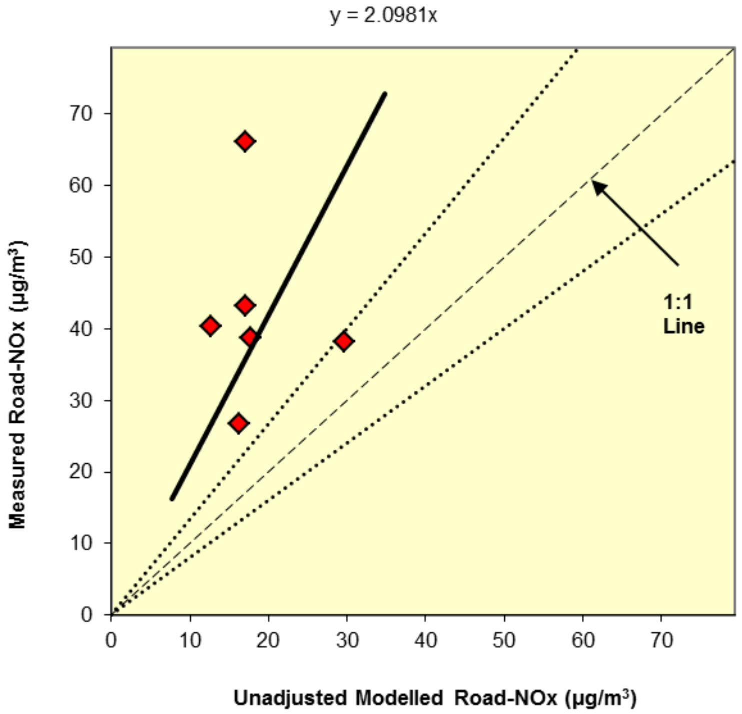

Figure A2.1: Comparison of Measured Road NOx to Unadjusted Modelled Road NOx Concentrations. The dashed lines show ± 25%.

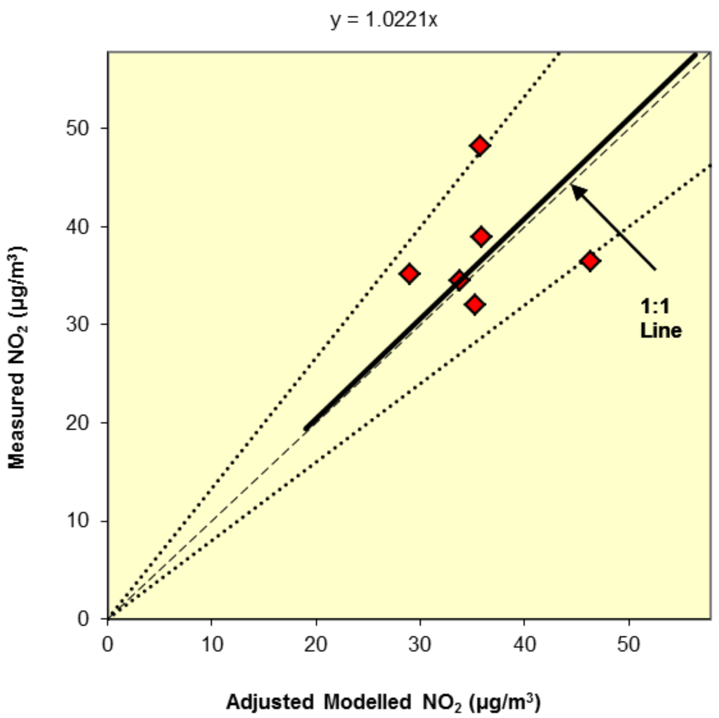

Figure A2.2: Comparison of Measured Total NO_2 to Final Adjusted Modelled Total NO_2 Concentrations. The dashed lines show ± 25%.

Ammonia

A2.20 There are no nearby ammonia monitors. It has therefore not been possible to verify the model for ammonia. The model outputs of road ammonia have therefore been adjusted by applying the adjustment factor calculated for road NOx.

Model Post-processing

A2.21 The model predicts road-NOx concentrations at each receptor location. These concentrations have been adjusted using the adjustment factor set out above, which, along with the background NO_2, has been processed through the NOx to NO_2 calculator available on the Defra LAQM Support website (Defra, 2018b). The traffic mix within the calculator has been set to “All UK traffic”, which is considered suitable for the study area. The calculator predicts the component of NO_2 based on the adjusted road-NOx and the background NO_2.

Deposition Rates

A2.22 Deposition has not been included within the dispersion model because the principal depositing component of concern is nitrogen dioxide and this is calculated from nitrogen oxides outside of the model. Instead, deposition has been calculated from the predicted ambient concentrations using the deposition velocities set out in Table A2.2. Deposition velocities refer to a height above ground, typically 1 or 2 m, although in practice the precise height makes little difference and here they have been applied to concentrations predicted at a height of 0 m above ground. The velocities are applied simply by multiplying a concentration (µg/m^3) by the velocity (m/s) to predict a deposition flux (µg/m^2/s). Subsequent calculations required to present the data as kg/ha/yr of nitrogen follow basic chemical and mathematical rules[5].

Table A2.2: Deposition Velocities Used in This Assessment

Pollutant	Deposition Velocity (m/s)	Reference
Nitrogen Dioxide	0.0015 m/s (Grassland)	AQTAG06 (Environment Agency, 2011)
Ammonia	0.02 m/s (Grassland)	AQTAG06 (Environment Agency, 2011)

A2.23 Wet deposition has been discounted. Wet deposition of the emitted pollutants this close to the emission source will be restricted to wash-out, or below cloud scavenging. For this to occur, rain droplets must come into contact with the gas molecules before they hit the ground. Falling raindrops displace the air around them, effectively pushing gasses away. The low solubility of nitrogen dioxide means that any scavenging of this gas will be a negligible factor. While wash-out of sulphur dioxide might be more significant, the very low sulphur oxide emission rates mean that discounting wet deposition is highly unlikely to affect the outcomes of the assessment.

5 For example, 1 kg N/ha/yr = 0.071 keq/ha/yr

A3 Contour Plots

Impacts With Local Plan

Annual Mean Nitrogen Oxides

10.1 Contours of the areas where changes in the annual mean nitrogen oxides concentrations are greater than 1% of the critical level screening criterion (the red areas) and the total nitrogen oxides concentrations are above the critical level (30 µg/m^3) (the grey areas) are shown in Figure A3.1 to Figure A3.4.

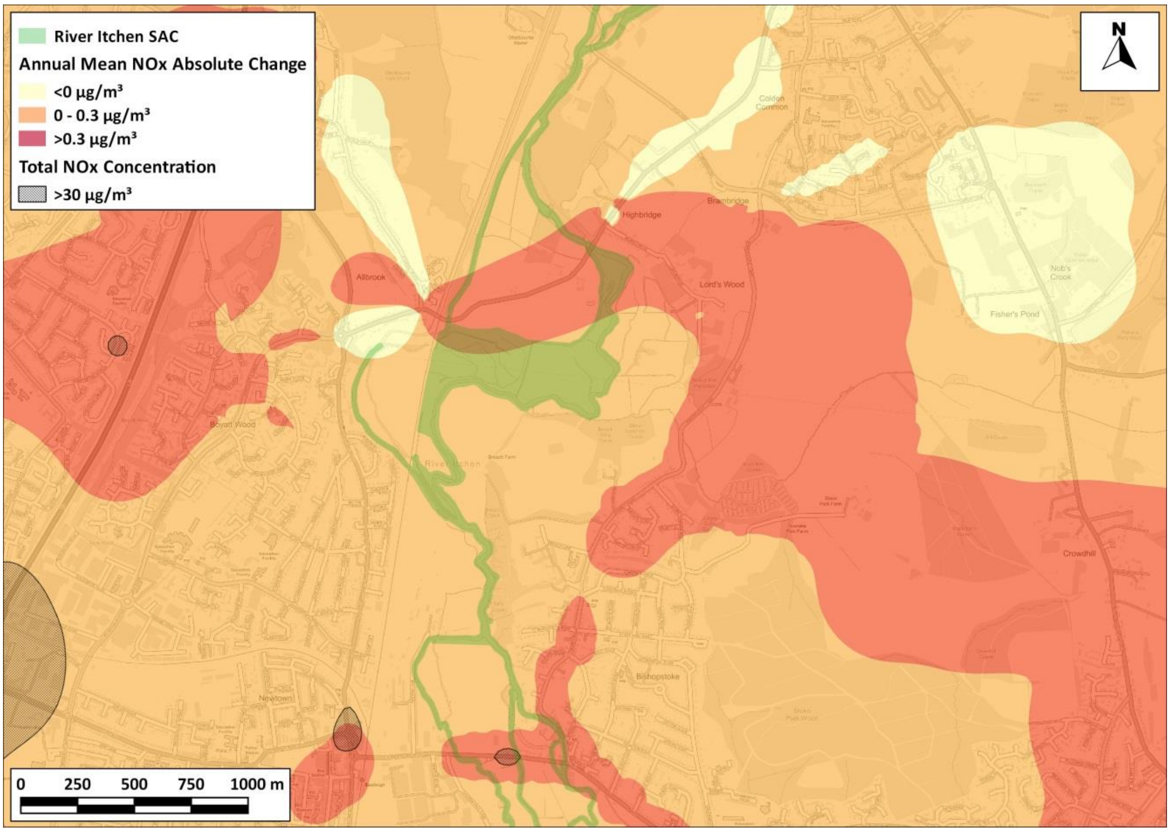

Figure A3.1: River Itchen Annual Mean NO_x: Absolute Change and Total Concentration

Figure A3.2: Solent Maritime Annual Mean NO_x: Absolute Change and Total Concentration

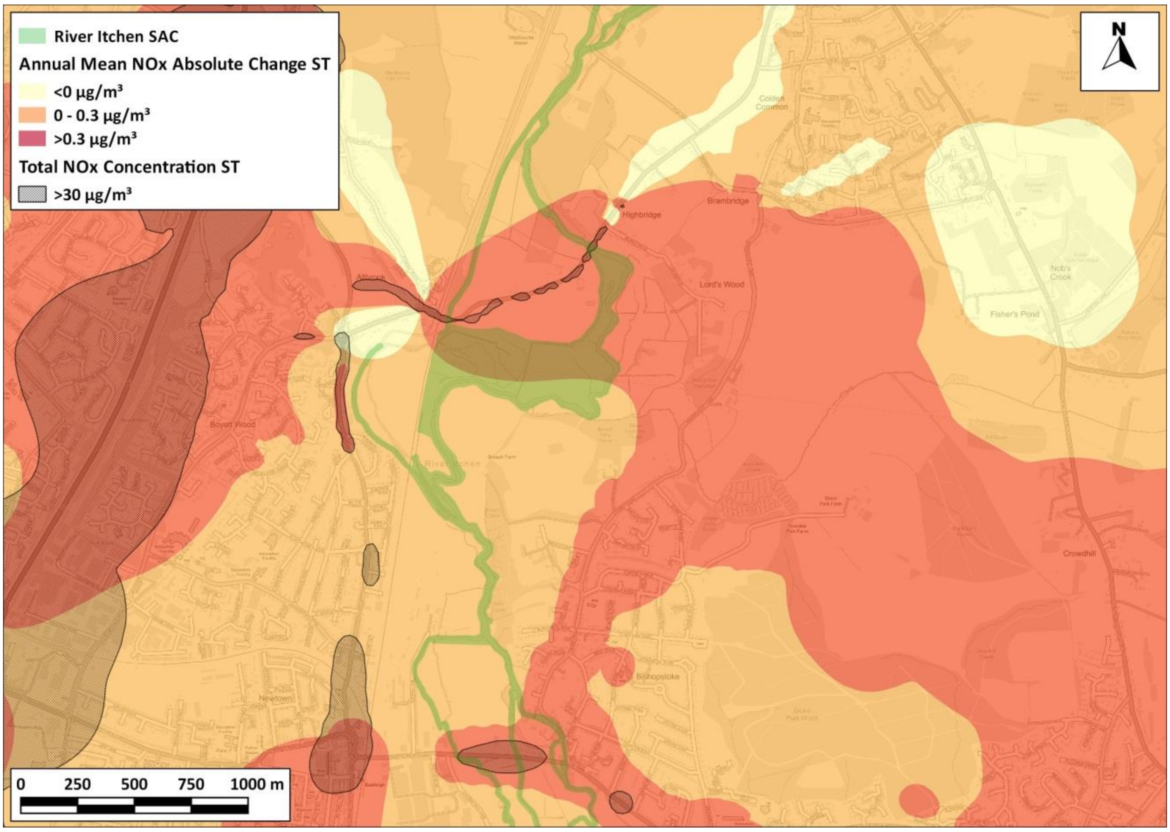

Figure A3.3: River Itchen Annual Mean NO_X: Absolute Change and Total Concentration Sensitivity Test

Figure A3.4: Solent Maritime Annual Mean NO_x: Absolute Change and Total Concentration Sensitivity Test

24-hour Mean Nitrogen Oxides

10.2 Contours of the area where changes in the 24-hour mean nitrogen oxides concentrations are greater than 10% of the critical level screening criterion (the red areas) are shown in Figure A3.5 and Figure A3.6.

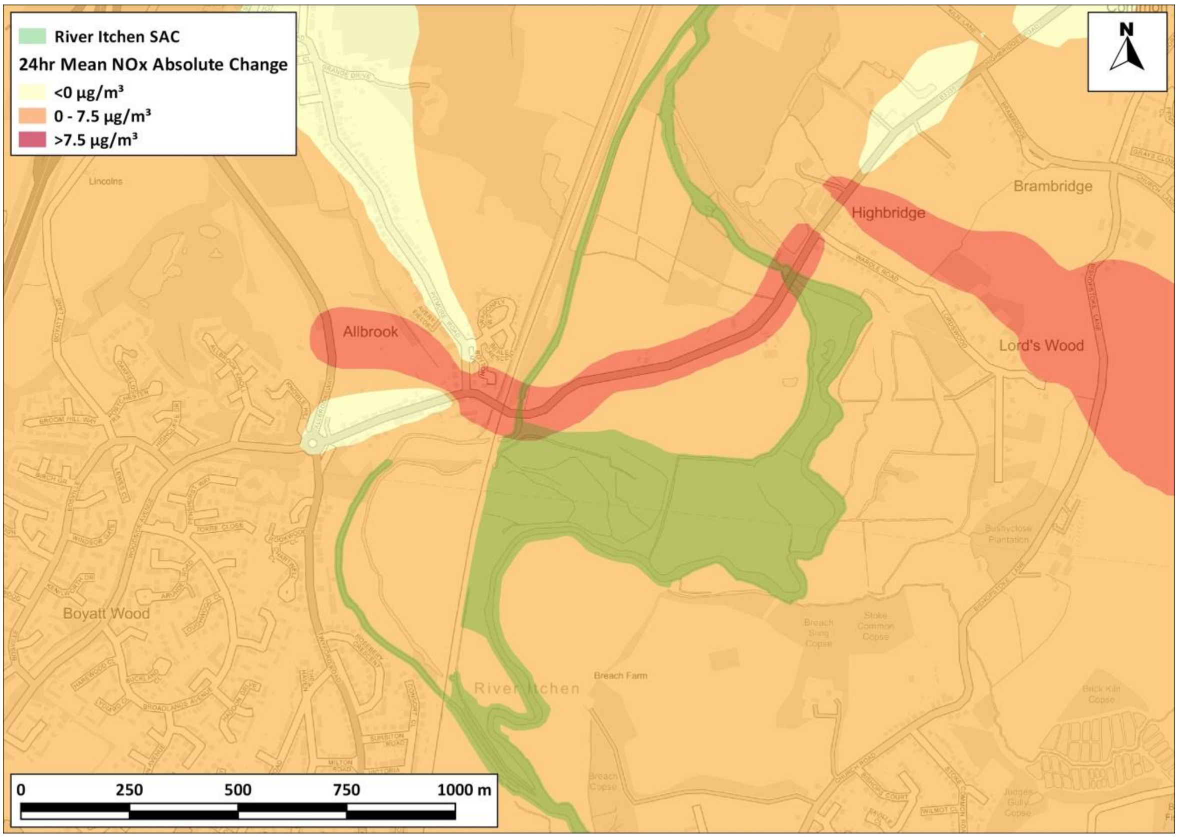

Figure A3.5: River Itchen 24-hour Mean NO_x: Absolute Change

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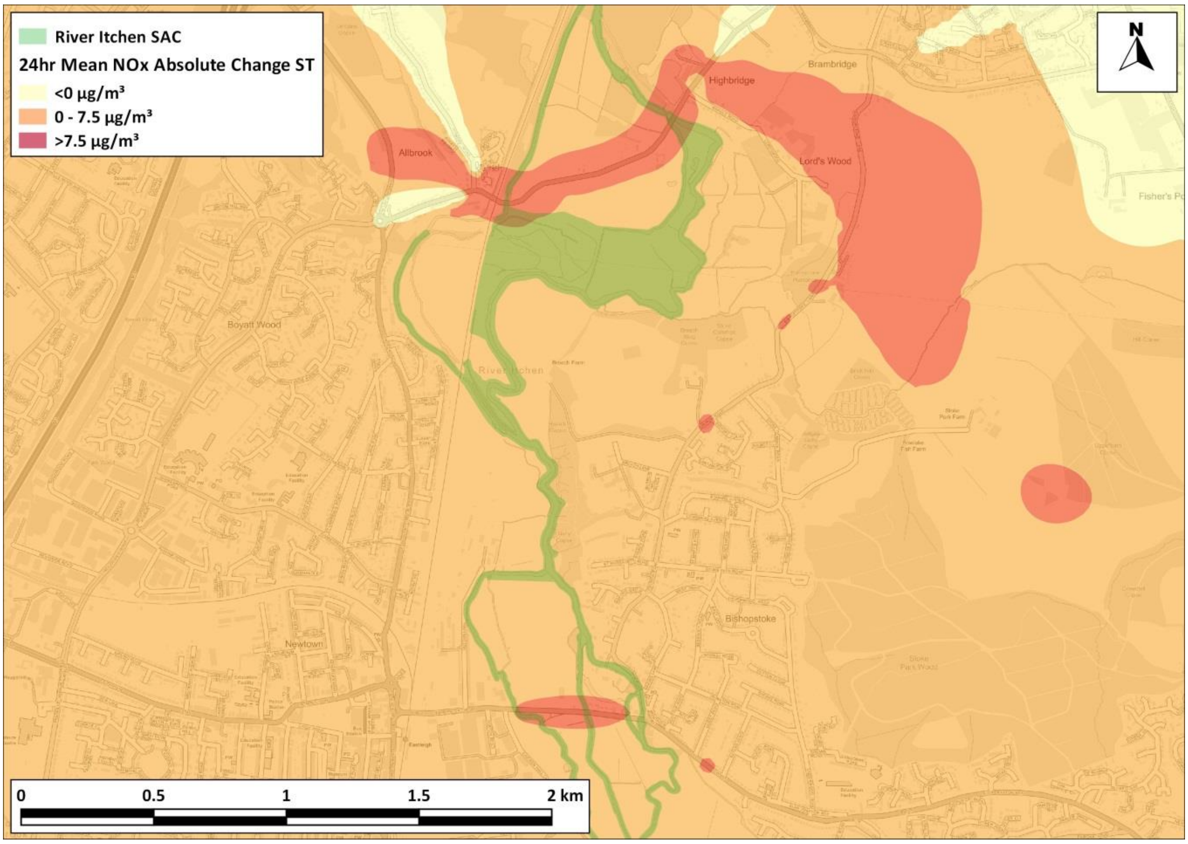

Figure A3.6: River Itchen 24-hour Mean NO_x: Absolute Change Sensitivity Test

Nutrient Nitrogen Deposition

10.3 Contours of the areas where changes in the nutrient nitrogen deposition rates are greater than 1% of the critical load screening criterion (the red areas) and the total nutrient nitrogen deposition rates are above the critical loads (the grey areas) are shown in Figure A3.7 to Figure A3.12. In Figure A3.7, Figure A3.10 and Figure A3.11 the whole area is grey.

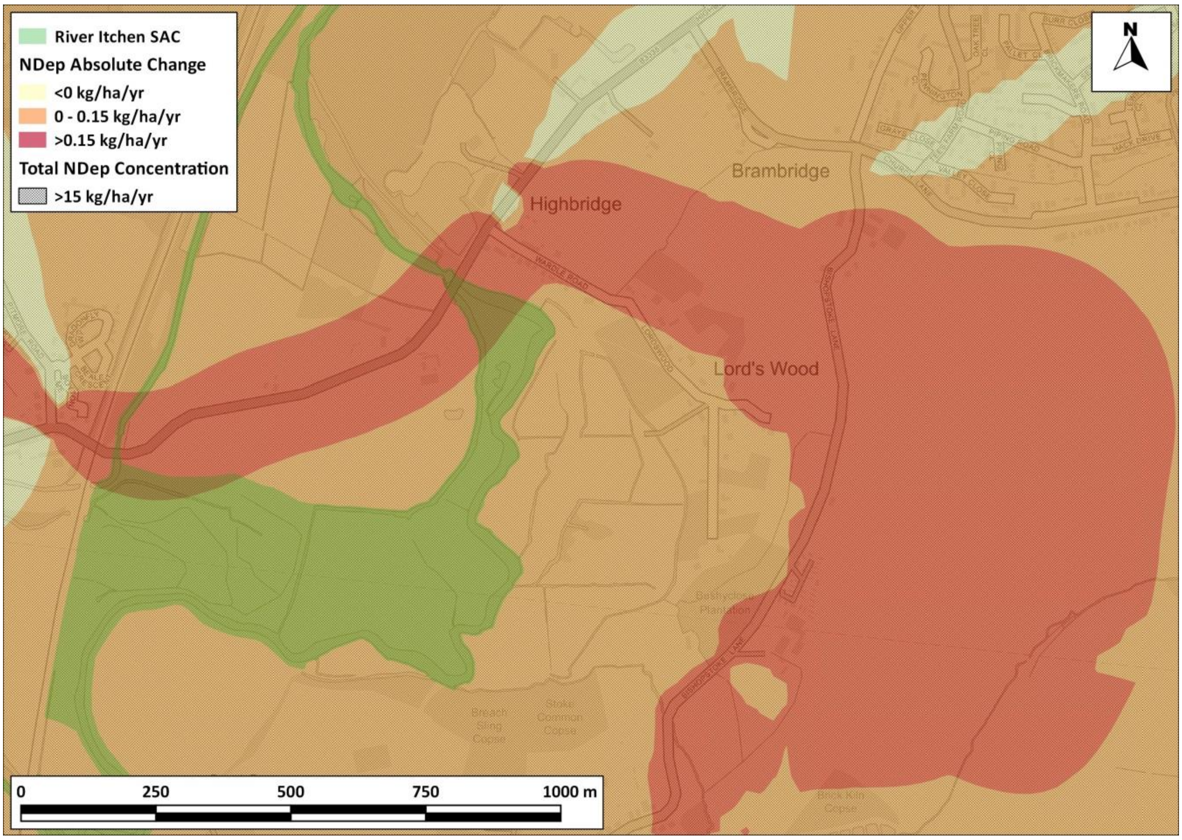

Figure A3.7: River Itchen (north) Nutrient Nitrogen Deposition: Absolute Change and Total Rate

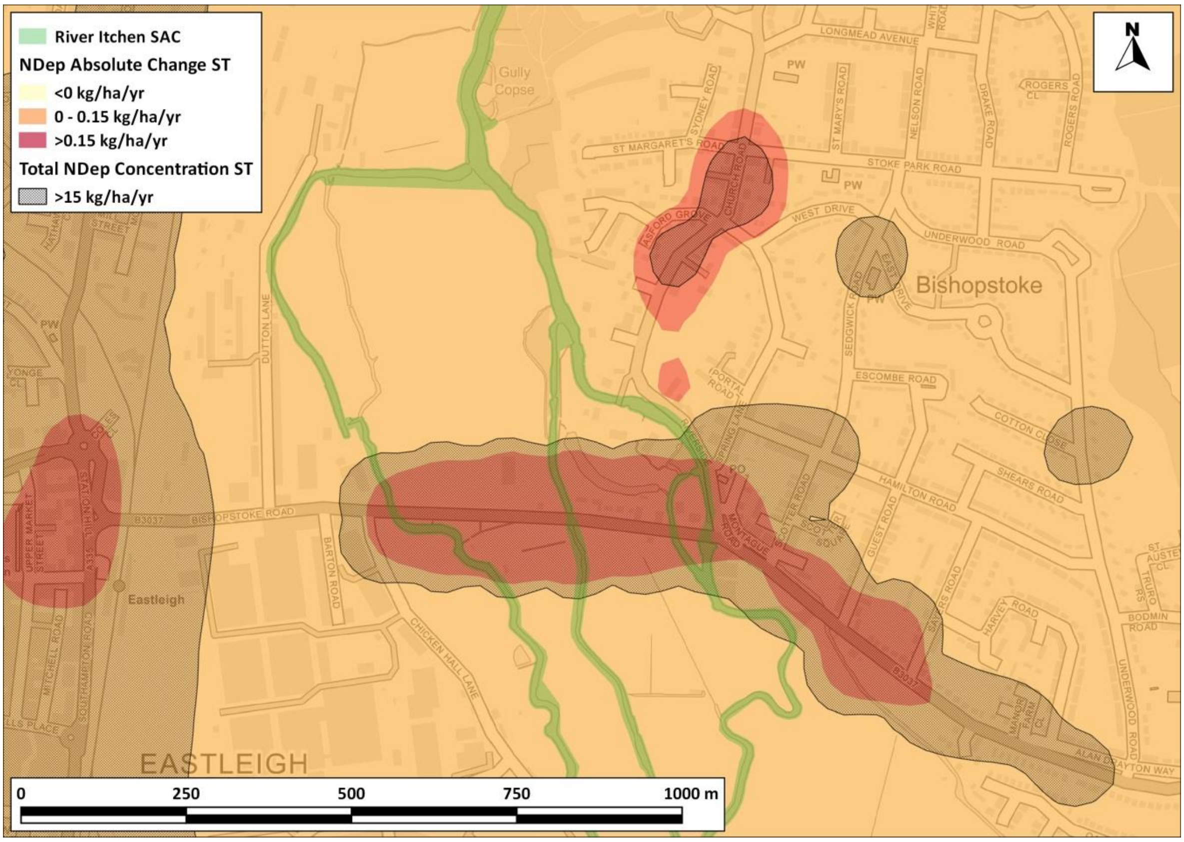

Figure A3.8: River Itchen (south) Nutrient Nitrogen Deposition: Absolute Change and Total Rate

Figure A3.9: Solent Maritime Nutrient Nitrogen Deposition: Absolute Change and Total Rate

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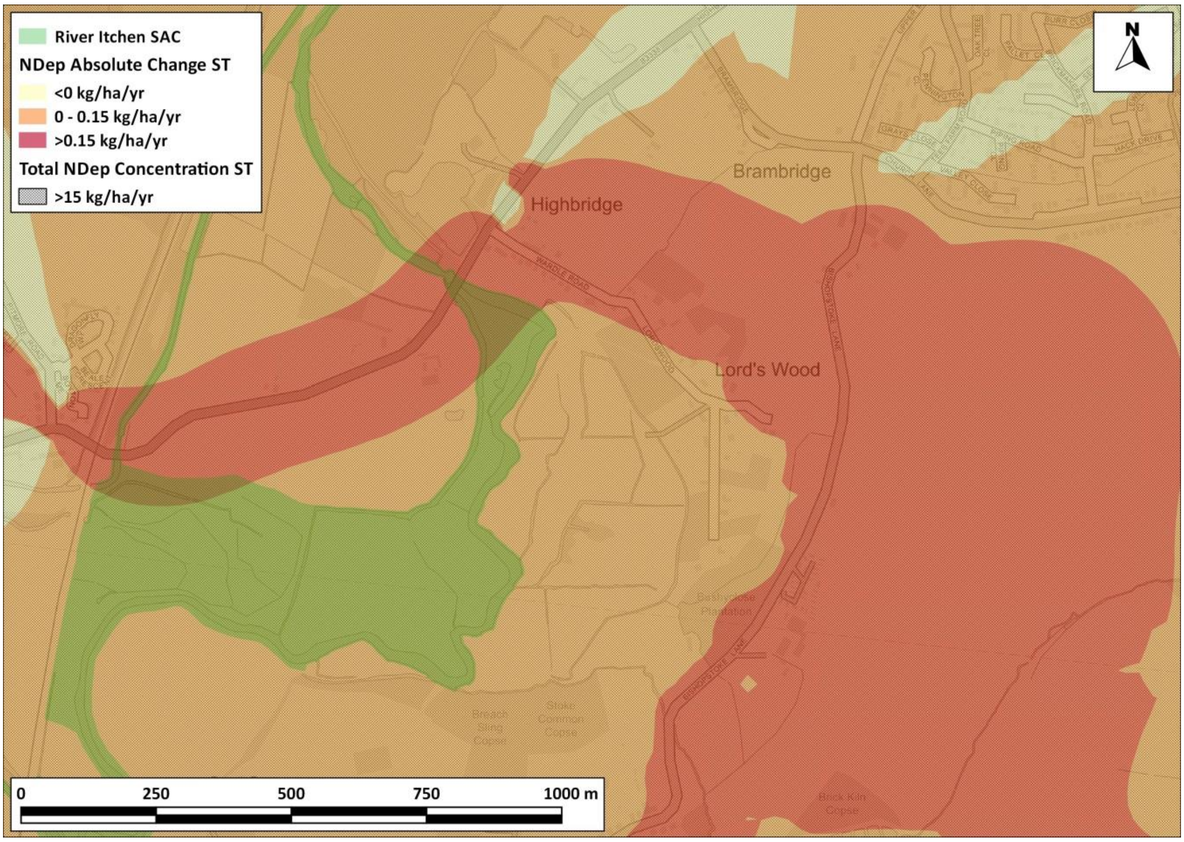

Figure A3.10: River Itchen (north) Nutrient Nitrogen Deposition: Absolute Change and Total Rate Sensitivity Test

Figure A3.11: River Itchen (south) Nutrient Nitrogen Deposition: Absolute Change and Total Rate Sensitivity Test

Figure A3.12: Solent Maritime Nutrient Nitrogen Deposition: Absolute Change and Total Rate Sensitivity Test

Annual Mean Ammonia

10.4 Contours of the area where changes in the annual mean ammonia concentrations are greater than 1% of the critical level screening criterion (the red areas) and the total ammonia concentrations are above the critical level (3 µg/m^3) (the grey areas) are shown in Figure A3.13.

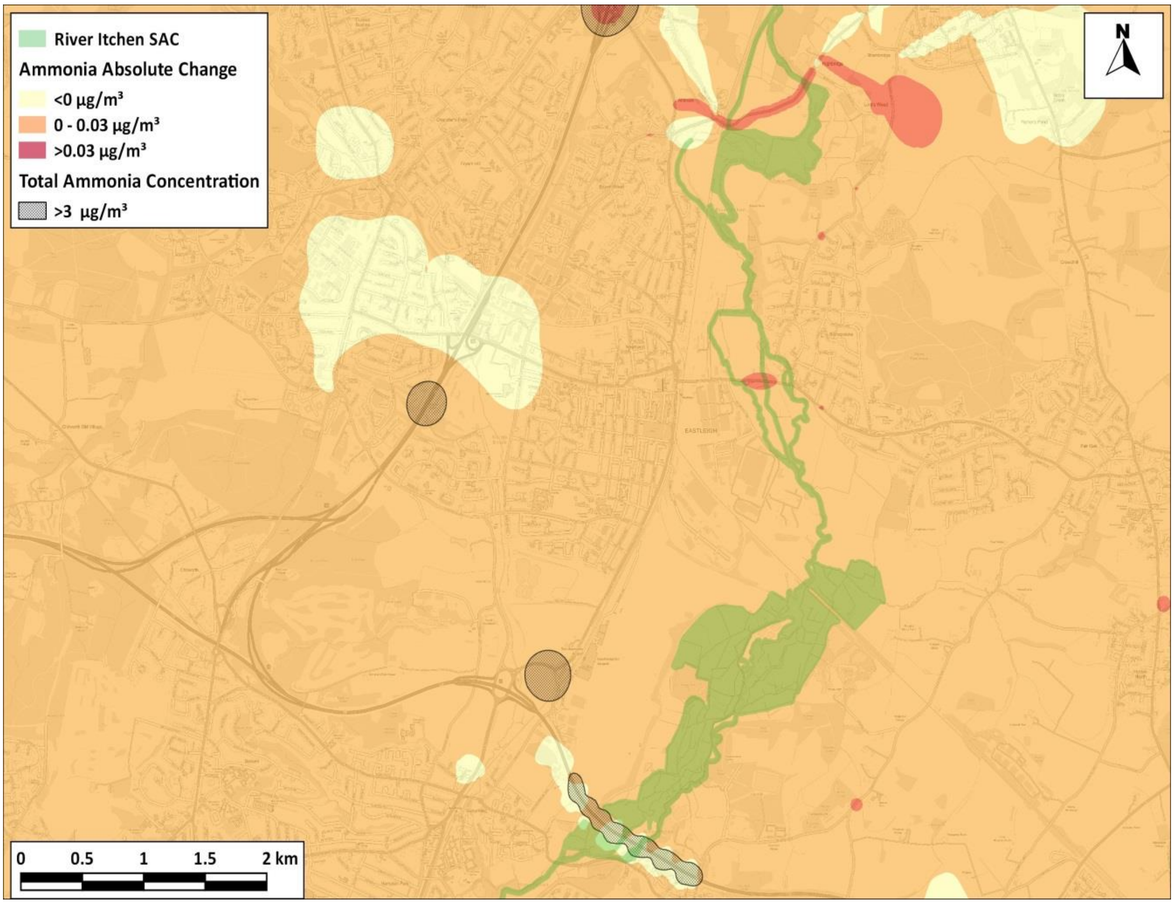

Figure A3.13: River Itchen Annual Mean Ammonia: Absolute Change and Total Concentration

Impacts 'In Combination'

Annual Mean Nitrogen Oxides

10.5 Contours of the areas where changes in the annual mean nitrogen oxides concentrations are greater than 1% of the critical level screening criterion (the red areas) and the total nitrogen oxides concentrations are above the critical level (30 µg/m^3) (the grey areas) are shown in Figure A3.14 to Figure A3.17.

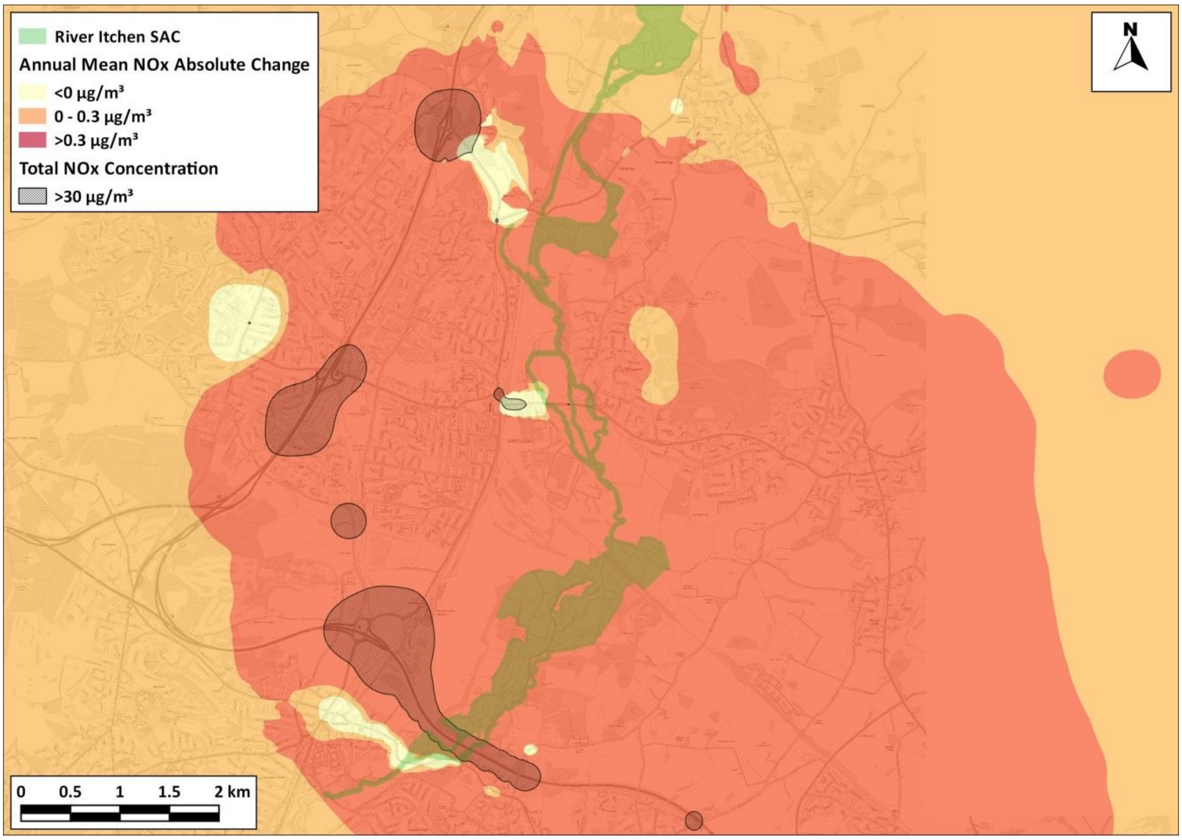

Figure A3.14: River Itchen Annual Mean NO_x: Absolute Change and Total Concentration

Figure A3.15: Solent Maritime Annual Mean NO_x: Absolute Change and Total Concentration

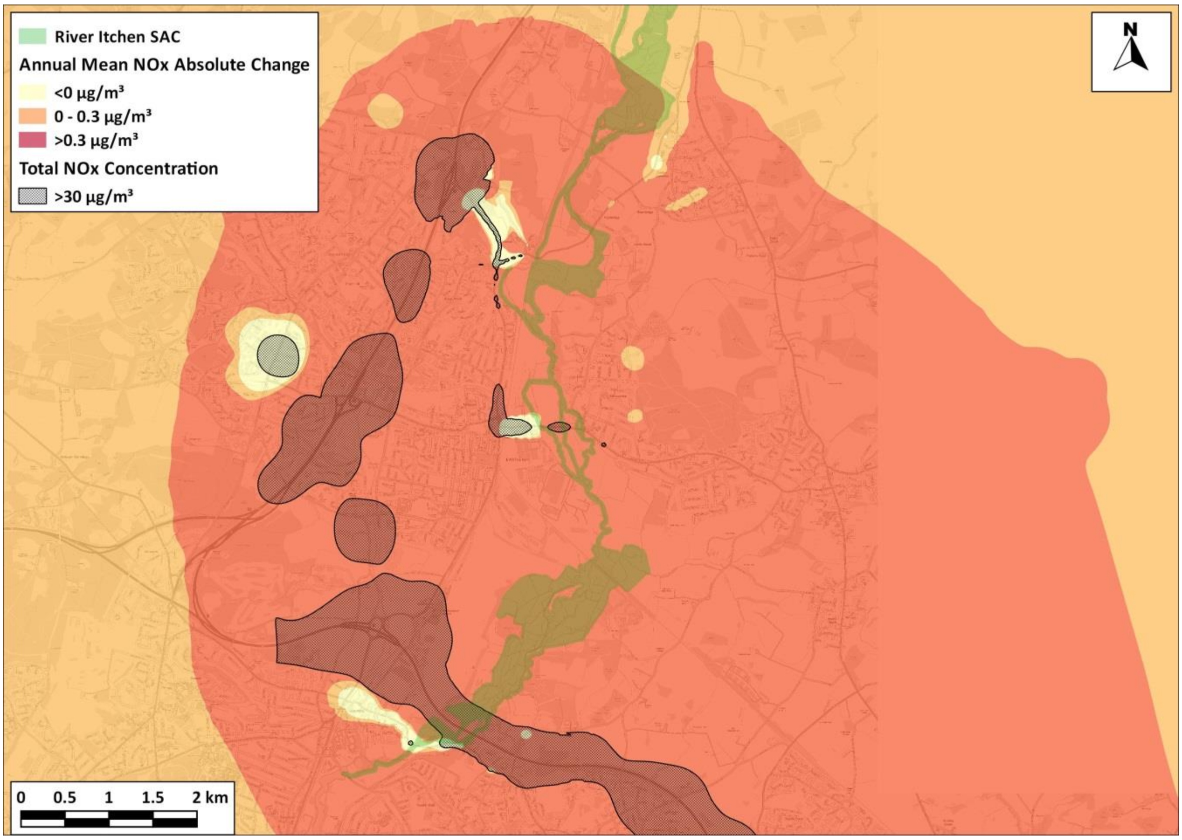

Figure A3.16: River Itchen Annual Mean NO_x: Absolute Change and Total Concentration Sensitivity Test

Figure A3.17: Solent Maritime Annual Mean NO_x: Absolute Change and Total Concentration Sensitivity Test

24-hour Mean Nitrogen Oxides

10.6 Contours of the area where changes in the 24-hour mean nitrogen oxides concentrations are greater than 10% of the critical level screening criterion (red areas) are shown in Figure A3.18 to Figure A3.21.

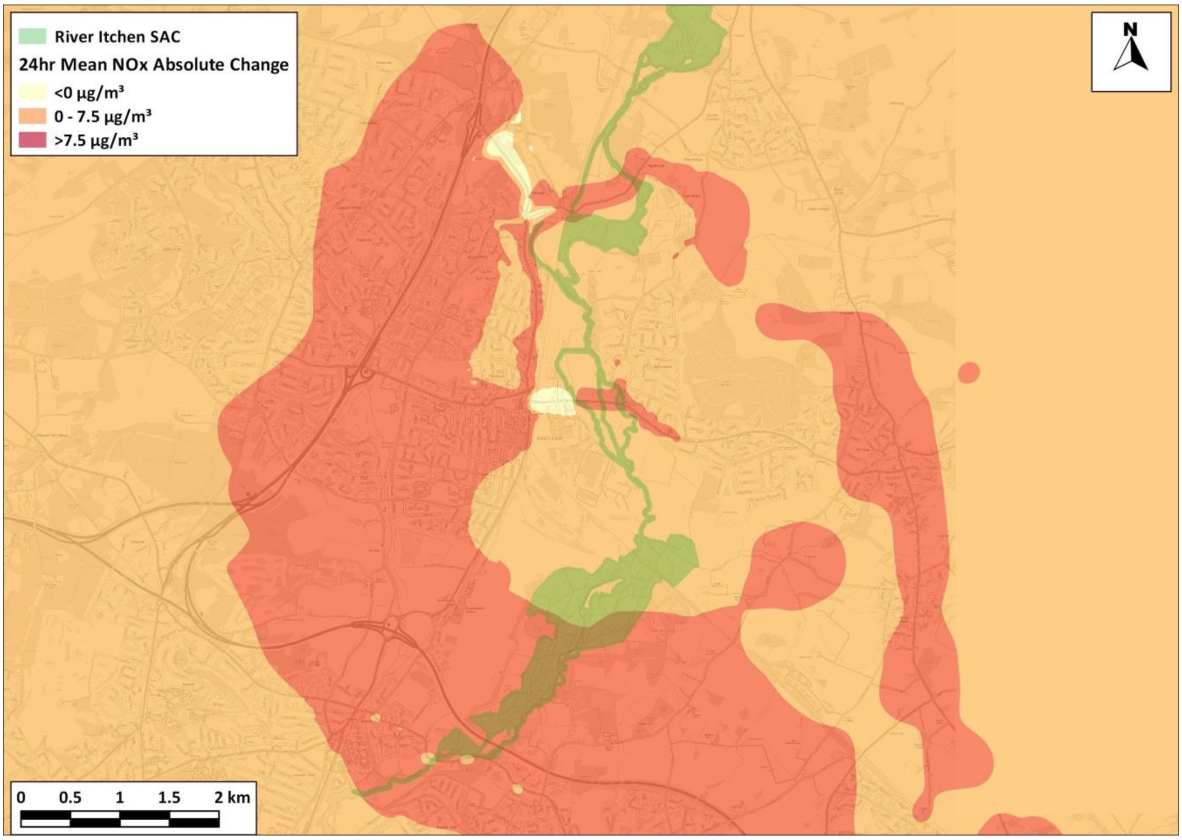

Figure A3.18: River Itchen 24-hour Mean NO_x: Absolute Change

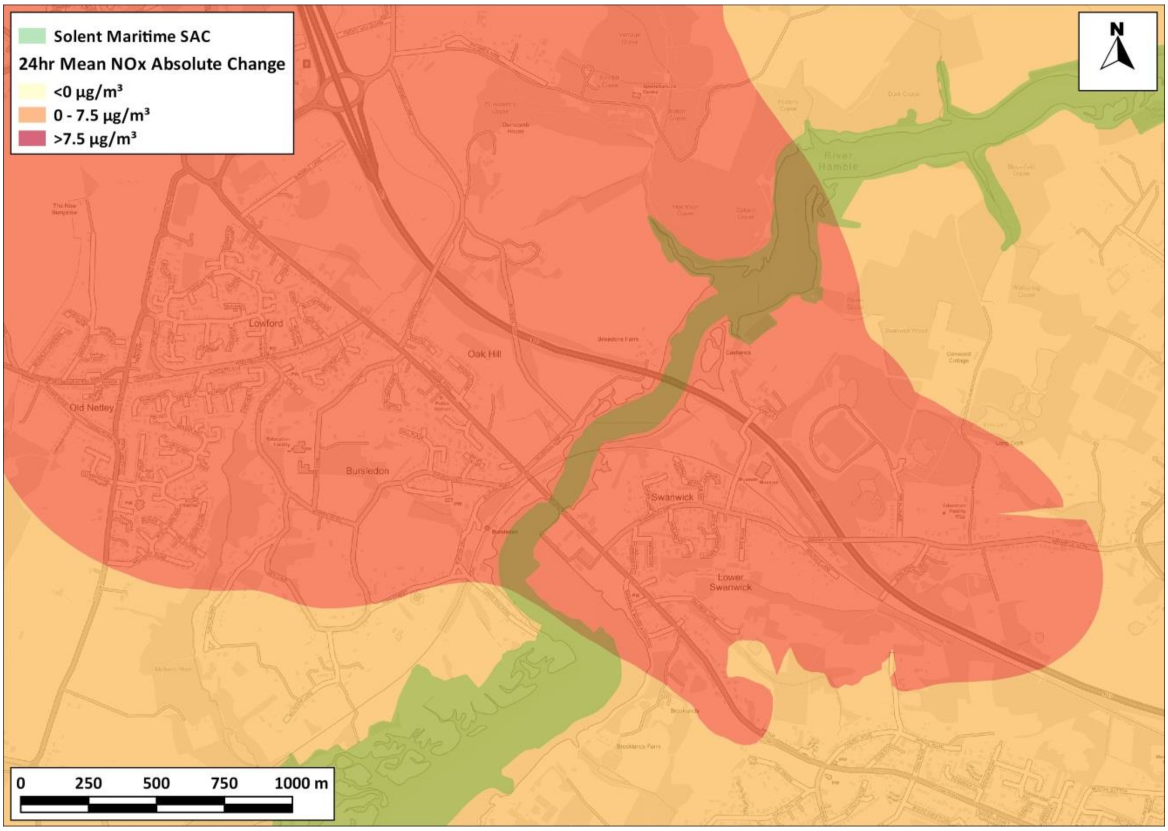

Figure A3.19: Solent Maritime 24-hour Mean NO_x: Absolute Change

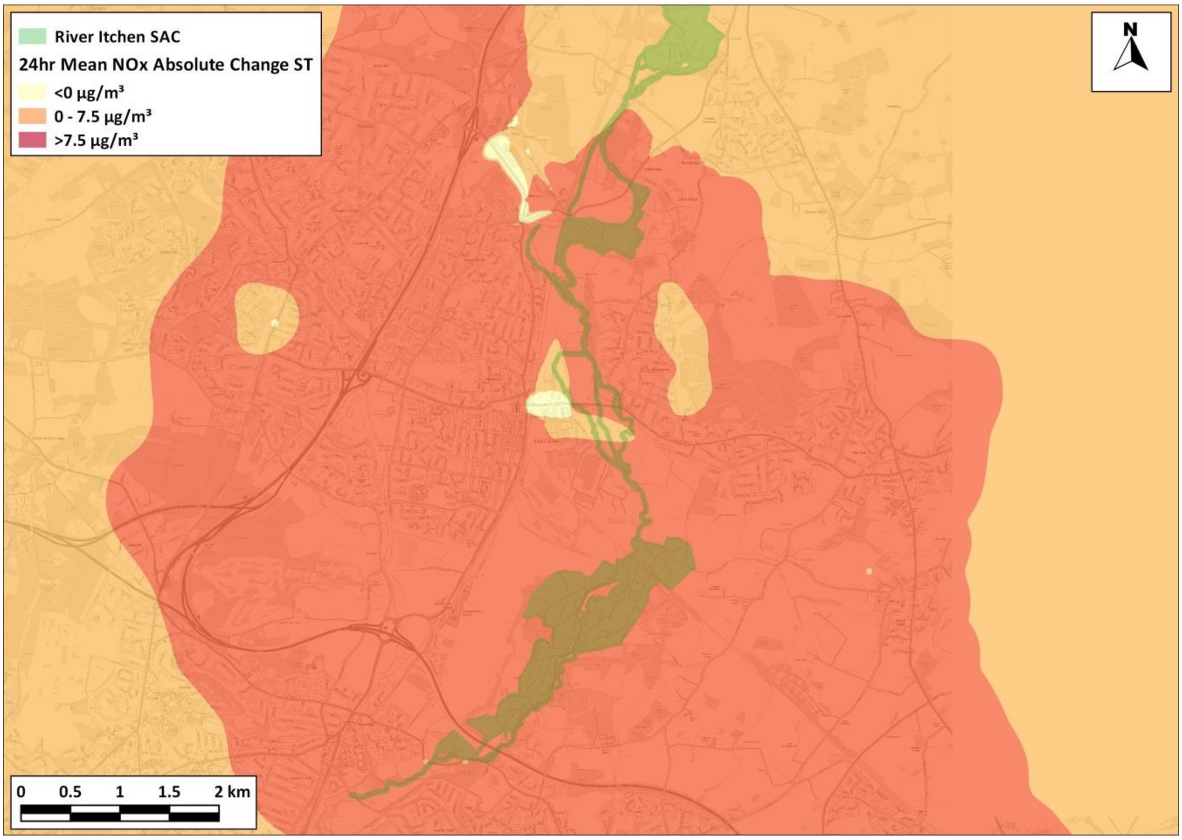

Figure A3.20: River Itchen 24-hour Mean NO_x: Absolute Change Sensitivity Test

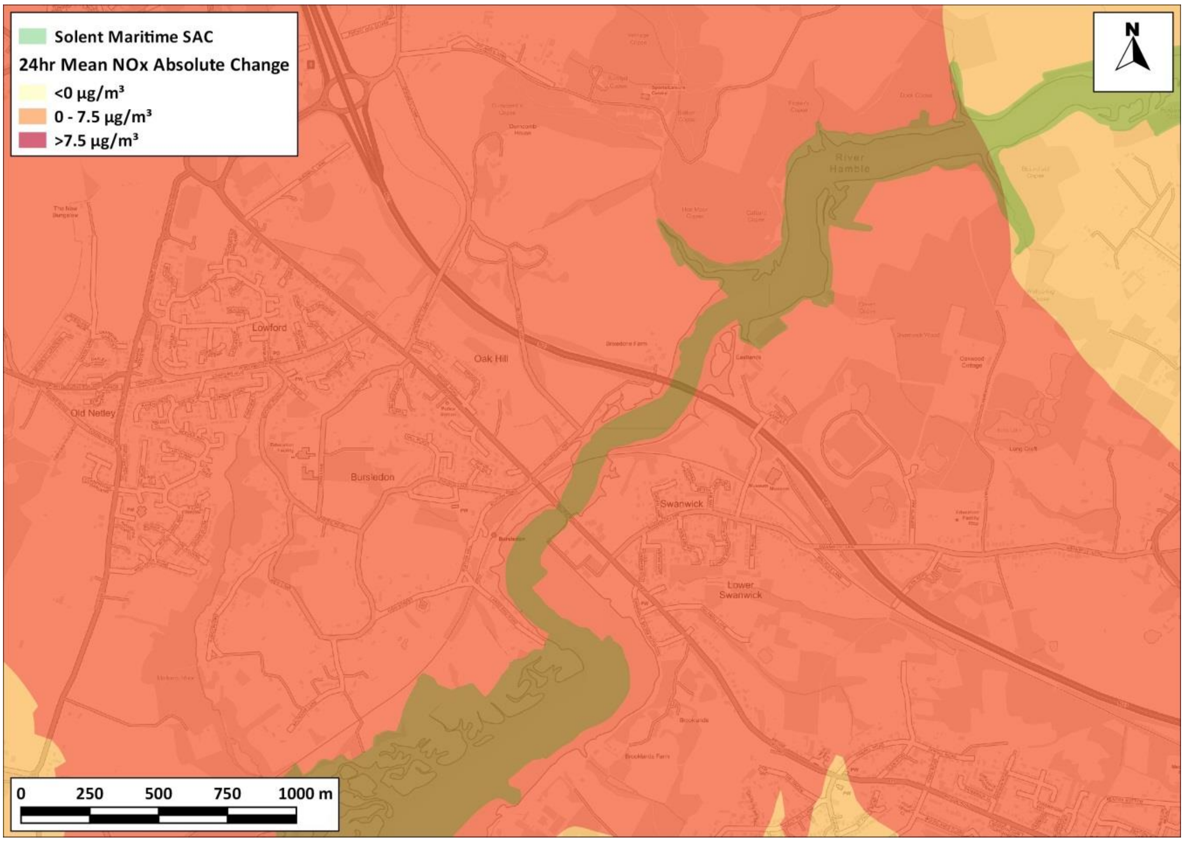

Figure A3.21: Solent Maritime 24-hour Mean NO_x: Absolute Change Sensitivity Test

Nutrient Nitrogen Deposition

10.7 Contours of the areas where changes in the nutrient nitrogen deposition rates are greater than 1% of the critical load screening criterion (the red areas) and the total nutrient nitrogen deposition rates are above the critical loads (the grey areas) are shown in Figure A3.22 to Figure A3.25.

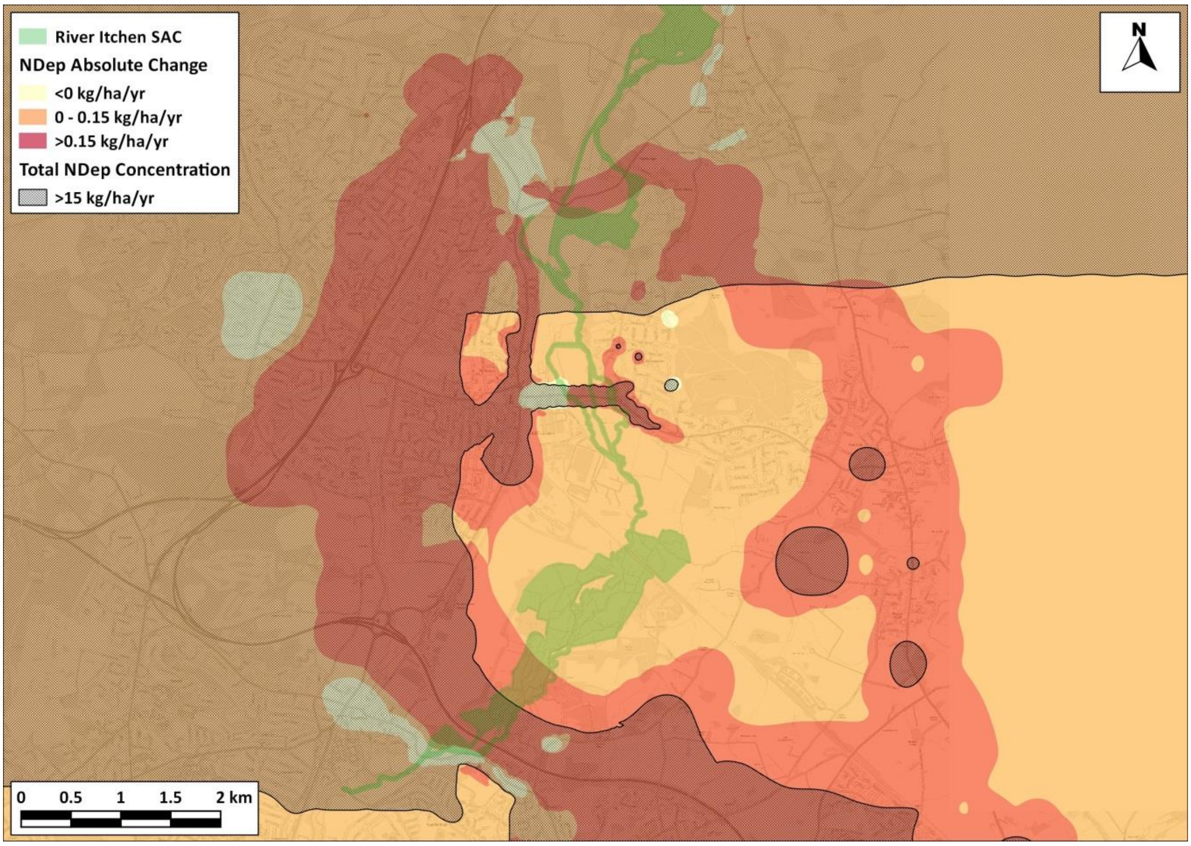

Figure A3.22: River Itchen Nutrient Nitrogen Deposition: Absolute Change and Total Rate

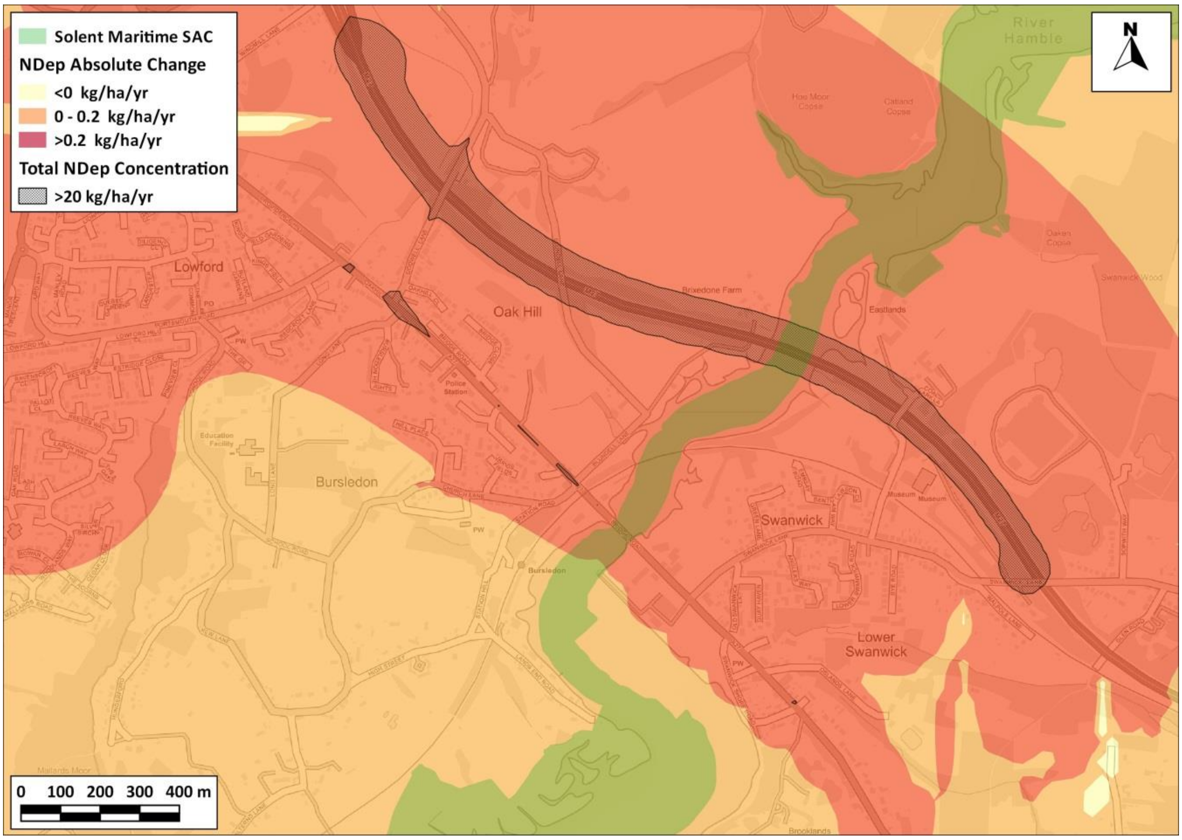

Figure A3.23: Solent Maritime Nutrient Nitrogen Deposition: Absolute Change and Total Rate

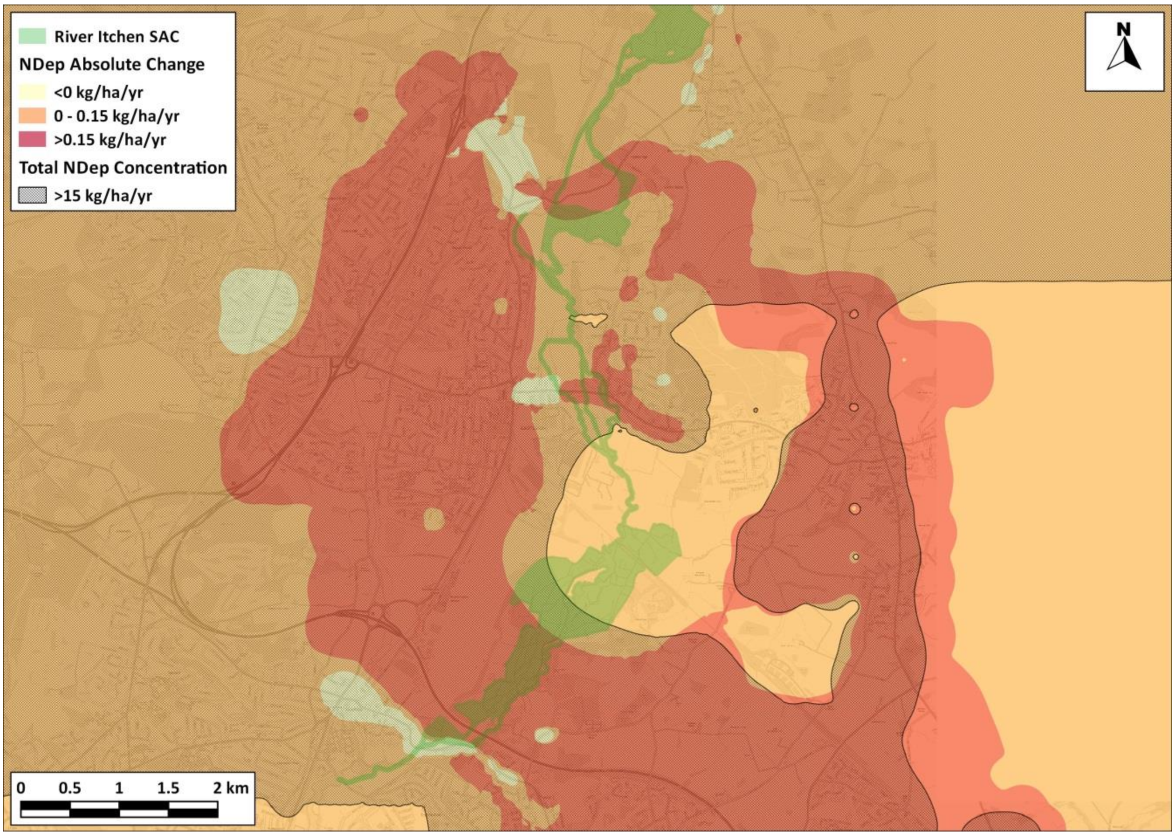

Figure A3.24: River Itchen Nutrient Nitrogen Deposition: Absolute Change and Total Rate Sensitivity Test

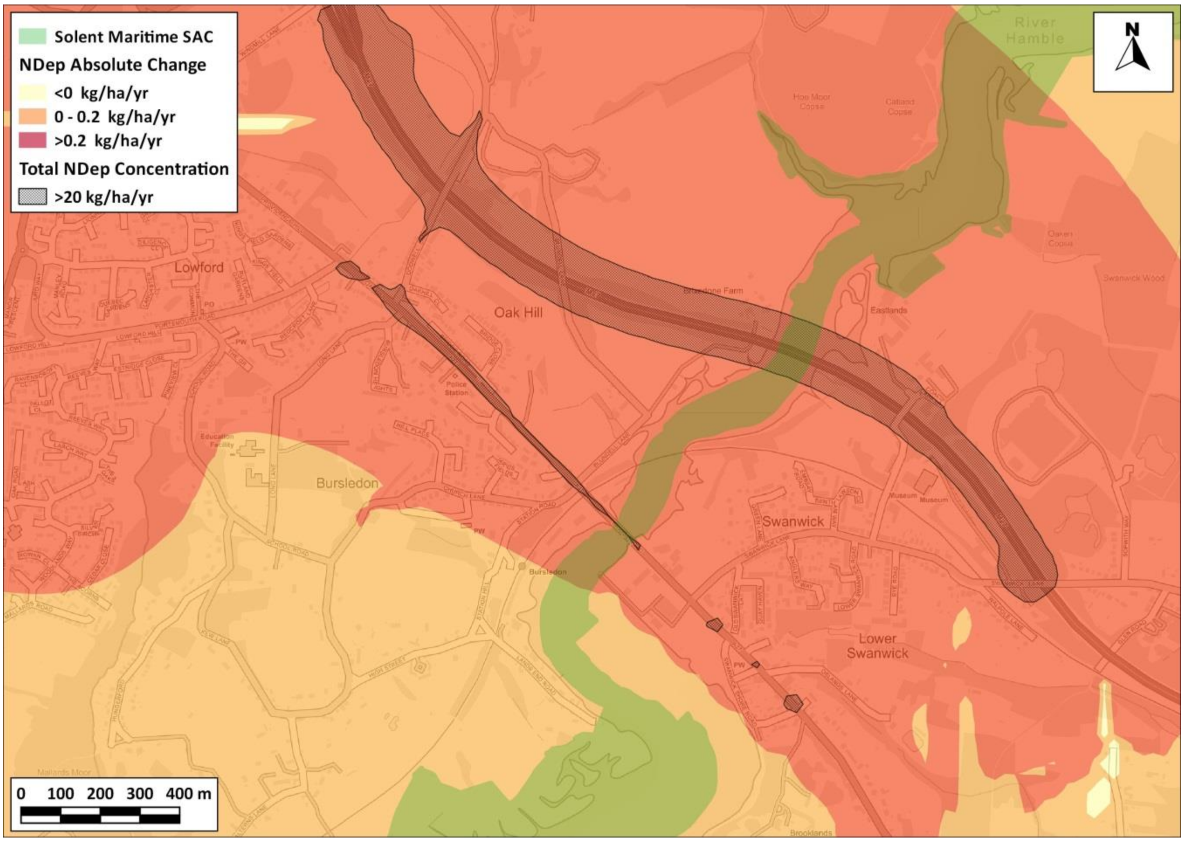

Figure A3.25: Solent Maritime Nutrient Nitrogen Deposition: Absolute Change and Total Rate Sensitivity Test

Annual Mean Ammonia

10.8 Contours of the areas where changes in the annual mean ammonia concentrations are greater than 1% of the critical level screening criterion and the total ammonia concentrations are above the critical level (3 µg/m^3) are shown in Figure A3.26 and Figure A3.27.

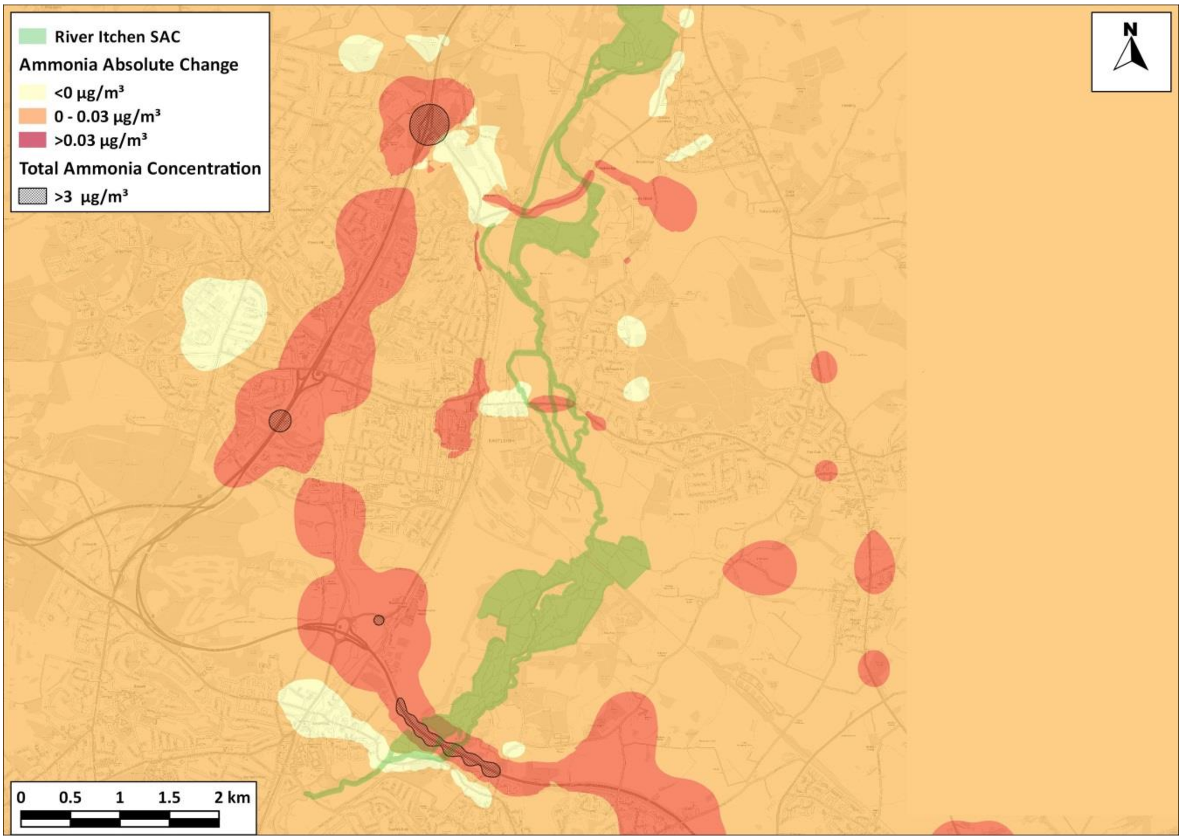

Figure A3.26: River Itchen Annual Mean Ammonia: Absolute Change and Total Concentration

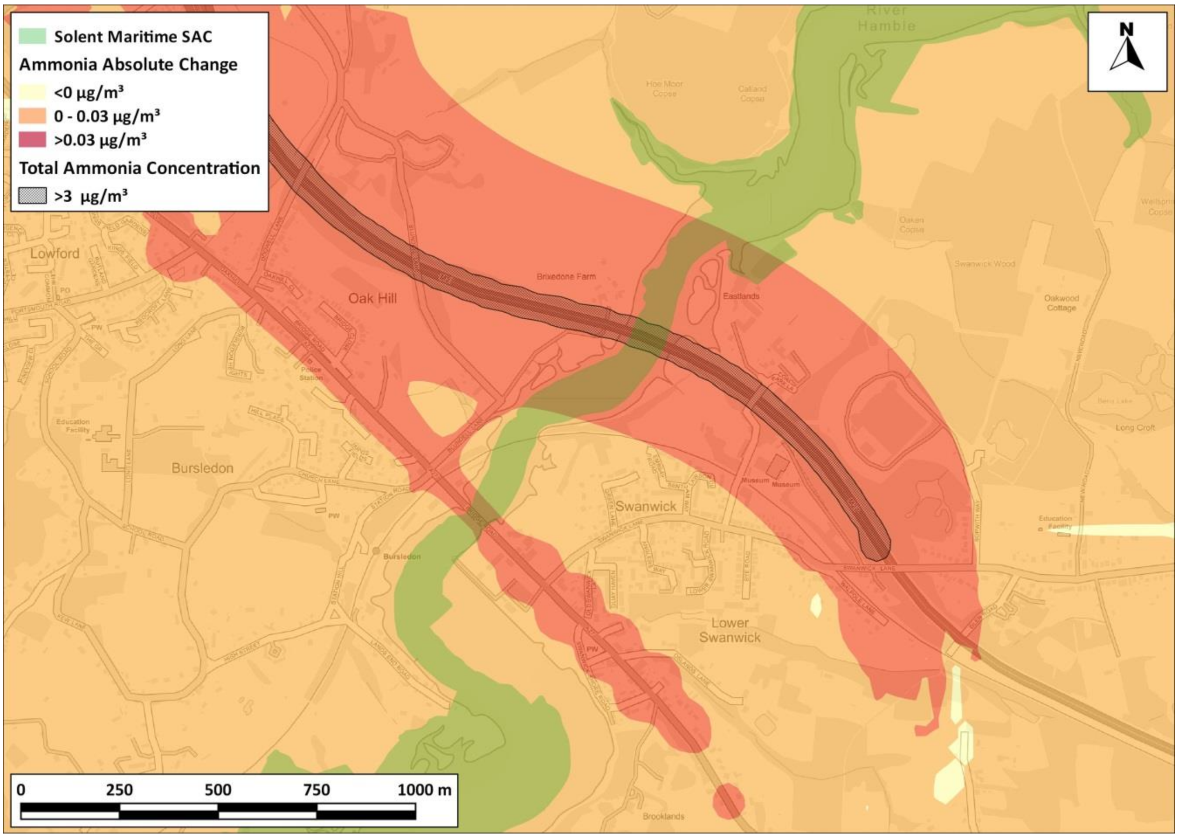

Figure A3.27: Solent Maritime Annual Mean Ammonia: Absolute Change and Total Concentration

A4 Transect Plots

Impacts With Local Plan

A4.1 Transects showing the change in nitrogen deposition to the River Itchen SAC with distance from Highbridge Road, Bishopstoke Road and the M27 are shown in Figure A4.1 to Figure A4.16.

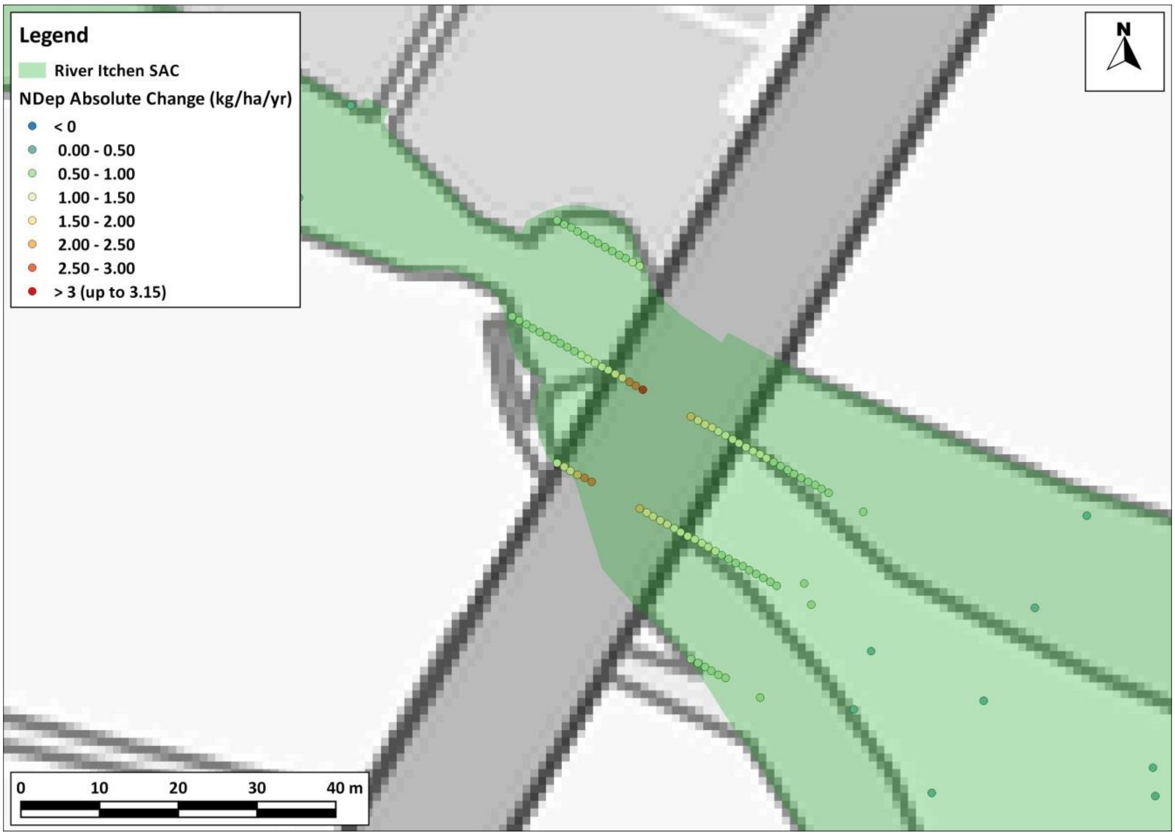

Figure A4.1: Highbridge Road East

Figure A4.2: Highbridge Road West

Figure A4.3: Bishopstoke Road East

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Figure A4.4: Bishopstoke Road Central

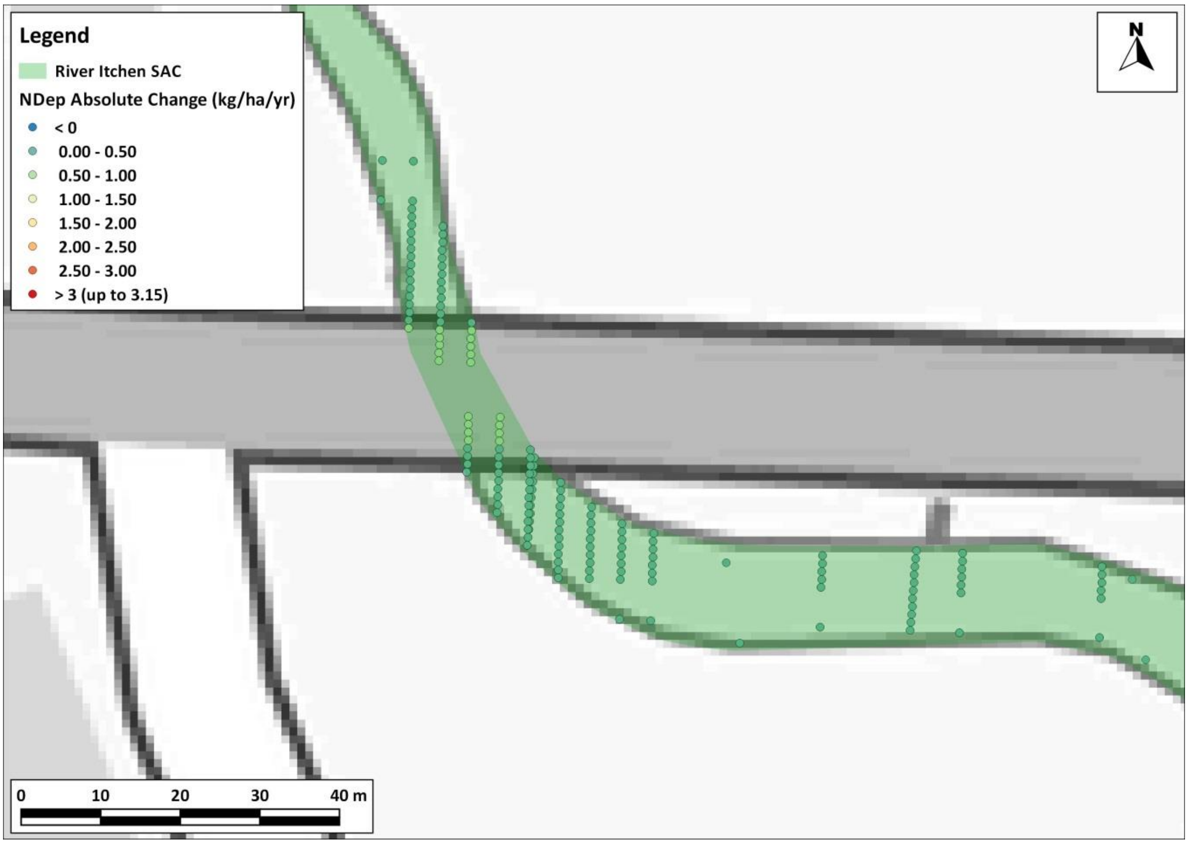

Figure A4.5: Bishopstoke Road West

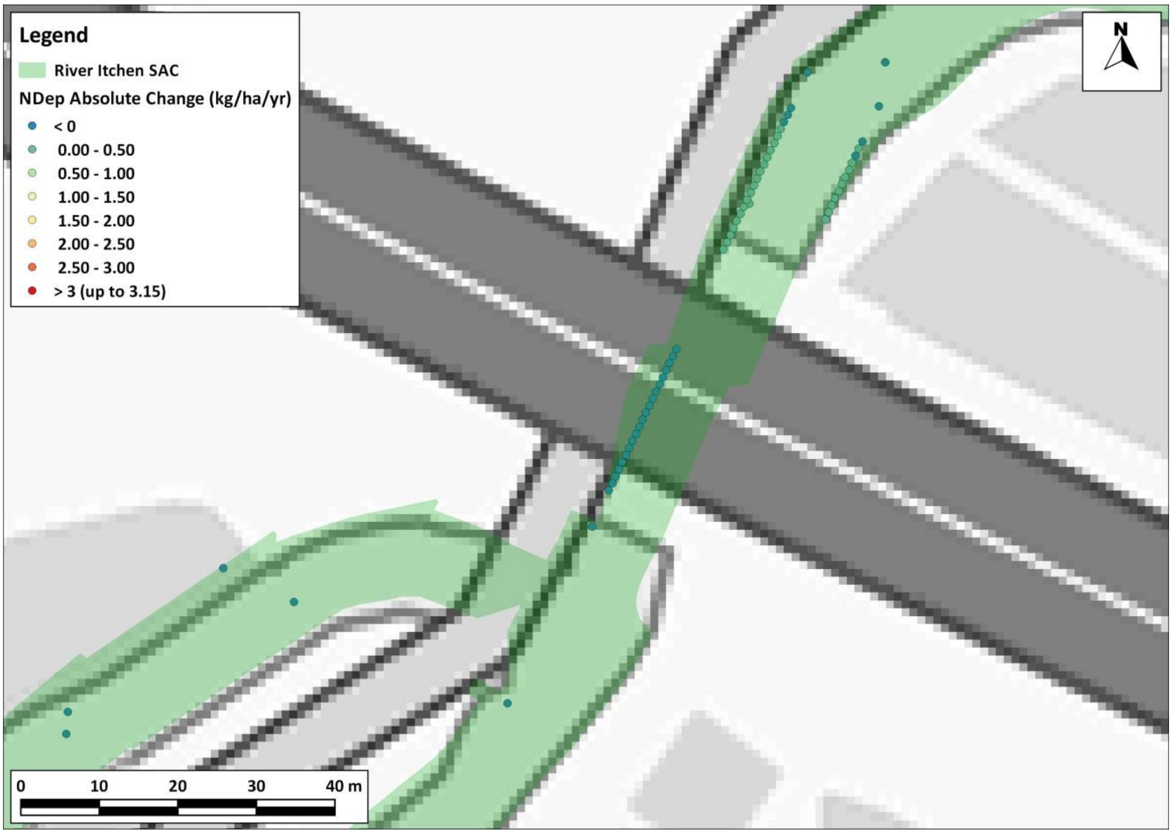

Figure A4.6: M27 River Itchen SAC East

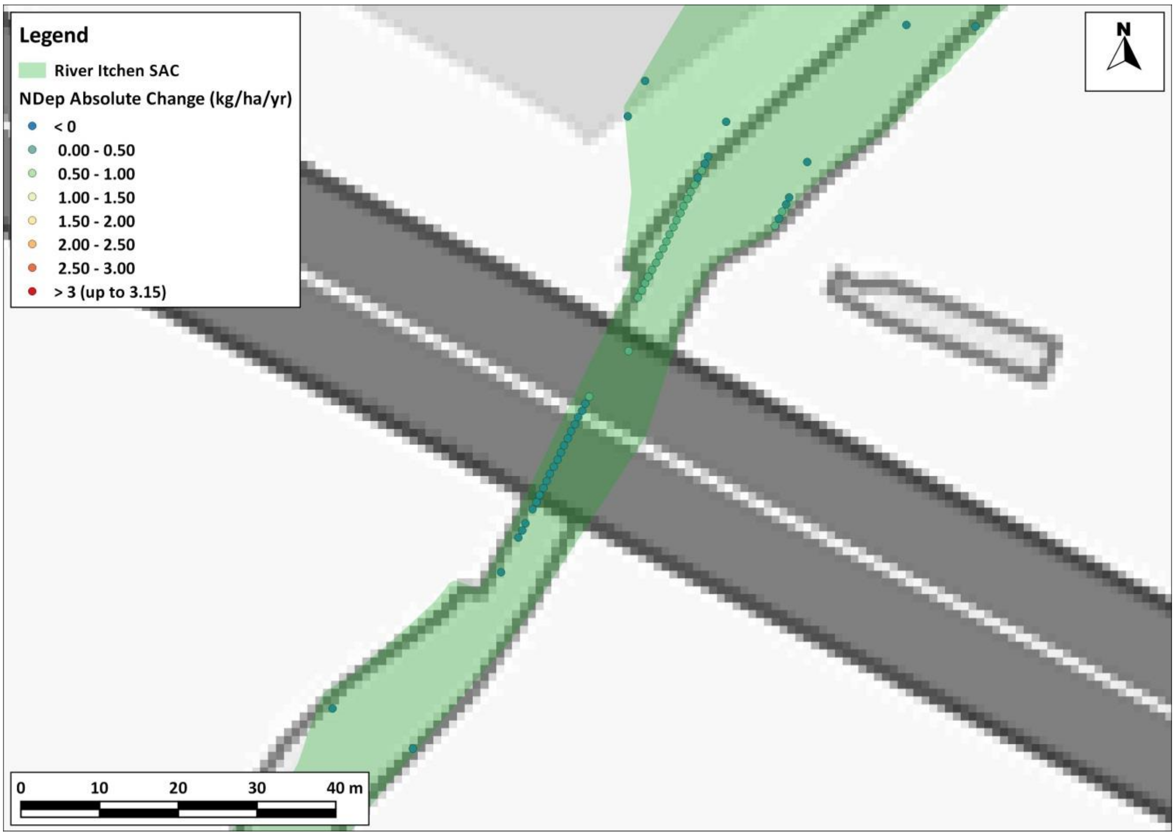

Figure A4.7: M27 River Itchen SAC West

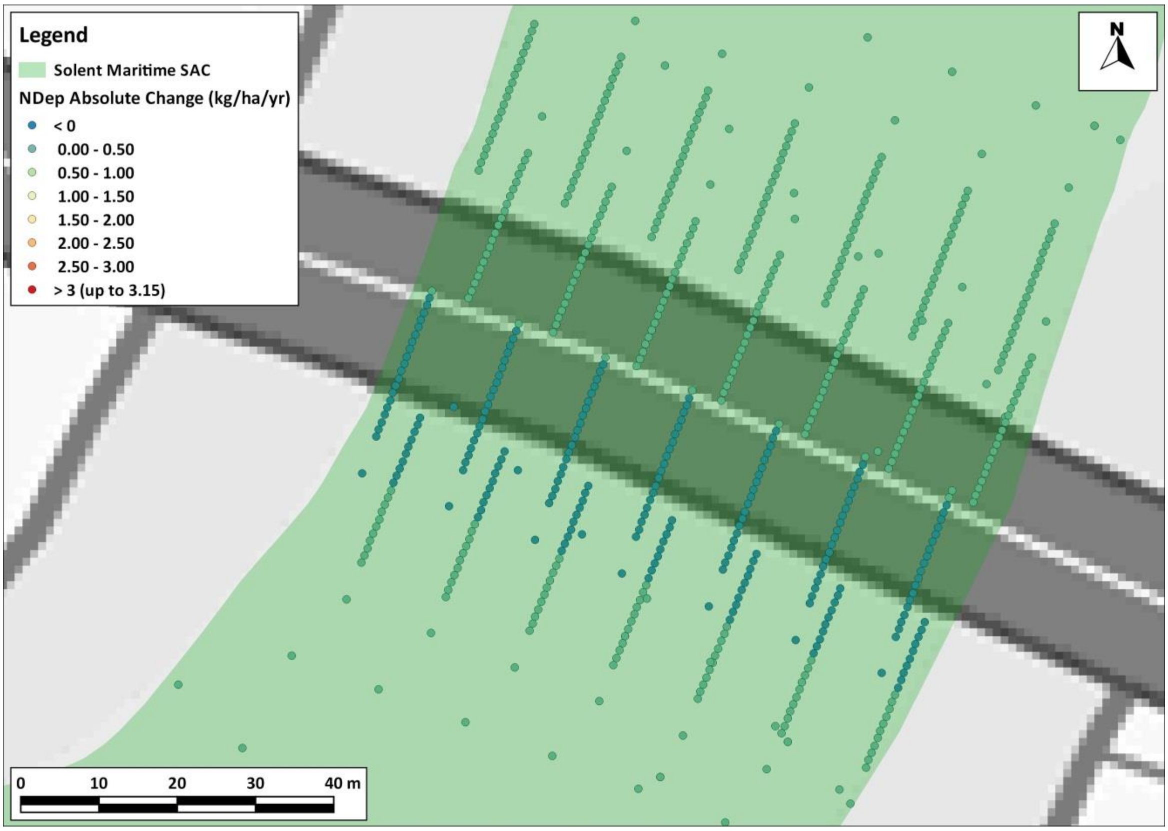

Figure A4.8: M27 Solent Maritime SAC

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Sensitivity Test

Figure A4.9: Highbridge Road East Sensitivity Test

Figure A4.10: Highbridge Road West Sensitivity Test

Figure A4.11: Bishopstoke Road East Sensitivity Test

Figure A4.12: Bishopstoke Road Central Sensitivity Test

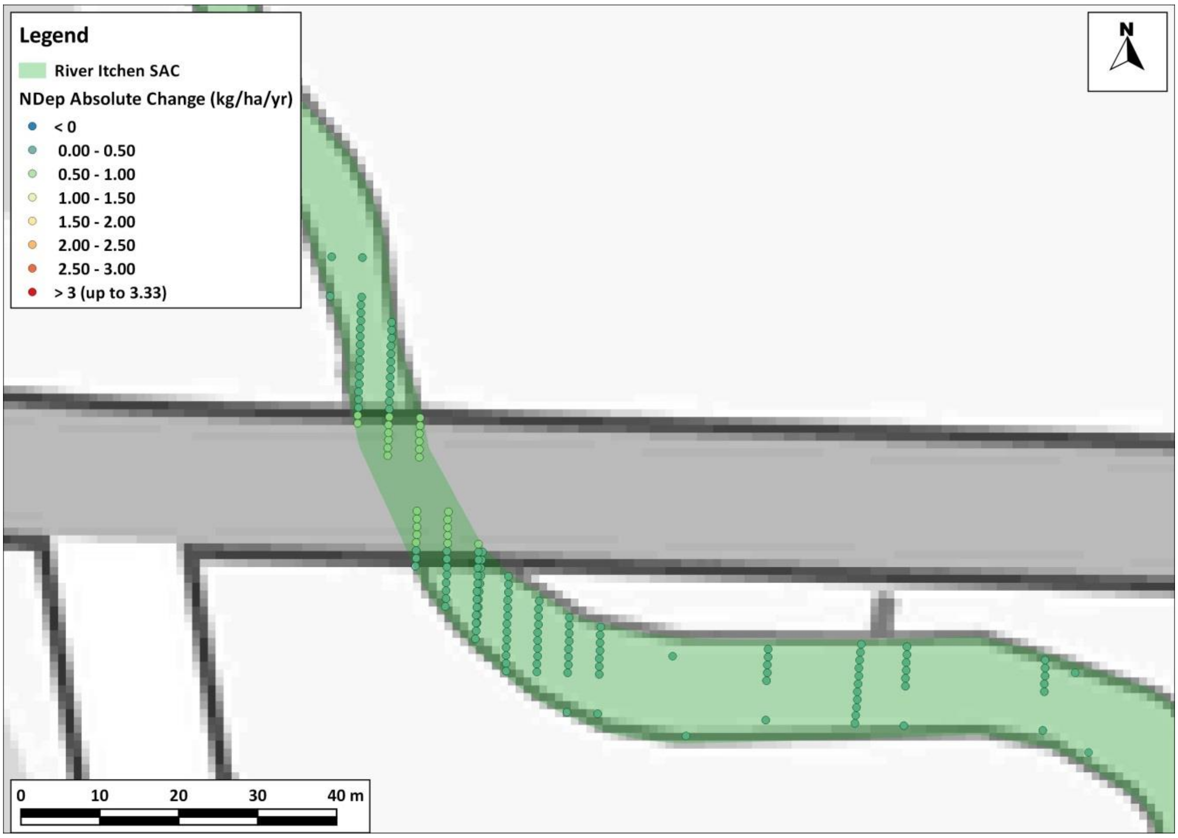

Figure A4.13: Bishopstoke Road West Sensitivity Test

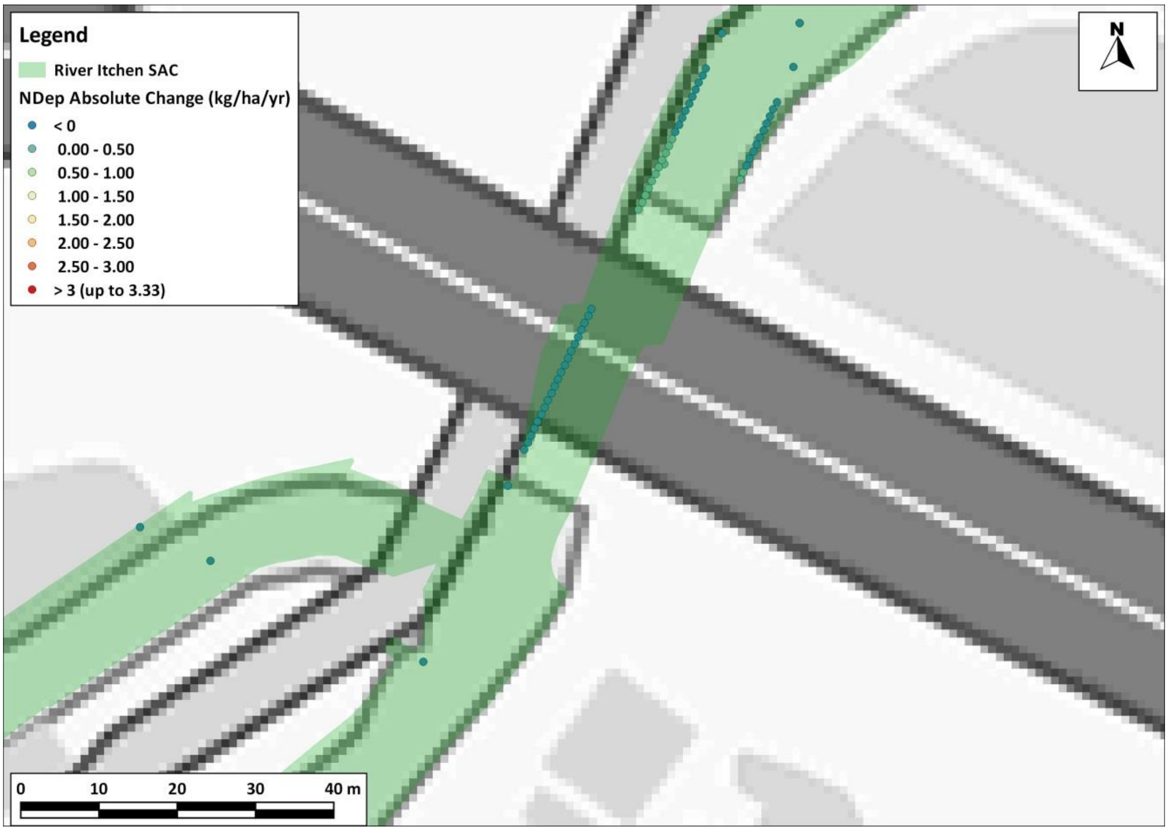

Figure A4.14: M27 River Itchen SAC East Sensitivity Test

Figure A4.15: M27 River Itchen SAC West Sensitivity Test

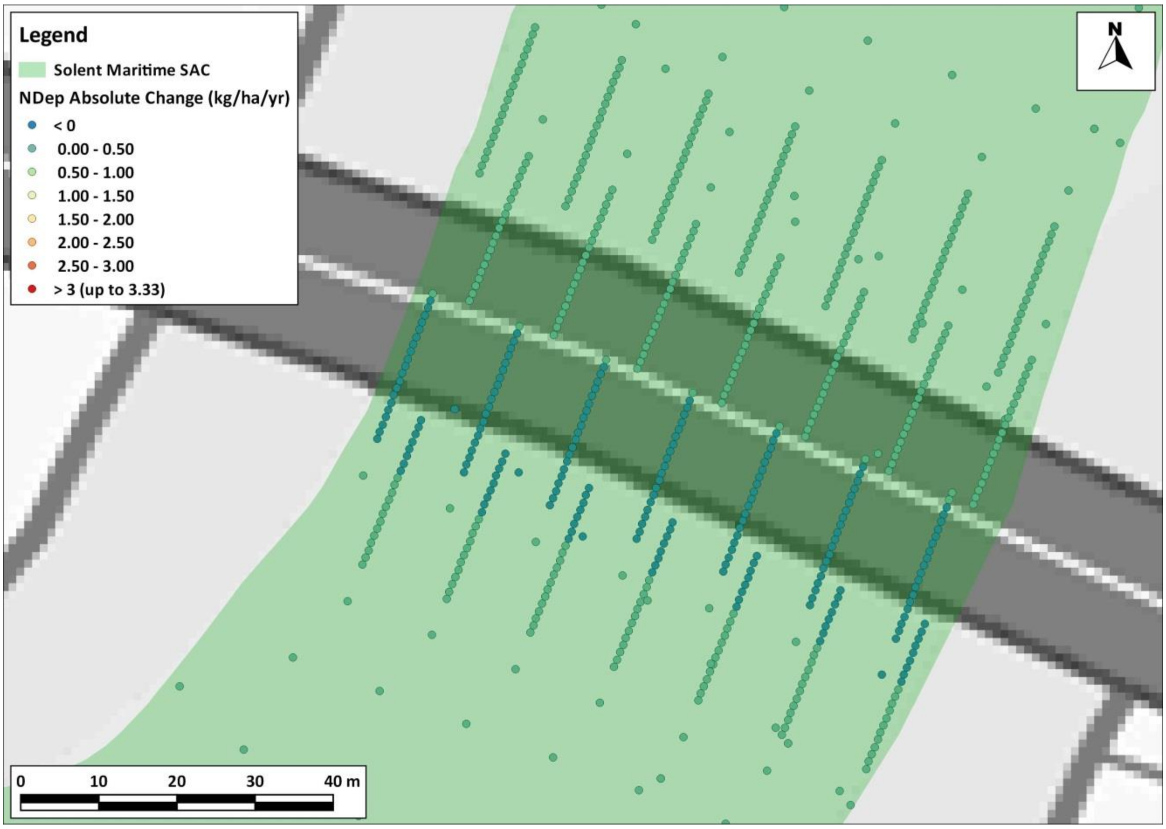

Figure A4.16: M27 Solent Maritime SAC Sensitivity Test

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Impacts 'In Combination'

A4.2 Transects showing the change in nitrogen deposition to the River Itchen SAC with distance from Highbridge Road, Bishopstoke Road and the M27 are shown in Figure A4.17 to Figure A4.32.

Figure A4.17: Highbridge Road East

Figure A4.18: Highbridge Road West

Figure A4.19: Bishopstoke Road East

Figure A4.20: Bishopstoke Road Central

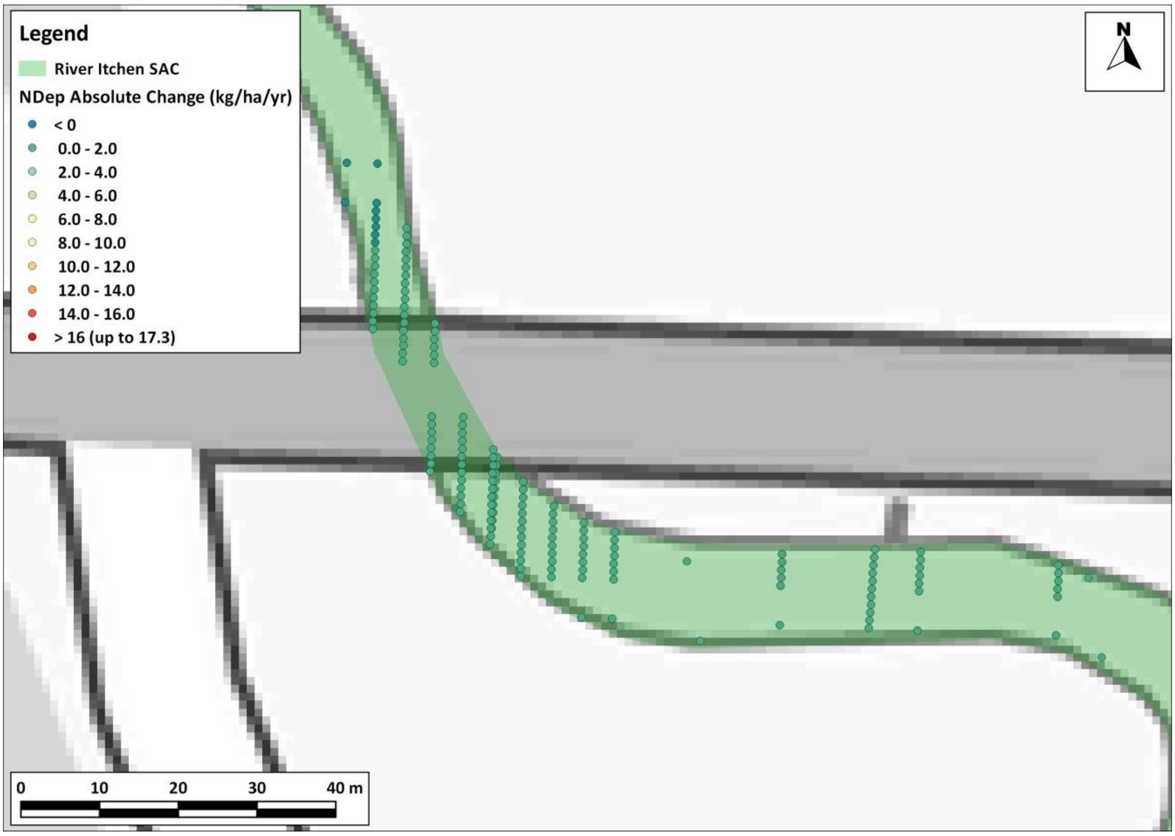

Figure A4.21: Bishopstoke Road West

Figure A4.22: M27 River Itchen SAC East

Figure A4.23: M27 River Itchen SAC West

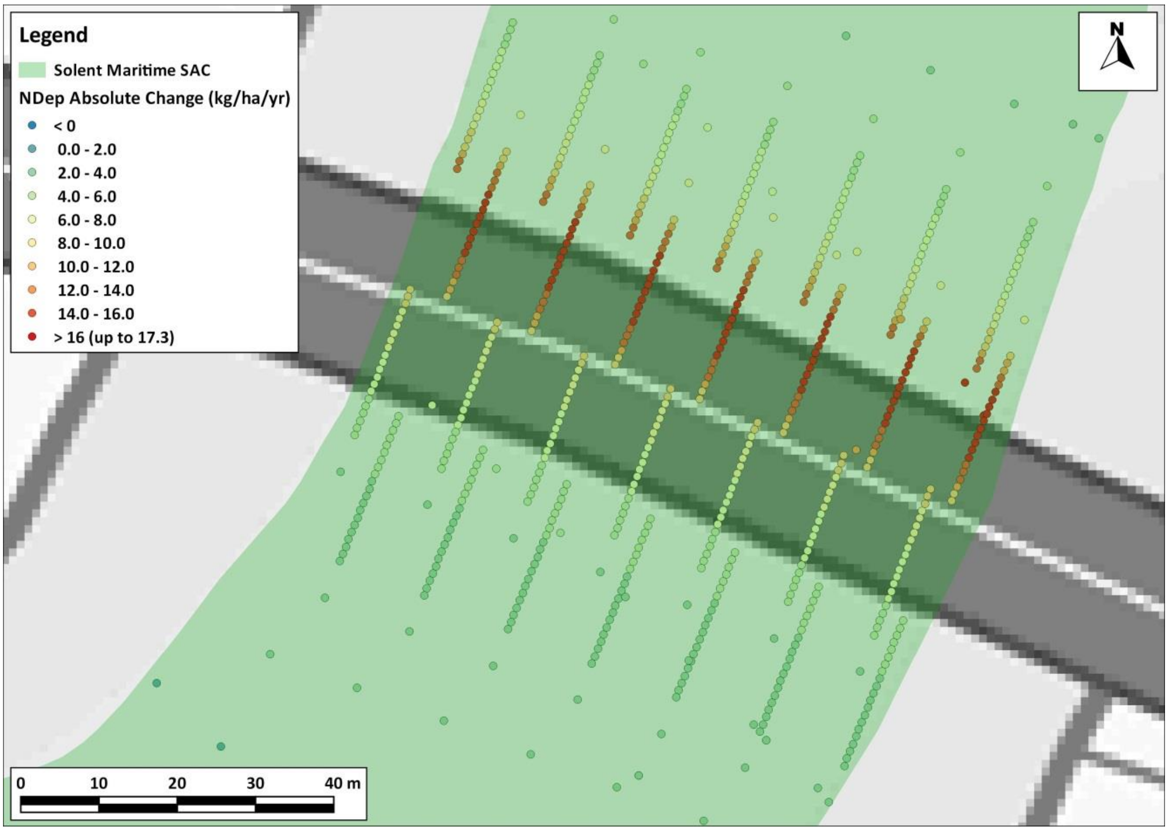

Figure A4.24: M27 Solent Maritime SAC

Sensitivity Test

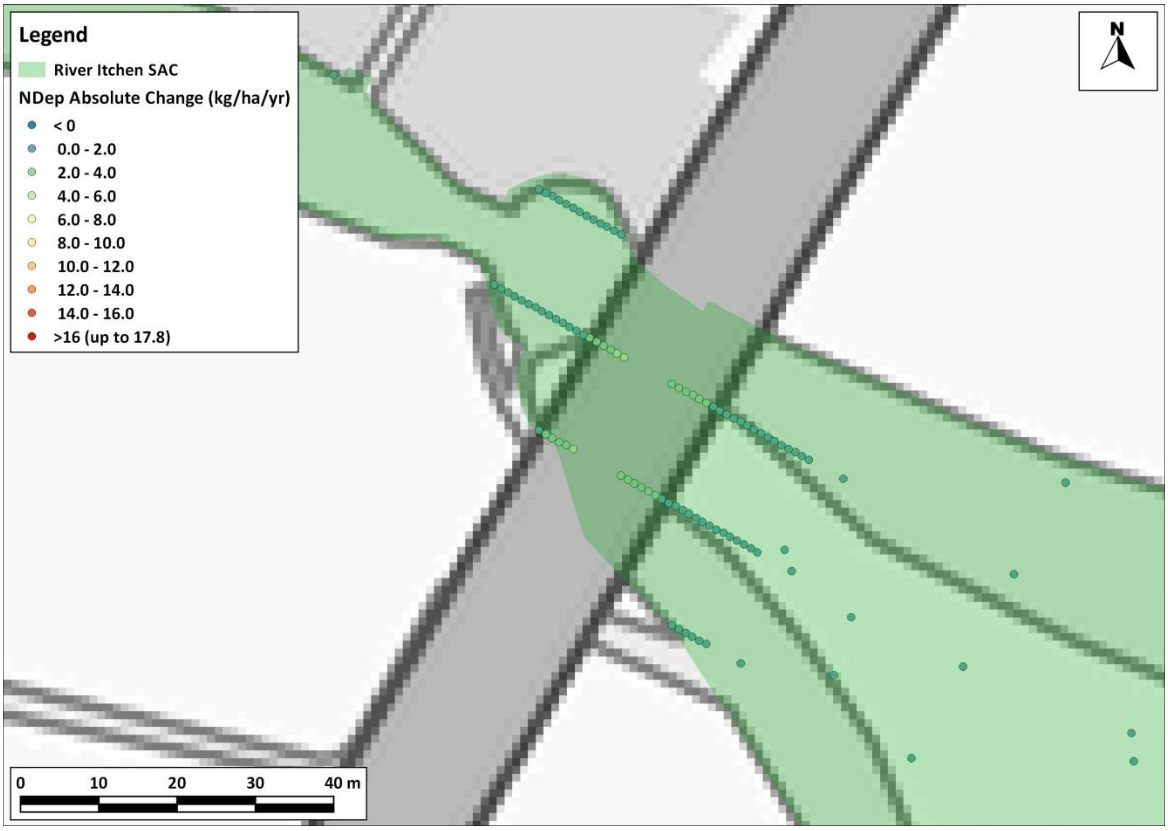

Figure A4.25: Highbridge Road East Sensitivity Test

Figure A4.26: Highbridge Road West Sensitivity Test

Figure A4.27: Bishopstoke Road East Sensitivity Test

Figure A4.28: Bishopstoke Road Central Sensitivity Test

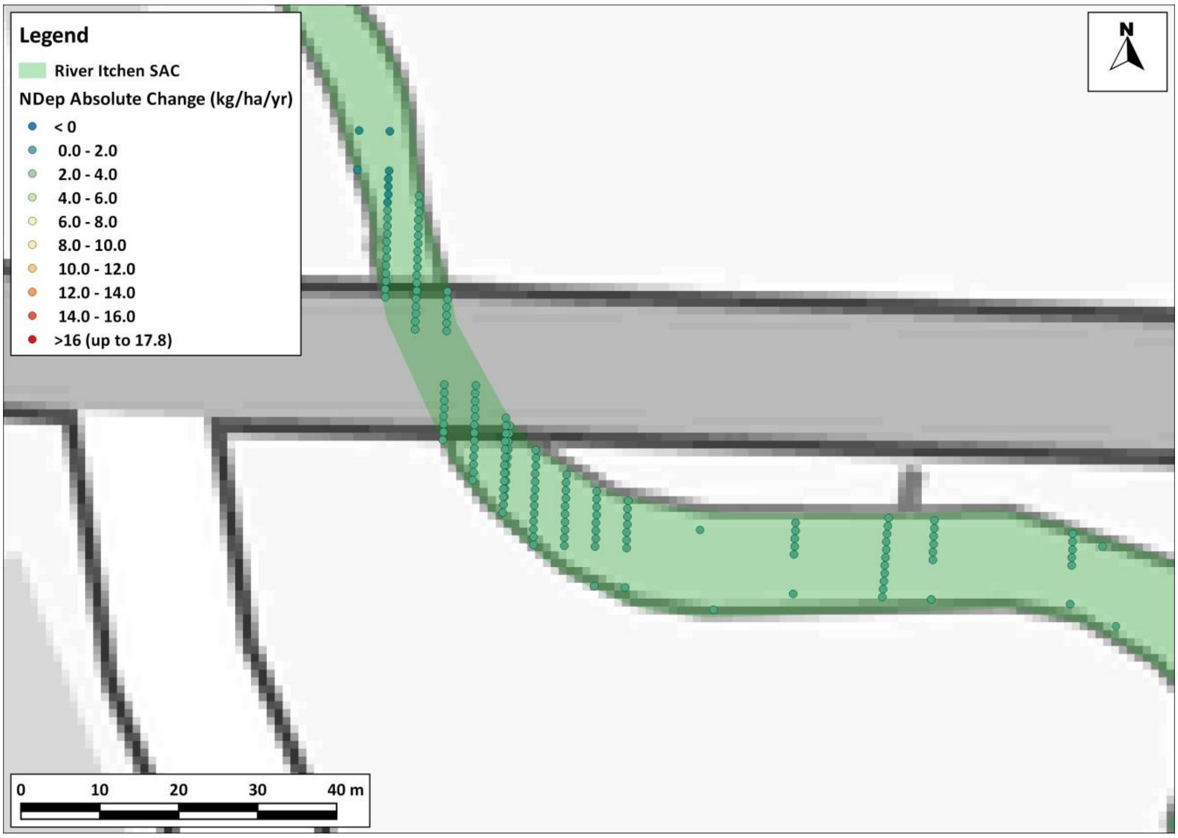

Figure A4.29: Bishopstoke Road West Sensitivity Test

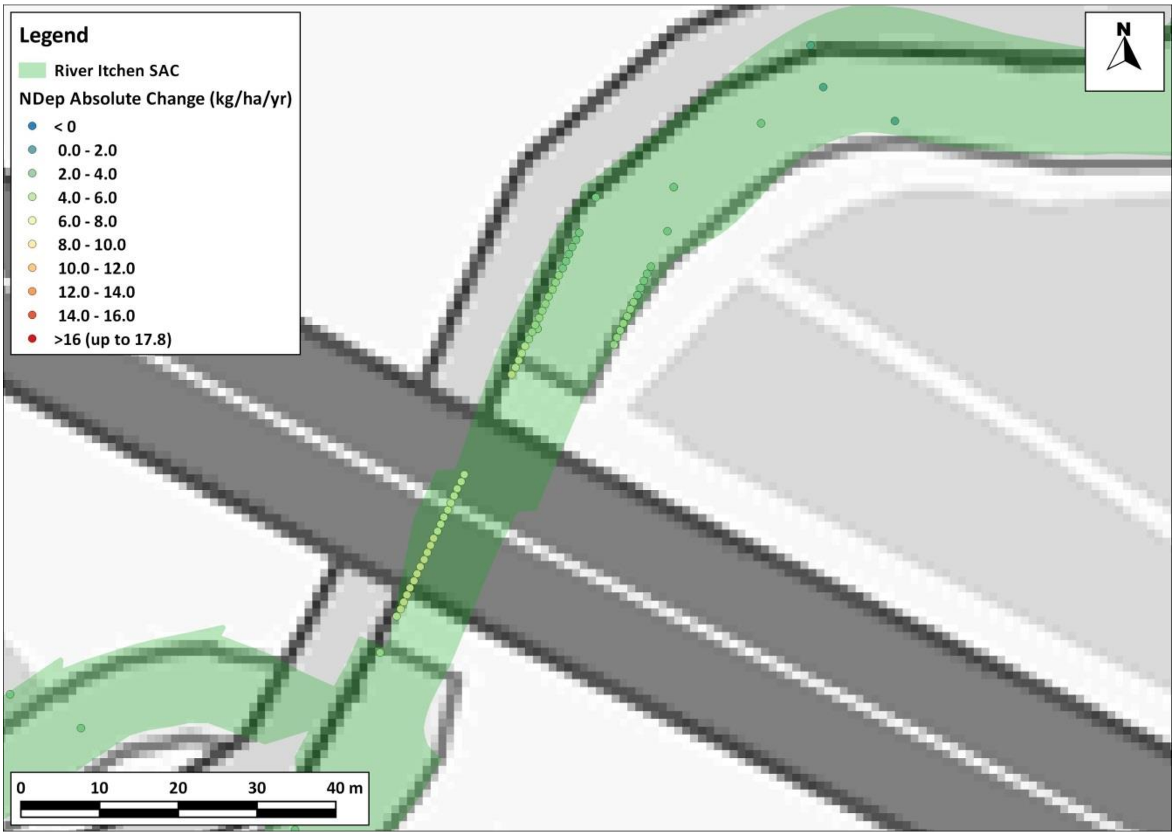

Figure A4.30: M27 River Itchen SAC East Sensitivity Test

Figure A4.31: M27 River Itchen SAC West Sensitivity Test

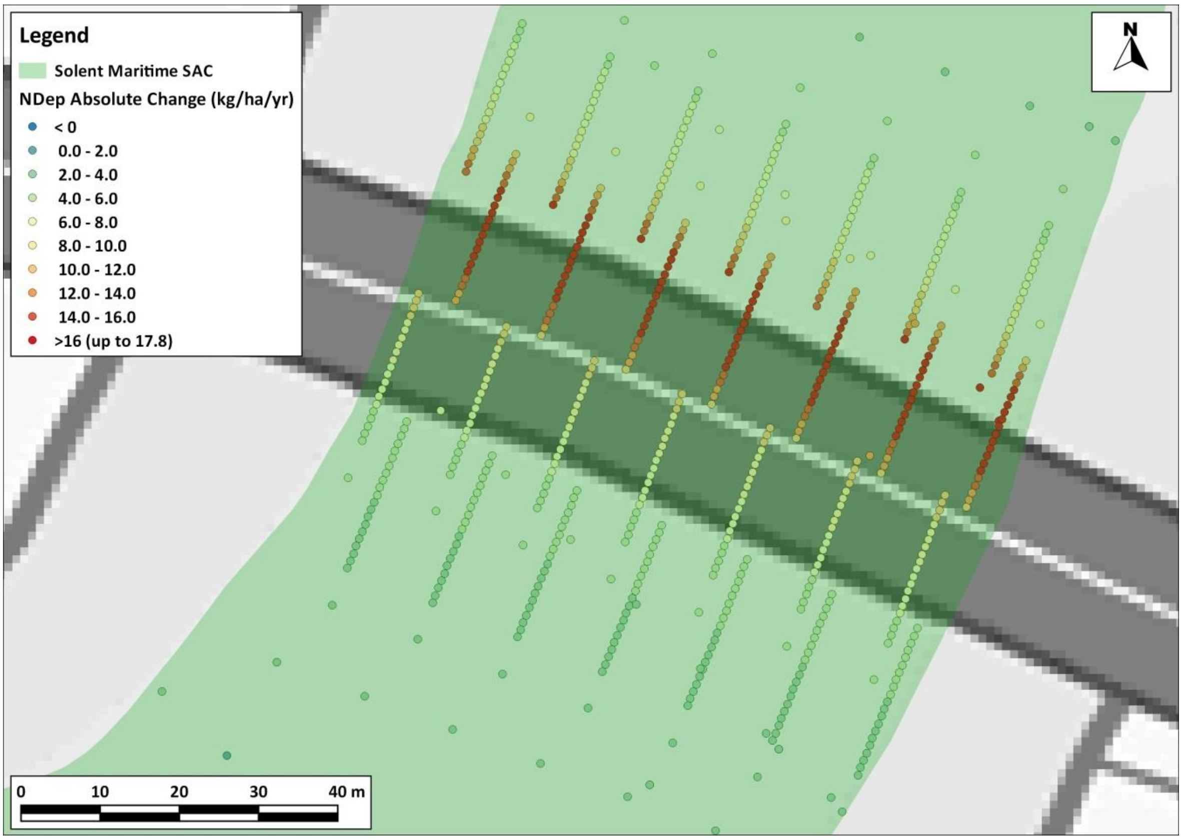

Figure A4.32: M27 Solent Maritime SAC Sensitivity Test