The High Speed Rail (London – West Midlands) (Greatmoor Railway Sidings Etc.) Order

Environmental Statement – technical appendices
Volume 4.3:
Air quality impact assessment

August 2016
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Department for Transport

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Contents

List of tables

1 Introduction

1.1.1 This technical appendix supports the Greatmoor Railway Sidings, Volume 2: Main Environmental Statement (ES). The technical appendix sets out the detailed findings of the air quality impact assessment. For the background to the assessment and the overall approach to the air quality impact assessment refer to the Volume 2: Main ES.

1.1.2 The air quality appendix for the Proposed Scheme comprises:

- effects arising during construction (section 2):
  - dust impact evaluation and risk rating;
  - air quality assessment - road traffic and on site construction traffic; and
- effects arising during operation (Section 3):
  - air quality assessment – operation of the sidings.

1.1.3 Maps referred to throughout the air quality appendix are shown on Map ES-10: Air Quality Receptor Locations, in Volume 3 of this ES.

2 Effects arising during construction

2.1 Dust impact evaluation and risk

2.1.1 This section provides details of the assessment of dust emissions during construction of the Proposed Scheme.

2.1.2 The assessment follows the approach set out in the Institute of Air Quality Management (IAQM) guidance[1]. It focuses on the areas around the worksites where there are sensitive receptors within 350m from the construction site boundary and/or within 50m of the routes used by construction vehicles on the public highway and up to 500m from construction site entrance.

2.1.3 The primary elements of the Proposed Scheme which have been considered in the dust impact evaluation are the proximity of the construction of the Proposed Scheme in relation to existing sensitive receptors. No assessment has been made of impacts associated with the HS2 Phase One scheme as these are considered in the HS2 Phase One ES.

2.1.4 The assessment is based on consideration of the four main dust generating activities (as set out in the guidance), namely; demolition, earthworks, construction and trackout. Demolition impacts have however been excluded from the assessment as no demolition work is understood to be taking place as part of the site activities.

2.1.5 The sensitivity of the area to dust soiling, human health and ecological impacts has also been assessed for each of the three dust-generating activities above. Following the above stages, the overall Risk of impacts is considered.

2.1.6 The assessment was undertaken for the site as a whole, with due consideration for the following sensitive receptors due to their proximity to dust generating activities: Lower Greatmoor Farm and Sheephouse Wood SSSI.

2.1.7 The receptors that are considered relevant for this assessment are shown on Map ES-10: Air Quality Receptor Location, in Volume 3 of this ES.

2.1.8 No assessment of impacts associated with construction traffic on the trace haul route has been undertaken, as this is incorporated in the HS2 Phase One ES.

2.1.9 The dust assessment concluded that, with the implementation of the draft CoCP, there will be negligible impacts at sensitive human and ecological receptors as a result of construction of the Proposed Scheme.

[1] Institute of Air Quality Management (IAQM), 2014, Guidance on the Assessment of Dust from Demolition and Construction, IAQM

Table 1: Evaluation and risk rating of construction activities

Activity	Distance to nearest receptor	Dust emission class	Dust risk category	Sensitivity of surrounding area	Magnitude of impact (with draft CoCP mitigation measures)	Principal justifications
Lower Greatmoor Farm						
Demolition	No demolition activities will be required					
Earthworks	Less than 20m	Large	Medium	Medium	Negligible	1. Total site area greater than 10,000m2. 2. Fewer than 10 receptors within 20m of the site.
Construction	Less than 20m	Large	Medium	Medium	Negligible	1. Use of dusty construction materials. 2. Fewer than 10 receptors within 20m of the site.
Trackout	Less than 20m	Medium	Medium	Medium	Negligible	1. Less than 100 heavy goods vehicles (HGVs) on road. 2. Fewer than 10 receptors within 20m of roadside.
Sheephouse Wood SSSI						
Demolition	No demolition activities will be required					
Earthworks	Less than 20m	Large	Medium	High	Negligible	1. Total site area greater than 10,000m2. 2. Sheephouse Wood SSSI is less than 20m from the site.
Construction	Less than 20m	Large	Medium	High	Negligible	1. Use of dusty construction materials. 2. Sheephouse Wood SSSI is less than 20m from the site.
Trackout	No trackout within 100m of the site.					

2.2 Air quality assessment - road traffic

Overall assessment approach

2.2.1 Assessment of the effects of emissions arising from changes to traffic flows during both the construction and operational stages of the Proposed Scheme is limited to receptors located along roads that meet any of the criteria specified in the Design Manual for Roads and Bridges (DMRB)[2]. These criteria are as follows:

- road alignment change by 5m or more;
- daily traffic flows change by 1000 annual average daily traffic (AADT) or more;
- heavy duty vehicle (HDV) flows change by 200 AADT or more;
- daily average traffic speed changes by 10kph or more; or
- peak hour traffic speed changes by 20kph or more.

2.2.2 Assessment of the effects is limited to receptors located within 200m along roads considered to be affected (i.e. meet DMRB criteria above).

2.2.3 The assessment has focused on the primary air pollutants associated with vehicle emissions. These pollutants are oxides of nitrogen (NOx), nitrogen dioxide (NO_2) and particulate matter (PM10).

2.3 Model inputs and verification

2.3.1 Due to the use of the DMRB methodology, model verification was not required.

2.4 Construction traffic model

2.4.1 The additional traffic generated during the construction stage has the potential to change air quality for some receptors.

2.4.2 During the anticipated construction period, on Station Road there are approximately 250 HDV movements and 136 Light Duty Vehicle (LDV) movements per day (one-way), totalling 386 movements. The change in AADT for HDV movements is above the DMRB criteria for undertaking a local air quality assessment and therefore an assessment of impacts from construction traffic movements at sensitive receptors has been undertaken.

2.4.3 In addition, there are also increases of 125 HGVs/day in traffic on the A41, which will result in impacts on sensitive ecological receptors. Detailed modelling has therefore been undertaken to assess these impacts.

2.4.4 The assessment also considered impacts arising at sensitive human and ecological receptors around the construction activity at the proposed sidings location. This was undertaken due to the changes in rail traffic on the Aylesbury Link railway line, the impact of emissions from the Greatmoor EfW facility, the impact of traffic emissions accessing the Greatmoor EfW facility and traffic accessing the sidings site on trace.

[2] Highways Agency, 2007, Design Manual for Roads and Bridges (DMRB), Volume 11 Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 1 Air Quality, HA207/07, The Stationery Office

This was undertaken due to the close proximity of sensitive human and ecological receptors to the construction activity and because the baseline was changing due to the operation of the Greatmoor EfW facility.

Receptors assessed

2.4.5 The receptors considered in the assessment are on Station Road, on the A41 and in the vicinity of the construction site of the Proposed Scheme.

Table 2: Modelled receptors (construction phase)

Description/location	Ordnance Survey coordinates
Crossroads Farm	473292, 218590
Lower Greatmoor Farm	470467, 222231
Woodlands Farm	471457, 221340
Oak Tree Farm	470914, 221240
Moor Farm	470121, 222529
Ham Home-cum-Hamgreen woods SSSI	469227, 218983
Sheephouse Wood SSSI	469718, 223492
Finemere Wood SSSI	471328, 222133
Grendon and Doddershall Woods SSSI	470327, 221457
Hewin's Wood	470412, 221738
Track leading to the Aylesbury Link railway line NLR	471105, 221908

Design Manual for Roads and Bridges model results

2.4.1 Assessment of impacts due to increases in traffic during construction on the public highway were undertaken for Station Road for sensitive human receptors. This section provides the summary of the modelled pollutant concentrations for the assessed receptors using the DMRB methodology. The magnitude of change and impact descriptor for the human receptors identified are derived following the Environmental Protection UK (EPUK) methodology.

Table 3: Summary of DMRB annual mean NO_2 results (construction phase)

Receptor	Concentrations (µg/m³)			Change in concentrations (µg/m³)	Magnitude of change	Impact descriptor
	2016 baseline	2017 without Proposed Scheme	2017 with Proposed Scheme			
Crossroads Farm	8.6	9.0	9.8	0.83	Imperceptible increase	Negligible

Table 4: Summary of DMRB annual mean PM10 results (construction phase)

Receptor	Concentrations (µg/m³)			Change in concentrations (µg/m³)	Magnitude of change	Impact descriptor
	2016 baseline	2017 without Proposed Scheme	2017 with Proposed Scheme			
Crossroads Farm	15.6	15.5	15.5	0.085	Imperceptible increase	Negligible

Detailed modelling results

2.4.2 This section provides the summary of the modelled pollutant concentrations for the assessed receptors using ADMS-Roads. The magnitude of change and impact descriptor for human receptors are derived following the EPUK methodology[Error! Bookmark not defined.]. The criteria used to define significance at the ecological sites identified are in line with guidance set out in the Environment Agency H1 guidance document[3], which in turn refers back to joint Environment Agency/Natural England guidance. With regard to the impacts on ecological receptors, in order to indicate area of the habitat that may be subject to significant effects, the modelling included transects with receptors at increasing distances away from the roadside.

Sensitive Human Receptors

2.4.3 An assessment was undertaken of the potential impacts on sensitive human receptors due to changes in emissions arising from the construction traffic accessing the site on trace. The modelling results show that there are no significant effects at all receptors.

Table 5: Summary of DMRB annual mean NO2 results (construction phase)

Receptor	Concentrations (µg/m³)			Change in concentrations (µg/m³)	Magnitude of change	Impact descriptor
	2016 baseline	2017 without Proposed Scheme	2017 with Proposed Scheme			
Lower Greatmoor Farm	8.50	9.55	9.58	0.0300	Imperceptible increase	Negligible
Woodlands Farm	8.42	9.55	9.67	0.120	Imperceptible increase	Negligible
Oak Tree Farm	8.52	9.66	9.67	0.0100	Imperceptible increase	Negligible
Moor Farm	8.50	9.52	9.54	0.0200	Imperceptible increase	Negligible

[3] Environment Agency, (2011), *H1 Annex F - Air Emissions v2.2*

Sensitive Ecological Receptors

2.4.4 Impacts were considered at Ham Home-cum-Hamgreen Woods SSSI, due to emissions from construction phase traffic on the A41. The impacts associated with NO_x are set out in Table 6, and for nutrient nitrogen in Table 7.

Table 6: Critical level assessment for NO_x for the protection of vegetation for Ham Home and Hamgreen Woods SSSI

Receptor	NOx concentrations (µg/m³)							
	2016 baseline	**2017 without Proposed Scheme**	**2017 with Proposed Scheme**	**Change in concentrations (µg/m³)**	**Critical level (µg/m³) (annual mean)**	**Change in concentrations as % of critical level**	**Total NOx as a % of critical level**	**Potentially significant?[11]**
0m	12.4	27.8	28.1	0.346	30	1.2%	94%	Yes
10m	12.4	20.0	20.2	0.182	30	0.61%	67%	No
20m	12.4	17.2	17.3	0.120	30	0.40%	58%	No
50m	12.4	14.6	14.7	0.0629	30	0.21%	49%	No
100m	12.4	13.4	13.4	0.0351	30	0.12%	45%	No
200m	12.4	12.6	12.6	0.0185	30	0.062%	42%	No

2.4.5 The results show that the area of the SSSI closest to the road, the changes in NO_x concentrations are greater than 1% of the critical load and potentially significant effects are predicted. However, at 10m and beyond there are no potentially significant effects.

Table 7: Critical load - nutrient nitrogen deposition for Ham Home-cum-Hamgreen Woods SSSI

Receptor	Nitrogen deposition rate (kg N/ha/year)							
	2016 baseline deposition	**2017 without Proposed Scheme**	**2017 with Proposed Scheme**	**Change in deposition (kg N/ha/year)**	**Critical load range (Kg N/ha/year)**	**Change in deposition as % of critical load**	**Total nitrogen deposition as a % of critical load**	**Potentially significant?[12]**
Ham Home-cum-Hamgreen Woods SSSI	32.8	37.4	37.5	0.10	15 (lower)	0.66%	250%	No
					20 (upper)	0.50%	187%	No

2.4.6 The results illustrate that there are no potentially significant effects predicted due to nutrient nitrogen deposition.

2.4.7 Assessment was also undertaken of the potential impacts on sensitive ecological receptors due to changes in emissions arising from the construction traffic accessing the site on trace. The impacts associated with NO_x are set out in Table 8, and for nutrient nitrogen in Table 9.

Table 8: Critical level assessment for NO_x for the protection of vegetation for Sheephouse Woods, Finemere Woods and Grendon and Doddershall Woods

Receptor	NOx concentrations (µg/m³)							
	2016 baseline	**2017 without Proposed Scheme**	**2017 with Proposed Scheme**	**Change in concentrations (µg/m³)**	**Critical level (µg/m³) (annual mean)**	**Change in concentrations as % of critical level**	**Total NOx as a % of critical level**	**Potentially significant?[11]**
Sheephouse Wood SSSI	13.9	13.7	13.7	0.0329	30	0.11%	46%	No
Finemere Wood SSSI	11.5	11.3	11.4	0.107	30	0.36%	38%	No
Grendon and Doddershall Woods SSSI	11.8	11.5	11.5	0.0131	30	0.044%	38%	No

Receptor	NOx concentrations (µg/m³)							
Hewin's Wood	11.6	11.3	11.3	0.0189	30	0.063%	38%	No
Track leading to the Aylesbury Link railway line NLR	11.6	12.1	12.2	0.117	30	0.39%	41%	No

2.4.8 The results show that there are no potentially significant effects due to traffic on trace.

Table 9: Critical load - nutrient nitrogen deposition for Sheephouse Wood SSSI, Finemere Wood SSSI and Grendon and Doddershall Woods SSSI

Receptor	Nitrogen deposition rate (kg N/ha/year)							
	2016 baseline deposition	2017 without Proposed Scheme	2017 with Proposed Scheme	Change in deposition (kg N/ha/year)	Critical load range (Kg N/ha/year)	Change in deposition as % of critical load	Total nitrogen deposition as a % of critical load	Potentially significant?[12]
Sheephouse Wood SSSI	35.1	35.2	35.2	0.0095	15	0.063%	235%	No
					20	0.047%	176%	No
Finemere Woods SSSI	30.5	30.6	30.6	0.031	15	0.21%	204%	No
					20	0.15%	153%	No
Grendon and Doddershall Woods SSSI	35.1	35.2	35.2	0.0038	15	0.025%	235%	No
					20	0.019%	176%	No

2.4.9 The results illustrate that there are no potentially significant effects predicted due to nutrient nitrogen deposition.

3 Effects arising during operations

Overall assessment approach

3.1.1 The assessment of the effects of emissions arising from changes due to the operations of the sidings has been assessed using dispersion modelling. The assessments take into consideration the recent changes in the baseline due to the operation of the Greatmoor EfW facility, including stack emissions and associated traffic, and the proposed dualling of the Aylesbury Link railway line proposed to be operational in 2022.

3.1.2 The assessment has focused on oxides of nitrogen (NO_x) and nutrient nitrogen deposition for sensitive ecological receptors, and nitrogen dioxide (NO_2) for sensitive human receptors.

3.2 Model inputs and verification

3.2.1 Model verification was not undertaken as there is no suitable monitoring data available.

3.3 Operational model

3.3.1 An assessment was undertaken of the operations of the Proposed Scheme using ADMS-Roads. This considered emissions from: rail locomotives on the Aylesbury Link railway line; rail locomotives using the sidings; traffic associated with the operation of the Greatmoor EfW facility; traffic from the sidings to the Calvert landfill; the operation of the Greatmoor EfW facility. The assessment considered impacts on sensitive ecological receptors and sensitive human receptors.

Receptors assessed

3.3.2 The receptors considered in the assessment are on the A41 and in the vicinity of the construction site for the Proposed Scheme.

Table 10: Modelled receptors (operation phase)

Description/location	Ordnance Survey coordinates
Lower Greatmoor Farm	470467, 222231
Woodlands Farm	471457, 221340
Oak Tree Farm	470914, 221240
Moor Farm	470121, 222529
Ham Home-cum-Hamgreen woods SSSI	469227, 218983
Sheephouse Wood SSSI	469718, 223492
Finemere Wood SSSI	471328, 222133

Description/location	Ordnance Survey coordinates
Grendon and Doddershall Woods SSSI	470327, 221457
Hewin's Wood	470412, 221738
Track leading to the Aylesbury Link railway line NLR	471105, 221908

Assessment input data

3.3.3 The assessment required consideration of a number of different sources of emissions. This was required to establish the future baseline and the operational impacts. Furthermore, mitigation options were considered for the operational phase.

3.3.4 Historically, the Proposed Scheme location was essentially undeveloped, with the only local sources of emissions being activities associated with the Calvert landfill site and freight train movements on the Aylesbury Link railway line, the majority of which were also associated with the Calvert landfill. However, recently there have been a number of changes that have introduced additional sources of emissions, and changed some of those already in existence. The Proposed Scheme will also change the location and nature of emissions. These are discussed in detail in the Volume 2: Main ES and the key changes are set out in Table 11 for the future baseline operational and mitigated scenarios.

3.3.5 In terms of the model methodology, in line with the air quality impact assessments for the HS2 Phase One scheme, Heathrow Airport Meteorological data for 2012 was used in the assessment. Pollutant deposition velocities and ambient to deposition conversion factors were obtained from the Environment Agency AQTAG06 document. The factors used are deposition velocity of 0.003ms^{-1} for woodlands for NO_x and a conversion of 95.9 to convert between µg/m^3 and kg N ha^{-1} year^{-1} for NO_x to nutrient nitrogen deposition.

3.3.6 In terms of derivation of emissions, the following data have been used:

- the Bell Dumper trucks used to transfer MSW from the sidings to the Greatmoor EfW facility have an engine rating of 216kW, and are compliant with USEPA Tier II emission limits of 6.6g NO_x/kWh[4];
- the Caterpillar Dumper trucks used to transfer spoil from the sidings to Calvert landfill have an engine rating of approximately 214kW, and are compliant with USEPA Tier IV emission limits of 0.4g NO_x/kWh[5];
- the emissions and the design parameters for the Greatmoor EfW facility are derived from the FCC Environmental Permit for the facility[6];
- freight trains using the Aylesbury Link railway line and the railway sidings are

[4] https://www.dieselnet.com/standards/us/nonroad.php
[5] https://www.dieselnet.com/standards/us/nonroad.php
[6] Greatmoor energy from waste facility Buckinghamshire air quality – technical appendix 6/a atmospheric dispersion modelling http://www.fccenvironment.co.uk/assets/files/pdf/Greatmoor/environmental-statement/chapter6/appendix-6-a.pdf

assumed to be hauled by Class 66 locomotives. The emissions from these locomotives are 120g NO_x/km[7]; and

- passenger services using the Aylesbury Link railway line are assumed to use Class 165 Diesel Multiple Units or similar. The emissions from these DMUs are 18.6g NO_x/km[8].

[7] Strategic Rail Authority (2001) Rail Emissions Model, Table 6
[8] Strategic Rail Authority (2001) Rail Emissions Model, Table 6

Table 11: Key changes to emission sources

Source	Future Baseline	Operational case	Mitigated operational case	Other assumptions	Key change
MSW waste trucks	A fleet of 5 Bell Dumper trucks compliant with USEPA Tier II emission limits are used to take MSW from the existing sidings to the Greatmoor EfW facility, using a haul road running parallel to the Aylesbury Link railway line.	A fleet of 5 Bell Dumper trucks compliant with USEPA Tier II emission limits are used to take MSW from the existing sidings to the Greatmoor EfW facility, using a haul road running parallel to the Aylesbury Link railway line.	A fleet of 5 Road going HGVs compliant with Euro VI emission limits are used to take MSW from the new sidings to the Greatmoor EfW facility, using a haul road running parallel to the Aylesbury Link railway line. 66 HGV movements a day are required to unload the trains.	The fleet are assumed to operate for 12 hours per day, 286 days per year	The Euro VI haul trucks have substantially lower emissions
Spoil waste trucks	A fleet of 5 Caterpillar Dumper trucks compliant with USEPA Tier IV emission limits are used to take spoil from the existing sidings to Calvert landfill site, accessing the landfill in the northeast corner.	A fleet of 5 Caterpillar Dumper trucks compliant with USEPA Tier IV emission limits are used to take spoil from the new sidings to Calvert landfill site, accessing the landfill in the southeast corner.	A fleet of 5 Caterpillar Dumper trucks compliant with USEPA Tier IV emission limits are used to take spoil from the Proposed Scheme to Calvert landfill site, accessing the landfill in the southeast corner	The fleet are assumed to operate for 12 hours per day, 286 days per year	Changed access point to Calvert landfill
HGVs accessing the Greatmoor EfW facility	A maximum of 138 HGVs per day access the Greatmoor EfW facility from Greatmoor Road and the A41.	A maximum of 138 HGVs per day access the Greatmoor EfW facility from Greatmoor Road and the A41.	A maximum of 138 HGVs per day access the Greatmoor EfW facility from Greatmoor Road and the A41.	The HGVs on Greatmoor Road are assumed to be typical England Rural fleet composition	No change between base and operational cases
Greatmoor EfW facility to Calvert HGVs	HGVs take 12 loads of bottom ash from the Greatmoor EfW facility to Calvert landfill per day, accessing in southeast corner	HGVs take 12 loads of bottom ash from the Greatmoor EfW facility to Calvert landfill per day, accessing in southeast corner	HGVs take 12 loads of bottom ash from the Greatmoor EfW facility to Calvert landfill per day, accessing in southeast corner	The HGVs on Greatmoor Road are assumed to be typical England Rural fleet composition	No change between base and operational cases
Greatmoor EfW facility	The Greatmoor EfW facility is operational.	The Greatmoor EfW facility is operational.	The Greatmoor EfW facility is operational.	The Greatmoor EfW facility is assumed to be operating at Permitted capacity continuously. No buildings effects are included, as these	No change between base and operational cases

Source	Future Baseline	Operational case	Mitigated operational case	Other assumptions	Key change
				cannot be represented in ADMS-Roads	
Aylesbury Link railway line	The line is dualled, and carrying 6 passenger trains each way on weekdays, 3 passenger trains each way on Saturdays and no passenger trains on Sundays. 4 freight trains per day use the line to the existing railway sidings. 1 other freight service uses the line per month.	The line is dualled, and carrying 6 passenger trains each way on weekdays, 3 passenger trains each way on Saturdays and no passenger trains on Sundays. 4 freight trains per day use the line to the new railway sidings. 1 other freight service uses the line per month.	The line is dualled, and carrying 6 passenger trains each way on weekdays, 3 passenger trains each way on Saturdays and no passenger trains on Sundays. 4 freight trains per day use the line to the new railway sidings. 1 other freight service uses the line per month.	Freight services are assumed to be hauled by a single Class 66 locomotive. Passenger services are assumed to be Class 165 or similar	No change between base and operational cases
Railway sidings	Not included in base model	Two railway sidings are included, with two trains per day on each siding. Sidings are total length of 1000m, with run around loop.	Two railway sidings are included, with two trains per day on each siding. Sidings are total length of 1000m, with run around loop.	4 waste trains a day, comprising of 3 spoil trains and 1 MSW train. Freight services are assumed to be hauled by a single Class 66 locomotive.	Operational cases include locomotives on the freight sidings.

Detailed modelling results

Sensitive Human Receptors

3.3.7 This section provides the summary of the modelled pollutant concentrations for the assessed sensitive human receptors using ADMS-roads. The magnitude of change and impact descriptor for human receptors are derived following the EPUK methodology**Error! Bookmark not defined.**. As set out in Table 12, these results are for the operational case compared to the future base case, without mitigation. The results illustrate that there are no significant effects on human receptors as a result of the Proposed Scheme.

Table 12: Summary of Detailed Modelling results for annual mean NO_2 results

Receptor	Concentrations (µg/m³)			Change in concentrations (µg/m³)	Magnitude of change	Impact descriptor
	2016 baseline	2019 without Proposed Scheme	2019 with Proposed Scheme			
Lower Greatmoor Farm	8.50	15.03	16.5	1.49	Small increase	Negligible
Woodlands Farm	8.42	14.93	15.0	0.080	Imperceptible increase	Negligible
Oak Tree Farm	8.52	15.08	15.1	0.070	Imperceptible increase	Negligible
Moor Farm	8.50	14.95	15.4	0.42	Imperceptible increase	Negligible

Sensitive ecological receptors

3.3.8 This section provides the summary of the modelled pollutant concentrations for the assessed sensitive ecological receptors using ADMS-roads. The criteria used to define significance at the ecological sites identified are in line with guidance set out in the Environment Agency H1 guidance document[9], which in turn refers back to joint Environment Agency/Natural England guidance.

3.3.9 Impacts change between the without scheme and with scheme designs, principally due to the movement of sidings activity from the current location, to the new location. The movement of the sidings results in a decrease in impact in some locations, and an increase in impacts at other locations. In order to illustrate these changes, impacts are tabulated for a number of receptor locations along the boundary of each habitat, and the change across the extent of each habitat is illustrated in the figures. The significance of these impacts is discussed in detail in the Volume 2; Main ES.

3.3.10 The impacts set out in Table 13 and Table 14 are for the operational case compared to the future base case, without mitigation. The impacts set out in Table 15 and Table 16 are for the operational case compared to the future base case, with mitigation.

[9] Environment Agency, (2011), *H1 Annex F - Air Emissions v2.2*

Table 13: Critical level assessment for NO_x for the protection of vegetation – operational case

Receptor	NOx concentrations (µg/m³)							
	2016 baseline	2017 without Proposed Scheme	2017 with Proposed Scheme	Change in concentrations (µg/m³)	Critical level (annual mean)	Change in concentrations as % of critical level	Total NOx as a % of critical level	Potentially significant adverse
Sheephouse Wood Location 1	13.9	14.0	13.6	-0.4	30	-1%	45%	No
Sheephouse Wood Location 2	13.9	13.8	13.6	-0.2	30	-1%	45%	No
Sheephouse Wood Location 3	13.9	13.7	13.7	-0.09	30	-0.3%	46%	No
Sheephouse Wood Location 4	13.9	13.7	13.8	0.0	30	0%	46%	No
Sheephouse Wood Location 5	13.9	13.7	14.3	0.6	30	2.2%	48%	No
Sheephouse Wood Location 6	13.9	13.6	14.3	0.75	30	2.5%	48%	No
Sheephouse Wood Location 7	13.9	13.6	14.3	0.73	30	2.4%	48%	No
Sheephouse Wood Location 8	13.9	13.6	14.3	0.63	30	2.1%	48%	No
Sheephouse Wood Location 9	13.9	13.7	14.4	0.69	30	2.3%	48%	No
Finemere Wood Location 1	11.5	11.3	11.6	0.355	30	1.2%	39%	No
Finemere Wood Location 2	11.5	11.3	11.6	0.374	30	1.2%	39%	No
Finemere Wood Location 3	11.5	11.3	11.6	0.364	30	1.2%	39%	No
Finemere Wood Location 4	11.5	11.2	11.5	0.221	30	0.7%	38%	No

Receptor	NOx concentrations (µg/m³)							
	2016 baseline	2017 without Proposed Scheme	2017 with Proposed Scheme	Change in concentrations (µg/m³)	Critical level (annual mean)	Change in concentrations as % of critical level	Total NOx as a % of critical level	Potentially significant adverse
Grendon and Doddershall Woods Location 1	11.8	11.5	11.7	0.148	30	0.5%	39%	No
Grendon and Doddershall Woods Location 2	11.8	11.5	11.7	0.166	30	0.6%	39%	No
Grendon and Doddershall Woods Location 3	11.8	11.5	11.7	0.149	30	0.5%	39%	No
Grendon and Doddershall Woods Location 4	11.8	11.5	11.6	0.118	30	0.39%	39%	No
Grendon and Doddershall Woods Location 5	11.8	11.5	11.5	0.031	30	0.10%	38%	No
Hewins Wood Location 1	11.6	11.3	11.6	0.315	30	1.0%	39%	No
Track leading to the Aylesbury Link railway line NLR 1	11.6	11.4	11.8	0.380	30	1.3%	39%	No
Track leading to the Aylesbury Link railway line NLR 2	11.6	11.6	12.0	0.336	30	1.1%	40%	No
Track leading to the Aylesbury Link railway line NLR 3	11.6	12.1	12.4	0.301	30	1.0%	41%	No
Track leading to the Aylesbury Link railway line NLR 4	11.6	11.4	11.7	0.264	30	0.9%	39%	No

Table 14: Critical load - nutrient nitrogen deposition – operational case

Receptor	Nitrogen deposition rate (kg N/ha/year)							
	2016 baseline deposition	2017 without Proposed Scheme	2017 with Proposed Scheme	Change in deposition (kg N/ha/year)	Critical load range (kg N/ha/year)	Change in deposition as % of critical load	Total nitrogen deposition as a % of critical load	Potentially significant adverse
Sheephouse Wood Location 1	35.1	35.3	35.2	-0.11	15	-0.76%	235%	No
					20	-0.57%	176%	No
Sheephouse Wood Location 2	35.1	35.3	35.2	-0.07	15	-0.45%	235%	No
					20	-0.34%	176%	No
Sheephouse Wood Location 3	35.1	35.2	35.2	-0.026	15	-0.17%	235%	No
					20	-0.13%	176%	No
Sheephouse Wood Location 4	35.1	35.2	35.2	0.01	15	0.037%	235%	No
					20	0.028%	176%	No
Sheephouse Wood Location 5	35.1	35.2	35.4	0.19	15	1.2%	236%	Yes
					20	0.93%	177%	No
Sheephouse Wood Location 6	35.1	35.2	35.4	0.21	15	1.4%	236%	Yes
					20	1.1%	177%	Yes

Receptor	Nitrogen deposition rate (kg N/ha/year)							
	2016 baseline deposition	2017 without Proposed Scheme	2017 with Proposed Scheme	Change in deposition (kg N/ha/year)	Critical load range (kg N/ha/year)	Change in deposition as % of critical load	Total nitrogen deposition as a % of critical load	Potentially significant adverse
Sheephouse Wood Location 7	35.1	35.2	35.4	0.210	15	1.4%	236%	Yes
					20	1.1%	177%	Yes
Sheephouse Wood Location 8	35.1	35.2	35.4	0.182	15	1.2%	236%	Yes
					20	0.91%	177%	No
Sheephouse Wood Location 9	35.1	35.2	35.4	0.199	15	1.3%	236%	Yes
					20	0.99%	177%	No
Finemere Wood Location 1	30.5	30.6	30.7	0.102	15	0.68%	205%	No
					20	0.51%	154%	No
Finemere Wood Location 2	30.5	30.6	30.7	0.108	15	0.72%	205%	No
					20	0.54%	154%	No
Finemere Wood Location 3	30.5	30.6	30.7	0.105	15	0.70%	205%	No
					20	0.52%	154%	No

Receptor	Nitrogen deposition rate (kg N/ha/year)							
	2016 baseline deposition	2017 without Proposed Scheme	2017 with Proposed Scheme	Change in deposition (kg N/ha/year)	Critical load range (kg N/ha/year)	Change in deposition as % of critical load	Total nitrogen deposition as a % of critical load	Potentially significant adverse
Finemere Wood Location 4	30.5	30.6	30.7	0.064	15	0.42%	204%	No
					20	0.32%	153%	No
Grendon and Doddershall Woods Location 1	35.1	35.2	35.2	0.0426	15	0.28%	235%	No
					20	0.21%	176%	No
Grendon and Doddershall Woods Location 2	35.1	35.2	35.2	0.048	15	0.32%	235%	No
					20	0.24%	176%	No
Grendon and Doddershall Woods Location 3	35.1	35.2	35.2	0.0428	15	0.29%	235%	No
					20	0.21%	176%	No
Grendon and Doddershall Woods Location 4	35.1	35.2	35.2	0.0338	15	0.23%	235%	No
					20	0.17%	176%	No
Grendon and Doddershall Woods Location 5	35.1	35.2	35.2	0.0088	15	0.06%	235%	No
					20	0.044%	176%	No

Table 15: Critical level assessment for NO_x for the protection of vegetation – operational case with mitigation

Receptor	NOx concentrations (µg/m³)							
	2016 baseline	2017 without Proposed Scheme	2017 with Proposed Scheme	Change in concentrations (µg/m³)	Critical level (annual mean)	Change in concentrations as % of critical level	Total NOx as a % of critical level	Potentially significant adverse
Sheephouse Wood Location 1	13.9	14.0	13.5	-0.44	30	-1.5%	45%	No
Sheephouse Wood Location 2	13.9	13.8	13.6	-0.29	30	-1.0%	45%	No
Sheephouse Wood Location 3	13.9	13.7	13.6	-0.19	30	-0.6%	45%	No
Sheephouse Wood Location 4	13.9	13.7	13.6	-0.2	30	-0.53%	45%	No
Sheephouse Wood Location 5	13.9	13.7	13.7	0.005	30	0.02%	46%	No
Sheephouse Wood Location 6	13.9	13.6	13.7	0.06	30	0.19%	46%	No
Sheephouse Wood Location 7	13.9	13.6	13.7	0.06	30	0.20%	46%	No
Sheephouse Wood Location 8	13.9	13.6	13.7	0.05	30	0.17%	46%	No
Sheephouse Wood Location 9	13.9	13.7	13.7	0.06	30	0.20%	46%	No
Finemere Wood Location 1	11.5	11.3	11.3	0.026	30	0.086%	38%	No
Finemere Wood Location 2	11.5	11.3	11.3	0.027	30	0.090%	38%	No
Finemere Wood Location 3	11.5	11.3	11.3	0.026	30	0.087%	38%	No
Finemere Wood Location 4	11.5	11.2	11.3	0.016	30	0.053%	38%	No

Receptor	NOx concentrations (µg/m³)							
	2016 baseline	2017 without Proposed Scheme	2017 with Proposed Scheme	Change in concentrations (µg/m³)	Critical level (annual mean)	Change in concentrations as % of critical level	Total NOx as a % of critical level	Potentially significant adverse
Grendon and Doddershall Woods Location 1	11.8	11.5	11.5	0.010	30	0.033%	38%	No
Grendon and Doddershall Woods Location 2	11.8	11.5	11.5	0.011	30	0.037%	38%	No
Grendon and Doddershall Woods Location 3	11.8	11.5	11.5	0.010	30	0.034%	38%	No
Grendon and Doddershall Woods Location 4	11.8	11.5	11.5	0.008	30	0.026%	38%	No
Grendon and Doddershall Woods Location 5	11.8	11.5	11.5	0.002	30	0.0064%	38%	No
Hewins Wood Location 1	11.6	11.3	11.3	0.021	30	0.069%	38%	No
Track leading to the Aylesbury Link railway line NLR 1	11.6	11.4	11.5	0.027	30	0.090%	38%	No
Track leading to the Aylesbury Link railway line NLR 2	11.6	11.6	11.6	0.023	30	0.078%	39%	No
Track leading to the Aylesbury Link railway line NLR 3	11.6	12.1	12.1	0.021	30	0.069%	40%	No
Track leading to the Aylesbury Link railway line NLR 4	11.6	11.4	11.4	0.018	30	0.060%	38%	No

Table 16: Critical load - nutrient nitrogen deposition – operational case with mitigation

Receptor	Nitrogen deposition rate (kg N/ha/year)							
	2016 baseline deposition	2017 without Proposed Scheme	2017 with Proposed Scheme	Change in deposition (kg N/ha/year)	Critical load range (kg N/ha/year)	Change in deposition as % of critical load	Total nitrogen deposition as a % of critical load	Potentially significant adverse
Sheephouse Wood Location 1	35.1	35.3	35.2	-0.1268	15	-0.85%	234%	No
					20	-0.63%	176%	No
Sheephouse Wood Location 2	35.1	35.3	35.2	-0.0842	15	-0.56%	235%	No
					20	-0.42%	176%	No
Sheephouse Wood Location 3	35.1	35.2	35.2	-0.0534	15	-0.36%	235%	No
					20	-0.27%	176%	No
Sheephouse Wood Location 4	35.1	35.2	35.2	-0.0458	15	-0.31%	235%	No
					20	-0.23%	176%	No
Sheephouse Wood Location 5	35.1	35.2	35.2	0.0014	15	0.0091%	235%	No
					20	0.0068%	176%	No
Sheephouse Wood Location 6	35.1	35.2	35.2	0.0164	15	0.11%	235%	No
					20	0.082%	176%	No

Receptor	Nitrogen deposition rate (kg N/ha/year)							
	2016 baseline deposition	2017 without Proposed Scheme	2017 with Proposed Scheme	Change in deposition (kg N/ha/year)	Critical load range (kg N/ha/year)	Change in deposition as % of critical load	Total nitrogen deposition as a % of critical load	Potentially significant adverse
Sheephouse Wood Location 7	35.1	35.2	35.2	0.0175	15	0.12%	235%	No
					20	0.088%	176%	No
Sheephouse Wood Location 8	35.1	35.2	35.2	0.0150	15	0.10%	235%	No
					20	0.075%	176%	No
Sheephouse Wood Location 9	35.1	35.2	35.2	0.0170	15	0.11%	235%	No
					20	0.085%	176%	No
Finemere Wood Location 1	30.5	30.6	30.6	0.007	15	0.050%	204%	No
					20	0.037%	153%	No
Finemere Wood Location 2	30.5	30.6	30.6	0.008	15	0.052%	204%	No
					20	0.039%	153%	No
Finemere Wood Location 3	30.5	30.6	30.6	0.008	15	0.050%	204%	No
					20	0.038%	153%	No

Receptor	Nitrogen deposition rate (kg N/ha/year)							
	2016 baseline deposition	2017 without Proposed Scheme	2017 with Proposed Scheme	Change in deposition (kg N/ha/year)	Critical load range (kg N/ha/year)	Change in deposition as % of critical load	Total nitrogen deposition as a % of critical load	Potentially significant adverse
Finemere Wood Location 4	30.5	30.6	30.6	0.005	15	0.030%	204%	No
					20	0.023%	153%	No
Grendon and Doddershall Woods Location 1	35.1	35.2	35.2	0.0029	15	0.019%	235%	No
					20	0.014%	176%	No
Grendon and Doddershall Woods Location 2	35.1	35.2	35.2	0.0032	15	0.021%	235%	No
					20	0.016%	176%	No
Grendon and Doddershall Woods Location 3	35.1	35.2	35.2	0.0029	15	0.019%	235%	No
					20	0.015%	176%	No
Grendon and Doddershall Woods Location 4	35.1	35.2	35.2	0.0023	15	0.015%	235%	No
					20	0.011%	176%	No
Grendon and Doddershall Woods Location 5	35.1	35.2	35.2	0.0006	15	0.004%	235%	No
					20	0.003%	176%	No

3.3.12 The assessment of the mitigated operational case show that the inclusion of mitigation will remove all potentially significant effects. This case will come to pass upon operation of the Proposed Scheme through the replacement of the existing vehicles, through the application of controls via a planning condition.

3.3.13 The impacts are illustrated in Figure 1 which shows the change in NOx between the future base case and the operational case and Figure 2 which shows the change in NOx between the future base case and the mitigated operational case.

Figure 1: Change in NOx between the future base case and the operational case

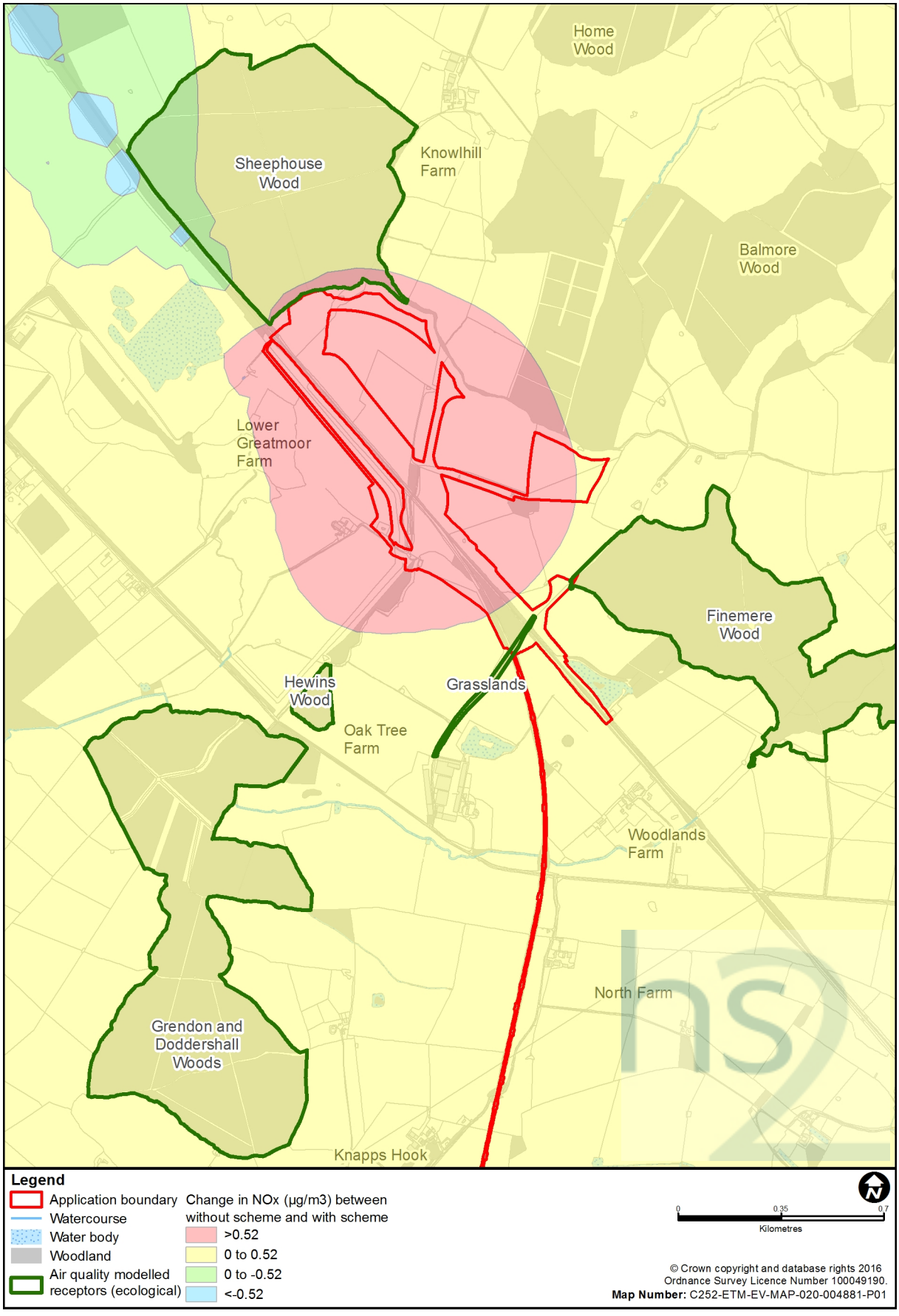
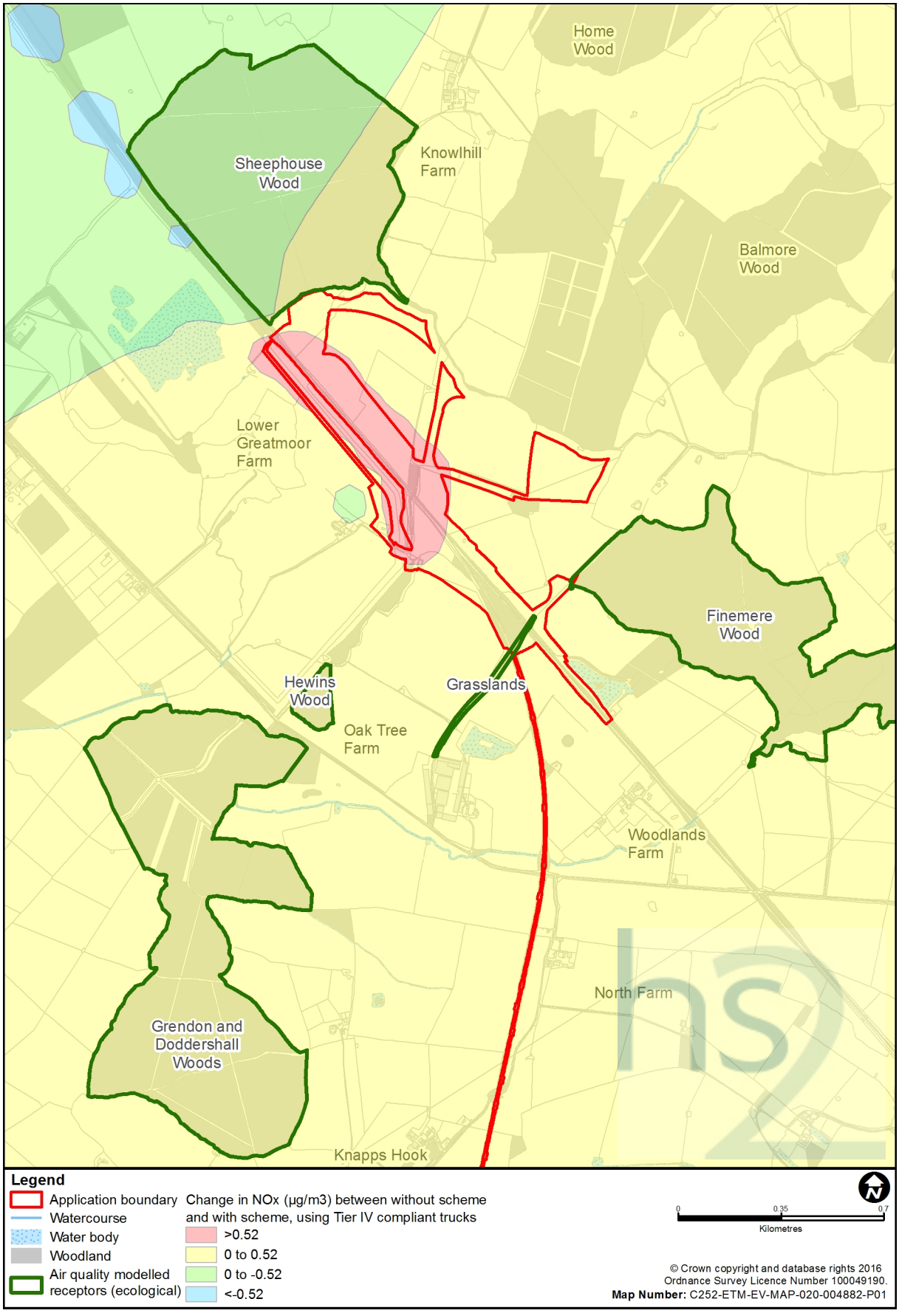


Figure 2: Change in NOx between the future base case and the mitigated operational case



4 References

- Highways Agency, 2007, Design Manual for Roads and Bridges (DMRB), Volume 11 Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 1 Air Quality, HA207/07, The Stationery Office.
- Institute of Air Quality Management (IAQM), 2014, Guidance on the Assessment of Dust from Demolition and Construction, IAQM.