Conditions 31 item (iii) and 32 item (iv): Air Quality Modelling Report in relation to Oxford Meadows SAC and Hook Meadow and Trap Grounds SSSI

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Conditions 31 item (iii) and 32 item (iv): Air Quality Modelling Report in relation to Oxford Meadows SAC and Hook Meadow and Trap Grounds SSSI

November 2015

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EXECUTIVE SUMMARY

The report examines the effects of the Scheme on air quality at both the Oxford Meadows Special Area of Conservation (SAC) and the Hook and Trap Grounds Site of Special Scientific Interest (SSSI). The assessment shows that the implementation of the Scheme is predicted to reduce traffic on the A34. This improvement associated with the Scheme means that no adverse impacts are predicted on the Oxford Meadow SAC from Scheme related traffic using the A34. However, when considering impacts from the A40 on the SAC, all impacts are predicted to be *'Insignificant'* for NO_X, acid deposition and nutrient nitrogen deposition.

Impacts from the rail emissions upon the Hook Meadow and Trap Grounds SSSI are predicted to be *'Potentially Significant'* on some parts of the designated habitat. Therefore further investigation is necessary to provide an understanding of the response of the habitat to changes in NO_X ambient concentrations and nutrient nitrogen deposition once the post operational monitoring has been undertaken. When considering acid deposition rates on the Hook Meadow and Trap Grounds SSSI from rail emissions, impacts are predicted to be *'Insignificant'*.

Whilst the Scheme will see an increase in train movements between Oxford and Bicester and therefore a decrease in air quality, this is in the overall context of a prediction of decreasing traffic movements from A34 and future electrification of the rail lines. Therefore, the outcome of this modelling assessment should be balanced against these anticipated positive air quality benefits to the wider environment.

Whilst this report presents a robust assessment, it is only a set of predictions based on predicted road and rail traffic flows and emissions data. It predates the collection and analysis of operational road and rail traffic data and air quality monitoring data. The modelled levels of nitrogen disposition will need to be validated against the measured data attributable to the Scheme once available. Only then will it be appropriate to consider whether there is any real potential for effects and need for mitigation.

1 INTRODUCTION

1.1 OVERVIEW

The Scheme is to construct improvements to the existing railway line between Bicester and Oxford, including a new track alongside the existing mainline between Oxford North Junction and Oxford Station and to construct a new station at Oxford Parkway. This report examines the effects of the Scheme on air quality at both the Oxford Meadows Special Area of Conservation (SAC) and the Hook and Trap Grounds Site of Special Scientific Interest (SSSI).

The Scheme is likely to result in changes to air quality through diesel engine exhaust emissions from trains which will increase in number and frequency following the improvements. Changes in motor vehicle exhaust emission will also occur from changes in road traffic, with increases in traffic along the A40 from commuters travelling to the proposed new station at Oxford Parkway, and decreases in traffic along the A34 due to a commuter modal shift to the railway. The key change will be to emissions of oxides of nitrogen (NO_x), and subsequently nutrient nitrogen deposition.

The assessment of impacts on ecological receptors compares predicted impacts arising from emissions to air against relevant critical levels and critical loads for the protection of ecological receptors.

1.2 PLANNING CONTEXT

Approval for the Scheme was granted by the Secretary of State subject to a number of conditions. Two of these conditions relate specifically to the effects of gaseous emissions resultant from the Scheme, and contain measures to protect the designated sites. Condition 31 relates to the Oxford Meadows SAC, and Condition 32 to the Hook Meadow and Trap Grounds SSSI.

- **Condition 31 Measures for the protection of the lowland hay meadow habitat at the Oxford Meadows Special Area of Conservation ("SAC") -** *'Development shall not commence on the Individual Section or Sections between Oxford North Junction and Rewley Abbey Stream ("the relevant sections") until a Scheme of Further Assessment of Air Quality in relation to the Cassington Meadows SSSI, the Pixey and Yarton Meads SSSI and the Wolvercote Meadow SSSI that are co-terminous with part of the Oxford Meadows SAC ("the relevant parts of the SAC") has been submitted to and approved in writing by the local planning authority for the relevant parts of the SAC (in consultation with Natural England).'*

- **Condition 32 Measures for the Protection of the Hook Meadow and Trap Ground SSSI -** *'Development shall not commence on the Individual Section or Sections between Oxford North Junction and Rewley Abbey Stream ("the relevant sections") until a Scheme of Further Assessment of air quality in relation to the*

Hook Meadow and Trap Grounds SSSI ("the SSSI") has been submitted to and approved by the local planning authority (in consultation with Natural England).'

1.3 *PURPOSE OF THIS DOCUMENT*

This document sets out the results of the air quality modelling study as part of the "*Scheme of Further Assessment of Air Quality*" in order to meet the requirements set out in Condition 31 item (iii) and Condition 32 Item (iv), namely:

- **Condition 31 Item (iii)** *'predictions, based on the air quality monitoring, for a period of 10 years after opening of the relevant sections of the development to passenger rail traffic, of the likely additional rates of exposure to oxides of nitrogen (and inferred nitrogen deposition) of the relevant parts of the SAC, that are likely to arise as a consequence of the opening of the relevant sections of the development to passenger rail traffic and the development's associated road traffic'*

- **Condition 32 Item (iv)** *'predictions, based on the air quality monitoring, railway operations and other data, for a period of 10 years after opening of the relevant sections of the development to passenger rail traffic, of the likely additional rates of exposure to oxides of nitrogen (and inferred nitrogen deposition) of the SSSI, that can be attributed to the opening and use of the relevant sections of the development for passenger rail traffic'.*

2 *LEGAL FRAMEWORK*

2.1 *AIR QUALITY STANDARDS AND GUIDELINES FOR ECOLOGY*

Impacts at sensitive ecological receptors primarily arise as a result of air pollutants by the following mechanisms:

- direct impacts on flora due to increased concentrations of airborne pollutants; and
- indirect impacts on flora due to changes in soil chemistry brought about by deposition of pollutants to soil.

The *European Habitats Directive*(1) sets out the legal framework requiring European Union (EU) member states to protect habitat sites supporting vulnerable and protected species, as listed within the Directive. This Directive was incorporated into UK domestic legislation by means of the *Conservation of Habitats and Species Regulations 2010*(2). This legislation requires the protection of certain sites including SACs, Special Protection Areas (SPAs) and Ramsar sites. In addition, within this air quality assessment, consideration is also made of impacts on nationally important ecology sites in the form of SSSIs and any relevant locally designated habitat sites.

The relevant standards and guidelines for assessing impacts to sensitive ecological receptors are derived from the following sources:

- air quality standards for NO_x for the protection of habitats are derived from European Union Air Quality Standards(3) and are included in the Air Quality Standards Regulations 2010(4); and
- guidelines for the assessment of acid and nutrient nitrogen deposition have been derived according to habitat type, and are set out on the Air Pollution Information System (APIS) website(5).

On the basis of the above legislative framework and guidance, relevant critical levels (that relate to airborne pollutants) and site specific critical loads (that relate to deposition of materials to soils) have been established. These values represent the relevant environmental criteria for this assessment, and are set out in *Section 4.1.2*.

(1) Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora
(2) Statutory Instrument 2010 No. 490 The Conservation of Habitats and Species Regulations 2010
(3) European Union (2008) Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on Ambinet Air Quality and Cleaner Air for Europe. [Online] Available from: http://ec.europa.eu/environment/air/quality/standards.htm [Accessed: 9th October 2015].
(4) Environmental Protection (2010) The Air Quality Standards Regulations 2010. [Online] Available from: http://www.legislation.gov.uk/uksi/2010/1001/pdfs/uksi_20101001_en.pdf [Accessed 9th October 2015].
(5) Centre for Ecology and Hydrology (2010) UK Air Pollution Information Service. [Online] Available from: http://www.apis.ac.uk/ [Accessed: 9th October 2015]

3 BASELINE

3.1 OVERVIEW

Ambient background concentrations of NO_x are required to predict the likely impacts on air quality and deposition as a result of changing road and rail emissions associated with the proposed Scheme. An air quality monitoring survey was initiated in April 2014 and ran for twelve months until the end of March 2015. The survey was carried out in line with the approved Scheme of Assessment to assess the baseline exposure to NO_x and inferring nitrogen deposition of the relevant parts of the SAC and SSSI.

A total of eight diffusion tube transects (up to 200m in length) were established across the habitat sites with up to five sample points located at intervals of 10m, 20m, 50m, 100m and 200m from the relevant road or railway line. The sample locations were chosen to determine potential impacts from rail or road emissions, and arranged in transects to investigate how far from the road or rail sources these impacts extended.

The study identified that emissions from existing traffic on the Bicester to Oxford line, the Oxford to Birmingham mainline and both the A40 and the A34 contribute to the monitored concentrations at the associated monitoring points. A requirement to establish a 'true' background therefore exists for the purpose of the modelling assessment, that being the NO_x concentration which would remain if all road traffic and rail traffic were removed.

3.2 DEFINING THE 'TRUE' BACKGROUND

The 'true' baseline was established based upon Department for Environment, Food & Rural Affairs (DEFRA) mapping(1). In the UK, a national modelling exercise has been undertaken to identify baseline concentrations of several pollutants. These are available on a 1 x 1km grid square for the whole of the country. This is discussed in more detail in *Annex A*.

Table 3.1 shows the grid square identified to be representative of the baseline used as the basis for determining the future year baseline.

Table 3.1 DEFRA Grid Square

Habitat Site	Local Authority	Grid Square (x,y)	NO_x (µg/m³) (2014)
Oxford Meadow SAC	West Oxfordshire District Council	446500, 210500	19.7
Hook Meadow and Trap Grounds SSSI	Oxford City Council	449500, 209500	22.1

(1) DEFRA (2011) Interpolated mapping data: Local Air Quality Management Support. [Online] Available from: http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html [Accessed 12th October 2015].

3.3 *FUTURE YEAR BASELINE*

For the purpose of predicting future year impacts, the DEFRA background mapping has been used as a basis to derive future year atmospheric background concentrations of NO_x and deposition rates due to NO_x have been calculated. The data estimates the proportion of the projected NO_x baseline which can be attributed to specific source sectors including transport, industry and commercial sectors from 2011 to 2030. Projections are based, amongst other things, on road transport forecasts, assumptions on diesel car use, vehicle sale projections and the introduction of vehicle emission standards up to Euro 6/VI (1) . As a result baseline NO_x concentrations are predicted to decrease. This decrease has been accounted for in the future year baseline.

The mapping, however, only provides information on NO_x concentrations and does not provide a method of determining future year changes in concentrations of ammonia (NH_3), sulphur dioxide (SO_2) and hydrogen chloride (HCl), or the supplementary components of nutrient nitrogen (NN) and acid deposition (AD). As a result, future year contributions of these pollutants to deposition are assumed to remain constant in future on a precautionary basis. In order to best represent the future baseline, and not over or under estimate the contribution from any one pollutant to the baseline, only the reduction in NO_x from traffic sources has been accounted for in the baseline NN and AD deposition. The calculations for the derivation of future baseline at both the Oxford Meadow SAC and the Hook Meadow and Trap Grounds SSSI are presented in *Annex A*. The baseline data used in the assessment is presented in *Table 3.2*, *Table 3.3* and *Table 3.4*.

Table 3.2 ***Ambient NO_x ($\mu g/m^3$)***

Habitat	**Background ($\mu g/m^3$)**				
	2014/15	**2017**	**2020**	**2023**	**2027**
Oxford Meadow SAC (Transect 1-4)	19.7	18.9	18.0	17.6	17.3
Hook Meadow and Trap Ground SSSI (Transect 5-8)	22.1	21.2	20.2	n/a*	19.5

*This year was not considered as a scenario for modelling impacts from the rail as no definitive information was available for rail movements on the Oxford to Bicester line.

(1) DEFRA (2014) Air Pollution Background Concentration Maps: A User Guide for Local Authorities [Online] Available from: http://laqm.defra.gov.uk/documents/Background-maps-user-guide-v1.0.pdf [Accessed 12th November 2015]

Table 3.3 *Nutrient Nitrogen Deposition (KgN/ha/yr)*

Year	NO_x	NH_3	Total Nitrogen Deposition
Oxford Meadow SAC (Transect 1-4)			
2014/15	2.84	13.7	16.5
2017	2.72		16.4
2020	2.59		16.3
2023	2.54		16.2
2027	2.49		16.2
Hook Meadow and Trap Grounds SSSI (Transects 5-8)			
2014/15	3.18	13.3	16.5
2017	3.05		16.4
2020	2.91		16.2
2027	2.81		16.1

Table 3.4 *Acid Deposition (keq/ha/yr)*

Year	NO_x	NH_3	Total Nitrogen Deposition	Total Sulphur Deposition*
Oxford Meadow SAC (Transect 1-4)				
2014/15	0.20	0.97	1.18	0.21
2017	0.19		1.17	
2020	0.18		1.16	
2023	0.18		1.16	
2027	0.18		1.16	
Hook Meadow and Trap Grounds SSSI (Transects 5-8)				
2014/15	0.23	0.95	1.18	0.20
2017	0.22		1.17	
2020	0.21		1.16	
2027	0.20		1.15	

*HCl is captured within the sulphur baseline

4 METHODOLOGY

4.1 ASSESSMENT CRITERIA

4.1.1 *Overview*

The potential impacts on sensitive habitats are assessed through comparison with relevant critical loads and critical levels. The assessment criteria and significance criteria used in this assessment are set out in this section.

4.1.2 *Assessment Criteria for Designated Habitat Sites*

The criteria for assessment of impacts at sensitive ecological receptors are derived from:

- UK statutory Air Quality Standards; and
- critical loads estimated by the Centre for Ecology and Hydrology (CEH) and set out on the APIS website(1).

Impacts relating directly to atmospheric concentrations of NO_x are not habitat or species specific and are the same for all locations. These are set out in *Table 4.1*. Impacts relating to acid and nutrient nitrogen deposition are habitat and species specific; the site specific critical loads are set out in *Table 4.2* and for both the Oxford Meadow SAC and Hook Meadow and Trap Grounds SSSI.

Table 4.1 ***Critical Level for Oxides of Nitrogen (NOx)***

Site	**Critical Level for NOx (μg/m³)**
Oxford Meadow SAC	30 (annual mean)
Hook Meadow and Trap Grounds SSSI	

Table 4.2 ***Critical Load for Nutrient Nitrogen Deposition***

Site	**Relevant Nitrogen Critical Load Class**	**Empirical Critical Load (kg N/ha/yr)**
Oxford Meadow SAC	Low and medium altitude hay meadows	20 - 30
Hook Meadow and Trap Grounds SSSI		

(1) Centre for Ecology and Hydrology (2009) Air Pollution Information System [Online] Available from: http://www.apis.ac.uk [Accessed 12th October 2015].

Table 4.3 *Critical Load for Acid Deposition*

Site	Acidity Class	Acidity Critical Load (Keq) – Low range		
		MinCLminN	MinCLMaxS	MinCLMaxN
Oxford Meadow SAC	Calcareous grassland (using base cation)	0.856	4.000	4.856
Hook Meadow and Trap Grounds SSSI				

Note: High Range values are also available, however only the low range values are considered as these are more conservative.

4.1.3 *Significance Criteria*

The significance of impacts is based on guidance specified by the Expert Panel on Air Quality Standards (EPAQS) as detailed in the Environment Agency (EA) Technical Guidance Note H1(1). The significance is determined in terms of:

- Process Contribution (PC), this is the impact associated with emissions from the Scheme only; and

- Predicted Environmental Concentration (PEC), this is the impact associated with PC added to the existing background conditions.

Impacts of emissions are considered not to have significant effects upon sensitive ecological receptors if:

- the PC <1% of the Long Term Critical Load or Critical Level; or , if PC> 1%; then

- the PEC <70% of the Critical Load or Critical Level.

On the basis of this guidance, the following terms have therefore been utilised in this assessment:

- ***Insignificant***
  - Where the PC <1% of the Long Term Critical Load or Critical Level; or
  - Where the PC >1% of the Long Term Critical Load or Critical Level but the PEC <70%

- ***Potentially Significant***
  - Where the PC >1% of the Long Term Critical Load or Critical Level and the PEC >70%

(1) Environment Agency (2011) H1 Annex F - Air Emissions, v2.2

This approach is used to give clear definition of which effects can be disregarded as insignificant. Where a potentially significant impact is identified, this does not necessarily mean that the effect on the habitat and species of interest will be significant. Instead, it provides an indication of where further investigation of the potential impacts of emissions from the Scheme may be required in order to determine whether there is the potential for significant harm to arise.

4.2 *MODELLING APPROACH*

4.2.1 *Dispersion Modelling Software*

The Atmospheric Dispersion Modelling System (ADMS) Roads dispersion model has been used as the air quality model for the assessment of the long term air quality impacts. No short term impacts will be considered as the focus of the study is long term deposition.

ADMS-Roads, a version of the ADMS, is a PC-based model for simulating the dispersion in the atmosphere of pollutants released from industrial and road traffic sources in urban areas. ADMS-Roads simulates the dispersion of emissions using point, line, area and volume source models. It is designed to allow consideration of dispersion problems ranging from simple (e.g. a single isolated point source or a single road) to complex problems (e.g. multiple industrial and road traffic emissions over a large area).

A significant difference between ADMS-Roads and older models used for air dispersion modelling is that ADMS-Roads applies a more advanced description of the boundary layer structure based on the Monin-Obukhov length and the boundary layer height. Older models characterised the boundary layer in terms of the Pasquill stability parameter. In the current approach, the boundary layer structure is defined in a manner that allows for a realistic representation of the changing characteristics of dispersion with height. The result is generally a more accurate and soundly based prediction of the concentrations of pollutants.

The model has been used to predict the incremental impact of emissions of NO_x from both the road and rail traffic associated with the Scheme as the nature of emissions from both sources are similar. This is considered to be a more robust approach than using an industrial based dispersion model (for example ADMS5) to model emissions from trains. There are certain differences however in the approach taken to model impacts from the roads and rail based on the information available. Whilst ADMS Roads is not specifically designed to assess rail emissions, the availability of monitoring data to validate the model means that ADMS Roads can be used with confidence.

4.2.2 *Specific Approach to Modelling Roads*

The ADMS-Roads model was used to predict the incremental impact of emissions of NO_x from road traffic associated with the Scheme. A baseline year was modelled with Annual Average Daily Traffic (AADT) traffic data from Automatic Traffic Counters (ATCs) along the A34 and A40. *Annex B* sets out in detail the predicted future traffic data. The results of the base model were compared to results from the monitoring survey and used to generate a validation factor using the actual data recorded against the predicted values in the model. Future years were modelled, taking account of the correction factors from the validation along with the relevant changes in traffic, relevant changes in traffic emissions, and future air quality baseline derived using the methodology previously discussed. Modelled concentrations were compared against Critical Levels and Critical Loads to identify if and where exceedances are predicted to occur.

The following specific considerations and assumptions were made:

- The roads adjacent to and within 200m of the Oxford Meadow SAC were included in the detailed modelling exercise, these being the A40 and the A34.
- The A34 is a dual carriageway and was modelled as two road sources: northbound carriageway and southbound carriageway. The A40 is single carriageway and was modelled as a single road source with combined carriageways. The vertices used to replicate the centre of the roads are provided in *Annex A.*
- The roads modelling was undertaken on the basis of AADT split into Light Duty Vehicle (LDV) (<3.5 tonne) and Heavy Duty Vehicle (HGV) (>3.5 tonne).
- Vehicle speeds were assumed to be constant along the length of each road as there are no major junctions within the model domain.
- The vehicle fleet emissions were derived from emissions data in UK Emission Factor Toolkit (EFT) v6.01 (2VC), as built in to the ADMS model.
- The modelling of the baseline year and baseline data collected during the air quality survey was combined to provide a verification factor. As there are multiple verification points available, the average from the 10m and 20m transect points were used, as these are representative of the areas of the habitats most likely to be impacted. Detailed information regarding the verification process is presented in *Annex A.*
- The assessment considers only ambient NO_x, and derived nutrient nitrogen and acid deposition. No conversion of NO_x to NO_2 was required.

- The following nine scenarios were considered for detailed modelling:
  - Basecase for 2014;
  - Do Nothing/Do Something for 2017 (opening year);
  - Do Nothing/Do Something for 2020 (+ 3 years);
  - Do Nothing/Do Something for 2023 (+ 6 years);
  - Do Nothing/Do Something for 2027 (+ 10 years).

Traffic data for each scenario are presented in *Annex A.*

4.2.3 *Specific Approach to Modelling Trains*

ADMS-Roads was used to model rail sources, as mentioned, whilst the model is not specifically designed to model rail sources the availability of monitoring data to validate the model meant that it could be used with confidence. The Oxford to Birmingham mainline remained operational during the monitoring period, and therefore a baseline year was modelled using average daily train movements along the mainline. During the monitoring period, there were no trains operational on the Bicester to Oxford line for nine of the twelve months of the monitoring, and the overall contribution from these trains is considered to be negligible. The results of the base model were compared to results from the monitoring survey and used to generate a validation factor, using the actual data recorded against the predicted values in the model.

Future year scenarios have been modelled for trains using the Bicester to Oxford line only as the contribution from the mainline is assumed to remain static. The impact assessment takes account of the correction factor calculated from the validation process and considers the changes in the future air quality baseline derived using the methodology set out in *Section 3.3.*

The following specific considerations and assumptions were made when modelling the impacts from trains using the main line and branch line:

- Oxford to Birmingham main line:
  - The main line adjacent to and within 200m of the Hook Meadow and Trap Grounds SSSI and the Oxford Meadow SAC was modelled for the baseline year (2014/15). No modelling of the main line was performed for future year scenarios as no accurate information on frequencies of trains or NO_x emission factors are available to predict impacts.
  - Modelling of the main line was undertaken for the baseline year only in order to generate a validation factor to apply to the model results (*Annex A*)
  - The rail line was modelled as one combined source. The vertices used to replicate the centre of the rail lines are provided in *Annex A.*
  - Information for both passenger and freight trains using the mainline during the baseline year were sourced from Network Rail timetables for the period 14 December 2014 to 16 May 2015 and information used indicatively for the whole monitoring period.
  - The rail modelling was undertaken on the basis of Annual Average Daily Rail movements.

- Unit emission factors for Diesel Multiple Units (DMUs) and locomotives for passenger trains and freight trains respectively are presented in *Annex A*.

- Bicester to Oxford line:
  - The Bicester to Oxford line adjacent to and within 200m of the Hook Meadow and Trap Grounds SSSI and the Oxford Meadow SAC was included in the 2017, 2020 and 2027 scenarios. No modelling of the main line was performed for future year scenarios as no accurate information on train frequencies or NOx emission factors were available to predict impacts.
  - The rail lines were modelled as one combined source. The vertices used to replicate the centre of the rail lines are provided in Annex A.
  - The rail modelling was undertaken on the basis of Annual Average Daily Rail movements associated with the Scheme.
  - It has been assumed that emissions from existing passenger and freight services on the mainline remain constant at all dates of assessment.
  - No specific information on train type and frequency was provided for the Bicester to Oxford line following the opening of the Scheme. Based upon previous work for the Scheme, passenger trains are a mixture of Class 168 and 172 DMU and freight trains are hauled by Class 66 locomotives. This is in line with the approved noise and vibration Schemes of Assessments.
  - The future train fleet was assumed to consist of the currently available DMUs and locomotives. This is a cautious assumption, since any changes to the fleet are likely to be new designs, which are either more efficient or will incorporate ammonia abatement.
  - The assessment only considers ambient NOx, and derived nutrient nitrogen deposition. Therefore, no conversion of NOx to NO2 is required.
  - The following six scenarios were considered for detailed modelling of the Bicester to Oxford line:
    - Do Nothing/Do Something for 2017 (opening year);
    - Do Nothing/Do Something for 2020 (+ 3 years); and
    - Do Nothing/Do something for 2027 (+ 10 years).
  - Information on trains and emission factors used in the modelling assessment are presented in *Annex A*.

4.2.4 *Meteorological Data Selection*

The meteorological data used in the model must be reflective of the local conditions. There are only a limited number of meteorological stations in the UK which measure all of the parameters required by the model. A review of available meteorological sites was undertaken, which focussed on the surrounding land use, the surrounding terrain and relative proximity to the coast. On the basis of these criteria, the nearest meteorological station considered representative of conditions is at RAF Brize Norton, which is approximately 22 km west of the Scheme. Data for Brize Norton from 1 April 2014 to 1April 2015 was acquired when compiling the baseline chapter and has been used to make future predictions of impacts relating to the Scheme. The windrose produced from this data is presented in Figure *4.1*. There is a meteorological monitoring station at the Oxford Meadows SAC run by Reading University; however, data from this station is not publically available and was not used in this study.

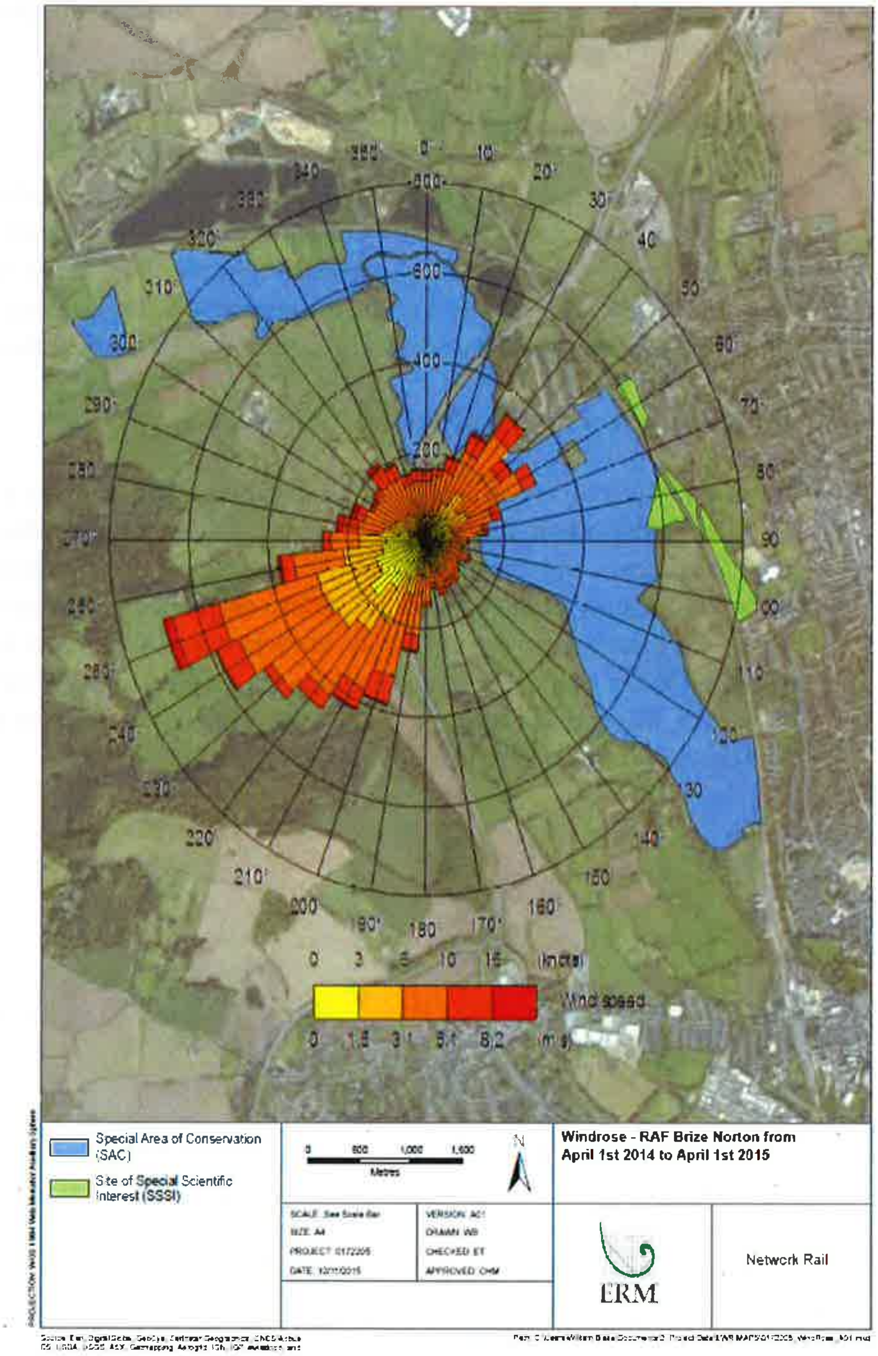
4.2.5 Consideration of Surface Roughness Effects

The surface roughness length is a representation of the disruption of airflow close to the ground due to obstructions and protuberances, such as buildings, trees and hedges. In this case a surface roughness of 0.2 m has been used for both the meteorological site and the dispersion site. This surface roughness was used as it reflects the agricultural land use surrounding the site.

4.2.6 Consideration of Terrain Effects

Changes in terrain elevations (i.e. hills or mountains) can have a significant impact on dispersion of emissions, in terms of funnelling of plumes and changing local wind flows. Terrain effects are typically considered important where there are sustained gradients of 1:10 or greater. There are no such sustained gradients in the vicinity of the Scheme and therefore terrain was not included in the model. In some locations the road sources are elevated. However, this is not considered to be significant adjacent to the transect locations, and therefore the roads were assumed to be flat.

Figure 4.1 ***Brize Norton - April 1st 2014 to April 1st 2015***



4.2.7 *Receptors*

The dispersion modelling study included the assessment of predicted pollutant concentrations using the following:

- the monitoring locations used in the air quality modelling survey, as presented in *Table 4.4* and *Table 4.5;* and

- a receptor grid with a 10m resolution to capture impacts across the whole habitat sites.

Table 4.4 *Oxford Meadow SAC - Discrete Receptors*

Monitoring location	Transect 1		Transect 2		Transect 3		Transect 4	
	x	y	x	y	x	y	x	y
10 meters	n/a	n/a	616682	5739370	n/a	n/a	617255	5738407
20 meters	n/a	n/a	616689	5739363	617214	5738435	617269	5738406
50 meters	615562	5739213	616687	5739331	617188	5738452	617288	5738378
100 meters	615582	5739171	616692	5739279	617142	5738472	617315	5738333
200 meters	615613	5739070	616692	5739167	617054	5738522	617401	5738281

Table 4.5 *Hook Meadow and Trap Grounds SSSI*

Monitoring location	Transect 1		Transect 2		Transect 3		Transect 4	
	x	y	x	y		x	y	x
10 meters	n/a	n/a	618699	5737846	618803	5737758	618878	5737587
20 meters	618679	5737813	618708	5737851	618809	5737766	618888	5737588
50 meters	618652	5737801	618733	5737869	618833	5737785	618915	5737603
100 meters	618611	5737791	n/a	n/a	n/a	n/a	n/a	n/a
200 meters	618521	5737736	n/a	n/a	n/a	n/a	n/a	n/a

5 *RESULTS AND DISCUSSION*

5.1 *INTRODUCTION*

Emissions from road traffic using the A40 and the A34 impact on the 'lowland hay meadow' sensitive habitat on the adjoining parts of the Oxford Meadows SAC. In the case of trains using the Oxford to Bicester line and the mainline, the relevant designated sensitive habitat is the 'lowland hay meadow' on parts of the Hook Meadow and Trap Grounds SSSI. Those parts of the Oxford Meadows SAC close to the Bicester to Oxford railway do not support sensitive habitat, for the purposes of Condition 31.

5.2 *IMPACTS FROM ROAD EMISSIONS ON OXFORD MEADOW SAC*

The PC and PEC for NO_x, acid deposition and nutrient nitrogen deposition against their respective percentages against critical levels and critical loads are presented in *Annex A* at each discrete receptor location and for the maximum point on the grid.

5.2.2 *NO_x*

Table 5.1 summarises the results of the assessment at the Oxford Meadow SAC. The table sets out predicted impacts as a result of the Scheme at the monitoring locations and also shows the maximum impacts on the habitat from both the A34 and the A40. The changes in PC and overall PEC have been compared to the critical level of 30µg/m^3 as specified in *Table 5.1*.

When considering the percentage change between future year 'Do Nothing' and 'Do Something' scenarios, the predicted impacts from traffic travelling on the A34 are set to decrease due to the Scheme being implemented. This is due to expected commuter shift to using the rail line. The impact on the habitat site from Scheme related traffic using the A34 is therefore considered *'Insignificant'*. When considering the Scheme related traffic using the A40, whilst impacts increase, the significance of these impacts is considered to be *'Insignificant'*.

Table 5.1 *Summary of Critical Level Assessment - Oxford Meadow SAC*

Transect number / distance from road (m)	Change in PC as a percentage of the CL (%)				PEC as % of Critical Level				Significance			
	2017 DN and 2017 DS	2020 DN and 2020 DS	2023 DN and 2023 DS	2027 DN and 2027 DS	2017 DS	2020 DS	2023 DS	2027 DS	2017 DN and 2017 DS	2020 DN and 2020 DS	2023 DN and 2023 DS	2027 DN and 2027 DS
Max. - A40	<1	<1	<1	<1	82	74	70	68	I	I	I	I
Max. - A34	*	*	*	*	167	135	119	109	I	I	I	I
T1_50	<1	<1	<1	<1	71	66	64	62	I	I	I	I
T1_100	<1	<1	<1	<1	68	63	62	60	I	I	I	I
T1_200	<1	<1	<1	<1	65	62	60	59	I	I	I	I
T2_10	<1	<1	<1	<1	88	78	74	71	I	I	I	I
T2_20	<1	<1	<1	<1	81	73	70	67	I	I	I	I
T2_50	<1	<1	<1	<1	71	66	64	62	I	I	I	I
T2_100	<1	<1	<1	<1	67	63	61	60	I	I	I	I
T2_200	<1	<1	<1	<1	65	62	60	59	I	I	I	I
T3_20	*	*	*	*	99	86	80	76	I	I	I	I
T3_50	*	*	*	*	82	74	70	68	I	I	I	I
T3_100	*	*	*	*	73	67	65	63	I	I	I	I
T3_200	*	*	*	*	67	63	61	60	I	I	I	I
T4_10	*	*	*	*	164	133	118	108	I	I	I	I
T4_20	*	*	*	*	126	106	96	89	I	I	I	I
T4_50	*	*	*	*	97	84	79	75	I	I	I	I
T4_100	*	*	*	*	83	74	70	68	I	I	I	I
T4_200	*	*	*	*	73	67	64	63	I	I	I	I

DN = Do Nothing, DS = Do Something, I = Insignificant, PS = Potentially Significant

Note: * indicates a negative value predicted as a result of improvements to traffic on the A34.

5.2.3 *Nutrient Nitrogen and Acid Deposition*

Table 5.2 and *Table 5.3* summarise the results of the assessment at the Oxford Meadow SAC. The table highlights predicted impacts as a result of the Scheme at the monitoring locations and also shows the maximum impacts on the grid associated with both the A34 and the A40.

Nutrient Nitrogen

When considering the percentage change between future year 'Do Nothing' and 'Do Something' scenarios compared to the minimum empirical critical load range of 20 KgN/ha/yr, the predicted impacts from traffic travelling on the A34 are set to decrease due to the Scheme being implemented. No adverse impacts on the habitat site from Scheme related traffic using the A34 are therefore predicted. When considering Scheme related traffic using the A40, whilst impacts increase, the significance of these impacts is considered to be *'Insignificant'*.

Acid Deposition

The predicted impacts from traffic travelling on the A34 are set to decrease due to the Scheme being implemented. No adverse impacts on the habitat site from Scheme related traffic using the A34 are therefore predicted. When considering Scheme related traffic using the A40, whilst impacts increase, the significance of these impacts is considered to be *'Insignificant'*.

Table 5.2 *Critical Load - Nutrient Nitrogen*

Transect number / distance from road (m)	Change in PC as a percentage of the minimum empirical critical load range of 20 KgN/ha/yr (%)				PEC as percentage of the minimum empirical critical load range of 20 KgN/ha/yr				Significance			
	2017 DN and 2017 DS	2020 DN and 2020 DS	2023 DN and 2023 DS	2027 DN and 2027 DS	2017 DS	2020 DS	2023 DS	2027 DS	2017 DN and 2017 DS	2020 DN and 2020 DS	2023 DN and 2023 DS	2027 DN and 2027 DS
Max. – A40	<1	<1	<1	<1	86	84	84	83	I	I	I	I
Max. – A34	*	*	*	*	104	98	94	92	I	I	I	I
T1_50	<1	<1	<1	<1	84	83	82	82	I	I	I	I
T1_100	<1	<1	<1	<1	83	82	82	81	I	I	I	I
T1_200	<1	<1	<1	<1	82	82	81	81	I	I	I	I
T2_10	<1	<1	<1	<1	87	85	84	84	I	I	I	I
T2_20	<1	<1	<1	<1	86	84	83	83	I	I	I	I
T2_50	<1	<1	<1	<1	84	83	82	82	I	I	I	I
T2_100	<1	<1	<1	<1	83	82	82	81	I	I	I	I
T2_200	<1	<1	<1	<1	83	82	81	81	I	I	I	I
T3_20	*	*	*	*	90	87	86	85	I	I	I	I
T3_50	*	*	*	*	86	84	84	83	I	I	I	I
T3_100	*	*	*	*	84	83	82	82	I	I	I	I
T3_200	*	*	*	*	83	82	82	81	I	I	I	I
T4_10	*	*	*	*	104	97	94	92	I	I	I	I
T4_20	*	*	*	*	96	91	89	88	I	I	I	I
T4_50	*	*	*	*	89	87	85	85	I	I	I	I
T4_100	*	*	*	*	86	84	84	83	I	I	I	I
T4_200	*	*	*	*	84	83	82	82	I	I	I	I

DN = Do Nothing, DS = Do Something, I = Insignificant, PS = Potentially Significant,

Note: * indicates a negative value predicted as a result of improvements to traffic on the A34.

Table 5.3 ***Critical Load - Acid Deposition***

Transect number / distance from road (m)	Change in PC as a percentage of the minimum empirical critical load range (%)				PEC as percentage of the minimum empirical critical load range (%)				Significance			
	2017 DN and 2017 DS	2020 DN and 2020 DS	2023 DN and 2023 DS	2027 DN and 2027 DS	2017 DS	2020 DS	2023 DS	2027 DS	2017 DN and 2017 DS	2020 DN and 2020 DS	2023 DN and 2023 DS	2027 DN and 2027 DS
Max. - A40	<1	<1	<1	<1	30	29	29	29	I	I	I	I
Max. - A34	*	*	*	*	35	33	32	31	I	I	I	I
T1_50	<1	<1	<1	<1	38	35	33	33	I	I	I	I
T1_100	<1	<1	<1	<1	29	29	29	28	I	I	I	I
T1_200	<1	<1	<1	<1	29	28	28	28	I	I	I	I
T2_10	<1	<1	<1	<1	29	28	28	28	I	I	I	I
T2_20	<1	<1	<1	<1	30	29	29	29	I	I	I	I
T2_50	<1	<1	<1	<1	30	29	29	29	I	I	I	I
T2_100	<1	<1	<1	<1	29	29	28	28	I	I	I	I
T2_200	<1	<1	<1	<1	29	28	28	28	I	I	I	I
T3_20	*	*	*	*	29	28	28	28	I	I	I	I
T3_50	*	*	*	*	31	30	30	29	I	I	I	I
T3_100	*	*	*	*	30	29	29	29	I	I	I	I
T3_200	*	*	*	*	29	29	29	28	I	I	I	I
T4_10	*	*	*	*	29	28	28	28	I	I	I	I
T4_20	*	*	*	*	35	33	32	31	I	I	I	I
T4_50	*	*	*	*	32	31	31	30	I	I	I	I
T4_100	*	*	*	*	31	30	29	29	I	I	I	I
T4_200	*	*	*	*	30	29	29	29	I	I	I	I

DN = Do Nothing, DS = Do Something, I = Insignificant, PS = Potentially Significant

Note: * indicates a negative value predicted as a result of improvements to traffic on the A34.

5.3 *IMPACTS FROM RAILWAY EMISSIONS ON THE HOOK MEADOW AND TRAP GROUNDS SSSI*

The incremental rail concentrations and deposition rates and total concentrations and deposition rates of NO_x, acid deposition and nutrient nitrogen deposition, as well as their respective percentages against critical levels and critical loads are presented in *Annex A* at each discrete receptor location.

5.3.2 *NO_x*

Table 5.5 summarises the results of the assessment at the Hook Meadow and Trap Grounds SSSI. The table highlights predicted impacts at the monitoring locations and the maximum impact anywhere on the habitat. The changes in PC and overall PEC have been compared to the critical level of 30µg/m^3 as specified in *Table 4.1*.

The results indicate *'Potentially Significant'* impacts occurring across the SSSI as a result of the additional trains using the Bicester to Oxford line. The area on which those impacts occur is presented in *Table 5.4*. The PC change between the 'Do-Nothing' and 'Do-Something' scenarios as a percentage of the critical level is predicted to increase up to 10 years after the opening of the line due to the incremental increase of trains using the Bicester to Oxford line.

The spatial scale of the *'Potentially Significant'* effects of railway emissions on the SSSI are shown in the contour plots in *Figure 5.1* to *Figure 5.3*. These plots provide the pollution footprint of NO_x at the designated habitat site.

Table 5.4 ***Area of 'Potentially Significant' Impacts on the SAC and the SSSI***

Habitat	Total Area (m^2)	Potentially Significant Area (m^2)		
		2017	2020	2027
Hook Meadow and Trap Grounds SSSI	138,788	75,466	89,427	90,365

Table 5.5 *Summary of Critical Level Assessment – Hook Meadow and Trap Grounds SSSI*

Transect number / distance from rail (m)	Change in PC as a percentage of the CL (%)			PEC as % of Critical Level			Significance		
	2017 DN and 2017 DS	2020 DN and 2020 DS	2027 DN and 2027 DS	2017 DN and 2017 DS	2020 DN and 2020 DS	2027 DN and 2027 DS	2017 DN and 2017 DS	2020 DN and 2020 DS	2027 DN and 2027 DS
Max.	3.3	7.0	9.0	158	154	152	PS	PS	PS
T5_20	1.2	2.4	2.7	91	88	86	PS	PS	PS
T5_50	<1	1.8	2.0	79	76	74	I	PS	PS
T5_100	<1	1.3	1.4	75	72	70	I	PS	PS
T5_200	<1	<1	<1	73	70	67	I	I	I
T6_10	1.7	3.3	3.8	110	107	105	PS	PS	PS
T6_20	2.0	3.8	4.4	97	93	91	PS	PS	PS
T6_50	3.4	6.6	8.0	84	80	78	PS	PS	PS
T7_10	10	20	27	84	81	78	PS	PS	PS
T7_20	7.9	15	19	82	79	76	PS	PS	PS
T7_50	4.2	8.3	9.7	79	75	73	PS	PS	PS
T8_10	10	20	27	90	87	84	PS	PS	PS
T8_20	7.6	15	19	86	83	81	PS	PS	PS
T8_50	3.9	7.8	9.1	80	77	75	PS	PS	PS

DN = Do Nothing, DS = Do Something, I = Insignificant, PS = Potentially Significant

Figure 5.1 *NOx - 2017*

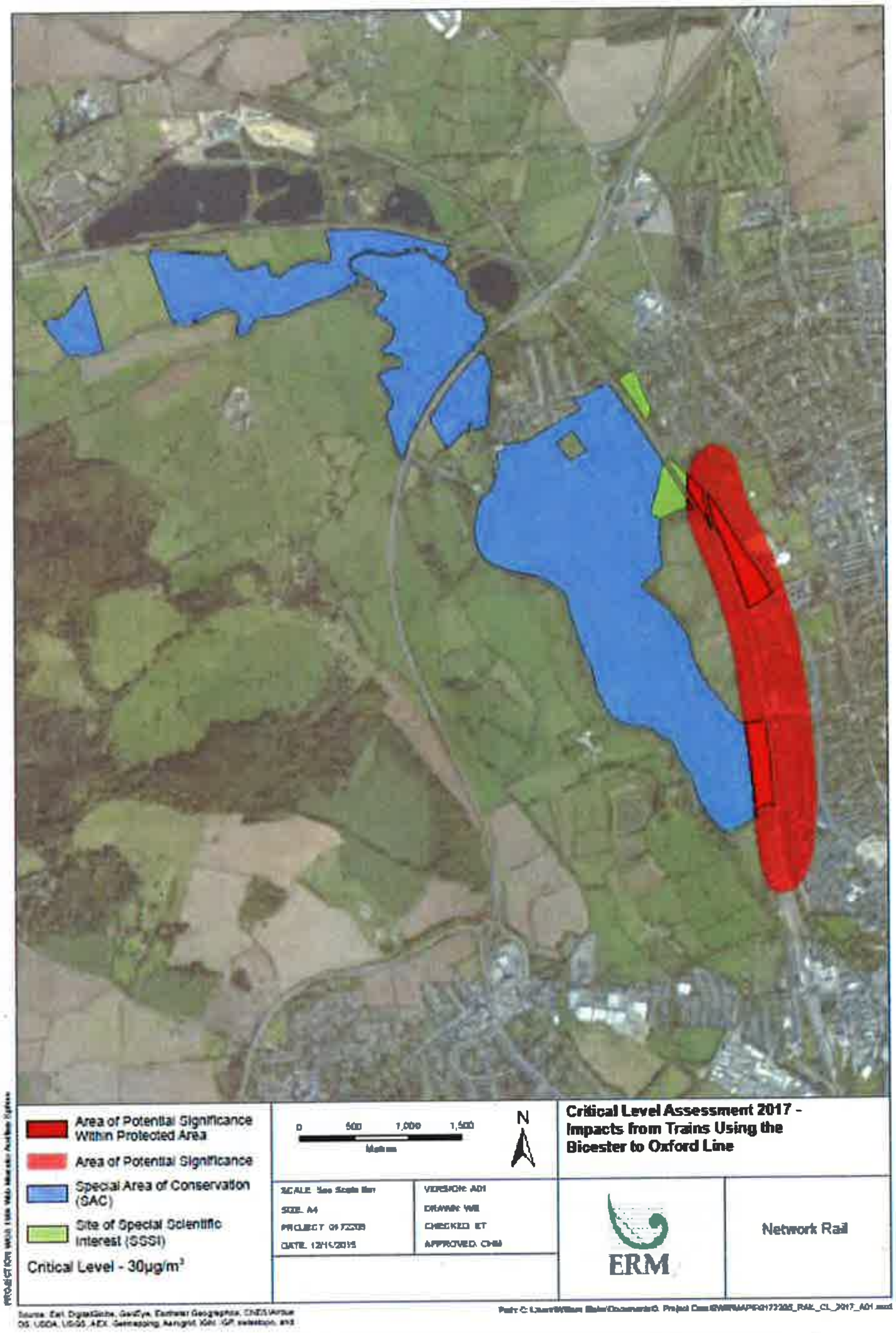


Figure 5.2 *NOx - 2020*

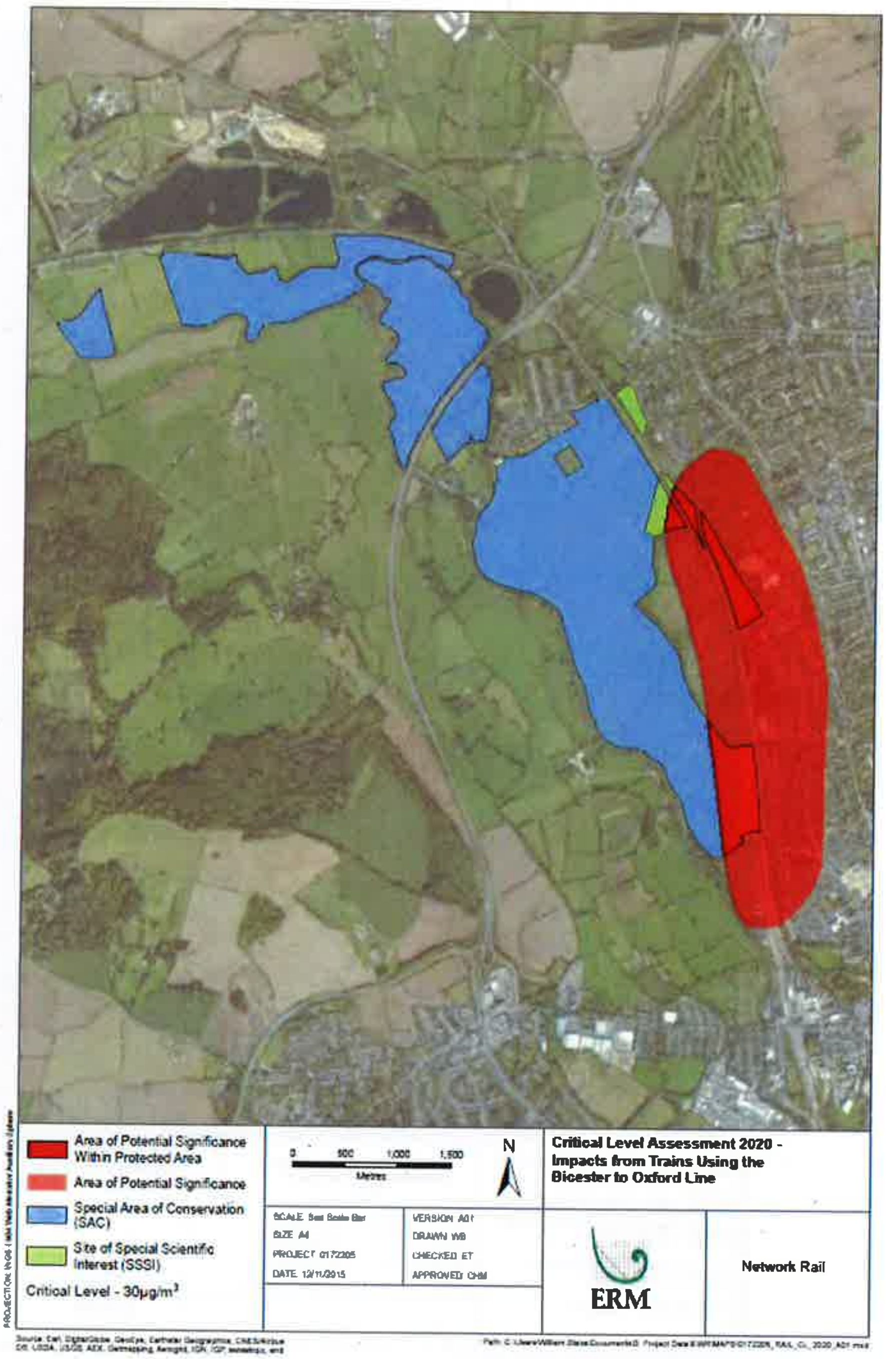


Figure 5.3   *NOx - 2027*

5.3.3 *Nutrient Nitrogen and Acid Deposition*

Table 5.7, Table 5.8 and *Table 5.9* summarise the results of the assessment at the Hook Meadow and Trap Grounds SSSI. The tables highlight predicted impacts at the monitoring/discrete receptor locations and the maximum on the grid, and compares findings to the empirical critical load ranges as specified in *Table 4.2.*

Nutrient Nitrogen

When considering the change in PC between the 'Do-Nothing' and 'Do-Something' scenarios compared to the minimum empirical critical load range of 20 KgN/ha/yr (*Table 5.7*) the results indicate *'Potentially Significant'* impacts across the SSSI as a result of the additional trains using the Bicester to Oxford line. The area on which those impacts occur across both habitats is presented in *Table 5.6*. Using the lower end of the critical load range in this way is considered to be a conservative approach.

Table 5.6 Area of 'Potentially Significant' Impacts on the SSSI when applying the conservative approach

Habitat	Total Area (m²)	Potentially Significant Area (m²)		
		2017	2020	2027
Hook Meadow and Trap Grounds SSSI	138,788	75,466	89,427	90,365

In order to understand whether these impacts occur when compared to the maximum empirical critical load range of 30 KgN/ha/yr, a separate comparison has been made and results presented in *Table 5.8*. The results indicate that when compared to the higher end of the criteria, no *'Potentially Significant'* impacts are predicted to occur.

Acid Deposition

Results in *Table 5.9* indicate that there are no *'Potentially Significant'* impacts when considering the criteria presented in *Section 4.1.3*.

Table 5.7 *Critical Load - Nutrient Nitrogen - minimum empirical critical load*

Transect number / distance from rail (m)	Change in PC as a percentage of the minimum empirical critical load range of 20 KgN/ha/yr (%)			PEC as percentage of the minimum empirical critical load range of 20 KgN/ha/yr			Significance		
	2017 DN and 2017 DS	2020 DN and 2020 DS	2027 DN and 2027 DS	2017 DS	2020 DS	2027 DS	2017 DN and 2017 DS	2020 DN and 2020 DS	2027 DN and 2027 DS
Max.	<1	1.5	1.9	101	101	101	I	PS	PS
T5_20	<1	<1	<1	87	86	86	I	I	I
T5_50	<1	<1	<1	84	83	83	I	I	I
T5_100	<1	<1	<1	83	83	82	I	I	I
T5_200	<1	<1	<1	82	82	81	I	I	I
T6_10	<1	<1	<1	91	90	90	I	I	I
T6_20	<1	<1	<1	88	88	87	I	I	I
T6_50	<1	1.4	1.7	85	85	85	I	PS	PS
T7_10	2.2	4.4	5.7	87	88	89	PS	PS	PS
T7_20	1.7	3.3	4.1	86	87	87	PS	PS	PS
T7_50	<1	1.8	2.1	85	85	85	I	PS	PS
T8_10	2.3	4.4	5.9	88	90	91	PS	PS	PS
T8_20	1.6	3.2	4.0	87	88	88	PS	PS	PS
T8_50	<1	1.7	2.0	85	85	85	I	PS	PS

DN = Do Nothing, DS = Do Something, I = Insignificant, PS = Potentially Significant

Table 5.8 *Critical Load - Nutrient Nitrogen – maximum empirical critical load*

Transect number / distance from rail (m)	Change in PC as a percentage of the minimum empirical critical load range of 30 KgN/ha/yr (%)			PEC as percentage of the maximum empirical critical load range of 30 KgN/ha/yr			Significance		
	2017 DN and 2017 DS	2020 DN and 2020 DS	2027 DN and 2027 DS	2017 DS	2020 DS	2027 DS	2017 DN and 2017 DS	2020 DN and 2020 DS	2027 DN and 2027 DS
Max.	<1	1.0	1.3	68	68	68	I	I	I
T5_20	<1	<1	<1	58	57	57	I	I	I
T5_50	<1	<1	<1	56	56	55	I	I	I
T5_100	<1	<1	<1	55	55	55	I	I	I
T5_200	<1	<1	<1	55	55	54	I	I	I
T6_10	<1	<1	<1	61	60	60	I	I	I
T6_20	<1	<1	<1	59	58	58	I	I	I
T6_50	<1	<1	1.2	57	57	57	I	I	I
T7_10	1.5	2.9	3.8	58	59	60	I	I	I
T7_20	1.1	2.2	2.8	57	58	58	I	I	I
T7_50	<1	1.2	1.4	56	56	56	I	I	I
T8_10	1.5	2.9	3.9	59	60	60	I	I	I
T8_20	1.1	2.1	2.7	58	59	59	I	I	I
T8_50	<1	1.1	1.3	57	57	57	I	I	I

DN = Do Nothing, DS = Do Something, I = Insignificant, PS = Potentially Significant

Table 5.9 *Critical Load – Acid Deposition -*

Transect number / distance from rail (m)	Change in PC as a percentage of the minimum empirical critical load range (%)			PEC as percentage of the minimum empirical critical load range (%)			Significance		
	2017 DN and 2017 DS	2020 DN and 2020 DS	2027 DN and 2027 DS	2017 DS	2020 DS	2027 DS	2017 DN and 2017 DS	2020 DN and 2020 DS	2027 DN and 2027 DS
Max.	<1	<1	<1	34	34	34	I	I	I
T5_20	<1	<1	<1	30	29	29	I	I	I
T5_50	<1	<1	<1	29	29	29	I	I	I
T5_100	<1	<1	1.1	29	28	29	I	I	I
T5_200	<1	<1	1.2	28	28	29	I	I	I
T6_10	<1	<1	<1	31	31	29	I	I	I
T6_20	<1	<1	<1	30	30	29	I	I	I
T6_50	<1	<1	<1	29	29	30	I	I	I
T7_10	<1	1.3	2.2	30	30	31	I	I	I
T7_20	<1	<1	1.8	29	30	30	I	I	I
T7_50	<1	<1	1.4	29	29	30	I	I	I
T8_10	<1	1.3	1.8	30	31	31	I	I	I
T8_20	<1	<1	1.5	30	30	30	I	I	I
T8_50	<1	<1	1.3	29	29	30	I	I	I

DN = Do Nothing, DS = Do Something, I = Insignificant, PS = Potentially Significant

6 SUMMARY AND CONCLUSIONS

This assessment provide a prediction of the potential impacts to air quality and the subsequent effects to both the Oxford Meadow SAC and the Hook Meadow and Trap Grounds SSSI from changing road and rail emissions following the opening of the Scheme in 2017. The air quality impacts have been evaluated using ADMS-roads.

The implementation of the Scheme is predicted to reduce traffic on the A34. This improvement associated with the Scheme means that no adverse impacts are predicted on the Oxford Meadow SAC from Scheme related traffic using the A34. On the contrary, traffic using the A40 is predicted to increase as a result of the Scheme becoming operational. However, when considering impacts from the A40 on the SAC, all impacts are predicted to be *'Insignificant'* for NO_X, acid deposition and nutrient nitrogen deposition.

Impacts from the rail emissions upon the Hook Meadow and Trap Grounds SSSI are predicted to be *'Potentially Significant'* on some parts of the designated habitat when considering atmospheric concentrations of NO_x and when compared to the lower nutrient nitrogen deposition Critical Load. On this basis, the potential for significant impacts cannot be discounted and therefore further investigation is necessary to provide an understanding of the response of the habitat to changes in NO_X ambient concentrations and nutrient nitrogen deposition once the post operational monitoring has been undertaken.

When considering acid deposition rates on the Hook Meadow and Trap Grounds SSSI from rail emissions, impacts are predicted to be *'Insignificant'*.

Whilst the Scheme will see an increase in train movements between Oxford and Bicester and therefore a decrease in air quality, this is in the overall context of a prediction of decreasing traffic movements from A34 and future electrification of the rail lines. Therefore, the contribution of the train movements should be balanced against the positive air quality benefits to the wider environment.

Whilst this report presents a robust assessment, it is only a set of predictions based on predicted road and rail traffic flows and emissions data. It predates the collection and analysis of operational road and rail traffic data and air quality monitoring data. The modelled levels of nitrogen disposition will need to be validated against the measured data attributable to the Scheme once available. Only then will it be appropriate to consider whether there is any real potential for effects and need for mitigation. The Monitoring and Mitigation Report, which has already been submitted for approval, contains:

- a methodology and programme for monitoring rates of exposure to oxides of nitrogen;

- a methodology for attributing the relevant proportions of the recorded exposures to oxides of nitrogen to elements of the Scheme;

- criteria and thresholds for the inferred nitrogen deposition from oxides of nitrogen designed to protect Oxford Meadows SAC and the Hook Meadow and Trap Grounds SSSI;

- proposed means of mitigation in the event that the criteria or thresholds are not met, or are exceeded; and

- arrangements for reporting the proposed monitoring and mitigation.

Annex A

Air Quality Modelling and Assessment:

East West Rail Phase 1: Condition 31 item (iii) and Condition 32 item (iv)

1 *INTRODUCTION*

This annex supports the air quality impact assessment and details the information and the methods used to perform the assessment. This annex contains the following:

- Information regarding the *ADMS* verification process;
- The methodology used to calculate nutrient nitrogen and acid deposition from monitored and predicted concentrations of NO_x;
- The methodology used to calculate future year baseline concentrations and deposition rates of NO_x and nitrogen;
- Road traffic data used in the impact assessment;
- Information on train numbers and emission factors used in the impact assessment;
- Road and rail vertices used in impact assessment;
- Detailed results from the modelling exercise; and
- Limitations to the study.

The *ADMS* verification process was performed to ensure that the model predictions were consistent with observed concentrations. The method used is described in the *DEFRA* Technical Guidance LAQM.TG(09)(1). The modelled data was verified against data obtained from the air quality monitoring survey performed from April 2014 to April 2015. The modelling itself was performed using baseline road traffic data collected during the monitoring period, and information on Diesel Multiple Units (DMUs) and Locomotives using the Birmingham to Oxford main line during the same period. Model verification was performed using data collected at transects adjacent to both the Oxford Meadow SAC and the Hook Meadow and Trap Grounds SSSI. The average of data from the 10m and 20m transect points were used as these are the most representative of the areas of the habitats most impacted. The final verification factor used for the road and rail modelling was 0.47 and 0.38 respectively.

The model verification exercise using both modelled and monitored data at transects on the SAC and SSSI is presented below in *Table 2.1* and *Table 2.2* respectively.

Table 2.1 ADMS Verification Process Using Modelled and Monitored NO_x Concentrations at Transect 1 to 4.

Transect/Distance (meters)	Modelled concentration[1] (µg/m³)	Monitored concentration[2] (µg/m³)	Baseline concentration[3] (µg/m³)	Monitored - Baseline[4] (µg/m³)	Verification Factor[5]
T1_50	7.54	23.6		3.89	0.52
T1_100	4.11	21.0		1.30	0.32
T1_200	1.93	20.7		0.94	0.49
T2_10	22.2	31.2		11.4	0.51
T2_20	16.0	27.3		7.58	0.47
T2_50	7.35	23.3		3.55	0.48
T2_100	3.99	23.2		3.49	0.87
T2_200	2.12	22.3		2.54	1.20
T3_20	34.6	39.8	19.7	20.1	0.58
T3_50	18.4	33.3		13.6	0.74
T3_100	9.73	30.6		10.9	1.12
T3_200	4.22	27.9		8.22	1.95
T4_10	95.7	55.4		35.7	0.37
T4_20	60.0	45.2		25.5	0.42
T4_50	32.1	35.9		16.2	0.50
T4_100	18.8	32.4		12.7	0.68
T4_200	9.06	27.3		7.56	0.83

1 Modelled NO_x concentration at each monitoring location using baseline traffic data 2014/15
2 Monitored NO_x concentrations at monitoring points along transect 1 to 4 (annual average)
3 The West Oxfordshire District Council estimated background air pollution map was used to determine a baseline NO_x concentration (grid square 446500, 210500)
4 Roads contribution to background NO_x
5 Verification factor = (monitored NO_x - baseline NO_x) / modelled NO_x

(1) *DEFRA* Technical Guidance LAQM.TG(09) (2009) - Part IV of the Environmental Act 1995 Environment (Northern Ireland) Order 2002 Part III - Local Air Quality Management

Table 2.2 ***ADMS Verification Process Using Modelled and Monitored NO_x Concentrations at Transect 5 to 8.***

Transect/Distance (meters)	Modelled concentration[1] (μg/m³)	Monitored concentration[2] (μg/m³)	Baseline concentration[3] (μg/m³)	Monitored - Baseline[4] (μg/m³)	Verification Factor[4]
T5_20	16.3	28.8		6.7	0.41
T5_50	6.92	25.2		3.1	0.44
T5_100	3.88	22.8		0.6	0.16
T5_200	1.79	24.6		2.5	1.40
T6_10	31.4	28.0		5.8	0.19
T6_20	20.6	29.3		7.2	0.35
T6_50	10.3	25.7	22.1	3.6	0.35
T7_10	10.4	25.2		3.0	0.29
T7_20	9.05	26.7		4.6	0.50
T7_50	6.32	22.5		0.4	0.06
T8_10	15.2	29.0		6.8	0.45
T8_20	12.4	27.9		5.7	0.46
T8_50	7.74	27.3		5.2	0.67

[1] Modelled NO_x concentration at each monitoring location using baseline DMU and locomotive data 2014/15

[2] Monitored NO_x concentrations at sampling points along transect 5 to 8 (annual average)

[3] The Oxford City Council estimated background air pollution map was used to determine a baseline NO_x concentration (grid square 449500, 209500)

[4] Roads contribution to background NO_x

[5] Verification factor = (monitored NO_x - baseline NO_x) / modelled NO_x

3 CALCULATION OF ACID AND NUTRIENT NITROGEN DEPOSITION

Baseline nutrient nitrogen and acid deposition have been derived from monitored concentrations of NO_x to define the present baseline and derive baseline for those future years considered in the impact assessment. The concentration of NO_x arising in ambient air due to road and rail sources has also been converted into nutrient nitrogen and acid deposition rate at monitoring locations and used to define impacts. The derivation is based upon *Environment Agency* guidance(1) and uses conversion factors set out in *Table 3.1*, *Table 3.2* and *Table 3.3* to perform an appropriate assessment under the *Habitats Regulations*. The factors take into account the difference in deposition velocity and mechanisms experienced in forests, and grasslands and other non-arboreal areas.

Table 3.1 Recommended Dry Deposition Velocities

Pollutant		**Recommended deposition velocity, m s^{-1}**
NO_2	Grassland	0.0015
	Forest	0.003
SO_2	Grassland	0.012
	Forest	0.024
NH_3	Grassland	0.020
	Forest	0.030
HCl	Grassland	0.025
	Forest	0.060
HNO_3		0.040
Sulphate aerosol, SO_4^{2-}		0.010

Table 3.2 Dry Deposition Flux Conversion Factors for Nutrient Nitrogen Deposition

Pollutant m^{-2} s_{-1} of species	**Conversion factor to kg N ha^{-1} $year^{-1}$**
NO_2	95.9
NH_3	260
HNO_3	70

Table 3.3 Dry Deposition Flux Conversion Factors for Acidification

Pollutant µg m^{-2} s^{-1} of species	**Conversion factor to keq ha^{-1} $year^{-1}$**
NO_2	6.84
NH_3	18.5
HNO_3	5.00
SO_2	9.84
HCl	8.63

(1) AQTAG06 – Technical Guidance on Detailed Modelling Approach for an Appropriate Assessment for Emissions to Air, Environment Agency, produced 06/02/04, Version 8

4 DEFINING THE FUTURE YEAR BASELINE

Future year baseline concentrations of NO_x and nutrient nitrogen and acid deposition rates are derived using the following information:

- monitored concentrations from the air quality survey reported in the Conditions 31 and 32: Baseline Report of Air Quality in relation to Oxford Meadows SAC and Hook Meadow and Trap Grounds SSSI, August 2015 and calculated deposition rates using the methodology outlined in *Section 3;*

- site specific baseline deposition data from *APIS* (1); and

- future changes in NO_x calculated using *DEFRA* (2) mapping.

The DEFRA mapping sets out the predicted change in background NO_x concentrations into the future, with decreases predicted due to the uptake of lower emission vehicles and the implementation of policies and measures to reduce emissions of NO_x. However, NO_x is only one component of nutrient nitrogen deposition and acid deposition and does not account for the majority of deposition. In the case of nutrient nitrogen for example, ammonia is the dominant source of nitrogen deposition. However, there is no reliable data available to quantify future changes in ammonia, and therefore future deposition rates are subject to some uncertainty. On this basis, the pragmatic approach was taken, whereby the road traffic component of baseline NO_x was taken to be reducing, but other NO_x sources, ammonia and other pollutants that contribute to nutrient nitrogen and acid deposition were assumed to remain static. This approach was adopted to avoid overstating the influence of ammonia deposition in the future.

The process for calculating the future year baseline in the Oxford Meadow SAC and the Hook Meadow and Trap Grounds SSSI is presented below.

4.1.1 *Oxford Meadow SAC*

The NO_x background concentration found in grid square 446500, 210500 using the West Oxfordshire District Council estimated background air pollution map was used as indicative of the true NO_x baseline across the habitat site. This grid square was selected as it was considered most representative of the true baseline of those available.

The NO_x concentration and the subsequent deposition rate are presented in *Table 4.1.*

(1) Centre for Ecology and Hydrology (2009) Air Pollution Information System [Online] Available from: http://www.apis.ac.uk [Accessed 12th October 2015].
(2) *DEFRA* (2011) Interpolated mapping data: Local Air Quality Management Support. [Online] Available from: http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html [Accessed 12th October 2015].

Table 4.1 ***Ambient Concentration and Deposition Rate***

Ambient NO_x and deposition rate at grid square 446500, 210500		
Ambient NO_x from *DEFRA* mapping (2014)	19.7	µg/m³
Nutrient Nitrogen deposition arising from NO_x	2.84	kgN/ha/yr
Acid deposition arising from NO_x	0.20	Keq /ha/yr

Factors have been derived from these projections to determine future year background concentrations from the information in *Table 4.1* are derived using DEFRA background mapping. The projected concentrations of NO_x and associated traffic contributions were extracted and factors were derived by determining the reduction in NO_x concentrations associated with traffic sources relative to the previous year. The process to establish future year baseline is presented in *Table 4.2*.

Table 4.2 ***Calculation of Factors using DEFRA Mapping***

DEFRA mapping	**2014**	**2017**	**2020**	**2023**	**2027**
NO_x background (µg/m³)	19.7	17.7	15.4	14.9	14.4
Contribution from road sources (µg/m³)	4.84	4.01	3.10	2.76	2.46
Percentage roads contribution (%)	25	23	20	19	17
Percentage decrease from previous year	-	-17%	-23%	-11%	-11%
Factor	-	**0.83**	**0.77**	**0.89**	**0.89**

The factors were applied consecutively to the NO_x concentration and the NO_x proportion of nutrient nitrogen deposition and acid deposition at grid square 446500, 210500 to establish future year baseline. The results are presented in *Table 4.3*, *Table 4.4* and *Table 4.5*.

Table 4.3 ***Future Year NOx Concentrations***

Year	**Factor**	**NO_x -Traffic only**	**NO_x - Total**
		(µg/m³)	
2014	-	4.8	19.7
2017	0.83	4.01	18.9
2020	0.77	3.10	18.0
2023	0.89	2.76	17.6
2027	0.89	2.46	17.3

Table 4.4 ***Future Year Nutrient Nitrogen (NN) Deposition***

Year	Factor	NO_x - Traffic only	NO_x - Total (KgN/ha/yr)	NH_3	NN total
2014	-	0.70	2.84		16.5
2017	0.83	0.58	2.72		16.4
2020	0.77	0.45	2.59	13.71[1]	16.3
2023	0.89	0.40	2.54		16.2
2027	0.89	0.35	2.49		16.2

[1] The maximum NN deposition rate (NO_X + NH_3) for Lowland Hay Meadows (neutral grassland) of 16.5KgN/ha/yr was extracted from APIS specifically for the Oxford Meadow SAC. The monitored NO_x deposition of 2.84KgN/ha/yr was subtracted to provide the NH_3 background proportion of total NN deposition. This figure was assumed to remain constant for all future year scenarios

Table 4.5 ***Future Year Acid Deposition (AD) keq/ha/yr)***

Year	Factor	NO_x -Traffic only	NO_x - Total	NH_3 (keq/ha/yr)	N total	SO_2
2014	-	0.050	0.20		1.18	
2017	0.83	0.041	0.19		1.17	
2020	0.77	0.032	0.18	0.97[1]	1.16	0.21[2]
2023	0.89	0.028	0.18		1.16	
2027	0.89	0.025	0.18		1.16	

[1] The maximum nitrogen deposition rate (NO_x + NH_3) for Lowland Hay Meadows (neutral grassland) of 1.18keq/ha/yr has been extracted from APIS and the monitored NO_x deposition rate of 0.20keq/ha/yr subtracted to provide the remaining NH_3 background proportion of acid deposition. This figure is assumed to remain constant for all future year scenarios.

[2] The maximum sulphur deposition rate for Lowland Hay Meadows (neutral grassland) of 0.21keq/ha/yr has been used for all scenarios. This information is provided on APIS and is specific to the Oxford Meadow SAC.

4.1.2 *Hook Meadow and Trap Grounds SSSI*

The NO_x background concentration from grid square 449500, 209500 using the *Oxford City Council* estimated background air pollution map was used as indicative of the true baseline across the habitat site. The grid square was selected as the majority of the monitoring locations were located within the square and it was considered representative of the baseline in the area.

The NO_x concentration and the subsequent deposition rate are presented in *Table 4.6*.

Table 4.6 ***Ambient Concentration and Deposition Rate***

Baseline		
Ambient NO_x from *DEFRA* mapping (2014)	22.1	µg/m³
Nutrient Nitrogen deposition derived from NO_x	3.18	kgN/ha/yr
Acid deposition derived from NO_x	0.23	Keq /ha/yr

The factors used to determine future year background concentrations from the information in *Table 4.2* are derived using *DEFRA* background mapping. The projected concentrations of NO_x and associated traffic contributions were extracted and factors were derived by determining the reduction in NO_x concentrations associated with traffic sources relative to the previous year. The process to establish future year baseline is presented in *Table 4.7.*

Table 4.7 ***Calculation of Factors using DEFRA Mapping***

DEFRA mapping	2014	2017	2020	2027
NO_x background (μg/m³)	22.1	19.9	17.4	16.5
Contribution from road sources (μg/m³)	5.76	4.80	3.83	3.14
Percentage roads contribution (%)	26%	24%	22%	19%
Percentage decrease from previous year	-	-17%	-20%	-18%
Factor (from previous year)	-	**0.83**	**0.80**	**0.82**

The factors were applied consecutively to the NO_x concentration and the NO_x proportion of nutrient nitrogen deposition and acid deposition at grid square 449500, 209500 to establish future year baseline. The results are presented in *Table 4.8*, *Table 4.9* and *Table 4.10*.

Table 4.8 ***Future Year NOx Concentrations***

Year	Factor	NO_x- Traffic only	NO_x - Total
		(μg/m³)	
2014	-	5.76	22.1
2017	0.83	4.80	21.2
2020	0.80	3.83	20.2
2027	0.82	3.14	19.5

Table 4.9 ***Future Year Nutrient Nitrogen (NN) Deposition***

Year	Factor	NO_x- Traffic only	NO_x	NH_3	NN total
			(KgN/ha/Yr)		
2014	-	0.83	3.18		16.5
2017	0.83	0.69	3.05	13.31[1]	16.4
2020	0.80	0.55	2.91		16.2
2027	0.82	0.45	2.81		16.1

[1] The maximum NN deposition rate (NO_X + NH_3) for neutral grassland of 16.5KgN/ha/yr was extracted from APIS specifically for the Hook Meadow and Trap Ground SSSI. The monitored NO_x deposition of 3.18KgN/ha/yr was subtracted to provide the NH_3 background proportion of total NN deposition. This figure was assumed to remain constant for all future year scenarios

Table 4.10   Future Year Acid Deposition (AD)

Year	Factor	NO_x - Traffic only	NO_x	NH_3	N total	SO_2
				(keq/ha/yr)		
2014	-	0.059	0.23	0.95[1]	1.18	0.20[2]
2017	0.83	0.049	0.22		1.17	
2020	0.77	0.039	0.21		1.16	
2027	0.89	0.032	0.20		1.15	

[1] The maximum nitrogen deposition rate (NO_x + NH_3) neutral grassland of 1.18keq/ha/yr was extracted from APIS and the monitored NO_x deposition rate of 0.23keq/ha/yr subtracted to provide the remaining NH_3 background proportion of acid deposition. This figure was assumed to remain constant for all future year scenarios

[2] The maximum sulphur deposition rate for neutral grassland of 0.20keq/ha/yr was used as baseline for all scenarios. This information is provided on APIS and is specific to the Hook Meadow and Trap Ground SSS

5 *ROAD TRAFFIC DATA*

Road traffic data for the A34 and the A40 used in the air quality impact assessment is presented in *Table 5.1* to *Table 5.18*.

The baseline road traffic data presented in *Table 5.1* and *Table 5.2* was calculated based on traffic counts and rail passenger surveys undertaken over a one year period by PFA consulting.

PFA was commissioned to derive traffic data for 2017, 2020, 2023 and 2027 to inform the air quality impact assessment. The methodology is presented in *Annex B*.

5.1 BASELINE – 2014/2015

Table 5.1 *A34 Traffic Data*

Period 14/15	Annual Average Daily Traffic (AADT) (vehicles)		Heavy Goods Vehicles (HGV) %		AADT (HGV)		AADT (Light Goods Vehicles) (LGV)		Average Speed (kph)	
	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound
2-8 April	35,393	35,177	18.8	16.1	6654	5663	28739	29514	99.3	99.9
5-11 May	34,157	34,612	17.7	15.3	6046	5296	28111	29316	99.6	101
3-9 June	36,563	36,972	18.4	16.3	6728	6026	29835	30946	99.1	101
1-7 July	37,163	38,343	18.5	16.2	6875	6212	30288	32131	97.5	99.6
2-8 August	37,391	37,363	18.4	16.8	6880	6277	30511	31086	98.3	n/a
31-6 September	37,383	37,345	17.6	18.5	6579	6909	30804	30436	n/a	n/a
1-7 October	35,355	35,865	17.7	18.9	6258	6778	29097	29087	n/a	n/a
4-10 November	35,016	35,837	18	18.9	6303	6773	28713	29064	n/a	n/a
2-8 December	35,073	35,191	20	18.3	7015	6440	28058	28751	98.2	n/a
14-20 January	32,519	32,364	19.4	17.3	6309	5599	26210	26765	99.3	99.0
3-9 February	33,494	34,102	19.2	17.1	6431	5831	27063	28271	100	100
4-10 March	35,163	35,848	19.1	17.1	6716	6130	28447	29718	101	99.9
AADT	35389	35752	18.6	17.2	6566	6161	28823	29590	99.2	100
Vehicle count/hr	1475	1490	18.6	17.2	274	257	1201	1233	99.2	100

Table 5.2 *A40 Traffic Data*

Period 14/15	Annual Average Daily Traffic (AADT) (vehicles)		Heavy Goods Vehicles (HGV) %		AADT (HGV)		AADT (Light Goods Vehicles) (LGV)		Average Speed (kph)	
	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound
2-8 April	12,141	11,401	10	10.7	1214	1220	10927	10181	63.9	78.7
5-11 May	12,036	11,028	10.8	10.2	1300	1125	10736	9903	65.2	83.7
3-9 June	12,084	11,467	10.6	11.2	1281	1284	10803	10183	63.4	83.7
1-7 July	11,566	11,206	10.4	10.2	1203	1143	10363	10063	61.0	80.8
2-8 August	12,215	11,899	10.8	11	1319	1309	10896	10590	58.1	86.7
31-6 September	12,079	11,952	10.3	9	1244	1076	10835	10876	64.9	76.9
1-7 October	11,443	11,326	10.8	11.4	1236	1291	10207	10035	60.7	80.5
4-10 November	11,795	11,474	9	11.3	1062	1297	10733	10177	66.1	82.1
2-8 December	10,803	10,797	9.6	11.7	1037	1263	9766	9534	63.1	83.2
14-20 January	10,938	10,843	11.8	11.4	1291	1236	9647	9607	71.5	83.2
3-9 February	11,194	10,662	11.3	12.5	1265	1333	9929	9329	69.2	82.4
4-10 March	11,687	11,436	11.3	11.9	1321	1361	10366	10075	68.6	78.1
AADT	11665	11291	10.6	11.0	1231	1245	10434	10046	64.9	81.5
AADT (eastbound/westbound)	22956		10.8		2476		20480		73.2	
Vehicle count/hr	957		10.8		103		853		73.2	

5.2 2017 - DO NOTHING

Table 5.3 *A34 Traffic Data*

Period 14/15	Annual Average Daily Traffic (AADT) (vehicles)		Heavy Goods Vehicles (HGV) %		AADT (HGV)		AADT (Light Goods Vehicles) (LGV)		Average Speed (kph)	
	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound
2-8 April	36685	36461	18.8	16.1	6897	5870	29788	30591	99.3	99.9
5-11 May	35404	35875	17.7	15.3	6266	5489	29137	30386	99.6	101
3-9 June	37898	38321	18.4	16.3	6973	6246	30924	32075	99.1	101
1-7 July	38519	39743	18.5	16.2	7126	6438	31393	33304	97.5	99.6
2-8 August	38756	38727	18.4	16.8	7131	6506	31625	32221	98.3	n/a
31-6 September	38747	38708	17.6	18.5	6820	7161	31928	31547	n/a	n/a
1-7 October	36645	37174	17.7	18.9	6486	7026	30159	30148	n/a	n/a
4-10 November	36294	37145	18	18.9	6533	7020	29761	30125	n/a	n/a
2-8 December	36353	36475	20	18.3	7271	6675	29083	29800	98.2	n/a
14-20 January	33706	33545	19.4	17.3	6539	5803	27167	27742	99.3	99.0
3-9 February	34717	35347	19.2	17.1	6666	6044	28051	29302	100	100
4-10 March	36446	37156	19.1	17.1	6961	6354	29485	30803	101	99.9
AADT	36681	37057	18.6	17.2	6806	6386	29875	30670	99.2	100
Vehicle count/hr	1528	1544	18.6	17.2	284	266	1245	1278	99.2	100

Table 5.4 *A40 Traffic Data*

Period 14/15	Annual Average Daily Traffic (AADT) (vehicles)		Heavy Goods Vehicles (HGV) %		AADT (HGV)		AADT (Light Goods Vehicles) (LGV)		Average Speed (kph)	
	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound
2-8 April	12555	11790	10.0	10.7	1256	1262	11300	10528	63.9	78.7
5-11 May	12446	11404	10.8	10.2	1344	1163	11102	10241	65.2	83.7
3-9 June	12496	11858	10.6	11.2	1325	1328	11171	10530	63.4	83.7
1-7 July	11960	11588	10.4	10.2	1244	1182	10717	10406	61.0	80.8
2-8 August	12632	12305	10.8	11	1364	1354	11267	10951	58.1	86.7
31-6 September	12491	12360	10.3	9.0	1287	1112	11204	11247	64.9	76.9
1-7 October	11833	11712	10.8	11.4	1278	1335	10555	10377	60.7	80.5
4-10 November	12197	11865	9.0	11.3	1098	1341	11099	10524	66.1	82.1
2-8 December	11171	11165	9.6	11.7	1072	1306	10099	9859	63.1	83.2
14-20 January	11311	11213	11.8	11.4	1335	1278	9976	9934	71.5	83.2
3-9 February	11576	11026	11.3	12.5	1308	1378	10268	9647	69.2	82.4
4-10 March	12086	11826	11.3	11.9	1366	1407	10720	10419	68.6	78.1
AADT	12063	11676	10.6	11.0	1273	1287	10790	10389	64.9	81.5
AADT (eastbound/westbound)	23739		10.8		2560		21179		73.2	
Vehicle count/hr	989		10.8		107		882		73.2	

5.3 2017 – DO SOMETHING

Table 5.5 *A34 Traffic Data*

Period 14/15	Annual Average Daily Traffic (AADT) (vehicles)		Heavy Goods Vehicles (HGV) %		AADT (HGV)		AADT (Light Goods Vehicles) (LGV)		Average Speed (kph)	
	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound
2-8 April	36450	36196	18.8	16.1	6853	5828	29598	30369	99.3	99.9
5-11 May	35169	35611	17.7	15.3	6225	5448	28944	30162	99.6	101
3-9 June	37663	38057	18.4	16.3	6930	6203	30733	31854	99.1	101
1-7 July	38285	39478	18.5	16.2	7083	6395	31202	33083	97.5	99.6
2-8 August	38521	38462	18.4	16.8	7088	6462	31433	32001	98.3	n/a
31-6 September	38513	38444	17.6	18.5	6778	7112	31735	31332	n/a	n/a
1-7 October	36411	36910	17.7	18.9	6445	6976	29966	29934	n/a	n/a
4-10 November	36059	36881	18.0	18.9	6491	6970	29569	29910	n/a	n/a
2-8 December	36118	36211	20.0	18.3	7224	6627	28895	29584	98.2	n/a
14-20 January	33471	33281	19.4	17.3	6493	5758	26978	27523	99.3	99.0
3-9 February	34482	35082	19.2	17.1	6621	5999	27861	29083	100	100
4-10 March	36212	36892	19.1	17.1	6916	6309	29295	30583	101	99.9
AADT	36446	36792	18.6	17.2	6762	6341	29684	30451	99.2	100
Vehicle count/hr	1519	1533	18.6	17.2	282	264	1237	1269	99.2	100

Table 5.6 A40 Traffic Data

Period 14/15	Annual Average Daily Traffic (AADT) (vehicles)		Heavy Goods Vehicles (HGV) %		AADT (HGV)		AADT (Light Goods Vehicles) (LGV)		Average Speed (kph)	
	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound
2-8 April	12936	12176	10	10.7	1294	1303	11642	10874	63.9	78.7
5-11 May	12827	11791	10.8	10.2	1385	1203	11442	10588	65.2	83.7
3-9 June	12877	12245	10.6	11.2	1365	1371	11512	10873	63.4	83.7
1-7 July	12341	11975	10.4	10.2	1283	1221	11057	10753	61.0	80.8
2-8 August	13012	12691	10.8	11	1405	1396	11607	11295	58.1	86.7
31-6 September	12871	12746	10.3	9	1326	1147	11546	11599	64.9	76.9
1-7 October	12214	12099	10.8	11.4	1319	1379	10895	10720	60.7	80.5
4-10 November	12578	12252	9	11.3	1132	1384	11446	10867	66.1	82.1
2-8 December	11552	11552	9.6	11.7	1109	1352	10443	10200	63.1	83.2
14-20 January	11691	11599	11.8	11.4	1380	1322	10312	10277	71.5	83.2
3-9 February	11956	11412	11.3	12.5	1351	1427	10605	9986	69.2	82.4
4-10 March	12466	12213	11.3	11.9	1409	1453	11057	10759	68.6	78.1
AADT	12443	12063	10.6	11.0	1313	1330	11130	10733	64.9	81.5
AADT (eastbound/westbound)	24506		10.8		2643		21863		73.2	
Vehicle count/hr	1021		10.8		110		911		73.2	

5.4 2020 – DO NOTHING

Table 5.7 *A34 Traffic Data*

Period 14/15	Annual Average Daily Traffic (AADT) (vehicles)		Heavy Goods Vehicles (HGV) %		AADT (HGV)		AADT (Light Goods Vehicles) (LGV)		Average Speed (kph)	
	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound
2-8 April	38348	38114	18.8	16.1	7209	6136	31139	31978	99.3	99.9
5-11 May	37009	37502	17.7	15.3	6551	5738	30458	31764	99.6	101
3-9 June	39616	40059	18.4	16.3	7289	6530	32327	33530	99.1	101
1-7 July	40266	41545	18.5	16.2	7449	6730	32817	34814	97.5	99.6
2-8 August	40513	40483	18.4	16.8	7454	6801	33059	33682	98.3	n/a
31-6 September	40504	40463	17.6	18.5	7129	7486	33376	32978	n/a	n/a
1-7 October	38307	38860	17.7	18.9	6780	7344	31527	31515	n/a	n/a
4-10 November	37940	38829	18.0	18.9	6829	7339	31111	31491	n/a	n/a
2-8 December	38002	38129	20.0	18.3	7600	6978	30401	31152	98.2	n/a
14-20 January	35234	35066	19.4	17.3	6835	6066	28399	29000	99.3	99.0
3-9 February	36291	36950	19.2	17.1	6968	6318	29323	30631	100	100
4-10 March	38099	38841	19.1	17.1	7277	6642	30822	32199	101	99.9
AADT	38344	38737	18.6	17.2	7114	6676	31230	32061	99.2	100
Vehicle count/hr	1598	1614	18.6	17.2	296	278	1301	1336	99.2	100

Table 5.8 *A40 Traffic Data*

Period 14/15	Annual Average Daily Traffic (AADT) (vehicles)		Heavy Goods Vehicles (HGV) %		AADT (HGV)		AADT (Light Goods Vehicles) (LGV)		Average Speed (kph)	
	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound
2-8 April	13099	12301	10	10.7	1310	1316	11789	10984	63.9	78.7
5-11 May	12986	11898	10.8	10.2	1402	1214	11583	10685	65.2	83.7
3-9 June	13037	12372	10.6	11.2	1382	1386	11655	10986	63.4	83.7
1-7 July	12479	12090	10.4	10.2	1298	1233	11181	10857	61.0	80.8
2-8 August	13179	12838	10.8	11.0	1423	1412	11755	11426	58.1	86.7
31-6 September	13032	12895	10.3	9.0	1342	1161	11690	11734	64.9	76.9
1-7 October	12346	12220	10.8	11.4	1333	1393	11013	10827	60.7	80.5
4-10 November	12726	12379	9.0	11.3	1145	1399	11580	10980	66.1	82.1
2-8 December	11655	11649	9.6	11.7	1119	1363	10536	10286	63.1	83.2
14-20 January	11801	11699	11.8	11.4	1393	1334	10408	10365	71.5	83.2
3-9 February	12077	11503	11.3	12.5	1365	1438	10712	10065	69.2	82.4
4-10 March	12609	12338	11.3	11.9	1425	1468	11184	10870	68.6	78.1
AADT	12585	12182	10.6	11.0	1328	1343	11257	10839	64.9	81.5
AADT (eastbound/westbound)	24767		10.8		2671		22096		73.2	
Vehicle count/hr	1032		10.8		111		921		73.2	

5.5 2020 – Do Something

Table 5.9 A34 Traffic Data

Period 14/15	Annual Average Daily Traffic (AADT) (vehicles)		Heavy Goods Vehicles (HGV) %		AADT (HGV)		AADT (Light Goods Vehicles) (LGV)		Average Speed (kph)	
	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound
2-8 April	38097	37830	18.8	16.1	7162	6091	30934	31740	99.3	99.9
5-11 May	36757	37218	17.7	15.3	6506	5694	30251	31524	99.6	101
3-9 June	39364	39775	18.4	16.3	7243	6483	32121	33292	99.1	101
1-7 July	40014	41261	18.5	16.2	7403	6684	32612	34576	97.5	99.6
2-8 August	40261	40199	18.4	16.8	7408	6753	32853	33445	98.3	n/a
31-6 September	40253	40179	17.6	18.5	7084	7433	33168	32746	n/a	n/a
1-7 October	38055	38576	17.7	18.9	6736	7291	31320	31285	n/a	n/a
4-10 November	37688	38545	18.0	18.9	6784	7285	30904	31260	n/a	n/a
2-8 December	37750	37845	20.0	18.3	7550	6926	30200	30920	98.2	n/a
14-20 January	34983	34782	19.4	17.3	6787	6017	28196	28765	99.3	99.0
3-9 February	36039	36666	19.2	17.1	6919	6270	29119	30396	100	100
4-10 March	37847	38557	19.1	17.1	7229	6593	30618	31964	101	99.9
AADT	38092	38453	18.6	17.2	7068	6627	31025	31826	99.2	100
Vehicle count/hr	1587	1602	18.6	17.2	294	276	1293	1326	99.2	100

Table 5.10 *A40 Traffic Data*

Period 14/15	Annual Average Daily Traffic (AADT) (vehicles)		Heavy Goods Vehicles (HGV) %		AADT (HGV)		AADT (Light Goods Vehicles) (LGV)		Average Speed (kph)	
	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound
2-8 April	13505	12713	10	10.7	1350	1360	12154	11353	63.9	78.7
5-11 May	13392	12311	10.8	10.2	1446	1256	11945	11055	65.2	83.7
3-9 June	13443	12784	10.6	11.2	1425	1432	12018	11352	63.4	83.7
1-7 July	12885	12503	10.4	10.2	1340	1275	11545	11227	61.0	80.8
2-8 August	13585	13250	10.8	11.0	1467	1458	12118	11793	58.1	86.7
31-6 September	13438	13307	10.3	9.0	1384	1198	12054	12110	64.9	76.9
1-7 October	12752	12632	10.8	11.4	1377	1440	11375	11192	60.7	80.5
4-10 November	13132	12792	9.0	11.3	1182	1445	11950	11346	66.1	82.1
2-8 December	12061	12061	9.6	11.7	1158	1411	10903	10650	63.1	83.2
14-20 January	12207	12111	11.8	11.4	1440	1381	10767	10730	71.5	83.2
3-9 February	12483	11916	11.3	12.5	1411	1489	11073	10426	69.2	82.4
4-10 March	13015	12751	11.3	11.9	1471	1517	11544	11233	68.6	78.1
AADT	12991	12594	10.6	11.0	1371	1389	11620	11206	64.9	81.5
AADT (eastbound/westbound)	25586		10.8		2760		22826		73.2	
Vehicle count/hr	1066		10.8		115		951		73.2	

5.6 2023 – DO NOTHING

Table 5.11 A34 Traffic Data

Period 14/15	Annual Average Daily Traffic (AADT) (vehicles)		Heavy Goods Vehicles (HGV) %		AADT (HGV)		AADT (Light Goods Vehicles) (LGV)		Average Speed (kph)	
	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound
2-8 April	40097	39852	18.8	16.1	7538	6416	32559	33436	99.3	99.9
5-11 May	38696	39212	17.7	15.3	6849	5999	31847	33213	99.6	101
3-9 June	41422	41886	18.4	16.3	7622	6827	33801	35058	99.1	101
1-7 July	42102	43439	18.5	16.2	7789	7037	34313	36402	97.5	99.6
2-8 August	42360	42329	18.4	16.8	7794	7111	34566	35217	98.3	n/a
31-6 September	42351	42308	17.6	18.5	7454	7827	34897	34481	n/a	n/a
1-7 October	40054	40631	17.7	18.9	7090	7679	32964	32952	n/a	n/a
4-10 November	39670	40600	18.0	18.9	7141	7673	32529	32926	n/a	n/a
2-8 December	39734	39868	20.0	18.3	7947	7296	31787	32572	98.2	n/a
14-20 January	36841	36665	19.4	17.3	7147	6343	29694	30322	99.3	99.0
3-9 February	37945	38634	19.2	17.1	7286	6606	30660	32028	100	100
4-10 March	39836	40612	19.1	17.1	7609	6945	32227	33668	101	99.9
AADT	40092	40503	18.6	17.2	7439	6980	32654	33523	99.2	100
Vehicle count/hr	1671	1688	18.6	17.2	310	291	1361	1397	99.2	100

Table 5.12 *A40 Traffic Data*

Period 14/15	Annual Average Daily Traffic (AADT) (vehicles)		Heavy Goods Vehicles (HGV) %		AADT (HGV)		AADT (Light Goods Vehicles) (LGV)		Average Speed (kph)	
	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound
2-8 April	13668	12835	10.0	10.7	1367	1373	12302	11462	63.9	78.7
5-11 May	13550	12415	10.8	10.2	1463	1266	12087	11149	65.2	83.7
3-9 June	13604	12910	10.6	11.2	1442	1446	12162	11464	63.4	83.7
1-7 July	13021	12616	10.4	10.2	1354	1287	11667	11329	61.0	80.8
2-8 August	13752	13396	10.8	11.0	1485	1474	12266	11922	58.1	86.7
31-6 September	13599	13456	10.3	9.0	1401	1211	12198	12245	64.9	76.9
1-7 October	12883	12751	10.8	11.4	1391	1454	11491	11297	60.7	80.5
4-10 November	13279	12917	9.0	11.3	1195	1460	12084	11458	66.1	82.1
2-8 December	12162	12155	9.6	11.7	1168	1422	10994	10733	63.1	83.2
14-20 January	12314	12207	11.8	11.4	1453	1392	10861	10815	71.5	83.2
3-9 February	12602	12003	11.3	12.5	1424	1500	11178	10503	69.2	82.4
4-10 March	13157	12875	11.3	11.9	1487	1532	11670	11343	68.6	78.1
AADT	13133	12711	10.6	11.0	1386	1401	11747	11310	64.9	81.5
AADT (eastbound/westbound)	25844		10.8		2787		23057		73.2	
Vehicle count/hr	1077		10.8		116		961		73.2	

5.7 2023 – DO SOMETHING

Table 5.13 ***A34 Traffic Data***

Period 14/15	Annual Average Daily Traffic (AADT) (vehicles)		Heavy Goods Vehicles (HGV) %		AADT (HGV)		AADT (Light Goods Vehicles) (LGV)		Average Speed (kph)	
	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound
2-8 April	39828	39549	18.8	16.1	7488	6367	32340	33181	99.3	99.9
5-11 May	38428	38908	17.7	15.3	6802	5953	31626	32955	99.6	101
3-9 June	41153	41582	18.4	16.3	7572	6778	33581	34804	99.1	101
1-7 July	41833	43135	18.5	16.2	7739	6988	34094	36147	97.5	99.6
2-8 August	42091	42025	18.4	16.8	7745	7060	34347	34965	98.3	n/a
31-6 September	42082	42005	17.6	18.5	7406	7771	34676	34234	n/a	n/a
1-7 October	39785	40328	17.7	18.9	7042	7622	32743	32706	n/a	n/a
4-10 November	39401	40296	18.0	18.9	7092	7616	32309	32680	n/a	n/a
2-8 December	39465	39564	20.0	18.3	7893	7240	31572	32324	98.2	n/a
14-20 January	36572	36362	19.4	17.3	7095	6291	29477	30071	99.3	99.0
3-9 February	37676	38331	19.2	17.1	7234	6555	30443	31776	100	100
4-10 March	39567	40309	19.1	17.1	7557	6893	32010	33416	101	99.9
AADT	39823	40199	18.6	17.2	7389	6928	32435	33272	99.2	100
Vehicle count/hr	1659	1675	18.6	17.2	308	289	1351	1386	99.2	100

Table 5.14 ***A40 Traffic Data***

Period 14/15	Annual Average Daily Traffic (AADT) (vehicles)		Heavy Goods Vehicles (HGV) %		AADT (HGV)		AADT (Light Goods Vehicles) (LGV)		Average Speed (kph)	
	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound
2-8 April	14100	13273	10.0	10.7	1410	1420	12690	11853	63.9	78.7
5-11 May	13982	12854	10.8	10.2	1510	1311	12472	11542	65.2	83.7
3-9 June	14036	13348	10.6	11.2	1488	1495	12548	11853	63.4	83.7
1-7 July	13453	13054	10.4	10.2	1399	1331	12053	11722	61.0	80.8
2-8 August	14183	13834	10.8	11.0	1532	1522	12651	12312	58.1	86.7
31-6 September	14030	13894	10.3	9.0	1445	1250	12585	12643	64.9	76.9
1-7 October	13314	13189	10.8	11.4	1438	1504	11876	11685	60.7	80.5
4-10 November	13710	13356	9.0	11.3	1234	1509	12476	11846	66.1	82.1
2-8 December	12594	12593	9.6	11.7	1209	1473	11385	11120	63.1	83.2
14-20 January	12746	12645	11.8	11.4	1504	1442	11242	11204	71.5	83.2
3-9 February	13034	12441	11.3	12.5	1473	1555	11561	10886	69.2	82.4
4-10 March	13589	13313	11.3	11.9	1536	1584	12053	11729	68.6	78.1
AADT	13564	13150	10.6	11.0	1431	1450	12133	11700	64.9	81.5
AADT (eastbound/westbound)	26714		10.8		2881		23832		73.2	
Vehicle count/hr	1113		10.8		120		993		73.2	

5.8 2027 – DO NOTHING

Table 5.15 ***A34 Traffic Data***

Period 14/15	Annual Average Daily Traffic (AADT) (vehicles)		Heavy Goods Vehicles (HGV) %		AADT (HGV)		AADT (Light Goods Vehicles) (LGV)		Average Speed (kph)	
	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound
2-8 April	42383	42124	18.8	16.1	7968	6782	34415	35342	99.3	99.9
5-11 May	40903	41448	17.7	15.3	7240	6342	33663	35106	99.6	101
3-9 June	43784	44274	18.4	16.3	8056	7217	35728	37057	99.1	101
1-7 July	44503	45916	18.5	16.2	8233	7438	36270	38477	97.5	99.6
2-8 August	44776	44742	18.4	16.8	8239	7517	36537	37226	98.3	n/a
31-6 September	44766	44721	17.6	18.5	7879	8273	36887	36447	n/a	n/a
1-7 October	42338	42948	17.7	18.9	7494	8117	34844	34831	n/a	n/a
4-10 November	41932	42915	18.0	18.9	7548	8111	34384	34804	n/a	n/a
2-8 December	42000	42141	20.0	18.3	8400	7712	33600	34429	98.2	n/a
14-20 January	38942	38756	19.4	17.3	7555	6705	31387	32051	99.3	99.0
3-9 February	40109	40837	19.2	17.1	7701	6983	32408	33854	100	100
4-10 March	42108	42928	19.1	17.1	8043	7341	34065	35587	101	99.9
AADT	42379	42813	18.6	17.2	7863	7378	34516	35434	99.2	100
Vehicle count/hr	1766	1784	18.6	17.2	328	307	1438	1476	99.2	100

Table 5.16 A40 Traffic Data

Period 14/15	Annual Average Daily Traffic (AADT) (vehicles)		Heavy Goods Vehicles (HGV) %		AADT (HGV)		AADT (Light Goods Vehicles) (LGV)		Average Speed (kph)	
	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound
2-8 April	14415	13536	10.0	10.7	1442	1448	12974	12088	63.9	78.7
5-11 May	14290	13094	10.8	10.2	1543	1336	12747	11758	65.2	83.7
3-9 June	14347	13615	10.6	11.2	1521	1525	12827	12090	63.4	83.7
1-7 July	13732	13305	10.4	10.2	1428	1357	12304	11948	61.0	80.8
2-8 August	14503	14128	10.8	11.0	1566	1554	12937	12574	58.1	86.7
31-6 September	14341	14191	10.3	9.0	1477	1277	12864	12913	64.9	76.9
1-7 October	13586	13447	10.8	11.4	1467	1533	12119	11914	60.7	80.5
4-10 November	14004	13623	9.0	11.3	1260	1539	12744	12084	66.1	82.1
2-8 December	12826	12819	9.6	11.7	1231	1500	11595	11319	63.1	83.2
14-20 January	12987	12874	11.8	11.4	1532	1468	11454	11406	71.5	83.2
3-9 February	13291	12659	11.3	12.5	1502	1582	11789	11077	69.2	82.4
4-10 March	13876	13578	11.3	11.9	1568	1616	12308	11962	68.6	78.1
AADT	13850	13406	10.6	11.0	1462	1478	12388	11928	64.9	81.5
AADT (eastbound/westbound)	27256		10.8		2939		24316		73.2	
Vehicle count/hr	1136		10.8		122		1013		73.2	

5.9 2027 – DO SOMETHING

Table 5.17 A34 Traffic Data

Period 14/15	Annual Average Daily Traffic (AADT) (vehicles)		Heavy Goods Vehicles (HGV) %		AADT (HGV)		AADT (Light Goods Vehicles) (LGV)		Average Speed (kph)	
	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound
2-8 April	42091	41795	18.8	16.1	7913	6729	34178	35066	99.3	99.9
5-11 May	40611	41118	17.7	15.3	7188	6291	33423	34827	99.6	101
3-9 June	43492	43944	18.4	16.3	8003	7163	35490	36782	99.1	101
1-7 July	44211	45586	18.5	16.2	8179	7385	36032	38201	97.5	99.6
2-8 August	44484	44413	18.4	16.8	8185	7461	36299	36951	98.3	n/a
31-6 September	44474	44391	17.6	18.5	7828	8212	36647	36179	n/a	n/a
1-7 October	42046	42619	17.7	18.9	7442	8055	34604	34564	n/a	n/a
4-10 November	41640	42585	18.0	18.9	7495	8049	34145	34537	n/a	n/a
2-8 December	41708	41812	20.0	18.3	8342	7652	33367	34160	98.2	n/a
14-20 January	38650	38426	19.4	17.3	7498	6648	31152	31779	99.3	99.0
3-9 February	39817	40508	19.2	17.1	7645	6927	32172	33581	100	100
4-10 March	41816	42598	19.1	17.1	7987	7284	33829	35314	101	99.9
AADT	42087	42483	18.6	17.2	7809	7321	34278	35162	99.2	100
Vehicle count/hr	1754	1770	18.6	17.2	325	305	1428	1465	99.2	100

Table 5.18 *A40 Traffic Data*

Period 14/15	Annual Average Daily Traffic (AADT) (vehicles)		Heavy Goods Vehicles (HGV) %		AADT (HGV)		AADT (Light Goods Vehicles) (LGV)		Average Speed (kph)	
	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound
2-8 April	14881	14009	10.0	10.7	1488	1499	13392	12510	63.9	78.7
5-11 May	14756	13566	10.8	10.2	1594	1384	13162	12182	65.2	83.7
3-9 June	14813	14087	10.6	11.2	1570	1578	13243	12510	63.4	83.7
1-7 July	14198	13777	10.4	10.2	1477	1405	12721	12372	61.0	80.8
2-8 August	14968	14600	10.8	11.0	1617	1606	13352	12994	58.1	86.7
31-6 September	14807	14663	10.3	9.0	1525	1320	13282	13344	64.9	76.9
1-7 October	14052	13920	10.8	11.4	1518	1587	12534	12333	60.7	80.5
4-10 November	14470	14096	9.0	11.3	1302	1593	13167	12503	66.1	82.1
2-8 December	13292	13292	9.6	11.7	1276	1555	12016	11737	63.1	83.2
14-20 January	13452	13346	11.8	11.4	1587	1522	11865	11825	71.5	83.2
3-9 February	13756	13132	11.3	12.5	1554	1641	12202	11490	69.2	82.4
4-10 March	14341	14051	11.3	11.9	1621	1672	12721	12379	68.6	78.1
AADT	14315	13878	10.6	11.0	1511	1530	12805	12348	64.9	81.5
AADT (eastbound/westbound)	28194		10.8		3041		25153		73.2	
Vehicle count/hr	1175		10.8		127		1048		73.2	

5.10 *TRAIN EMISSIONS DATA*

The rail modelling was undertaken on the basis of Annual Average Daily Rail (AADR) movements for the following scenarios:

- Existing passenger and freight trains using the main line during the monitoring period (2014/2015) for model verification purposes; and
- Additional passenger and freight trains using the Bicester to Oxford line in 2017, 2020 and 2027.

5.10.1 *Existing Trains*

During the baseline monitoring period, trains remained operational on the Oxford to Birmingham main line. Information on existing trains using the Bicester to Oxford line was not available at the time of performing the assessment. The main line trains were modelled and impacts predicted at the monitoring locations on the SSSI. Information on train frequencies using the main line was extracted from the Network Rail timetable for both passenger and freight trains between Sunday 14 December 2014 and Saturday 16 May 2015 (1) (2) and used as indicative of the whole year. The modelling was performed to:

- allow a verification factor to be determined by comparing modelled results to monitored concentrations at the discrete receptor/monitoring locations; and
- determine the significance of impacts in the 2017, 2020 and 2027 scenarios. For the purpose of the assessment the assumption was made that the do nothing scenarios for the future years would consist of mainline trains only during the baseline year, prior to the scheme becoming operational.

5.10.2 *Passenger Trains with Scheme*

No services were operating on the Bicester to Oxford route during the baseline monitoring period. For the purpose of the assessment the assumption was made that in 2017, the Chiltern Railways passenger services will be operating, with the EWR Phase 2 services operating from 2020.

Although the final fleet mix is not confirmed at this time, it is anticipated that the Chiltern fleet would run on a majority as Class 168s. During peak hours (assumed to be 7 - 9 am and 5 - 7 pm), the Class 168 DMUs may comprise of up to eight cars. The majority of the Class 168 DMUs will be run with four cars for the rest of the day. Emissions factors representing a four car Class 168

(1) Network Rail - Working Timetable Sunday 14 December 2014 to Saturday 16 May 2015 - Freight and Departmental Services - Section PF05 Didcot to Calvert and Heyford
(2) Network Rail - Working Timetable Sunday 14 December 2014 to Saturday 16 May 2015 – Passenger Train Services – Section PA04 Reading to Heyford and Swindon

were therefore used in the modelling exercise to be reflective of long term impacts.

EWR will run a passenger service which will comprise Class 172 DMUs with four cars.

5.10.3 *Freight Trains with Scheme*

In the case of freight, it will be assumed that in 2017, the previous Bicester to Oxford freight services will have resumed. Between 2020 and 2027, it will be assumed that the Bicester to Oxford freight services will progressively increase to the full service. This assumption is based upon information original used in the noise and vibration schemes of assessment (1). Freight trains will generally be hauled by Class 66 locomotives.

5.10.4 *Summary of Train Movements with and without the Scheme*

Unit emission factors (2) (3) for passenger trains, and locomotives for freight trains for the modelling scenarios are presented in *Table 5.20*, *Table 5.21* and *Table 5.22* and *Table 5.22*. Emission rates for each train class after accounting for the number of train units are also presented.

Table 5.19 ***2014/15 - Baseline***

Class	Operator	Annual Average Daily Rail (AADR) movements	Train emission factor (g/km/train)	Train emission rate (g/km/s)
Class 165	Network Rail	43	30.3	0.015
Class 221	Network Rail	69	26.8	0.021
IC125	Network Rail	18	195	0.040
Class 66	Freight	83	120	0.115

5.11 2017 - DO SOMETHING

Table 5.20 ***Modelled Trains***

Class	Operator	Annual Average Daily Rail (AADR) movements	Train emission factor (g/km/train)	Train emission rate (g/km/s)
Class 168	Chiltern	68	58.9	0.046
Class 66	Freight	6	120	8.33×10^{-3}

(1) Environmental Resources Management (2015) Noise Scheme of Assessment for Route Section H. Reference: 0221083/11/H06

(2) AEA Technology (2001) – Rail and Road Emissions Model: Final Report (Prepared for the Strategic Rail Authority)

(3) AEA Technology (2007) – Estimation of Rail Environmental Costs (Prepared for the Department of Transport)

5.12 2020 DO SOMETHING

Table 5.21 Modelled Trains

Class	Operator	Annual Average Daily Rail (AADR) movements	Train emission factor (g/km/train)	Train emission rate (g/km/s)
Class 168	Chiltern	68	58.9	0.046
Class 172	East West Rail	78	58.9	0.053
Class 66	Freight	6	120	8.33×10^{-3}

5.13 2027 DO SOMETHING

Table 5.22 Modelled Trains

Class	Operator	Annual Average Daily Rail (AADR) movements	Train emission factor (g/km/train)	Train emission rate (g/km/s)
Class 168	Chiltern	68	58.9	0.046
Class 172	East West Rail	78	58.9	0.053
Class 66	Freight	25	120	0.035

In the model road and rail routes are defined using a series of vertices. The vertices used to define the road and rail sources are presented in *Table 6.1*, *Table 6.2* and *Table 6.3*. Coordinates are provided in UTM Zone 30N.

Table 6.1 ***A34 Vertices***

Vertices	Road Width	Northbound		Southbound	
		x	y	x	y
1	7	617002	5737853	617695	5738893
2	7	617007	5737872	617680	5738880
3	7	617014	5737902	617657	5738860
4	7	617021	5737931	617635	5738840
5	7	617030	5737960	617613	5738820
6	7	617038	5737988	617590	5738800
7	7	617046	5738017	617568	5738781
8	7	617056	5738046	617545	5738761
9	7	617066	5738074	617523	5738740
10	7	617076	5738102	617502	5738719
11	7	617087	5738130	617480	5738699
12	7	617099	5738158	617459	5738678
13	7	617111	5738185	617438	5738656
14	7	617123	5738213	617418	5738634
15	7	617136	5738240	617398	5738611
16	7	617149	5738266	617378	5738589
17	7	617163	5738293	617359	5738566
18	7	617177	5738319	617340	5738542
19	7	617192	5738346	617322	5738519
20	7	617207	5738372	617304	5738495
21	7	617212	5738380	617298	5738487
22	7	617223	5738397	617286	5738470
23	7	617239	5738422	617269	5738446
24	7	617250	5738439	617258	5738429
25	7	617255	5738448	617252	5738421
26	7	617272	5738472	617236	5738395
27	7	617290	5738497	617220	5738370
28	7	617308	5738521	617205	5738344
29	7	617326	5738545	617190	5738318
30	7	617345	5738568	617176	5738292
31	7	617364	5738591	617162	5738265
32	7	617384	5738614	617149	5738238
33	7	617403	5738636	617135	5738211
34	7	617423	5738659	617123	5738184
35	7	617444	5738680	617111	5738156
36	7	617465	5738701	617100	5738129
37	7	617487	5738722	617089	5738101
38	7	617509	5738743	617078	5738073
39	7	617531	5738763	617067	5738045
40	7	617553	5738783	617058	5738016
41	7	617575	5738803	617050	5737987
42	7	617598	5738824	617042	5737958
43	7	617620	5738843	617034	5737930
44	7	617643	5738863	617026	5737900
45	7	617666	5738882	617019	5737871
46	7	617688	5738901	617014	5737850

Table 6.2 *A40 Vertices*

Vertices	Road Width	Eastbound/Westbound	
		x	y
1	7.5	614961	5739152
2	7.5	615344	5739226
3	7.5	615413	5739238
4	7.5	615453	5739245
5	7.5	615492	5739251
6	7.5	615532	5739257
7	7.5	615630	5739273
8	7.5	615729	5739288
9	7.5	615769	5739294
10	7.5	615808	5739299
11	7.5	615848	5739305
12	7.5	615888	5739310
13	7.5	615927	5739315
14	7.5	615977	5739322
15	7.5	616027	5739328
16	7.5	616076	5739334
17	7.5	616126	5739339
18	7.5	616166	5739343
19	7.5	616206	5739347
20	7.5	616245	5739351
21	7.5	616285	5739355
22	7.5	616325	5739358
23	7.5	616365	5739361
24	7.5	616405	5739365
25	7.5	616445	5739368
26	7.5	616485	5739370
27	7.5	616525	5739373
28	7.5	616564	5739376
29	7.5	616604	5739378
30	7.5	616644	5739380
31	7.5	616684	5739381
32	7.5	616724	5739383
33	7.5	616764	5739384
34	7.5	616804	5739384
35	7.5	616844	5739382
36	7.5	616884	5739379
37	7.5	616924	5739374
38	7.5	616963	5739368
39	7.5	617003	5739361
40	7.5	617042	5739352
41	7.5	617081	5739343
42	7.5	617120	5739334
43	7.5	617158	5739324
44	7.5	617197	5739315
45	7.5	617236	5739306
46	7.5	617275	5739296
47	7.5	617314	5739287
48	7.5	617353	5739278
49	7.5	617392	5739268
50	7.5	617481	5739247

Table 6.3 ***Bicester to Oxford Line Vertices***

Vertices	Rail Width	Northbound/Southbound	
		x	y
1	6	619268	5735581
2	6	619256	5735632
3	6	619245	5735684
4	6	619236	5735735
5	6	619229	5735787
6	6	619224	5735840
7	6	619220	5735892
8	6	619216	5735944
9	6	619212	5735997
10	6	619208	5736049
11	6	619204	5736102
12	6	619199	5736154
13	6	619194	5736206
14	6	619188	5736258
15	6	619182	5736310
16	6	619175	5736363
17	6	619168	5736415
18	6	619160	5736467
19	6	619152	5736519
20	6	619144	5736570
21	6	619135	5736622
22	6	619125	5736674
23	6	619115	5736725
24	6	619105	5736777
25	6	619096	5736829
26	6	619092	5736881
27	6	619086	5736933
28	6	619074	5736984
29	6	619060	5737035
30	6	619046	5737085
31	6	619032	5737136
32	6	619017	5737186
33	6	619001	5737237
34	6	618984	5737286
35	6	618967	5737336
36	6	618949	5737385
37	6	618930	5737434
38	6	618909	5737482
39	6	618887	5737530
40	6	618865	5737578
41	6	618841	5737624
42	6	618818	5737672
43	6	618798	5737720
44	6	618782	5737770
45	6	618772	5737822
46	6	618765	5737874
47	6	618761	5737926
48	6	618758	5737979
49	6	618754	5738031
50	6	618750	5738083

Table 6.4 *Main Line Vertices*

Vertices	Rail Width	Northbound/Southbound	
		x	y
1	14	619264	5735580
2	14	619247	5735647
3	14	619234	5735715
4	14	619225	5735783
5	14	619218	5735852
6	14	619213	5735920
7	14	619208	5735989
8	14	619203	5736058
9	14	619197	5736127
10	14	619190	5736195
11	14	619182	5736264
12	14	619174	5736332
13	14	619165	5736401
14	14	619155	5736469
15	14	619145	5736537
16	14	619133	5736605
17	14	619120	5736673
18	14	619107	5736740
19	14	619093	5736808
20	14	619078	5736875
21	14	619062	5736942
22	14	619046	5737009
23	14	619029	5737076
24	14	619011	5737143
25	14	618992	5737209
26	14	618970	5737274
27	14	618946	5737339
28	14	618921	5737403
29	14	618894	5737467
30	14	618865	5737529
31	14	618834	5737591
32	14	618801	5737651
33	14	618766	5737711
34	14	618730	5737769
35	14	618692	5737827
36	14	618655	5737885
37	14	618617	5737943
38	14	618579	5738001
39	14	618542	5738058
40	14	618503	5738116
41	14	618465	5738173
42	14	618426	5738230
43	14	618387	5738286
44	14	618346	5738342
45	14	618304	5738397
46	14	618261	5738450
47	14	618216	5738503
48	14	618170	5738554
49	14	618124	5738606
50	14	618079	5738658

7 *ADDITIONAL RESULTS*

In addition to the summary results set out in the main report, detailed results at the specified monitoring points are presented in this section.

7.1 OXFORD MEADOW SAC

7.1.1 *Process Contribution (PC) and Predicted Environmental Concentration (PEC)*

The modelled PC at each monitoring location and the maximum anywhere on the habitat for each of the scenarios is presented in *Table 7.1*. The verification factor of 0.47 derived through the verification process in *Section 2* has been applied to all results.

The PEC at each monitoring location and the maximum anywhere on the habitat for each of the modelled scenarios is presented in *Table 7.2*. The baseline values presented in *Table 4.3* were used to determine future year PECs.

Table 7.1 *NO_x Process Contribution (PC)*

Transect number / distance from road (m)	PC (μg/m³)								
	2014 Basecase	2017 DN	2017 DS	2020 DN	2020 DS	2023 DN	2023 DS	2027 DN	2027 DS
Max A40	8.02	5.54	5.71	4.05	4.18	3.30	3.40	2.82	2.91
Max A34	46.7	31.4	31.2	22.7	22.5	18.3	18.2	15.6	15.5
T1_50	3.57	2.46	2.54	1.80	1.86	1.47	1.52	1.26	1.30
T1_100	1.95	1.34	1.39	0.99	1.02	0.80	0.83	0.69	0.71
T1_200	0.91	0.63	0.65	0.46	0.48	0.38	0.39	0.32	0.33
T2_10	10.5	7.27	7.49	5.32	5.49	4.33	4.47	3.70	3.82
T2_20	7.57	5.22	5.38	3.82	3.94	3.11	3.21	2.66	2.75
T2_50	3.48	2.40	2.47	1.76	1.81	1.43	1.48	1.22	1.27
T2_100	1.89	1.30	1.34	0.95	0.98	0.78	0.80	0.67	0.69
T2_200	1.00	0.69	0.71	0.51	0.52	0.41	0.42	0.35	0.36
T3_20	16.4	11.0	10.9	7.94	7.89	6.42	6.38	5.48	5.45
T3_50	8.72	5.88	5.84	4.25	4.22	3.44	3.42	2.95	2.93
T3_100	4.61	3.11	3.09	2.25	2.24	1.83	1.81	1.56	1.55
T3_200	2.00	1.35	1.34	0.98	0.97	0.79	0.79	0.68	0.68
T4_10	45.3	30.5	30.3	22.0	21.8	17.7	17.6	15.1	15.0
T4_20	28.4	19.1	19.0	13.8	13.7	11.1	11.1	9.50	9.44
T4_50	15.2	10.2	10.2	7.40	7.35	5.99	5.95	5.12	5.08
T4_100	8.88	5.99	5.95	4.33	4.31	3.52	3.49	3.01	2.99
T4_200	4.29	2.89	2.88	2.10	2.08	1.70	1.69	1.46	1.45

DN = Do Nothing, DS = Do Something

Table 7.2 *NO_x Predicted Environmental Concentration (PEC)*

Transect number / distance from road (m)		PEC (µg/m³)								
		2014 Basecase	2017 DN	2017 DS	2020 DN	2020 DS	2023 DN	2023 DS	2027 DN	2027 DS
	Baseline	19.7	18.9		18.0		17.6		17.3	
Max A40		27.7	24.4	24.6	22.0	22.2	20.9	21.0	20.2	20.3
Max A34		66.4	50.3	50.1	40.6	40.5	35.9	35.8	32.9	32.8
T1_50		23.3	21.4	21.4	19.8	19.8	19.1	19.2	18.6	18.6
T1_100		21.7	20.2	20.3	19.0	19.0	18.4	18.5	18.0	18.1
T1_200		20.6	19.5	19.5	18.4	18.5	18.0	18.0	17.7	17.7
T2_10		30.3	26.2	26.4	23.3	23.5	22.0	22.1	21.0	21.2
T2_20		27.3	24.1	24.3	21.8	21.9	20.8	20.9	20.0	20.1
T2_50		23.2	21.3	21.4	19.7	19.8	19.1	19.1	18.6	18.6
T2_100		21.6	20.2	20.2	18.9	19.0	18.4	18.4	18.0	18.0
T2_200		20.7	19.6	19.6	18.5	18.5	18.1	18.1	17.7	17.7
T3_20		36.1	29.9	29.8	25.9	25.9	24.1	24.0	22.8	22.8
T3_50		28.4	24.8	24.7	22.2	22.2	21.1	21.1	20.3	20.3
T3_100		24.3	22.0	22.0	20.2	20.2	19.5	19.5	18.9	18.9
T3_200		21.7	20.2	20.2	19.0	19.0	18.4	18.4	18.0	18.0
T4_10		65.0	49.4	49.2	39.9	39.8	35.4	35.3	32.4	32.3
T4_20		48.1	38.0	37.9	31.8	31.7	28.8	28.7	26.8	26.8
T4_50		34.9	29.1	29.1	25.4	25.3	23.6	23.6	22.5	22.4
T4_100		28.6	24.9	24.8	22.3	22.3	21.2	21.1	20.4	20.3
T4_200		24.0	21.8	21.8	20.1	20.1	19.3	19.3	18.8	18.8

DN = Do Nothing, DS = Do Something

7.1.2 *Critical Level Assessment*

The assessment is based on the modelled PC (*Table 7.1*) and the PEC (*Table 7.2)* at each monitoring location and the maximum anywhere on the habitat in relation to the critical level of 30μg/m³ set for the protection of vegetation *(Table 7.3)*. The assessment then considers the PC change between the 'Do Nothing' and 'Do Something' scenarios (*Table 7.4*) for each of the future years and defines the significance of that change using the significance criteria detailed in *Section 4.1.3* of the air quality modelling and assessment report.

Table 7.3 ***NO_x Process Contribution (PC) and Predicted Environmental Concentration (PEC) as a Percentage of the Critical Level for the Protection of Vegetation of 30µg/m³***

Transect number / distance from road (m)	2014 Basecase	2017 DN	2017 DS	2020 DN	2020 DS	2023 DN	2023 DS	2027 DN	2027 DS
	PC / Critical Level (%)								
Max A40	27	18	19	14	14	11	11	9	10
Max A34	156	105	104	76	75	61	61	52	52
T1_50	12	8	8	6	6	5	5	4	4
T1_100	6	4	5	3	3	3	3	2	2
T1_200	3	2	2	2	2	1	1	1	1
T2_10	35	24	25	18	18	14	15	12	13
T2_20	25	17	18	13	13	10	11	9	9
T2_50	12	8	8	6	6	5	5	4	4
T2_100	6	4	4	3	3	3	3	2	2
T2_200	3	2	2	2	2	1	1	1	1
T3_20	55	37	36	26	26	21	21	18	18
T3_50	29	20	19	14	14	11	11	10	10
T3_100	15	10	10	7	7	6	6	5	5
T3_200	7	4	4	3	3	3	3	2	2
T4_10	151	102	101	73	73	59	59	50	50
T4_20	95	64	63	46	46	37	37	32	31
T4_50	51	34	34	25	24	20	20	17	17
T4_100	30	20	20	14	14	12	12	10	10
T4_200	14	10	10	7	7	6	6	5	5
	PEC / Critical Level (%)								
Max A40	92	81	82	73	74	70	70	67	68
Max A34	221	168	167	135	135	120	119	110	109
T1_50	78	71	71	66	66	64	64	62	62
T1_100	72	67	68	63	63	61	62	60	60
T1_200	69	65	65	61	62	60	60	59	59
T2_10	101	87	88	78	78	73	74	70	71
T2_20	91	80	81	73	73	69	70	67	67
T2_50	77	71	71	66	66	64	64	62	62
T2_100	72	67	67	63	63	61	61	60	60

Transect	PC / Critical Level (%)								
T2_200	69	65	65	62	62	60	60	59	59
T3_20	120	100	99	86	86	80	80	76	76
T3_50	95	83	82	74	74	70	70	68	68
T3_100	81	73	73	67	67	65	65	63	63
T3_200	72	67	67	63	63	61	61	60	60
T4_10	217	165	164	133	133	118	118	108	108
T4_20	160	127	126	106	106	96	96	89	89
T4_50	116	97	97	85	84	79	79	75	75
T4_100	95	83	83	74	74	71	70	68	68
T4_200	80	73	73	67	67	64	64	63	63

DN = Do Nothing, DS = Do Something

Table 7.4 *Significance of Impact from Road Sources*

Transect number / distance from road (m)	Change in PC as a percentage of the CL (%)				Significance			
	2017 DN and 2017 DS	2020 DN and 2020 DS	2023 DN and 2023 DS	2027 DN and 2027 DS	2017 DN and 2017 DS	2020 DN and 2020 DS	2023 DN and 2023 DS	2027 DN and 2027 DS
Max A40	<1	<1	<1	<1	Insignificant	Insignificant	Insignificant	Insignificant
Max A34	*	*	*	*	Insignificant	Insignificant	Insignificant	Insignificant
T1_50	<1	<1	<1	<1	Insignificant	Insignificant	Insignificant	Insignificant
T1_100	<1	<1	<1	<1	Insignificant	Insignificant	Insignificant	Insignificant
T1_200	<1	<1	<1	<1	Insignificant	Insignificant	Insignificant	Insignificant
T2_10	<1	<1	<1	<1	Insignificant	Insignificant	Insignificant	Insignificant
T2_20	<1	<1	<1	<1	Insignificant	Insignificant	Insignificant	Insignificant
T2_50	<1	<1	<1	<1	Insignificant	Insignificant	Insignificant	Insignificant
T2_100	<1	<1	<1	<1	Insignificant	Insignificant	Insignificant	Insignificant
T2_200	<1	<1	<1	<1	Insignificant	Insignificant	Insignificant	Insignificant
T3_20	*	*	*	*	Insignificant	Insignificant	Insignificant	Insignificant
T3_50	*	*	*	*	Insignificant	Insignificant	Insignificant	Insignificant
T3_100	*	*	*	*	Insignificant	Insignificant	Insignificant	Insignificant
T3_200	*	*	*	*	Insignificant	Insignificant	Insignificant	Insignificant
T4_10	*	*	*	*	Insignificant	Insignificant	Insignificant	Insignificant
T4_20	*	*	*	*	Insignificant	Insignificant	Insignificant	Insignificant
T4_50	*	*	*	*	Insignificant	Insignificant	Insignificant	Insignificant
T4_100	*	*	*	*	Insignificant	Insignificant	Insignificant	Insignificant
T4_200	*	*	*	*	Insignificant	Insignificant	Insignificant	Insignificant

DN = Do Nothing, DS = Do Something

Note: * indicates a negative value predicted as a result of improvements to traffic on the A34.

7.1.3 *Critical Load Assessment – Nutrient Nitrogen*

The assessment is based on the modelled NO_x PC *(Table 7.1)* and the PEC *(Table 7.2)* at each monitoring location and the maximum found anywhere on the habitat. The PC and PECs are converted into deposition rates (*Table 7.5* and *Table 7.6*) using the methodology presented in *Section 3* of this annex and results compared to the empirical critical load range of 20kgN/ha/yr (*Table 7.7*). The baseline values presented in *Table 4.4* were used to determine future year PECs.

The assessment considers the PC change between the 'Do Nothing' and 'Do Something' scenarios for each of the future years (*Table 7.8*) and defines the significance of that change using the significance criteria detailed in *Section 4.1.3* of the air quality modelling and assessment report.

Table 7.5 *NO_x Process Contribution (PC)*

Transect number / distance from road (m)	PC (kgN/ha/yr)								
	2014 Basecase	2017 DN	2017 DS	2020 DN	2020 DS	2023 DN	2023 DS	2027 DN	2027 DS
Max A40	1.15	0.797	0.821	0.583	0.601	0.475	0.490	0.406	0.419
Max A34	6.71	4.52	4.49	3.26	3.24	2.63	2.61	2.24	2.23
T1_50	0.51	0.35	0.37	0.26	0.27	0.21	0.22	0.18	0.19
T1_100	0.28	0.19	0.20	0.14	0.15	0.12	0.12	0.10	0.10
T1_200	0.13	0.09	0.09	0.07	0.07	0.05	0.06	0.05	0.05
T2_10	1.51	1.05	1.08	0.76	0.79	0.62	0.64	0.53	0.55
T2_20	1.09	0.75	0.77	0.55	0.57	0.45	0.46	0.38	0.40
T2_50	0.50	0.35	0.36	0.25	0.26	0.21	0.21	0.18	0.18
T2_100	0.27	0.19	0.19	0.14	0.14	0.11	0.12	0.10	0.10
T2_200	0.14	0.10	0.10	0.07	0.07	0.06	0.06	0.05	0.05
T3_20	2.36	1.58	1.57	1.14	1.13	0.92	0.92	0.79	0.78
T3_50	1.26	0.85	0.84	0.61	0.61	0.50	0.49	0.42	0.42
T3_100	0.66	0.45	0.44	0.32	0.32	0.26	0.26	0.23	0.22
T3_200	0.29	0.19	0.19	0.14	0.14	0.11	0.11	0.10	0.10
T4_10	6.51	4.38	4.36	3.16	3.14	2.55	2.53	2.17	2.16
T4_20	4.09	2.75	2.73	1.98	1.97	1.60	1.59	1.37	1.36
T4_50	2.19	1.47	1.46	1.06	1.06	0.86	0.86	0.74	0.73
T4_100	1.28	0.86	0.86	0.62	0.62	0.51	0.50	0.43	0.43
T4_200	0.62	0.42	0.41	0.30	0.30	0.24	0.24	0.21	0.21

DN = Do Nothing, DS = Do Something

Table 7.6 ***Predicted Environmental Concentrations (PEC)***

Transect number / distance from road (m)	PEC (kgN/ha/yr)								
	2014 Basecase	2017 DN	2017 DS	2020 DN	2020 DS	2023 DN	2023 DS	2027 DN	2027 DS
Baseline	**16.5**	**16.4**		**16.3**		**16.2**		**16.2**	
Max A40	17.7	17.2	17.2	16.9	16.9	16.7	16.7	16.6	16.6
Max A34	23.2	20.9	20.9	19.5	19.5	18.9	18.8	18.4	18.4
T1_50	17.0	16.8	16.8	16.5	16.5	16.4	16.4	16.4	16.4
T1_100	16.8	16.6	16.6	16.4	16.4	16.3	16.3	16.3	16.3
T1_200	16.7	16.5	16.5	16.3	16.3	16.3	16.3	16.2	16.2
T2_10	18.0	17.4	17.5	17.0	17.1	16.8	16.9	16.7	16.7
T2_20	17.6	17.2	17.2	16.8	16.8	16.7	16.7	16.6	16.6
T2_50	17.0	16.7	16.8	16.5	16.5	16.4	16.4	16.4	16.4
T2_100	16.8	16.6	16.6	16.4	16.4	16.3	16.3	16.3	16.3
T2_200	16.7	16.5	16.5	16.3	16.3	16.3	16.3	16.2	16.2
T3_20	18.9	18.0	18.0	17.4	17.4	17.1	17.1	17.0	17.0
T3_50	17.8	17.2	17.2	16.9	16.9	16.7	16.7	16.6	16.6
T3_100	17.2	16.8	16.8	16.6	16.6	16.5	16.5	16.4	16.4
T3_200	16.8	16.6	16.6	16.4	16.4	16.3	16.3	16.3	16.3
T4_10	23.0	20.8	20.8	19.4	19.4	18.8	18.8	18.3	18.3
T4_20	20.6	19.2	19.1	18.3	18.2	17.8	17.8	17.5	17.5
T4_50	18.7	17.9	17.9	17.3	17.3	17.1	17.1	16.9	16.9
T4_100	17.8	17.3	17.3	16.9	16.9	16.7	16.7	16.6	16.6
T4_200	17.1	16.8	16.8	16.6	16.6	16.5	16.5	16.4	16.4

DN = Do Nothing, DS = Do Something

Table 7.7 ***NO_x Process Contribution (PC) and Predicted Environmental Concentration (PEC) as a Percentage of the Minimum Empirical Critical Load Range of 20kgN/ha/yr***

Transect number / distance from road (m)	PC / Critical Load (%)								
	2014 Basecase	2017 DN	2017 DS	2020 DN	2020 DS	2023 DN	2023 DS	2027 DN	2027 DS
Max A40	5.8	4.0	4.1	2.9	3.0	2.4	2.4	2.0	2.1
Max A34	33.6	22.6	22.5	16.3	16.2	13.2	13.1	11.2	11.1
T1_50	2.6	1.8	1.8	1.3	1.3	1.1	1.1	<1	<1
T1_100	1.4	<1	<1	<1	<1	<1	<1	<1	<1
T1_200	<1	<1	<1	<1	<1	<1	<1	<1	<1
T2_10	7.6	5.2	5.4	3.8	3.9	3.1	3.2	2.7	2.7
T2_20	5.4	3.8	3.9	2.7	2.8	2.2	2.3	1.9	2.0
T2_50	2.5	1.7	1.8	1.3	1.3	1.0	1.1	0.9	0.9
T2_100	1.4	<1	<1	<1	<1	<1	<1	<1	<1
T2_200	<1	<1	<1	<1	<1	<1	<1	<1	<1
T3_20	12	7.9	7.9	5.7	5.7	4.6	4.6	3.9	3.9
T3_50	6.3	4.2	4.2	3.1	3.0	2.5	2.5	2.1	2.1
T3_100	3.3	2.2	2.2	1.6	1.6	1.3	1.3	1.1	1.1
T3_200	1.4	<1	<1	<1	<1	<1	<1	<1	<1
T4_10	33	22	22	16	16	13	13	11	11
T4_20	20	14	14	10	10	8.0	8.0	6.8	6.8
T4_50	10.9	7.4	7.3	5.3	5.3	4.3	4.3	3.7	3.7
T4_100	6.4	4.3	4.3	3.1	3.1	2.5	2.5	2.2	2.2
T4_200	3.1	2.1	2.1	1.5	1.5	1.2	1.2	1.0	1.0
	PEC / Minimum Critical Load ()								
Max A40	88	86	86	84	84	83	84	83	83
Max A34	116	105	104	98	98	94	94	92	92
T1_50	85	84	84	83	83	82	82	82	82
T1_100	84	83	83	82	82	82	82	81	81
T1_200	83	82	82	82	82	81	81	81	81
T2_10	90	87	87	85	85	84	84	84	84
T2_20	88	86	86	84	84	83	83	83	83
T2_50	85	84	84	83	83	82	82	82	82
T2_100	84	83	83	82	82	82	82	81	81
T2_200	83	82	83	82	82	81	81	81	81
T3_20	94	90	90	87	87	86	86	85	85
T3_50	89	86	86	84	84	84	84	83	83

Transect	PC / Critical Load (%)								
T3_100	86	84	84	83	83	82	82	82	82
T3_200	84	83	83	82	82	82	82	81	81
T4_10	115	104	104	97	97	94	94	92	92
T4_20	103	96	96	91	91	89	89	88	88
T4_50	94	89	89	87	87	85	85	85	85
T4_100	89	86	86	84	84	84	84	83	83
T4_200	86	84	84	83	83	82	82	82	82

DN = Do Nothing, DS = Do Something

Table 7.8 ***Significance of Impact from Road Sources using the Minimum Empirical Critical Load Range of 20kgN/ha/yr***

Transect number / distance from road (m)	PC change as a percentage the critical load ()				Significance			
	2017 DN and 2017 DS	2020 DN and 2020 DS	2023 DN and 2023 DS	2027 DN and 2027 DS	2017 DN and 2017 DS	2020 DN and 2020 DS	2023 DN and 2023 DS	2027 DN and 2027 DS
Max A40	<1	<1	<1	<1	Insignificant	Insignificant	Insignificant	Insignificant
Max A34	*	*	*	*	Insignificant	Insignificant	Insignificant	Insignificant
T1_50	<1	<1	<1	<1	Insignificant	Insignificant	Insignificant	Insignificant
T1_100	<1	<1	<1	<1	Insignificant	Insignificant	Insignificant	Insignificant
T1_200	<1	<1	<1	<1	Insignificant	Insignificant	Insignificant	Insignificant
T2_10	<1	<1	<1	<1	Insignificant	Insignificant	Insignificant	Insignificant
T2_20	<1	<1	<1	<1	Insignificant	Insignificant	Insignificant	Insignificant
T2_50	<1	<1	<1	<1	Insignificant	Insignificant	Insignificant	Insignificant
T2_100	<1	<1	<1	<1	Insignificant	Insignificant	Insignificant	Insignificant
T2_200	<1	<1	<1	<1	Insignificant	Insignificant	Insignificant	Insignificant
T3_20	*	*	*	*	Insignificant	Insignificant	Insignificant	Insignificant
T3_50	*	*	*	*	Insignificant	Insignificant	Insignificant	Insignificant
T3_100	*	*	*	*	Insignificant	Insignificant	Insignificant	Insignificant
T3_200	*	*	*	*	Insignificant	Insignificant	Insignificant	Insignificant
T4_10	*	*	*	*	Insignificant	Insignificant	Insignificant	Insignificant
T4_20	*	*	*	*	Insignificant	Insignificant	Insignificant	Insignificant
T4_50	*	*	*	*	Insignificant	Insignificant	Insignificant	Insignificant
T4_100	*	*	*	*	Insignificant	Insignificant	Insignificant	Insignificant
T4_200	*	*	*	*	Insignificant	Insignificant	Insignificant	Insignificant

DN = Do Nothing, DS = Do Something

Note: * indicates a negative value predicted as a result of improvements to traffic on the A34.

7.1.4 *Critical Load Assessment - Acid Deposition*

The assessment is based on the modelled NO_x PC *(Table 7.1)* and the PEC *(Table 7.2)* at each monitoring location and the maximum found anywhere on the habitat. The PC and PECs are converted into deposition rates (*Table 7.9* and *Table 7.10*) using the EA methodology presented in *Section 3* of this annex and results compared to the site specific acidity critical loads as presented in *Table 4.3* of the air quality modelling and assessment report. The baseline values presented in *Table 4.4* were used to determine future year PECs.

The assessment considers the PC change between the 'Do Nothing' and 'Do Something' scenarios for each of the future years (*Table 7.12*) and defines the significance of that change using the significance criteria detailed in *Section 4.1.3* of the air quality modelling and assessment report.

Exceedance and deposition as a proportion of the critical load function is determined using the approved methodology detailed on the APIS (1) website.

(1) Centre for Ecology and Hydrology (2009) Air Pollution Information System [Online] Available from: http://www.apis.ac.uk/critical-load-function-tool [Accessed 12th October 2015].

Table 7.9 *NOx Process Contribution (PC)*

Transect number / distance from road (m)	PC (keq/ha/yr)								
	2014 Basecase	2017 DN	2017 DS	2020 DN	2020 DS	2023 DN	2023 DS	2027 DN	2027 DS
Max A40	0.0823	0.0568	0.0585	0.0416	0.0429	0.0339	0.0349	0.0289	0.0299
Max A34	0.479	0.322	0.320	0.232	0.231	0.188	0.186	0.160	0.159
T1_50	0.0366	0.0253	0.0261	0.0185	0.0191	0.0151	0.0156	0.0129	0.0134
T1_100	0.0200	0.0138	0.0142	0.0101	0.0104	8.24×10^{-3}	8.51×10^{-3}	7.06×10^{-3}	7.30×10^{-3}
T1_200	9.38×10^{-3}	6.47×10^{-3}	6.66×10^{-3}	4.74×10^{-3}	4.89×10^{-3}	3.86×10^{-3}	3.99×10^{-3}	3.31×10^{-3}	3.42×10^{-3}
T2_10	0.108	0.0745	0.0768	0.0546	0.0563	0.0444	0.0458	0.0380	0.0392
T2_20	0.0776	0.0536	0.0552	0.0392	0.0404	0.0319	0.0329	0.0273	0.0282
T2_50	0.0357	0.0246	0.0254	0.0180	0.0186	0.0147	0.0151	0.0126	0.0130
T2_100	0.0194	0.0134	0.0137	9.78×10^{-3}	0.0101	0.00797	0.0082	0.00682	7.04×10^{-3}
T2_200	0.0103	7.09×10^{-3}	7.27×10^{-3}	5.18×10^{-3}	5.32×10^{-3}	4.22×10^{-3}	4.34×10^{-3}	3.62×10^{-3}	3.72×10^{-3}
T3_20	0.168	0.113	0.112	0.0814	0.0809	0.0659	0.0654	0.0563	0.0559
T3_50	0.0895	0.0603	0.0599	0.0436	0.0433	0.0353	0.0351	0.0302	0.0300
T3_100	0.0473	0.0319	0.0317	0.0231	0.0229	0.0187	0.0186	0.0161	0.0160
T3_200	0.0205	0.0138	0.0138	0.0100	0.0100	8.13×10^{-3}	8.09×10^{-3}	6.97×10^{-3}	6.94×10^{-3}
T4_10	0.464	0.313	0.311	0.225	0.224	0.182	0.1808	0.155	0.154
T4_20	0.291	0.196	0.195	0.141	0.141	0.114	0.1136	0.0975	0.0968
T4_50	0.156	0.105	0.104	0.0759	0.0754	0.0614	0.0610	0.0525	0.0522
T4_100	0.0911	0.0615	0.0611	0.0445	0.0442	0.0361	0.0358	0.0309	0.0307
T4_200	0.0440	0.0297	0.0295	0.0215	0.0214	0.0174	0.0173	0.0150	0.0149

DN = Do Nothing, DS = Do Something

Table 7.10 Predicted Environmental Concentrations (PEC)

Transect number / distance from road (m)		PEC (keq/ha/yr)								
		2014 Basecase	2017 DN	2017 DS	2020 DN	2020 DS	2023 DN	2023 DS	2027 DN	2027 DS
	Baseline	**1.39**	**1.38**		**1.37**		**1.37**		**1.37**	
Max A40		1.47	1.44	1.44	1.41	1.41	1.40	1.40	1.39	1.40
Max A34		1.87	1.70	1.70	1.60	1.60	1.56	1.56	1.53	1.52
T1_50		1.43	1.41	1.41	1.39	1.39	1.38	1.38	1.38	1.38
T1_100		1.41	1.40	1.40	1.38	1.38	1.38	1.38	1.37	1.37
T1_200		1.40	1.39	1.39	1.38	1.38	1.37	1.37	1.37	1.37
T2_10		1.50	1.46	1.46	1.43	1.43	1.41	1.41	1.40	1.40
T2_20		1.47	1.44	1.44	1.41	1.41	1.40	1.40	1.39	1.39
T2_50		1.43	1.41	1.41	1.39	1.39	1.38	1.38	1.38	1.38
T2_100		1.41	1.39	1.40	1.38	1.38	1.38	1.38	1.37	1.37
T2_200		1.40	1.39	1.39	1.38	1.38	1.37	1.37	1.37	1.37
T3_20		1.56	1.49	1.49	1.45	1.45	1.43	1.43	1.42	1.42
T3_50		1.48	1.44	1.44	1.42	1.42	1.40	1.40	1.40	1.40
T3_100		1.44	1.41	1.41	1.40	1.40	1.39	1.39	1.38	1.38
T3_200		1.41	1.40	1.40	1.38	1.38	1.38	1.38	1.37	1.37
T4_10		1.85	1.69	1.69	1.60	1.60	1.55	1.55	1.52	1.52
T4_20		1.68	1.58	1.58	1.51	1.51	1.48	1.48	1.46	1.46
T4_50		1.55	1.49	1.49	1.45	1.45	1.43	1.43	1.42	1.42
T4_100		1.48	1.44	1.44	1.42	1.42	1.40	1.40	1.40	1.40
T4_200		1.43	1.41	1.41	1.39	1.39	1.39	1.39	1.38	1.38

DN = Do Nothing, DS = Do Something

Note: Baseline is inclusive of both Nitrogen and Sulphur deposition as a total deposition rate

Table 7.11 ***NO_x Process Contribution (PC) and Predicted Environmental Concentration (PEC) as a Percentage of the Acidity Critical Load Range***

Transect number / distance from road (m)	PC / Critical Load Function (%)								
	2014 Basecase	2017 DN	2017 DS	2020 DN	2020 DS	2023 DN	2023 DS	2027 DN	2027 DS
Max A40	1.7	1.2	1.2	0.9	0.9	0.7	0.7	0.6	0.6
Max A34	9.9	6.6	6.6	4.8	4.8	3.9	3.8	3.3	3.3
T1_50	<1	<1	<1	<1	<1	<1	<1	<1	<1
T1_100	<1	<1	<1	<1	<1	<1	<1	<1	<1
T1_200	<1	<1	<1	<1	<1	<1	<1	<1	<1
T2_10	2.2	1.5	1.6	1.1	1.2	<1	<1	<1	<1
T2_20	1.6	1.1	1.1	<1	<1	<1	<1	<1	<1
T2_50	<1	<1	<1	<1	<1	<1	<1	<1	<1
T2_100	<1	<1	<1	<1	<1	<1	<1	<1	<1
T2_200	<1	<1	<1	<1	<1	<1	<1	<1	<1
T3_20	3.5	2.3	2.3	1.7	1.7	1.4	1.3	1.2	1.2
T3_50	1.8	1.2	1.2	<1	<1	<1	<1	<1	<1
T3_100	1.0	<1	<1	<1	<1	<1	<1	<1	<1
T3_200	0.4	<1	<1	<1	<1	<1	<1	<1	<1
T4_10	9.6	6.4	6.4	4.6	4.6	3.7	3.7	3.2	3.2
T4_20	6.0	4.0	4.0	2.9	2.9	2.4	2.3	2.0	2.0
T4_50	3.2	2.2	2.1	1.6	1.6	1.3	1.3	1.1	1.1
T4_100	1.9	1.3	1.3	<1	<1	<1	<1	<1	<1
T4_200	0.9	0.6	0.6	0.4	0.4	0.4	0.4	0.3	0.3
	PEC / Critical Load Function (%)								
Max A40	30	30	30	29	29	29	29	29	29
Max A34	38	35	35	33	33	32	32	31	31
T1_50	42	38	38	35	35	33	33	33	33
T1_100	29	29	29	29	29	28	29	28	28
T1_200	29	29	29	28	28	28	28	28	28
T2_10	29	29	29	28	28	28	28	28	28
T2_20	31	30	30	29	29	29	29	29	29
T2_50	30	30	30	29	29	29	29	29	29
T2_100	29	29	29	29	29	28	28	28	28
T2_200	29	29	29	28	28	28	28	28	28
T3_20	29	29	29	28	28	28	28	28	28
T3_50	32	31	31	30	30	30	30	29	29

Transect	PC / Critical Load Function (%)								
T3_100	30	30	30	29	29	29	29	29	29
T3_200	30	29	29	29	29	29	29	28	28
T4_10	29	29	29	28	28	28	28	28	28
T4_20	38	35	35	33	33	32	32	31	31
T4_50	35	32	32	31	31	31	31	30	30
T4_100	32	31	31	30	30	29	29	29	29
T4_200	31	30	30	29	29	29	29	29	29

DN = Do Nothing, DS = Do Something

Table 7.12 ***Significance of Impact from Road Sources using the Acidity Empirical Critical Load Range***

Transect number / distance from road (m)	PC change as a percentage the critical load (%)				Significance			
	2017 DN and 2017 DS	2020 DN and 2020 DS	2023 DN and 2023 DS	2027 DN and 2027 DS	2017 DN and 2017 DS	2020 DN and 2020 DS	2023 DN and 2023 DS	2027 DN and 2027 DS
Max A40	<1	<1	<1	<1	Insignificant	Insignificant	Insignificant	Insignificant
Max A34	*	*	*	*	Insignificant	Insignificant	Insignificant	Insignificant
T1_50	<1	<1	<1	<1	Insignificant	Insignificant	Insignificant	Insignificant
T1_100	<1	<1	<1	<1	Insignificant	Insignificant	Insignificant	Insignificant
T1_200	<1	<1	<1	<1	Insignificant	Insignificant	Insignificant	Insignificant
T2_10	<1	<1	<1	<1	Insignificant	Insignificant	Insignificant	Insignificant
T2_20	<1	<1	<1	<1	Insignificant	Insignificant	Insignificant	Insignificant
T2_50	<1	<1	<1	<1	Insignificant	Insignificant	Insignificant	Insignificant
T2_100	<1	<1	<1	<1	Insignificant	Insignificant	Insignificant	Insignificant
T2_200	<1	<1	<1	<1	Insignificant	Insignificant	Insignificant	Insignificant
T3_20	*	*	*	*	Insignificant	Insignificant	Insignificant	Insignificant
T3_50	*	*	*	*	Insignificant	Insignificant	Insignificant	Insignificant
T3_100	*	*	*	*	Insignificant	Insignificant	Insignificant	Insignificant
T3_200	*	*	*	*	Insignificant	Insignificant	Insignificant	Insignificant
T4_10	*	*	*	*	Insignificant	Insignificant	Insignificant	Insignificant
T4_20	*	*	*	*	Insignificant	Insignificant	Insignificant	Insignificant
T4_50	*	*	*	*	Insignificant	Insignificant	Insignificant	Insignificant
T4_100	*	*	*	*	Insignificant	Insignificant	Insignificant	Insignificant
T4_200	*	*	*	*	Insignificant	Insignificant	Insignificant	Insignificant

DN = Do Nothing, DS = Do Something

Note: * indicates a negative value predicted as a result of improvements to traffic on the A34.

7.2 *HOOK MEADOW AND TRAP GROUNDS SSSI*

7.2.1 *Process Contribution (PC) and Predicted Environmental Concentration (PEC)*

The modelled PC at each monitoring location and the maximum found anywhere on the habitat for each of the scenarios is presented in *Table 7.13*. The verification factor of 0.38 derived through the verification process in *Section 2* has been applied to all results.

The PEC at each monitoring location and the maximum found anywhere on the habitat for each of the modelled scenarios is presented in *Table 7.14*. The baseline values presented in *Table 4.8* were used to determine future year PECs.

Table 7.13 *NO_x Process Contribution (PC)*

Transect number / distance from rail (m)	PC (µg/m³)						
	2014 DN	2017 DN	2017 DS	2020 DN	2020 DS	2027 DN	2027 DS
Max.	26.1	26.1	27.1	26.1	28.2	26.1	28.8
T5_20	6.17	6.17	6.54	6.17	6.90	6.17	6.99
T5_50	2.62	2.62	2.90	2.62	3.17	2.62	3.23
T5_100	1.47	1.47	1.67	1.47	1.86	1.47	1.90
T5_200	0.68	0.68	0.79	0.68	0.90	0.68	0.92
T6_10	11.9	11.9	12.4	11.9	12.9	11.9	13.0
T6_20	7.81	7.81	8.39	7.81	8.96	7.81	9.13
T6_50	3.88	3.88	4.90	3.88	5.88	3.88	6.29
T7_10	3.95	3.95	7.06	3.95	10.0	3.95	11.9
T7_20	3.43	3.43	5.78	3.43	8.04	3.43	9.18
T7_50	2.39	2.39	3.65	2.39	4.87	2.39	5.31
T8_10	5.74	5.74	8.87	5.74	11.9	5.74	13.9
T8_20	4.69	4.69	6.96	4.69	9.14	4.69	10.3
T8_50	2.93	2.93	4.12	2.93	5.26	2.93	5.67

DN = Do Nothing DS = Do Something

Table 7.14 ***NO_x Predicted Environmental Concentration (PEC)***

Transect number / distance from rail (m)	PEC (µg/m³)						
	2014 DN	2017 DN	2017 DS	2020 DN	2020 DS	2027 DN	2027 DS
Baseline	**22.1**	**21.2**	**21.2**	**20.2**	**20.2**	**19.5**	**19.5**
Max.	48.2	47.3	48.3	46.3	48.4	45.6	48.3
T5_20	28.3	27.3	27.7	26.4	27.1	25.7	26.5
T5_50	24.8	23.8	24.1	22.8	23.4	22.1	22.7
T5_100	23.6	22.6	22.8	21.7	22.1	21.0	21.4
T5_200	22.8	21.8	22.0	20.9	21.1	20.2	20.4
T6_10	34.0	33.1	33.6	32.1	33.1	31.4	32.5
T6_20	29.9	29.0	29.6	28.0	29.2	27.3	28.6
T6_50	26.0	25.1	26.1	24.1	26.1	23.4	25.8
T7_10	26.1	25.1	28.2	24.2	30.2	23.5	31.4
T7_20	25.6	24.6	27.0	23.6	28.2	22.9	28.7
T7_50	24.5	23.6	24.8	22.6	25.1	21.9	24.8
T8_10	27.9	26.9	30.0	26.0	32.1	25.3	33.4
T8_20	26.8	25.9	28.1	24.9	29.3	24.2	29.8
T8_50	25.1	24.1	25.3	23.1	25.5	22.4	25.2

DN = Do Nothing DS = Do Something

7.2.2 *Critical Level Assessment*

The assessment is based on the modelled PC (*Table 7.13*) and the PEC (*Table 7.14)* at each monitoring location and the maximum anywhere on the habitat in relation to the critical level of 30 $\mu g/m^3$ set for the protection of vegetation (*Table 7.15*). The assessment considers the PC change between the 'Do Nothing' and the 'Do Something' scenarios (*Table 7.16*) for each of the future years and defines the significance of that contribution using the significance criteria detailed in *Section 4.1.3* of the air quality modelling and assessment report.

Table 7.15 ***NO_x Process Contribution (PC) and Predicted Environmental Concentration (PEC) as a Percentage of the Critical Level for the Protection of Vegetation of 30µg/m³***

Transect number / distance from road (m)	2014 Basecase	2017 DN	2017 DS	2020 DN	2020 DS	2027 DN	2027 DS
	PC / Critical Level (%)						
Max.	87	87	90	87	94	87	96
T5_20	21	21	22	21	23	21	23
T5_50	9	9	10	9	11	9	11
T5_100	5	5	6	5	6	5	6
T5_200	2	2	3	2	3	2	3
T6_10	40	40	41	40	43	40	43
T6_20	26	26	28	26	30	26	30
T6_50	13	13	16	13	20	13	21
T7_10	13	13	24	13	33	13	40
T7_20	11	11	19	11	27	11	31
T7_50	8	8	12	8	16	8	18
T8_10	19	19	30	19	40	19	46
T8_20	16	16	23	16	30	16	34
T8_50	10	10	14	10	18	10	19
	PEC / Critical Level (%)						
Max.	161	158	161	154	161	152	161
T5_20	94	91	92	88	90	86	88
T5_50	83	79	80	76	78	74	76
T5_100	79	75	76	72	74	70	71
T5_200	76	73	73	70	70	67	68
T6_10	113	110	112	107	110	105	108
T6_20	100	97	99	93	97	91	95
T6_50	87	84	87	80	87	78	86
T7_10	87	84	94	81	101	78	105
T7_20	85	82	90	79	94	76	96
T7_50	82	79	83	75	84	73	83
T8_10	93	90	100	87	107	84	111
T8_20	89	86	94	83	98	81	99
T8_50	84	80	84	77	85	75	84

DN = Do Nothing, DS = Do Something

Table 7.16 *Significance of Impact from Rail Sources*

Transect number / distance from road (m)	Change in PC as a percentage of the CL (%)			Significance		
	2017 DN and 2017 DS	2020 DN and 2020 DS	2027 DN and 2027 DS	2017 DN and 2017 DS	2020 DN and 2020 DS	2027 DN and 2027 DS
Max.	3.3	7.0	9.2	Potentially Significant	Potentially Significant	Potentially Significant
T1_50	1.2	2.4	2.8	Potentially Significant	Potentially Significant	Potentially Significant
T1_100	<1	1.8	2.0	Insignificant	Potentially Significant	Potentially Significant
T1_200	<1	1.3	1.4	Insignificant	Potentially Significant	Potentially Significant
T2_10	<1	<1	<1	Insignificant	Insignificant	Insignificant
T2_20	1.7	3.3	3.8	Potentially Significant	Potentially Significant	Potentially Significant
T2_50	2.0	3.8	4.4	Potentially Significant	Potentially Significant	Potentially Significant
T2_100	3.4	6.6	8.0	Potentially Significant	Potentially Significant	Potentially Significant
T2_200	10	20.2	27	Potentially Significant	Potentially Significant	Potentially Significant
T3_20	7.9	15	19	Potentially Significant	Potentially Significant	Potentially Significant
T3_50	4.2	8.3	9.7	Potentially Significant	Potentially Significant	Potentially Significant
T3_100	10	20	27	Potentially Significant	Potentially Significant	Potentially Significant
T3_200	7.6	15	19	Potentially Significant	Potentially Significant	Potentially Significant
T4_10	3.9	7.8	9.1	Potentially Significant	Potentially Significant	Potentially Significant
T4_20	1.2	2.4	2.8	Potentially Significant	Potentially Significant	Potentially Significant
T4_50	0.9	1.8	2.0	Insignificant	Potentially Significant	Potentially Significant
T4_100	0.7	1.3	1.4	Insignificant	Potentially Significant	Potentially Significant
T4_200	0.4	0.7	0.8	Insignificant	Insignificant	Insignificant

DN = Do Nothing, DS = Do Something

7.2.3 *Critical Load Assessment - Nutrient Nitrogen*

The assessment is based on the modelled NO_x PC *(Table 7.13)* and the PEC *(Table 7.14)* at each monitoring location and the maximum found anywhere on the habitat. The PC and PECs are converted into deposition rates (*Table 7.17* and *Table 7.18*) using the methodology presented in *Section 3* of this annex and results compared to the empirical critical load range of 20 - 30kgN/ha/yr (*Table 7.19* and *Table 7.21*). The baseline values presented in *Table 4.9* were used to determine future year PECs.

The assessment considers the PC change for the 'Do Nothing' and the 'Do Something' scenarios (*Table 7.20* and *table 7.22*) and defines the significance of that contribution using the significance criteria detailed in *Section 4.1.3* of the air quality modelling and assessment report.

Table 7.17 ***NO_x Process Contribution (PC)***

Transect number / distance from road (m)	PC (kgN/ha/yr)						
	2014 Basecase	2017 DN	2017 DS	2020 DN	2020 DS	2027 DN	2027 DS
Max.	3.75	3.75	3.90	3.75	4.06	3.75	4.14
T520	0.888	0.888	0.941	0.888	0.993	0.888	1.01
T550	0.377	0.377	0.417	0.377	0.456	0.377	0.465
T5100	0.212	0.212	0.240	0.212	0.268	0.212	0.273
T5200	0.0974	0.0974	0.114	0.0974	0.129	0.097	0.132
T610	1.71	1.71	1.78	1.71	1.85	1.71	1.87
T620	1.12	1.12	1.21	1.12	1.29	1.12	1.31
T650	0.559	0.559	0.705	0.559	0.845	0.559	0.905
T710	0.568	0.568	1.015	0.568	1.442	0.568	1.72
T720	0.493	0.493	0.832	0.493	1.156	0.493	1.32
T750	0.344	0.344	0.526	0.344	0.701	0.344	0.764
T810	0.826	0.826	1.277	0.826	1.708	0.826	2.00
T820	0.675	0.675	1.001	0.675	1.315	0.675	1.48
T850	0.422	0.422	0.592	0.422	0.756	0.422	0.816

DN = Do Nothing, DS = Do Something

Table 7.18 ***Predicted Environmental Concentrations (PEC)***

Transect number / distance from road (m)	PEC (kgN/ha/yr)						
	2014 Basecase	2017 DN	2017 DS	2020 DN	2020 DS	2027 DN	2027 DS
Baseline	**16.5**	**16.4**		**16.2**		**16.2**	
Max.	20.3	20.1	20.3	20.0	20.3	19.9	20.3
T520	17.4	17.3	17.3	17.1	17.2	17.0	17.1
T550	16.9	16.8	16.8	16.6	16.7	16.5	16.6
T5100	16.7	16.6	16.6	16.5	16.5	16.4	16.4
T5200	16.6	16.5	16.5	16.3	16.4	16.2	16.3
T610	18.2	18.1	18.2	18.0	18.1	17.9	18.0
T620	17.6	17.5	17.6	17.4	17.5	17.3	17.5
T650	17.1	16.9	17.1	16.8	17.1	16.7	17.0
T710	17.1	16.9	17.4	16.8	17.7	16.7	17.9
T720	17.0	16.9	17.2	16.7	17.4	16.6	17.5
T750	16.9	16.7	16.9	16.6	16.9	16.5	16.9
T810	17.3	17.2	17.7	17.1	18.0	17.0	18.1
T820	17.2	17.1	17.4	16.9	17.6	16.8	17.6
T850	16.9	16.8	17.0	16.7	17.0	16.6	17.0

DN = Do Nothing, DS = Do Something

Table 7.19 ***NO_x Process Contribution (PC) and Predicted Environmental Concentration (PEC) as a Percentage of the Minimum Empirical Critical Load Range of 20kgN/ha/yr***

Transect number / distance from road (m)	PC / Critical Load (%)						
	2014 Basecase	2017 DN	2017 DS	2020 DN	2020 DS	2027 DN	2027 DS
Max.	19	19	19	19	20	19	21
T520	4.4	4.4	4.7	4.4	5.0	4.4	5.0
T550	1.9	1.9	2.1	1.9	2.3	1.9	2.3
T5100	1.1	1.1	1.2	1.1	1.3	1.1	1.4
T5200	<1	<1	<1	<1	<1	<1	<1
T610	8.6	8.6	8.9	8.6	9.3	8.6	9.4
T620	5.6	5.6	6.0	5.6	6.4	5.6	6.6
T650	2.8	2.8	3.5	2.8	4.2	2.8	4.5
T710	2.8	2.8	5.1	2.8	7.2	2.8	8.6
T720	2.5	2.5	4.2	2.5	5.8	2.5	6.6
T750	1.7	1.7	2.6	1.7	3.5	1.7	3.8
T810	4.1	4.1	6.4	4.1	8.5	4.1	10
T820	3.4	3.4	5.0	3.4	6.6	3.4	7.4
T850	2.1	2.1	3.0	2.1	3.8	2.1	4.1
	PEC / Minimum Critical Load (%)						
Max.	101	101	101	100	101	99	101
T520	87	86	87	86	86	85	86
T550	84	84	84	83	83	83	83
T5100	84	83	83	82	83	82	82
T5200	83	82	82	82	82	81	81
T610	91	90	91	90	90	89	90
T620	88	88	88	87	88	86	87
T650	85	85	85	84	85	84	85
T710	85	85	87	84	88	84	89
T720	85	84	86	84	87	83	87
T750	84	84	85	83	85	82	85
T810	87	86	88	85	90	85	91
T820	86	85	87	85	88	84	88
T850	85	84	85	83	85	83	85

DN = Do Nothing, DS = Do Something

Table 7.20 ***Significance of Impact from Rail Sources using the Minimum Empirical Critical Load Range of 20kgN/ha/yr***

Transect number / distance from road (m)	PC change as a percentage the critical load (%)			Significance		
	2017 DN and 2017 DS	2020 DN and 2020 DS	2027 DN and 2027 DS	2017 DN and 2017 DS	2020 DN and 2020 DS	2027 DN and 2027 DS
Max	<1	1.5	1.9	Insignificant	Potentially Significant	Potentially Significant
T1_50	<1	<1	<1	Insignificant	Insignificant	Insignificant
T1_100	<1	<1	<1	Insignificant	Insignificant	Insignificant
T1_200	<1	<1	<1	Insignificant	Insignificant	Insignificant
T2_10	<1	<1	<1	Insignificant	Insignificant	Insignificant
T2_20	<1	<1	<1	Insignificant	Insignificant	Insignificant
T2_50	<1	<1	<1	Insignificant	Insignificant	Insignificant
T2_100	<1	1.4	1.7	Insignificant	Potentially Significant	Potentially Significant
T2_200	2.2	4.4	5.7	Potentially Significant	Potentially Significant	Potentially Significant
T3_20	1.7	3.3	4.1	Potentially Significant	Potentially Significant	Potentially Significant
T3_50	<1	1.8	2.1	Insignificant	Potentially Significant	Potentially Significant
T3_100	2.3	4.4	5.9	Potentially Significant	Potentially Significant	Potentially Significant
T3_200	1.6	3.2	4.0	Potentially Significant	Potentially Significant	Potentially Significant
T4_10	<1	1.7	2.0	Insignificant	Potentially Significant	Potentially Significant
T4_20	<1	<1	<1	Insignificant	Potentially Significant	Potentially Significant
T4_50	<1	<1	<1	Insignificant	Insignificant	Insignificant
T4_100	<1	<1	<1	Insignificant	Insignificant	Insignificant
T4_200	<1	<1	<1	Insignificant	Insignificant	Insignificant

DN = Do Nothing, DS = Do Something

Table 7.21 ***NO_x Process Contribution (PC) and Predicted Environmental Concentration (PEC) as a Percentage of the Maximum Empirical Critical Load Range of 30kgN/ha/yr***

Transect number / distance from road (m)	PC / Critical Load (%)						
	2014 Basecase	**2017 DN**	**2017 DS**	**2020 DN**	**2020 DS**	**2027 DN**	**2027 DS**
Max	12.5	12.5	13.0	12.5	13.5	12.5	13.8
T520	3.0	3.0	3.1	3.0	3.3	3.0	3.4
T550	1.3	1.3	1.4	1.3	1.5	1.3	1.5
T5100	0.7	0.7	0.8	0.7	0.9	0.7	0.9
T5200	0.3	0.3	0.4	0.3	0.4	0.3	0.4
T610	5.7	5.7	5.9	5.7	6.2	5.7	6.2
T620	3.7	3.7	4.0	3.7	4.3	3.7	4.4
T650	1.9	1.9	2.3	1.9	2.8	1.9	3.0
T710	1.9	1.9	3.4	1.9	4.8	1.9	5.7
T720	1.6	1.6	2.8	1.6	3.9	1.6	4.4
T750	1.1	1.1	1.8	1.1	2.3	1.1	2.5
T810	2.8	2.8	4.3	2.8	5.7	2.8	6.7
T820	2.2	2.2	3.3	2.2	4.4	2.2	4.9
T850	1.4	1.4	2.0	1.4	2.5	1.4	2.7
	PEC / Minimum Critical Load (%)						
Max.	68	67	68	67	68	66	68
T520	58	58	58	57	57	57	57
T550	56	56	56	55	56	55	55
T5100	56	55	55	55	55	55	55
T5200	55	55	55	54	55	54	54
T610	61	60	61	60	60	60	60
T620	59	58	59	58	58	58	58
T650	57	56	57	56	57	56	57
T710	57	56	58	56	59	56	60
T720	57	56	57	56	58	55	58
T750	56	56	56	55	56	55	56
T810	58	57	59	57	60	57	60
T820	57	57	58	56	59	56	59
T850	56	56	57	56	57	55	57

DN = Do Nothing, DS = Do Something

Table 7.22 ***Significance of Impacts from Rail Sources using the Maximum Empirical Critical Load Range of 30kgN/ha/yr***

Transect number / distance from road (m)	PC change as a percentage the critical load (%)			Significance		
	2017 DN and 2017 DS	2020 DN and 2020 DS	2027 DN and 2027 DS	2017 DN and 2017 DS	2020 DN and 2020 DS	2027 DN and 2027 DS
Max	0.5	1.0	1.3	Insignificant	Insignificant	Insignificant
T520	<1	<1	<1	Insignificant	Insignificant	Insignificant
T550	<1	<1	<1	Insignificant	Insignificant	Insignificant
T5100	<1	<1	<1	Insignificant	Insignificant	Insignificant
T5200	<1	<1	<1	Insignificant	Insignificant	Insignificant
T610	<1	<1	<1	Insignificant	Insignificant	Insignificant
T620	<1	<1	<1	Insignificant	Insignificant	Insignificant
T650	<1	1.0	1.2	Insignificant	Insignificant	Insignificant
T710	1.5	2.9	3.8	Insignificant	Insignificant	Insignificant
T720	1.1	2.2	2.8	Insignificant	Insignificant	Insignificant
T750	0.6	1.2	1.4	Insignificant	Insignificant	Insignificant
T810	1.5	2.9	3.9	Insignificant	Insignificant	Insignificant
T820	1.1	2.1	2.7	Insignificant	Insignificant	Insignificant
T850	<1	1.1	1.3	Insignificant	Insignificant	Insignificant

DN = Do Nothing, DS = Do Something

7.2.4 *Critical Load Assessment - Acid Deposition*

The assessment is based on the modelled NO_x PC (Table 7.13) and the PEC (*Table 7.14*) at each monitoring location and the maximum found anywhere on the habitat. The PC and PECs are converted into deposition rates (*Table 7.23* and *Table 7.24*) using the EA methodology presented in *Section 3* of this annex and results compared to the site specific acidity critical loads as presented in *Table 4.3* of the air quality modelling and assessment report. The baseline values presented in *Table 4.9* were used to determine future year PECs.

The assessment considers the PC change between the 'Do Nothing' and 'Do Something' scenarios for each of the future years (*Table 7.26*) and defines the significance of that change using the significance criteria detailed in *Section 4.1.3* of the air quality modelling and assessment report.

Exceedance and deposition as a proportion of the critical load function is determined using the approved methodology detailed on the APIS (1) website.

(1) Centre for Ecology and Hydrology (2009) Air Pollution Information System [Online] Available from: http://www.apis.ac.uk/critical-load-function-tool [Accessed 12th October 2015].

Table 7.23 *NO_x Process Contribution (PC)*

Transect number / distance from road (m)	PC (keq/ha/yr)						
	2014 Basecase	2017 DN	2017 DS	2020 DN	2020 DS	2027 DN	2027 DS
Max.	0.268	0.268	0.278	0.268	0.289	0.268	0.295
T520	0.0633	0.0633	0.0671	0.0633	0.0708	0.0633	0.0718
T550	0.0269	0.0269	0.0298	0.0269	0.0325	0.0269	0.0331
T5100	0.0151	0.0151	0.0171	0.0151	0.0191	0.0151	0.0195
T5200	$6.95x10^{-3}$	$6.95x10^{-3}$	$8.10X10^{-3}$	$6.95x10^{-3}$	$9.22X10^{-3}$	$6.95x10^{-3}$	$9.39x10^{-3}$
T610	0.122	0.122	0.127	0.122	0.132	0.122	0.134
T620	0.0801	0.0801	0.0861	0.0801	0.0919	0.0801	0.0936
T650	0.0399	0.0399	0.0503	0.0399	0.0603	0.0399	0.0645
T710	0.0405	0.0405	0.0724	0.0405	0.103	0.0405	0.122
T720	0.0352	0.0352	0.0593	0.0352	0.0824	0.0352	0.0941
T750	0.0245	0.0245	0.0375	0.0245	0.0500	0.0245	0.0545
T810	0.0589	0.0589	0.0910	0.0589	0.122	0.0589	0.143
T820	0.0481	0.0481	0.0714	0.0481	0.0938	0.0481	0.105
T850	0.0301	0.0301	0.0422	0.0301	0.0539	0.0301	0.0582

DN = Do Nothing, DS = Do Something

Table 7.24 ***Predicted Environmental Concentrations (PEC)***

Transect number / distance from road (m)		PEC (kgN/ha/yr)						
		2014 Basecase	2017 DN	2017 DS	2020 DN	2020 DS	2027 DN	2027 DS
	Baseline	1.38	1.37		1.36		1.35	
Max.		1.65	1.64	1.65	1.65	1.63	1.62	1.65
T520		1.44	1.43	1.44	1.42	1.43	1.42	1.42
T550		1.41	1.40	1.40	1.39	1.39	1.38	1.39
T5100		1.40	1.39	1.39	1.38	1.38	1.37	1.37
T5200		1.39	1.38	1.38	1.37	1.37	1.36	1.36
T610		1.50	1.49	1.50	1.48	1.49	1.48	1.49
T620		1.46	1.45	1.46	1.44	1.45	1.43	1.45
T650		1.42	1.41	1.42	1.40	1.42	1.39	1.42
T710		1.42	1.41	1.44	1.40	1.46	1.39	1.48
T720		1.42	1.41	1.43	1.40	1.44	1.39	1.45
T750		1.40	1.39	1.41	1.38	1.41	1.38	1.41
T810		1.44	1.43	1.46	1.42	1.48	1.41	1.50
T820		1.43	1.42	1.44	1.41	1.45	1.40	1.46
T850		1.41	1.40	1.41	1.39	1.41	1.38	1.41

DN = Do Nothing, DS = Do Something

Note: Baseline is inclusive of both Nitrogen and Sulphur deposition as a total deposition rate

Table 7.25 ***NO_x Process Contribution (PC) and Predicted Environmental Concentration (PEC) as a Percentage of the Acidity Critical Load Range***

Transect number / distance from road (m)	PC / Critical Load Function (%)						
	2014 Basecase	**2017 DN**	**2017 DS**	**2020 DN**	**2020 DS**	**2027 DN**	**2027 DS**
Max	5.5	5.5	5.7	5.5	6.0	5.5	6.1
T520	1.3	1.3	1.4	1.3	1.5	1.3	1.5
T550	<1	<1	<1	<1	<1	<1	<1
T5100	<1	<1	<1	<1	<1	<1	<1
T5200	<1	<1	<1	<1	<1	<1	<1
T610	2.5	2.5	2.6	2.5	2.7	2.5	2.8
T620	1.6	1.6	1.8	1.6	1.9	1.6	1.9
T650	<1	<1	1.0	<1	1.2	<1	1.3
T710	<1	<1	1.5	<1	2.1	<1	2.5
T720	<1	<1	1.2	<1	1.7	<1	1.9
T750	<1	<1	<1	<1	1.0	<1	1.1
T810	1.2	1.2	1.9	1.2	2.5	1.2	2.9
T820	<1	<1	1.5	<1	1.9	<1	2.2
T850	<1	<1	<1	<1	1.1	<1	1.2
	PEC / Critical Load Function (%)						
Max	34	34	34	34	34	34	34
T520	30	30	30	29	29	29	29
T550	29	29	29	29	29	29	29
T5100	29	29	29	28	28	28	28
T5200	29	28	28	28	28	28	28
T610	31	31	31	31	31	31	31
T620	30	30	30	30	30	30	30
T650	29	29	29	29	29	29	29
T710	29	30	30	30	30	30	30
T720	29	29	29	30	30	30	30
T750	29	29	29	29	29	29	29
T810	30	30	30	31	31	31	31
T820	29	30	30	30	30	30	30
T850	29	29	29	29	29	29	29

DN = Do Nothing, DS = Do Something

Table 7.26 *Significance of Impact from Rail Sources using the Acidity Critical Load Range*

Transect number / distance from road (m)	PC change as a percentage the critical load ()			Significance		
	2017 DN and 2017 DS	2020 DN and 2020 DS	2027 DN and 2027 DS	2017 DN and 2017 DS	2020 DN and 2020 DS	2027 DN and 2027 DS
Max	<1	<1	<1	Insignificant	Insignificant	Insignificant
T520	<1	<1	<1	Insignificant	Insignificant	Insignificant
T550	<1	<1	<1	Insignificant	Insignificant	Insignificant
T5100	<1	<1	<1	Insignificant	Insignificant	Insignificant
T5200	<1	<1	<1	Insignificant	Insignificant	Insignificant
T610	<1	<1	<1	Insignificant	Insignificant	Insignificant
T620	<1	<1	<1	Insignificant	Insignificant	Insignificant
T650	<1	<1	<1	Insignificant	Insignificant	Insignificant
T710	<1	1.3	1.7	Insignificant	Insignificant	Insignificant
T720	<1	<1	1.2	Insignificant	Insignificant	Insignificant
T750	<1	<1	<1	Insignificant	Insignificant	Insignificant
T810	<1	1.3	1.7	Insignificant	Insignificant	Insignificant
T820	<1	<1	1.2	Insignificant	Insignificant	Insignificant
T850	<1	<1	<1	Insignificant	Insignificant	Insignificant

DN = Do Nothing, DS = Do Something

8 *ASSUMPTIONS AND LIMITATIONS*

The assessment undertaken in this study required the development several bespoke methodologies, over and above what is best practice for assessment of transport sources. This section identifies where assumptions had to be made, and the justification for these, and also identified the limitations of the approach used.

Baseline monitoring:

- Diffusion tubes provide an indication of air quality rather than highly accurate data that one would expect from an automatic continuous monitoring station;

- Locations of diffusion tube monitoring stations were plotted using a GPS unit and therefore there is a +/- 5 metre tolerance in their actual locations and their position in the model relative to the road and rail; and

- Within the baseline period, for 3 months some rail traffic was using the Bicester to Oxford line. However, the baseline monitoring is considered to represent conditions at the habitat sites with no train movements on the Bicester to Oxford line.

Assessment baseline:

- The 'true' baseline used in the modelling is based upon DEFRA mapping data. This is acknowledged to have some inherent uncertainty.

- The future baseline NOx arising from road traffic is determined from DEFRA mapping. No factors for future changes in other components that contribute to nutrient nitrogen and acid deposition, most critically ammonia, are available. On this basis, the future baseline becomes increasingly uncertain further into the future.

- The DEFRA mapping data will contain some contribution from the A34 and A40 in the relevant grid square. Therefore, there is some degree of double counting as these are also modelled.

***Roads modelling*:**

- Traffic data to inform the air quality impact assessment is based on projections of future traffic thus a margin of error exists between actual and modelled scenarios; and

- Emission rates for vehicles in the future are based on projections and are therefore not necessarily reflective of actual emission rates for the year(s) predictions have been made.

Rail modelling:

- No detailed information on future trains using the main line was available at the time of undertaking the assessment. The assumption was made that there is zero traffic growth on the main line, and that no new trains with lower emissions will be introduced.

Model verification:

- Comparing the model results to the monitoring results suggest that the model overestimates close to the road, and underestimated further afield. As one model verification factor is used, based upon the model performance at 10m and 20m from the roadside, the predicted impacts further from the road will have a larger degree of uncertainty.

Annex B

PFA Predicted Future Traffic Data:

East West Rail Phase 1: Condition 31 item (iii) and Condition 32 item (iv)

CHILTERN RAILWAYS ORDER 2012

CONDITION 31 – PREDICTED FUTURE TRAFFIC DATA

CHILTERN RAILWAYS

NOVEMBER 2015

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FIGURES

Figure 2.1 Site Context Plan

APPENDICES

Appendix A Oxford Meadows SAC and SSSI Location Plan

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1. INTRODUCTION

Background

1.1. Chiltern Railways Company Limited (CRCL), assisted by Network Rail (NR), is proposing to improve the railway between Bicester and Oxford, with a new chord line to link to the London Marylebone to Birmingham Moor Street railway at Bicester. The Scheme is called the 'Bicester to Oxford Improvements'. A Transport and Works Act Order (TWAO) application was submitted to the Secretary of State for Transport in January 2010 and the Order was approved by the Secretary of State on 23rd October 2012.

1.2. Approval for the Scheme was granted subject to a range of conditions. Two of these conditions relate specifically to the effects of gaseous emissions, and contain measures which have to be implemented to protect designated sites. Condition 31 relates to the Cassington Meadows SSSI, the Pixey and Yarnton Meads SSSI and the Wolvercote Meadow SSSI, and Condition 32 to the Hook Meadow and Trap Grounds SSSI.

1.3. The locations of the above areas are shown on the plan included at **Appendix A**.

1.4. As can be seen from the plan at **Appendix A**, the Hook Meadow and Trap Grounds SSSI borders the railway and is not impacted by road traffic, such that changes in road traffic as a result of the Scheme would not affect air quality within the SSSI. Therefore no input is required from a highway traffic perspective for Condition 32.

1.5. Condition 31 is worded as follows:

> **"Development shall not commence on the Individual Section or Sections between Oxford North Junction and Rewley Abbey Stream ("the relevant sections") until a Scheme of Further Assessment of Air Quality in relation to the Cassington Meadows SSSI, the Pixey and Yarton Meads SSSI and the Wolvercote Meadow SSSI that are co-terminous with part of the Oxford Meadows SAC ("the relevant parts of the SAC") has been submitted to and approved in writing by the local planning authority for the relevant parts of the SAC (in consultation with Natural England).**

1.6. The Scheme will result in changes to road traffic movements on the A34(T) and A40 following the introduction of the new station at Water Eaton. These changes could potentially have a bearing on air quality.

1.7. Baseline traffic data to inform air quality assessment has been previously collated and issued in PFA Consulting document E142-DOC01.

1.8. Previously it was the intention to provide future year data following the opening of the new station at Oxford Parkway, based on survey of actual passenger use. However, Oxford City Council has since requested that future year predicted data be supplied before operation of the new station at Oxford Parkway.

1.9. The methodology to establish the future year conditions is set out in Chapter 2.

1.10. This technical report has been prepared by PFA Consulting to set out the future year transport conditions to inform the air quality assessment work in discharge of Condition 31.

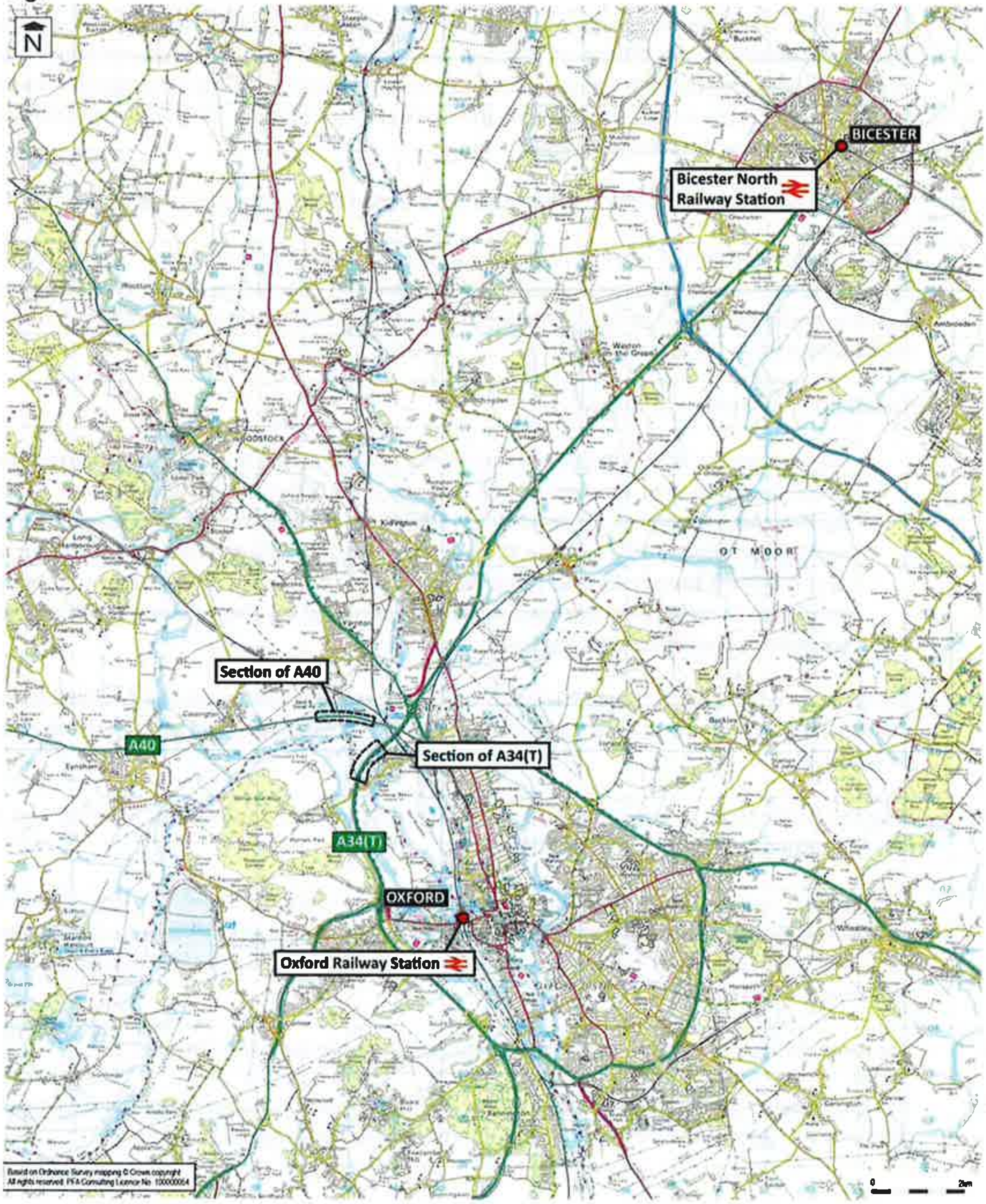
2. METHODOLOGY

Site Context

2.1. This report sets out predicted future year traffic information for the A34(T) and A40 with and without the Scheme.

2.2. The location of the stations and the relevant sections of the A34(T) and A40 are shown on **Figure 2.1**.

Figure 2.1: Site Context Plan



Methodology

2.3. To inform the air quality assessment, predicted data was required for 2017 as the 'opening year', 2020, 2023 and 2027.

Traffic Growth

2.4. NTM 2009 forecast traffic growth factors have been adjusted using the ratio of the local TEMPRO growth factors to the national average day car driver trip end growth derived using TEMPRO v6.2 in accordance with the latest guidance.

2.5. Separate growth factors have been calculated for 'Urban Principal' and 'Urban Trunk' roads.

2.6. These growth factors have been applied to the recorded traffic data for the A40 and A34(T), used to inform the baseline assessment for the years 2014/2015.

Scheme Impact

2.7. As no monitoring data with the scheme operational is as yet available, modelled data has been used. The modelled data was calculated using the cordoned Oxfordshire County Council Saturn model, Central Oxfordshire Transport Model (COTM), and the scheme related highway traffic derived from Steer Davis Gleave (SDG) rail passenger demand forecasts.

2.8. The modelled data previously informed the Proof of Evidence of Mr P. Tregear of PFA Consulting with respect to Condition 31, dated April 2012, and provided 'without' and 'with' scheme scenarios for 2016 and 2026.

2.9. It is proposed to use the modelled 'with Scheme' vehicle trips, factored to the appropriate assessment years as set out in paragraph 2.3.

2.10. 'Without Scheme' vehicle trips have been taken from the model and distributed using the distribution of existing rail trips at Bicester and Oxford from the rail passenger surveys undertaken for the baseline assessment.

2.11. The future year data, both 'with' and 'without' Scheme will provide data in a comparable format to that provided for the baseline assessment.

3. FUTURE YEARS TRAFFIC DATA AND IMPACT

Impact on A34(T) and A40

3.1. **Tables 3.1 to 3.8** set out the 'without' and 'with' Scheme traffic flows on the A34(T) and A40 for the four future years.

3.2. In all assessment years it can be seen that the Scheme results in a decrease in traffic along the A34(T), as fewer drivers travel to Oxford Station, but an increase along the A40. The decrease on the A34(T) and increase on the A40 is predicted to become greater over time as is a result of the increased use/popularity of the new Oxford Parkway Station.

3.3. The increase along the A40 can be attributed to people travelling to the new Oxford Parkway Station instead of Oxford Station, and people who previously drove to their destination using services from the new Water Eaton Station to travel to destinations such as Reading.

Table 3.1: 2017 Without Scheme Daily A34(T)/A40 Rail Passenger Road Traffic Impact

Month	Road	Direction	AADT Traffic Flow	Daily Impact	% Impact
April	A34(T)	Northbound	36,685	128	0.35%
		Southbound	36,461	128	0.35%
	A40	Eastbound	12,555	73	0.58%
		Westbound	11,790	73	0.62%
May	A34(T)	Northbound	35,404	128	0.36%
		Southbound	35,875	128	0.36%
	A40	Eastbound	12,446	73	0.59%
		Westbound	11,404	73	0.64%
June	A34(T)	Northbound	37,898	128	0.34%
		Southbound	38,321	128	0.33%
	A40	Eastbound	12,496	73	0.59%
		Westbound	11,858	73	0.62%
July	A34(T)	Northbound	38,519	128	0.33%
		Southbound	39,743	128	0.32%
	A40	Eastbound	11,960	73	0.61%
		Westbound	11,588	73	0.63%
August	A34(T)	Northbound	38,756	128	0.33%
		Southbound	38,727	128	0.33%
	A40	Eastbound	12,632	73	0.58%
		Westbound	12,305	73	0.59%
September	A34(T)	Northbound	38,747	128	0.33%
		Southbound	38,708	128	0.33%
	A40	Eastbound	12,491	73	0.59%
		Westbound	12,360	73	0.59%
October	A34(T)	Northbound	36,645	128	0.35%
		Southbound	37,174	128	0.34%
	A40	Eastbound	11,833	73	0.62%
		Westbound	11,712	73	0.62%
November	A34(T)	Northbound	36,294	128	0.35%
		Southbound	37,145	128	0.34%
	A40	Eastbound	12,197	73	0.60%
		Westbound	11,865	73	0.62%
December	A34(T)	Northbound	36,353	128	0.35%
		Southbound	36,475	128	0.35%
	A40	Eastbound	11,171	73	0.65%
		Westbound	11,165	73	0.66%
January	A34(T)	Northbound	33,706	128	0.38%
		Southbound	33,545	128	0.38%
	A40	Eastbound	11,311	73	0.65%
		Westbound	11,213	73	0.65%
February	A34(T)	Northbound	34,717	128	0.37%
		Southbound	35,347	128	0.36%
	A40	Eastbound	11,576	73	0.63%
		Westbound	11,026	73	0.66%
March	A34(T)	Northbound	36,446	128	0.35%
		Southbound	37,156	128	0.34%
	A40	Eastbound	12,086	73	0.61%
		Westbound	11,826	73	0.62%

Note: Impact on A34(T) and A40 takes account of trips routeing along both sections of road

Table 3.2: 2017 With Scheme Daily A34(T)/A40 Rail Passenger Road Traffic Impact

Month	Road	Direction	AADT Traffic Flow	Daily Impact	% Impact
April	A34(T)	Northbound	36,450	-235	-0.64%
		Southbound	36,196	-265	-0.73%
	A40	Eastbound	12,936	381	2.94%
		Westbound	12,176	387	3.18%
May	A34(T)	Northbound	35,169	-235	-0.67%
		Southbound	35,611	-265	-0.74%
	A40	Eastbound	12,827	381	2.97%
		Westbound	11,791	387	3.28%
June	A34(T)	Northbound	37,663	-235	-0.62%
		Southbound	38,057	-265	-0.70%
	A40	Eastbound	12,877	381	2.95%
		Westbound	12,245	387	3.16%
July	A34(T)	Northbound	38,285	-235	-0.61%
		Southbound	39,478	-265	-0.67%
	A40	Eastbound	12,341	381	3.08%
		Westbound	11,975	387	3.23%
August	A34(T)	Northbound	38,521	-235	-0.61%
		Southbound	38,462	-265	-0.69%
	A40	Eastbound	13,012	381	2.92%
		Westbound	12,691	387	3.05%
September	A34(T)	Northbound	38,513	-235	-0.61%
		Southbound	38,444	-265	-0.69%
	A40	Eastbound	12,871	381	2.96%
		Westbound	12,746	387	3.03%
October	A34(T)	Northbound	36,411	-235	-0.64%
		Southbound	36,910	-265	-0.72%
	A40	Eastbound	12,214	381	3.12%
		Westbound	12,099	387	3.20%
November	A34(T)	Northbound	36,059	-235	-0.65%
		Southbound	36,881	-265	-0.72%
	A40	Eastbound	12,578	381	3.03%
		Westbound	12,252	387	3.16%
December	A34(T)	Northbound	36,118	-235	-0.65%
		Southbound	36,211	-265	-0.73%
	A40	Eastbound	11,552	381	3.29%
		Westbound	11,552	387	3.35%
January	A34(T)	Northbound	33,471	-235	-0.70%
		Southbound	33,281	-265	-0.79%
	A40	Eastbound	11,691	381	3.25%
		Westbound	11,599	387	3.33%
February	A34(T)	Northbound	34,482	-235	-0.68%
		Southbound	35,082	-265	-0.75%
	A40	Eastbound	11,956	381	3.18%
		Westbound	11,412	387	3.39%
March	A34(T)	Northbound	36,212	-235	-0.65%
		Southbound	36,892	-265	-0.72%
	A40	Eastbound	12,466	381	3.05%
		Westbound	12,213	387	3.17%

Note: Impact on A34(T) and A40 takes account of trips routeing along both sections of road

Table 3.3: 2020 Without Scheme Daily A34(T)/A40 Rail Passenger Road Traffic Impact

Month	Road	Direction	AADT Traffic Flow	Daily Impact	% Impact
April	A34(T)	Northbound	38,348	137	0.36%
		Southbound	38,114	137	0.36%
	A40	Eastbound	13,099	79	0.60%
		Westbound	12,301	79	0.64%
May	A34(T)	Northbound	37,009	137	0.37%
		Southbound	37,502	137	0.37%
	A40	Eastbound	12,986	79	0.61%
		Westbound	11,898	79	0.66%
June	A34(T)	Northbound	39,616	137	0.35%
		Southbound	40,059	137	0.34%
	A40	Eastbound	13,037	79	0.60%
		Westbound	12,372	79	0.64%
July	A34(T)	Northbound	40,266	137	0.34%
		Southbound	41,545	137	0.33%
	A40	Eastbound	12,479	79	0.63%
		Westbound	12,090	79	0.65%
August	A34(T)	Northbound	40,513	137	0.34%
		Southbound	40,483	137	0.34%
	A40	Eastbound	13,179	79	0.60%
		Westbound	12,838	79	0.61%
September	A34(T)	Northbound	40,504	137	0.34%
		Southbound	40,463	137	0.34%
	A40	Eastbound	13,032	79	0.60%
		Westbound	12,895	79	0.61%
October	A34(T)	Northbound	38,307	137	0.36%
		Southbound	38,860	137	0.35%
	A40	Eastbound	12,346	79	0.64%
		Westbound	12,220	79	0.64%
November	A34(T)	Northbound	37,940	137	0.36%
		Southbound	38,829	137	0.35%
	A40	Eastbound	12,726	79	0.62%
		Westbound	12,379	79	0.64%
December	A34(T)	Northbound	38,002	137	0.36%
		Southbound	38,129	137	0.36%
	A40	Eastbound	11,655	79	0.68%
		Westbound	11,649	79	0.68%
January	A34(T)	Northbound	35,234	137	0.39%
		Southbound	35,066	137	0.39%
	A40	Eastbound	11,801	79	0.67%
		Westbound	11,699	79	0.67%
February	A34(T)	Northbound	36,291	137	0.38%
		Southbound	36,950	137	0.37%
	A40	Eastbound	12,077	79	0.65%
		Westbound	11,503	79	0.68%
March	A34(T)	Northbound	38,099	137	0.36%
		Southbound	38,841	137	0.35%
	A40	Eastbound	12,609	79	0.62%
		Westbound	12,338	79	0.64%

Note: Impact on A34(T) and A40 takes account of trips routeing along both sections of road

Table 3.4: 2020 With Scheme Daily A34(T)/A40 Rail Passenger Road Traffic Impact

Month	Road	Direction	AADT Traffic Flow	Daily Impact	% Impact
April	A34(T)	Northbound	38,097	-252	-0.66%
		Southbound	37,830	-284	-0.75%
	A40	Eastbound	13,505	406	3.01%
		Westbound	12,713	412	3.24%
May	A34(T)	Northbound	36,757	-252	-0.69%
		Southbound	37,218	-284	-0.76%
	A40	Eastbound	13,392	406	3.03%
		Westbound	12,311	412	3.35%
June	A34(T)	Northbound	39,364	-252	-0.64%
		Southbound	39,775	-284	-0.71%
	A40	Eastbound	13,443	406	3.02%
		Westbound	12,784	412	3.23%
July	A34(T)	Northbound	40,014	-252	-0.63%
		Southbound	41,261	-284	-0.69%
	A40	Eastbound	12,885	406	3.15%
		Westbound	12,503	412	3.30%
August	A34(T)	Northbound	40,261	-252	-0.63%
		Southbound	40,199	-284	-0.71%
	A40	Eastbound	13,585	406	2.99%
		Westbound	13,250	412	3.11%
September	A34(T)	Northbound	40,253	-252	-0.63%
		Southbound	40,179	-284	-0.71%
	A40	Eastbound	13,438	406	3.02%
		Westbound	13,307	412	3.10%
October	A34(T)	Northbound	38,055	-252	-0.66%
		Southbound	38,576	-284	-0.74%
	A40	Eastbound	12,752	406	3.18%
		Westbound	12,632	412	3.26%
November	A34(T)	Northbound	37,688	-252	-0.67%
		Southbound	38,545	-284	-0.74%
	A40	Eastbound	13,132	406	3.09%
		Westbound	12,792	412	3.22%
December	A34(T)	Northbound	37,750	-252	-0.67%
		Southbound	37,845	-284	-0.75%
	A40	Eastbound	12,061	406	3.37%
		Westbound	12,061	412	3.42%
January	A34(T)	Northbound	34,983	-252	-0.72%
		Southbound	34,782	-284	-0.82%
	A40	Eastbound	12,207	406	3.33%
		Westbound	12,111	412	3.41%
February	A34(T)	Northbound	36,039	-252	-0.70%
		Southbound	36,666	-284	-0.77%
	A40	Eastbound	12,483	406	3.25%
		Westbound	11,916	412	3.46%
March	A34(T)	Northbound	37,847	-252	-0.67%
		Southbound	38,557	-284	-0.74%
	A40	Eastbound	13,015	406	3.12%
		Westbound	12,751	412	3.23%

Note: Impact on A34(T) and A40 takes account of trips routeing along both sections of road

Table 3.5: 2023 Without Scheme Daily A34(T)/A40 Rail Passenger Road Traffic Impact

Month	Road	Direction	AADT Traffic Flow	Daily Impact	% Impact
April	A34(T)	Northbound	40,097	147	0.37%
		Southbound	39,852	147	0.37%
	A40	Eastbound	13,668	84	0.62%
		Westbound	12,835	84	0.66%
May	A34(T)	Northbound	38,696	147	0.38%
		Southbound	39,212	147	0.38%
	A40	Eastbound	13,550	84	0.62%
		Westbound	12,415	84	0.68%
June	A34(T)	Northbound	41,422	147	0.36%
		Southbound	41,886	147	0.35%
	A40	Eastbound	13,604	84	0.62%
		Westbound	12,910	84	0.65%
July	A34(T)	Northbound	42,102	147	0.35%
		Southbound	43,439	147	0.34%
	A40	Eastbound	13,021	84	0.65%
		Westbound	12,616	84	0.67%
August	A34(T)	Northbound	42,360	147	0.35%
		Southbound	42,329	147	0.35%
	A40	Eastbound	13,752	84	0.61%
		Westbound	13,396	84	0.63%
September	A34(T)	Northbound	42,351	147	0.35%
		Southbound	42,308	147	0.35%
	A40	Eastbound	13,599	84	0.62%
		Westbound	13,456	84	0.63%
October	A34(T)	Northbound	40,054	147	0.37%
		Southbound	40,631	147	0.36%
	A40	Eastbound	12,883	84	0.65%
		Westbound	12,751	84	0.66%
November	A34(T)	Northbound	39,670	147	0.37%
		Southbound	40,600	147	0.36%
	A40	Eastbound	13,279	84	0.63%
		Westbound	12,917	84	0.65%
December	A34(T)	Northbound	39,734	147	0.37%
		Southbound	39,868	147	0.37%
	A40	Eastbound	12,162	84	0.69%
		Westbound	12,155	84	0.69%
January	A34(T)	Northbound	36,841	147	0.40%
		Southbound	36,665	147	0.40%
	A40	Eastbound	12,314	84	0.68%
		Westbound	12,207	84	0.69%
February	A34(T)	Northbound	37,945	147	0.39%
		Southbound	38,634	147	0.38%
	A40	Eastbound	12,602	84	0.67%
		Westbound	12,003	84	0.70%
March	A34(T)	Northbound	39,836	147	0.37%
		Southbound	40,612	147	0.36%
	A40	Eastbound	13,157	84	0.64%
		Westbound	12,875	84	0.65%

Note: Impact on A34(T) and A40 takes account of trips routeing along both sections of road

Table 3.6: 2023 With Scheme Daily A34(T)/A40 Rail Passenger Road Traffic Impact

Month	Road	Direction	AADT Traffic Flow	Daily Impact	% Impact
April	A34(T)	Northbound	39,828	-269	-0.68%
		Southbound	39,549	-304	-0.77%
	A40	Eastbound	14,100	432	3.06%
		Westbound	13,273	438	3.30%
May	A34(T)	Northbound	38,428	-269	-0.70%
		Southbound	38,908	-304	-0.78%
	A40	Eastbound	13,982	432	3.09%
		Westbound	12,854	438	3.41%
June	A34(T)	Northbound	41,153	-269	-0.65%
		Southbound	41,582	-304	-0.73%
	A40	Eastbound	14,036	432	3.07%
		Westbound	13,348	438	3.28%
July	A34(T)	Northbound	41,833	-269	-0.64%
		Southbound	43,135	-304	-0.70%
	A40	Eastbound	13,453	432	3.21%
		Westbound	13,054	438	3.36%
August	A34(T)	Northbound	42,091	-269	-0.64%
		Southbound	42,025	-304	-0.72%
	A40	Eastbound	14,183	432	3.04%
		Westbound	13,834	438	3.17%
September	A34(T)	Northbound	42,082	-269	-0.64%
		Southbound	42,005	-304	-0.72%
	A40	Eastbound	14,030	432	3.08%
		Westbound	13,894	438	3.15%
October	A34(T)	Northbound	39,785	-269	-0.68%
		Southbound	40,328	-304	-0.75%
	A40	Eastbound	13,314	432	3.24%
		Westbound	13,189	438	3.32%
November	A34(T)	Northbound	39,401	-269	-0.68%
		Southbound	40,296	-304	-0.75%
	A40	Eastbound	13,710	432	3.15%
		Westbound	13,356	438	3.28%
December	A34(T)	Northbound	39,465	-269	-0.68%
		Southbound	39,564	-304	-0.77%
	A40	Eastbound	12,594	432	3.43%
		Westbound	12,593	438	3.48%
January	A34(T)	Northbound	36,572	-269	-0.74%
		Southbound	36,362	-304	-0.83%
	A40	Eastbound	12,746	432	3.39%
		Westbound	12,645	438	3.47%
February	A34(T)	Northbound	37,676	-269	-0.71%
		Southbound	38,331	-304	-0.79%
	A40	Eastbound	13,034	432	3.31%
		Westbound	12,441	438	3.52%
March	A34(T)	Northbound	39,567	-269	-0.68%
		Southbound	40,309	-304	-0.75%
	A40	Eastbound	13,589	432	3.18%
		Westbound	13,313	438	3.29%

Note: Impact on A34(T) and A40 takes account of trips routeing along both sections of road

Table 3.7: 2027 Without Scheme Daily A34(T)/A40 Rail Passenger Road Traffic Impact

Month	Road	Direction	AADT Traffic Flow	Daily Impact	% Impact
April	A34(T)	Northbound	42,383	160	0.38%
		Southbound	42,124	160	0.38%
	A40	Eastbound	14,415	92	0.64%
		Westbound	13,536	92	0.68%
May	A34(T)	Northbound	40,903	160	0.39%
		Southbound	41,448	160	0.39%
	A40	Eastbound	14,290	92	0.64%
		Westbound	13,094	92	0.70%
June	A34(T)	Northbound	43,784	160	0.37%
		Southbound	44,274	160	0.36%
	A40	Eastbound	14,347	92	0.64%
		Westbound	13,615	92	0.67%
July	A34(T)	Northbound	44,503	160	0.36%
		Southbound	45,916	160	0.35%
	A40	Eastbound	13,732	92	0.67%
		Westbound	13,305	92	0.69%
August	A34(T)	Northbound	44,776	160	0.36%
		Southbound	44,742	160	0.36%
	A40	Eastbound	14,503	92	0.63%
		Westbound	14,128	92	0.65%
September	A34(T)	Northbound	44,766	160	0.36%
		Southbound	44,721	160	0.36%
	A40	Eastbound	14,341	92	0.64%
		Westbound	14,191	92	0.65%
October	A34(T)	Northbound	42,338	160	0.38%
		Southbound	42,948	160	0.37%
	A40	Eastbound	13,586	92	0.67%
		Westbound	13,447	92	0.68%
November	A34(T)	Northbound	41,932	160	0.38%
		Southbound	42,915	160	0.37%
	A40	Eastbound	14,004	92	0.65%
		Westbound	13,623	92	0.67%
December	A34(T)	Northbound	42,000	160	0.38%
		Southbound	42,141	160	0.38%
	A40	Eastbound	12,826	92	0.71%
		Westbound	12,819	92	0.71%
January	A34(T)	Northbound	38,942	160	0.41%
		Southbound	38,756	160	0.41%
	A40	Eastbound	12,987	92	0.71%
		Westbound	12,874	92	0.71%
February	A34(T)	Northbound	40,109	160	0.40%
		Southbound	40,837	160	0.39%
	A40	Eastbound	13,291	92	0.69%
		Westbound	12,659	92	0.72%
March	A34(T)	Northbound	42,108	160	0.38%
		Southbound	42,928	160	0.37%
	A40	Eastbound	13,876	92	0.66%
		Westbound	13,578	92	0.68%

Note: Impact on A34(T) and A40 takes account of trips routeing along both sections of road

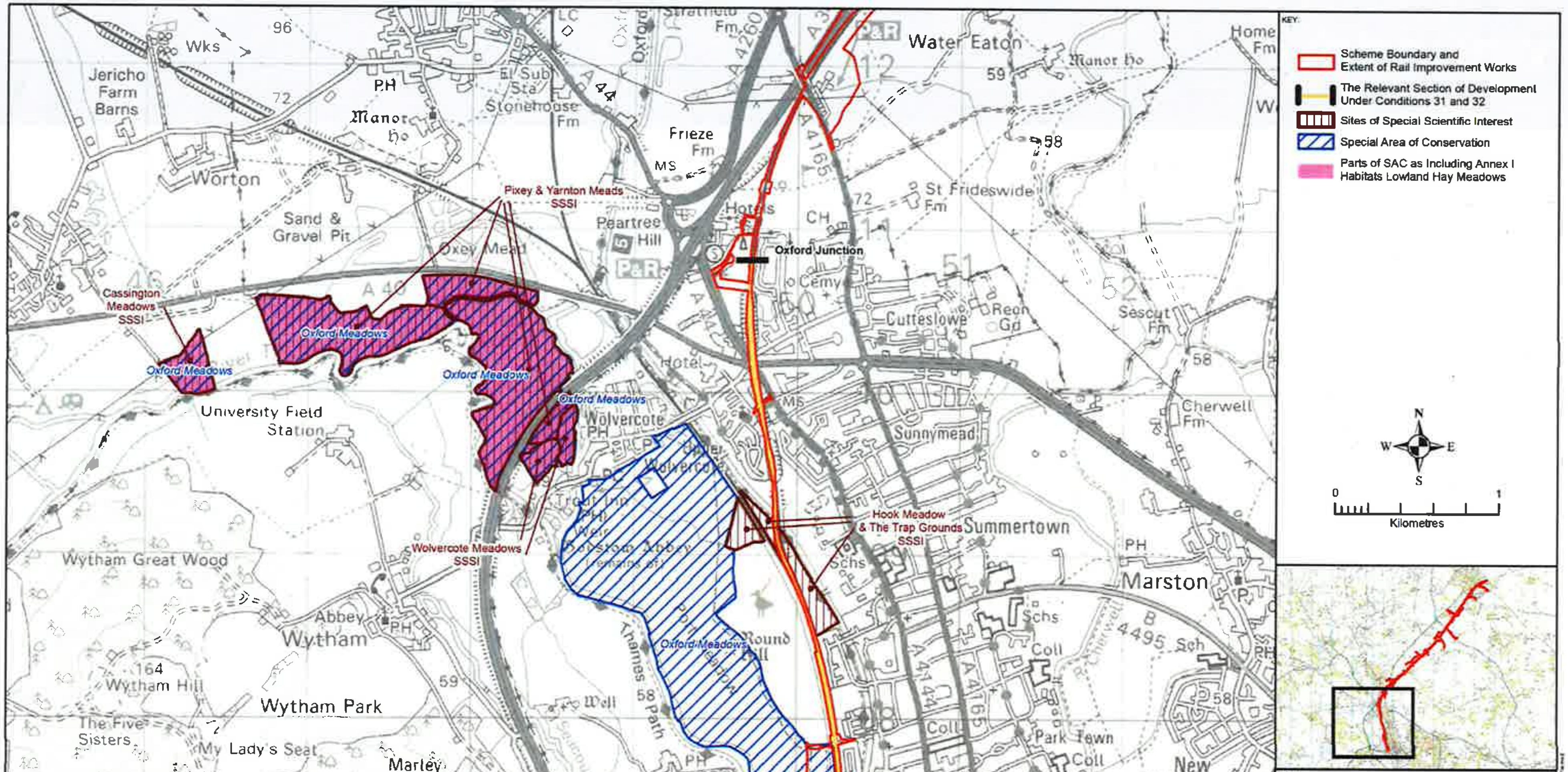
Table 3.8: 2027 With Scheme Daily A34(T)/A40 Rail Passenger Road Traffic Impact

Month	Road	Direction	AADT Traffic Flow	Daily Impact	% Impact
April	A34(T)	Northbound	42,091	-292	-0.69%
		Southbound	41,795	-330	-0.79%
	A40	Eastbound	14,881	466	3.13%
		Westbound	14,009	473	3.37%
May	A34(T)	Northbound	40,611	-292	-0.72%
		Southbound	41,118	-330	-0.80%
	A40	Eastbound	14,756	466	3.15%
		Westbound	13,566	473	3.48%
June	A34(T)	Northbound	43,492	-292	-0.67%
		Southbound	43,944	-330	-0.75%
	A40	Eastbound	14,813	466	3.14%
		Westbound	14,087	473	3.35%
July	A34(T)	Northbound	44,211	-292	-0.66%
		Southbound	45,586	-330	-0.72%
	A40	Eastbound	14,198	466	3.28%
		Westbound	13,777	473	3.43%
August	A34(T)	Northbound	44,484	-292	-0.66%
		Southbound	44,413	-330	-0.74%
	A40	Eastbound	14,968	466	3.11%
		Westbound	14,600	473	3.24%
September	A34(T)	Northbound	44,474	-292	-0.66%
		Southbound	44,391	-330	-0.74%
	A40	Eastbound	14,807	466	3.14%
		Westbound	14,663	473	3.22%
October	A34(T)	Northbound	42,046	-292	-0.69%
		Southbound	42,619	-330	-0.77%
	A40	Eastbound	14,052	466	3.31%
		Westbound	13,920	473	3.40%
November	A34(T)	Northbound	41,640	-292	-0.70%
		Southbound	42,585	-330	-0.77%
	A40	Eastbound	14,470	466	3.22%
		Westbound	14,096	473	3.35%
December	A34(T)	Northbound	41,708	-292	-0.70%
		Southbound	41,812	-330	-0.79%
	A40	Eastbound	13,292	466	3.50%
		Westbound	13,292	473	3.56%
January	A34(T)	Northbound	38,650	-292	-0.75%
		Southbound	38,426	-330	-0.86%
	A40	Eastbound	13,452	466	3.46%
		Westbound	13,346	473	3.54%
February	A34(T)	Northbound	39,817	-292	-0.73%
		Southbound	40,508	-330	-0.81%
	A40	Eastbound	13,756	466	3.38%
		Westbound	13,132	473	3.60%
March	A34(T)	Northbound	41,816	-292	-0.70%
		Southbound	42,598	-330	-0.77%
	A40	Eastbound	14,341	466	3.25%
		Westbound	14,051	473	3.36%

Note: Impact on A34(T) and A40 takes account of trips routeing along both sections of road

Appendices

Appendix A



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Plan 1.2
Designated Sites and Relevant Section of the Scheme

CLIENT: Chiltern Railways

SIZE: A3

DATE: 12/07/2013 | CHECKED: RM | PROJECT: 0172205

DRAWN: AZ | APPROVED: SG | SCALE: As Scale Bar

DRAWING: Plan 1_2 - Designated Sites and Relevant Section of the Scheme.mxd

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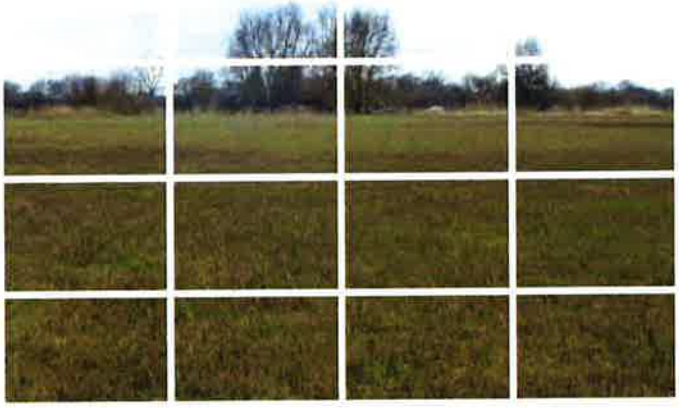

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