Assessment of Air Quality Impacts on Habitat Sites in Newcastle-under-Lyme

Air Quality Assessment Report

Sweco UK Limited	Reg. No. 2888385
Project Name	Newcastle under Lyme Strategic Transport Assessment
Project Number	65212118
Client	Newcastle-under-Lyme Council
Author	Lee Shelton
Controlled by	Lee Shelton
Approved by	Jen Simpson
Date	2025-02-13
Document reference	Assessment of Air Quality Impacts on Habitat Sites in Newcastle-under-Lyme_P05.docx

Change list

Version	Date	Description of the change	Reviewed	Approved by
P01.04	06/02/2025	First issue to client	JS	JS
P05	13/02/2025	Final Issue to client	JS	JS

Table of contents

1 Introduction

Sweco UK Ltd was commissioned by Newcastle-under-Lyme Council (NULC) to undertake a detailed air pollutant dispersion modelling study to inform the Regulation 19 Habitats Regulations Assessment of the Draft Local Plan 2020-2040.

A pre-submission Habitats Regulations Assessment[1] (HRA) was provided for consultee comments in July 2024 and Natural England (NE) responded with a letter[2] dated 4 October 2024 stating that:

"*Natural England advises that the plan is currently at risk of being unsound and/or not legally compliant due to the potential impacts on air quality in relation to internationally designated nature conservation sites*…"

The letter from NE highlights the allocations totalling approximately 8,000 dwellings and 63 ha of employment sites and increased congestion at Junction 16 of the M6 motorway. The letter further states that cumulative effects cannot be ruled out at internationally designated sites.

1.1 Purpose of this Assessment

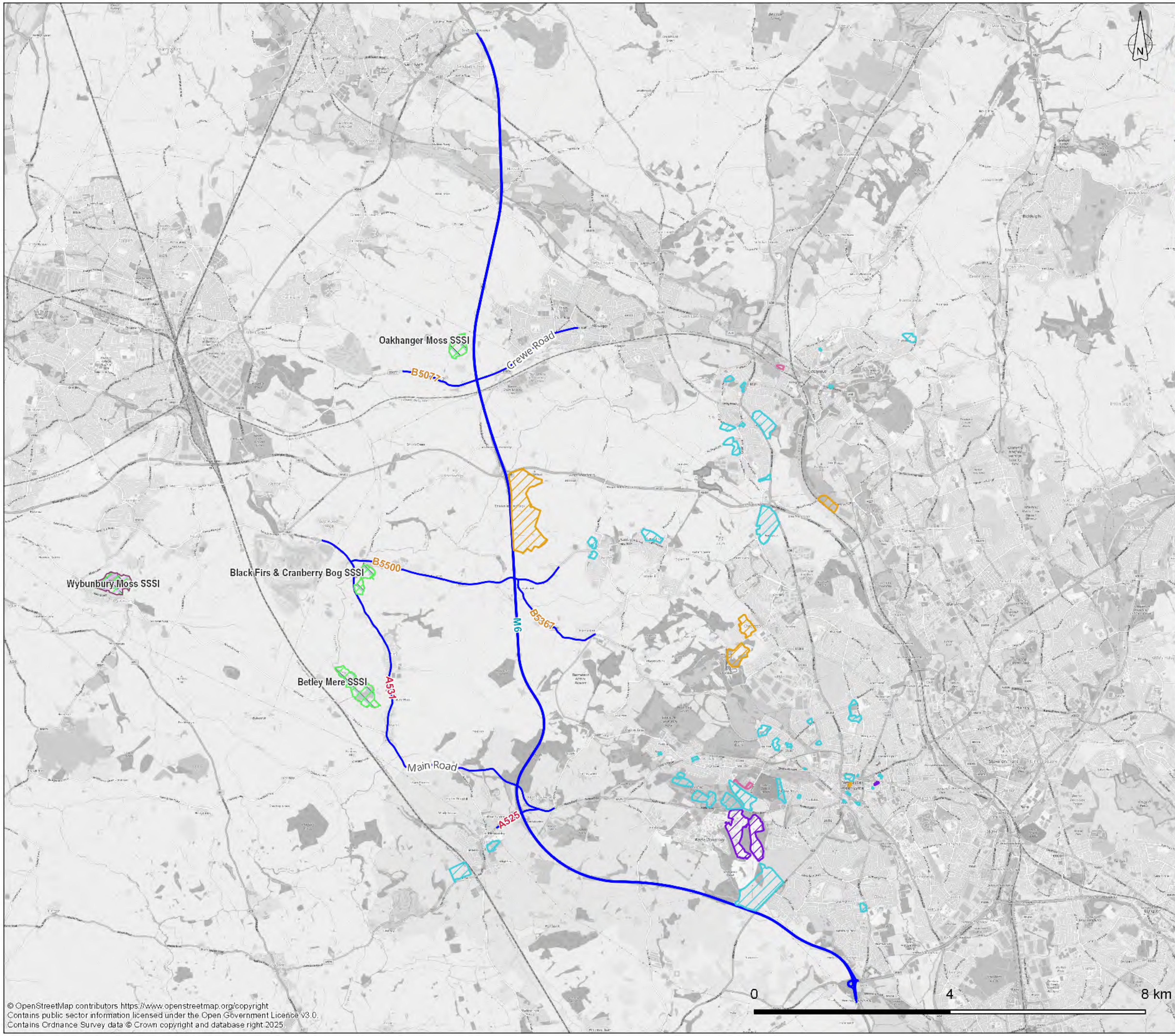
This study has been commissioned to quantify the concentrations of key air pollutants and the rates of nutrient deposition at key European Sites identified in the pre-submission HRA and in the NE letter. The study will examine the 'in-combination' effects on air quality and rates of deposition. The in-combination effects are based on the contribution to changes in traffic emissions from NULC's draft local plan added to the contributions to changes in traffic emissions from the local plans of neighbouring and nearby authorities.

The designated nature conservation sites that form the focus of this assessment were identified in the pre-submission HRA[1] determined through the screening and assessment process undertaken by Lepus Consulting and the consultation response letter from NE[2] that was specific in the requirement for further assessment. The European designated nature conservation sites included in this assessment are:

- Midland Meres and Mosses Phase 2 Ramsar – Black Firs and Cranberry Bog SSSI
- Midland Meres and Mosses Phase 2 Ramsar – Oakhanger Moss SSSI.

The European Site locations are presented in Figure 1 together with the NULC draft local plan allocations.

[1] Lepus Consulting (2024) *Newcastle-under-Lyme Publication Draft Local Plan 2020-2040 Regulation 19: Habitats Regulations Assessment*
[2] Natural England (2024) Letter addressed to 'Allan Clarke' via email, *Newcastle-under-Lyme Borough Council Regulation 19 pre-submission draft Plan*, Natural England Reference: 486256. This letter can also be found in **Appendix D**.



Legend

Modelled Road Network

Regulation 19 Local Plan Allocations

- Employment
- Gypsy+ Traveller
- Housing
- Mixed Use

Designated Nature Conservation Sites

- Wetland of International Importance (Ramsar)
- Special Area of Conservation (SAC)
- Site of Special Scientific Interest (SSSI)

Rev	Date	Amendment Details	Dr'n	Chk'	App'
Rev	13.02.2025	FIRST ISSUE	ABC	ABC	ABC

Sweco UK Limited
2nd Floor Quay 2, 139 Fountainbridge
Edinburgh, EH3 9QG
Tel: +44 (0)131 550 6300
www.sweco.co.uk

SWECO

Client

NEWCASTLE UNDER LYME BOROUGH COUNCIL

Project Title

Assessment of Air Quality Impacts on Habitat Sites in Newcastle-under-Lyme

Drawing Title

Figure 1
Location of European sites included in the Air Quality Assessment to inform the HRA

Project Stage: n/a

Status	Status Description
n/a	n/a

Drawn	Designed	Checked	Approved
LFS	LFS	JS	JS

Sheet Size	Scale	Sweco Ref	Revision
A3	1:75,000	65212118	P05

Drawing Number 65212118-SWE-XX-XX-D-AQ-0001

2 Legislation and Policy

This section provides a summary of relevant legislation and planning policies applicable to this assessment.

2.1 Legislation

The Conservation of Habitats and Species Regulations 2017 (as amended)

The *Conservation of Habitats and Species Regulations 2017* (as amended) ('Habitats Regulations'); Regulation 63 (1) states that:

'*A competent authority, before deciding to undertake, or give any consent, permission or other authorisation for, a plan or project which –*

(a) is likely to have a significant effect on a European site or a European offshore marine site (either alone or in-combination with other plans or projects), and

(b) is not directly connected with or necessary to the management of that site,

– must make an Appropriate Assessment of the implications for that site in view of that site's conservation objective.'

The Habitats Regulations also make allowance for projects or plans to be completed if they satisfy '*imperative reasons of overriding public interest (IROPI)*'. Regulations 64 and 68 apply in this regard.

National Air Quality Legislation

The *Air Quality Standards Regulations 2010* transposed the requirements of *Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe* into UK law. Upon the UK exit from the European Union the standards within these regulations were retained through *The Air Quality (Amendment of Domestic Regulations) (EU Exit) Regulations 2019* and *The Environment (Legislative Functions from Directives) (EU Exit) Regulations 2019*.

The UK *Air quality strategy: framework for local authority delivery* was published in 2023 as an update to the previous 2007 *Air Quality Strategy for England, Scotland Wales and Northern Ireland*. The 2023 strategy included the legislative limits and statutory objectives for the concentrations of pollutants in ambient air that were retained within the *Air Quality Standards Regulations 2010*. The strategy outlines the risks posed by oxides of nitrogen (NO_X) through their relationship with the deposition of reactive nitrogen to areas with sensitive biodiversity, and also the risks posed by ammonia (NH_3). Ammonia can react particularly with water in air and soils to form ammonium (NH4) and ammonium salts altering nutrient levels in soils and also having a direct toxic effect at higher concentrations. Ammonia also acts as a precursor to the formation of particulate matter enabling NH_3 to be transported significant distances in this form. Both NO_X and NH_3 contain nitrogen and so affect habitats through the deposition of nutrient nitrogen and through changes to the pH of soils as a result of changes to the availability of hydroxide ions. The strategy states that poor air quality is a key contributor to the decline of biodiversity in the UK and details the Critical Level (CLe) for NO_X.

Critical Levels for NH_3 are not stated within the strategy however the current levels were established in 2007 at a meeting of the UNECE Convention on Long-range Transboundary Air Pollution as detailed in the German Environment Agency *Manual on Methodologies and Criteria for Modelling and Mapping Critical Loads and Levels and Air Pollution Effects, Risks,* *and Trends*, reported in Cape *et al.*[3] and recorded on the UK Air Pollution Information system (APIS) website as the accepted criteria for assessment.

The applicable critical levels are shown in Table 1.

Table 1 Annual Mean NO_X and NH_3 Critical Levels Applicable to this Assessment

Pollutant	Critical Level	Measured as	Applicable to
Oxides of Nitrogen (NO_X)	30 µg/m³	Annual Mean	Protection of vegetation and ecosystems
Ammonia (NH_3)	3 µg/m³	Annual Mean	Higher plants
Ammonia (NH_3)	1 µg/m³	Annual Mean	Lower plants (lichens & bryophytes)

2.2 National Planning Policy Context

The current version of the National Planning Policy Framework[4] (NPPF) retains the presumption in favour of sustainable development. Plans should meet the growth and infrastructure requirements of the local area whilst improving the environment and mitigating against or adapting to the effects of climate change. The plan should form the starting point for discussions around decision making on planning and local development.

Plans should conserve and enhance the natural environment and the NPPF sets a hierarchy for allocations. Land with the least environment or amenity value should be allocated primarily, taking account of other policies within the NPPF and should be designed so as to maintain and enhance networks of habitats.

New and existing development should not contribute to adverse air pollution and should help to improve environmental conditions. The NPPF states that developments should minimise impacts on and provide net gains for biodiversity.

A specific section on habitats and biodiversity states that plans should identify, map and safeguard local sites rich in biodiversity and ecological network and that they should contribute towards conservation, restoration and enhancement of priority habitats.

Importantly, the presumption in favour of sustainable development does not apply where significant effects are predicted on a designated nature conservation site (alone or in-combination with other plans) unless an appropriate assessment can demonstrate that there will be no adverse impacts.

2.3 The Wealden Judgement

The Wealden Judgement[5], handed down in March 2017, introduced additional complexities into the HRA process in relation to in-combination and cumulative effects.

Prior to this Judgement, it was deemed that air quality impacts on European sites need only be considered alongside roads where the traffic growth associated with the individual Plan or

[3] Cape JN, van der Eerden LJ, Sheppard LJ, Leith ID and Sutton MA (2009) Evidence for changing the Critical Level for ammonia. Environmental Pollution, 157 (3), 1033-1037

[4] Ministry of Housing, Communities & Local government (2024) National Planning Policy Framework, December 2024. [Online] https://assets.publishing.service.gov.uk/media/675abd214cbda57cacd3476e/NPPF-December-2024.pdf, accessed January 2025

[5] Wealden District Council v. Secretary of State for Communities and Local Government, Lewes District Council, South Downs National Park Authority (2017) High Court of Justice, Case CO/3943/2016. [Online] https://caselaw.nationalarchives.gov.uk/ewhc/admin/2017/351?query=wealden+district+council&from_date=2017-01-01&to_date=2017-12-31

Project being assessed exceeded specified screening criteria. These criteria were typically based on changes in vehicle movements and taken from the Design Manual for Roads and Bridges (DMRB, LA105)[6], equating to:

- Increases of over 1,000 domestic vehicles per day or 200 Heavy Goods Vehicles per day (as Annual Average Daily Traffic (AADT)).

The Wealden Judgement found that the application of the criteria to the traffic growth associated with a single Local Plan was unsound on the basis that two Local Plans collectively contributing more than 1,000 domestic AADT could lead to a potentially significant effect. The Judge determined that further assessment of air quality impacts on European sites should have been carried out and quashed part of the Local Plan that would have led to an in-combination exceedance of 1,000 domestic AADT.

The challenges this poses for local authorities and assessors are:

- Uncertainty in the use of screening criteria – there is no widely accepted approach to the use of screening criteria. Indeed, whilst the 1,000 AADT criteria from the DMRB is widely used, other screening criteria from the Joint Nature Conservation Committee[7] based on discussions with ecologists and dispersion modelling of a 1% change in CLe and CLo do exist. The JNCC criteria are not necessarily intended for strategic local plans as a bespoke in-combination assessment is always expected to be required, however should be considered at the point where individual planning applications for allocations are submitted where impacts on a European Site are possible.
- Lack of a clear '*de minimus*' – there is case law that supports the use of *de minimus* thresholds in the assessment of potential impacts on European sites, i.e. where no 'appreciable effect' may occur[8] as the result of a Plan or Project. Some practitioners have argued that Wealden suggests there is no *de minimus* threshold for increases in traffic emissions, and a development leading to an increase of even one vehicle per day should be prohibited or subject to further assessment for in-combination traffic growth, whilst others have argued that the Wealden Judgement applies to the use of traffic thresholds alone.
- Difficulties devising and delivering local planning policy – where predicted Local Plan growth will result in increased vehicle emissions, it is more challenging to coordinate the appropriate scope of traffic modelling, air quality modelling and HRA work required in support.
- Difficulties assessing individual planning applications – how do Local Authorities determine planning applications that will increase vehicle movements in proximity to European sites whilst tracking cumulative growth.

[6] National Highways (2024) *Design Manual for Roads and Bridges LA105 Air Quality v0.1.0*

[7] Joint Nature Conservation Committee (2021) JNCC Report No. 696 Technical Report: Decision-making Thresholds for Air Pollution

[8] Sweetman v. An Bord Pleanála, Case C-258/11, CJEU judgment 11 April 2013

3 Scope and Methodology

This section provides details on the information used to inform the assessment and the specific methods used to undertake the assessment. It describes how the 'in-combination' effects of the local plan have been accounted for.

3.1 Key Data and Resources

Key data, guidance and resources relevant to the air quality assessment are described in **Table 2**.

Table 2: Key Data and Resources for the Air Quality Assessment

Data/Information	Description	Source
European Site Boundaries	Perimeter boundaries of the relevant European Sites included in the assessment in the form of GIS shapefiles	Natural England Geoportal
Baseline and future year traffic flow data for all modelled scenarios	Traffic flow data provided in both tabular and GIS shapefile format to allow emission calculations to be undertaken	Sweco UK Ltd Transport Consultants
Local air quality monitoring data	Air quality monitoring data referenced to the base year of the traffic data provided (2018) used to calibrate the air pollutant dispersion model	Newcastle-under-Lyme Borough Council and Cheshire East Council
Defra national background pollutant climate mapping data (2018 base year) (NO_2 and NO_X)	Background air quality datasets used to quantify total predicted pollutant outputs from the air pollutant dispersion model	Defra
Background NH_3 concentrations and rates of nitrogen deposition	Background air quality datasets used to quantify total predicted pollutant outputs from the air pollutant dispersion model	APIS
Critical Levels and Critical Loads applicable to the relevant European Sites	Site and habitat specific CLe and CLo values applicable to the relevant European sites. These form the criteria for the basis of the air quality assessment	Lepus and APIS
Defra Emission Factor Toolkit (EFT) v12	Vehicle emission factor calculator based on vehicle type, fleet composition, traffic flow and traffic speed. To be used to create inputs to the air pollutant dispersion model	Defra
National Atmospheric Emission Inventory	UK Fleet Composition Projections (Base 2022/2020 NAEI). For the UK outside London.	National Atmospheric Emission Inventory (NAEI)
Defra Local Air Quality Management (LAQM) Tools	A suite of tools published and updated regularly by Defra for the conversion of air pollutant dispersion model NO_X outputs to NO_2 outputs, and removal of specific NO_X components from the background pollutant datasets to prevent double-counting of emissions	Defra
National Highways NH_3 Emissions from Vehicles tool v4	A database of conversion factors to convert air pollutant dispersion model NO_X outputs to NH_3 outputs based on vehicle type, road type and vegetation type	National Highways

Data/Information	Description	Source
Atmospheric Dispersion Modelling System for Roads v5.0.1 (ADMS-Roads)	Steady-state gaussian plume dispersion model capable of predicting pollutant dispersion from the assessed road network and calculating pollutant concentrations at receptors	Cambridge Environmental Research Consultants (CERC)
Hourly sequential meteorological data	Data representative of the study area for the year 2018 (to align with the baseline traffic flows and air quality monitoring data) used for both model calibration and predictions of pollutant dispersal	ADM Ltd
Ordnance Survey Mastermap Topography	Detailed mapping data at 1:1,250 scale used to accurately locate roads within the pollutant dispersion model	Newcastle-under-Lyme Borough Council
Terrain data	Light Detection And Ranging (LiDAR) datasets for terrain and surface used to screen gradients within the dispersion modelling domain	Environment Agency
Institute of Air Quality Management (IAQM)	A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites	Institute of Air Quality Management
Natural England (NE)	Natural England’s Approach to Advising Competent Authorities on the Assessment of Road Traffic Emissions under the Habitat Regulations	Natural England
Defra and the Devolved Authorities	Local Air Quality Management Technical Guidance TG (22)	Defra and the Devolved Authorities
Air Quality Consultants	Ammonia Emissions from Roads for Assessing Impacts on Nitrogen-sensitive Habitats	Air Quality Consultants
Umwelt Bundesamt (German Environment Agency)	Text 109/2023 Manual on Methodologies and Criteria for Modelling and Mapping Critical Loads and Levels and Air Pollution Effects, Risks and Trends	German Environment Agency
Joint Nature Conservation Committee	JNCC Report No. 665 Nitrogen Futures	Joint Nature Conservation Committee
Air Quality Technical Advisory Group	AQTAG06 Technical guidance on detailed modelling approach for an appropriate assessment for emissions to air	Environment Agency
Air Quality Technical Advisory Group	AQTAG21 ‘Likely significant effect’ – use of 1% and 4% long-term thresholds and 10% short-term threshold	Environment Agency
National Highways	Design Manual for Roads and Bridges Sustainability & Environment Appraisal LA 105 Air Quality	National Highways

3.2 Assessment Methodology

3.2.1 Study Area

The study area for the assessment was determined through the identification of key road links within 200 m of the relevant European Sites listed in Section 1.1 and identified in the pre-submission HRA. The road links relevant to the European Sites are shown in Table 3.

Table 3 Roads within 200 m of European Sites

European Site	Road Type	Road Name
Midland Meres and Mosses Phase 2 Ramsar – Black Firs and Cranberry Bog SSSI	A	A531 Main Road
	B	B5500 Four Lanes End
Midland Meres and Mosses Phase 2 Ramsar – Oakhanger Moss SSSI	M	M6 Motorway

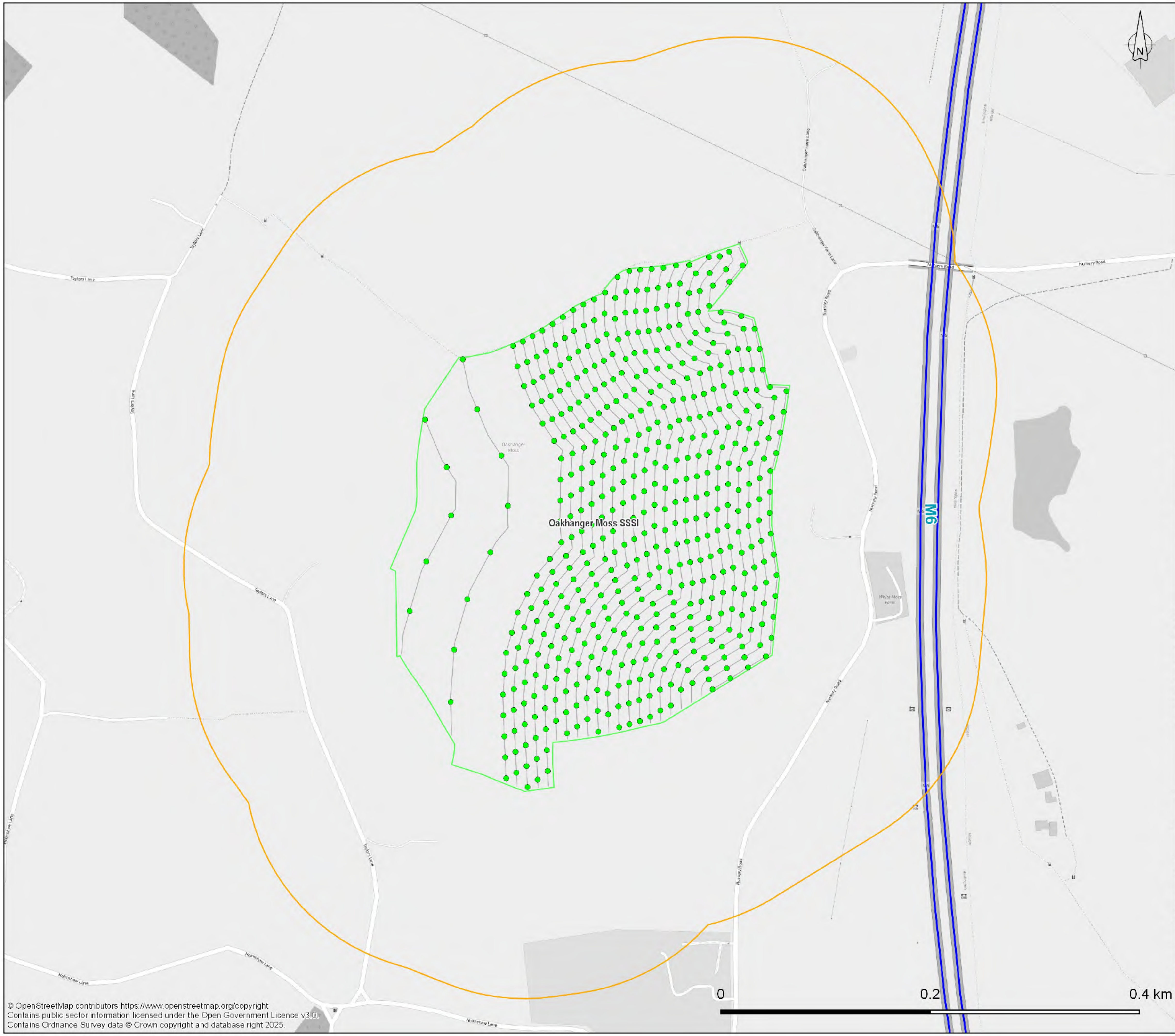
Additional links were included within the pollutant dispersion model for the purpose of model calibration.

3.2.1.1 Receptor Selection

Receptors were added starting with the site boundary where it was within 200 m of the nearest modelled road, following the guidance in LA 105, at intervals of 20 m along the boundary. From the boundary, concentric bands of receptors at 10 m intervals were modelled with an interval of 20 m along each band, up to 200 m from the site boundary. This approach allows the reporting of concentrations at 10 m intervals in the manner described in the NE guidance, whilst also providing zonal coverage of the site and allowing comprehensive identification of the worst-case affected locations within the site.

In the case of both sites, additional receptors were added beyond 200 m and up to 1km from the site boundary in 50 m bands in order to facilitate the creation of concentration or deposition rate isopleths.

The modelled receptors within each European Site are shown in Figure 2.



Legend

- Modelled Road Network
- Modelled Receptor Locations
- Receptor Placement Guides
- European Site Boundary
- European Site 200m Buffer

Rev	13.02.2025	FIRST ISSUE	ABC	ABC	ABC
Rev	Date	Amendment Details	Dr'n	Chk'	App'

Sweco UK Limited
2nd Floor Quay 2, 139 Fountainbridge
Edinburgh, EH3 9QG
Tel: +44 (0)131 550 6300
www.sweco.co.uk

SWECO

Client

NEWCASTLE UNDER LYME
BOROUGH COUNCIL

Project Title

Assessment of Air Quality Impacts on Habitat Sites in Newcastle-under-Lyme

Drawing Title

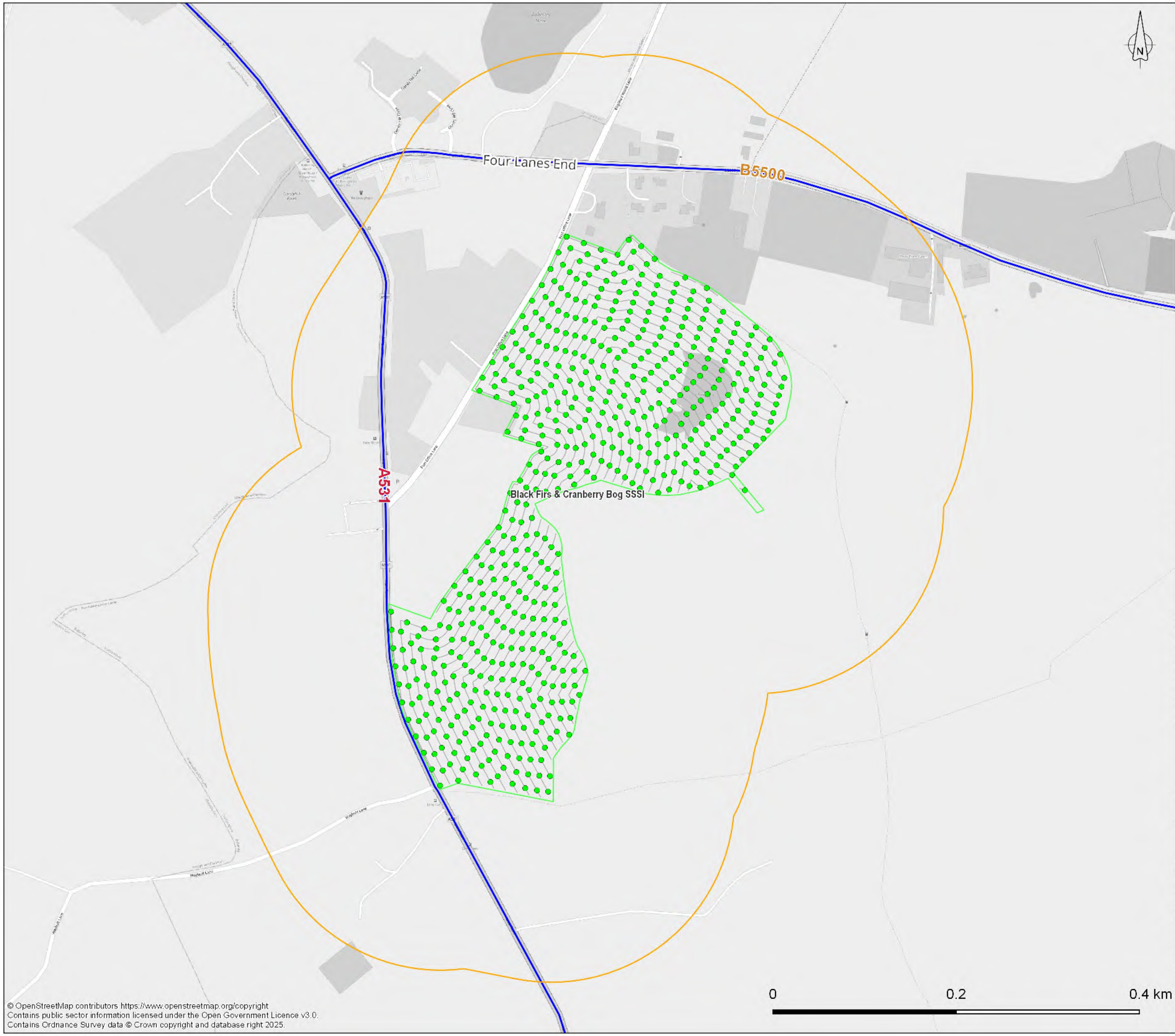
Figure 2
Receptor Locations and Roads within 200m at European Sites

Project Stage
n/a

Status	Status Description
n/a	n/a

Drawn	Designed	Checked	Approved
LFS	LFS	JS	JS
Sheet Size	**Scale**	**Sweco Ref**	**Revision**
A3	1:3,500	65212118	P05

Drawing Number 65212118-SWE-XX-XX-D-AQ-0002



Legend

- Modelled Road Network
- Modelled Receptor Locations
- Receptor Placement Guides
- European Site Boundary
- European Site 200m Buffer

Rev	13.02.2025	FIRST ISSUE	ABC	ABC	ABC
Rev	Date	Amendment Details	Dr'n	Chk'	App'

Sweco UK Limited
2nd Floor Quay 2, 139 Fountainbridge
Edinburgh, EH3 9QG
Tel: +44 (0)131 550 6300
www.sweco.co.uk

SWECO

Client

NEWCASTLE UNDER LYME
BOROUGH COUNCIL

Project Title

Assessment of Air Quality Impacts on Habitat Sites in Newcastle-under-Lyme

Drawing Title

Figure 2
Receptor Locations and Roads within 200m at European Sites

Project Stage
n/a

Status	Status Description
n/a	n/a

Drawn	Designed	Checked	Approved
LFS	LFS	JS	JS
Sheet Size	**Scale**	**Sweco Ref**	**Revision**
A3	1:4,000	65212118	P05

Drawing Number 65212118-SWE-XX-XX-D-AQ-0003

3.2.2 Dispersion Modelling

This section lists the key criteria for the pollutant dispersion model inputs. Further detail on the inputs can be found in **Appendix B**.

3.2.2.1 Model Scenarios

The following modelling scenarios were examined using the dispersion modelling software for the purpose of model calibration and to quantify the in-combination impacts of the local plan.

- **2018 Baseline**
  Traffic flows were provided for the 2015 base year of the strategic transport model for Newcastle-under-Lyme. Traffic flows additional to those required for the local plan dispersion modelling were incorporated into this dataset to facilitate model calibration against monitoring undertaken by NULC and Cheshire East Council.
  The Sweco Transport Consultants and NULC determined that no significant growth occurred between 2015 and 2018 therefore the 2015 flows are considered to be applicable for 2018.
- **2040 Alternative Future Baseline**
  This scenario used the 2018 base year flows together with emission factors for the future year. This scenario conservatively assumes no growth in traffic between the base year and future year whilst accounting for improvements in vehicle NO_X emissions and changes in fleet composition.
  This scenario aligns with paragraph 5.4.1.10 of the IAQM guidance[9] with respect to facilitating the calculation of in-combination impacts.
- **2040 Reference**
  This scenario uses future year flows, vehicle emissions and fleet composition and includes all future year growth for allocations and plans for neighbouring authorities, but explicitly *excludes* the NULC local plan and Stoke-on-Trent local plan.
  Any growth from neighbouring local authorities where local plan data was not explicitly available was incorporated through the use of TEMPro growth factors.
- **2040 With Local Plan**
  This scenario uses future year flows, vehicle emissions and fleet composition and includes all future year growth for the NULC and Stoke-on-Trent local plans, and allocations along neighbouring authority growth from local plans and allocations.
  Any growth from neighbouring local authorities where local plan data was not explicitly available was incorporated through the use of TEMPro growth factors.

Traffic data were provided as directional 24-hour AADT flows with additional data for flows of cars, light goods vehicles (<3.5 t), heavy goods vehicles (>3.5 t) and buses. Average road link speeds were provided in kilometres per hour (kph). Further detail on the origin of the traffic data can be found in Appendix E.

The requirement to assess the impacts from the NULC local plan in-combination was met through the comparison of the **2040 With Local Plan** scenario with the **2040 Alternative Future Baseline** scenario. The difference in traffic flows between these two scenarios was used for the purpose of screening links for potential impact against the 1,000 AADT criteria from the DMRB referred to in the NE guidance. The total flows from each of the two scenarios was used in the dispersion models.

To determine the impact of the NULC and Stoke-on-Trent local plans in isolation a comparison of the **2040 With Local Plan** scenario with the **2040 Reference** scenario was

[9] Institute of Air Quality Management (2020) A guide to the assessment of air quality impacts on designated nature conservation sites – version 1.1, Institute of Air Quality Management, London.

undertaken. The difference between these scenarios was used to determine the contribution of the local plan in isolation to the total contribution predicted using the in-combination methodology.

3.2.2.2 Vehicle Emission Inventories

The traffic data referred to in the scenarios listed above was used to produce emission inventories. The traffic data provided was disaggregated using the NAEI UK fleet composition projections so that the Detailed Option 4 could be used within the Defra EFT v12.0 The EFT v12.0 was used due to the year of the 2018 Baseline scenario as the reference year for the EFT v12.0. Later versions of the EFT used later reference years and therefore were not applicable for this investigation.

The latest year of 2030 within the EFT v12.0 was used to represent the 2040 future year scenarios. This is considered to be conservative as the EFT v12.0 does not account for permanent changes in travel habits that have been recorded following the Covid-19 lockdowns or the future bans on the sales of new internal combustion engine vehicles from 2030 and hybrid internal combustion engine vehicles from 2035.

The emissions inventories accounted for the traffic flow characteristics, including:

- Road type (e.g. urban, rural, motorway)
- Total vehicle flow by link (AADT)
- Percentage of HDVs per link
- Average link speed (km/h)

A detailed vehicle fleet breakdown derived for the future year (2042) scenarios using national vehicle fleet projections from a base year of 2022. The output for each link provided pollutant emissions in grams per kilometre per second (g/km/s) for input into the dispersion modelling software.

3.2.2.3 Meteorological Data

The five nearest meteorological stations are shown in Table 4.

Table 4 Nearest Meteorological Monitoring Locations

Station	Approx. distance from study area (km)	Percentage missing data for 2018
Leek Thorncliffe	28	13.9
Shawbury	34	2.4
Manchester	35	2.3
Rostherne No. 2	35	14.8
Hawarden	43	7.0

It was determined that no one station was representative of the study area and the European Sites, therefore modelled meteorological data using Numerical Weather Prediction (NWP) methods were used. This data was provided with a 4 km x 4 km resolution. Numerical Weather Prediction is an established and accepted method of prediction and forecast for meteorological patterns and the particular data source used is validated against observations. Data were provided for a location 53.05°N 2.38°W within the Black Firs and Cranberry Moss SSSI. An annual wind rose for the NWP data at Black Firs and Cranberry Moss SSSI is presented in **Appendix B**.

3.2.2.4 Terrain

Terrain data for the area were downloaded from the Defra LiDAR Open Data portal in the form of a 2 m resolution digital terrain model. Gradients in excess of 10% are described in LAQM.TG(22)[10] as having a potential effect on pollutant dispersion. No gradients in excess of 10% were identified in the study area therefore terrain was not applied to the dispersion model.

3.2.2.5 Background Pollutant Concentrations and Rates of Deposition

NOx and NO_2

Background pollutant concentrations of NO_X and NO_2 for 2018 and 2030 (2030 as a proxy for 2040) from a base year of 2018 were obtained from the Defra-Air background air quality archive at a 1 km x 1km resolution for the study area.

In order to be applicable to the model outputs in-square contributions for the roads being modelled was removed from the relevant NO_X and NO_2 background concentrations using the Defra NO_2 Adjustment for NO_X Sector Removal Tool v8.

Ammonia (NH_3)

Background pollutant concentrations for NH_3 and rates of nutrient nitrogen deposition for tall and short vegetation were obtained from APIS at a 1 km x 1km resolution for the study area. The data from APIS are provided as a 3-year average. The dataset used provides the 3-year average between 2020 and 2022 inclusive.

The background data from APIS was adjusted to 2030 (as a proxy for 2040) based on projections made in the JNCC Report NO. 696 Nitrogen Futures. Nationally, concentrations of NH_3 are predicted to increase by 0.08% per annum between 2017 and 2030. Rates of nutrient nitrogen deposition are projected to decrease by 1.04% per annum over the same period. These percentages are derived from the ‘Business As Usual’ scenario in the Nitrogen Futures report that assumes the targets required by the National Emissions Ceiling Regulations are not met. Without further spatial or temporal detail within the Nitrogen Futures figures these percentages were applied to the APIS data in a linear fashion.

In order to present the results and produce meaningful isopleths bilinear interpolation was applied to the 1 km x 1 km background datasets to produce 1 m resolution datasets.

3.2.2.6 Model Verification

Dispersion model verification was undertaken according to the guidance provided in LAQM.TG(22). Modelled annual NO_X outputs were compared to the monitored annual NO_X concentrations derived from the monitored annual NO_2 concentrations. The NO_2 diffusion tube monitoring locations used within the analysis are shown in Table 5 and Figure 3. Details of the results of the verification study can be found in **Appendix B**.

Table 5 Model Verification NO_2 Diffusion Tubes

Tube	x	y	Local Authority	Nearest European Site	Comments
DT3	378116	345488	NULC	Black First & Cranberry Moss (5.5 km)	Located 2m vertically below adjacent M6 raised roadway
DT28	377994	350105	NULC	Black First & Cranberry Moss (2.9 km)	-

[10] Defra and the Devolved Authorities (2022) Local Air Quality Management Technical Guidance TG(22). [Online] https://laqm.defra.gov.uk/wp-content/uploads/2022/08/LAQM-TG22-August-22-v1.0.pdf

Tube	x	y	Local Authority	Nearest European Site	Comments
CE146	377367	360934	Cheshire East	Oakhanger Moss (5.6 km)	-
CE234	377071	354979	Cheshire East	Oakhanger Moss (117 m)	Scoped out due to noise barrier installation works and associated speed restrictions in place during 2018 that affected monitored values
CE245	379054	355400	Cheshire East	Oakhanger Moss (2.1 km)	Scoped out as urban street canyon conditions present are not considered representative of conditions at the European Sites

Legend

- Modelled Road Network
- Verification Tubes

Designated Nature Conservation Sites

- Wetland of International Importance (Ramsar)
- Special Area of Conservation (SAC)
- Site of Special Scientific Interest (SSSI)

Rev	Date	Amendment Details	Dr'n	Chk'	App'
Rev	13.02.2025	FIRST ISSUE	ABC	ABC	ABC

Sweco UK Limited
2nd Floor Quay 2, 139 Fountainbridge
Edinburgh, EH3 9QG
Tel: +44 (0)131 550 6300
www.sweco.co.uk

SWECO

Client

NEWCASTLE UNDER LYME BOROUGH COUNCIL

Project Title

Assessment of Air Quality Impacts on Habitat Sites in Newcastle-under-Lyme

Drawing Title

Figure 3
Air Quality Monitoring Locations Included in the Assessment

Project Stage			
n/a			
Status	Status Description		
n/a	n/a		
Drawn	Designed	Checked	Approved
LFS	LFS	JS	JS
Sheet Size	Scale	Sweco Ref	Revision
A3	1:75,000	65212118	P05

Drawing Number 65212118-SWE-XX-XX-D-AQ-0004

3.2.2.7 Processing Model Outputs

Annual Mean NO_X Concentrations

Verified and adjusted annual mean road-NO_X concentrations were modelled at each receptor within the respective European site. The corresponding annual mean interpolated background NO_X concentrations were added, dependent on the year and grid square location, to derive the total annual mean NO_X concentrations at each receptor.

Annual Mean NO2 Concentrations

The modelled road-NO_x concentrations were converted to road-NO_2 using the Defra NO_x-NO_2 calculator v8.1[11] with the aid of the NO2 background concentrations. The road-NO2 concentrations were used to derive the road component for nutrient nitrogen deposition as described below.

Annual Mean NH_3 Concentrations

Emission factors for NH_3 are currently not available through the Defra EFT v12 or other LAQM tools as NH_3 is not part of the LAQM framework, therefore post processing methods are used to obtain concentrations of NH_3.

National Highways published a spreadsheet based tool (v4 published January 2024) . This spreadsheet converts Road NOx concentrations to Ammonia concentrations based on conversion ratios[12] The ratio applied at each receptor is dependent of the assessment year, vehicle type (light or heavy) and the dominant road type (i.e. motorway, urban, rural).

Therefore, the spreadsheet tool was used to convert the verified and adjusted predicted NO_X concentrations for HDV and LDV. The resulting HDV and LDV road-NH_3 concentrations were summed with their respective background NH_3 concentrations.

Nutrient Nitrogen Deposition

Predicted rates of N deposition specific to the contribution from vehicle emissions were derived from modelled road-NO_2 and road-NH_3 concentrations in each modelling scenario, as detailed in Section 5.

The associated N deposition rate from the road-NO_2 concentration was derived by applying the following conversions[13], based on habitat type:

- Grassland and similar habitats; 1 $\mu g/m^3$ NO_2 = 0.14 kgN/ha/yr
- Forests and similar habitats; 1 $\mu g/m^3$ NO_2 = 0.29 kgN/ha/yr

The associated N deposition rate from the road-NH_3 concentration was derived by applying the following conversions[13], based on habitat type:

- Grassland and similar habitats; 1 $\mu g/m^3$ NH_3 = 5.19 kgN/ha/yr

---

[11] Defra (2020*) NO_x to NO_2 calculator v8.1* (available via: https://laqm.defra.gov.uk/air-quality/air-quality-assessment/nox-to-no2-calculator/; accessed May 2024)

[12] Another NH_3 vehicle emissions tool has been published by Air Quality Consultants (Calculator for Road Emissions of Ammonia (CREAM V1A), 2020). However, the data on which the National Highways tool (2024) is based supersedes the data used in CREAM. Furthermore, the National Highways tool has been independently peer reviewed and supported by IAQM. As such, this tool was selected for use in this assessment.

[13] Derived based on recommended dry deposition velocities as per Environment Agency's Air Quality Technical Advisory Group (AQTAG) document – AQTAG06 (March 2014) *Technical guidance on detailed modelling approach for an appropriate assessment for emissions to air*

- Forests and similar habitats; 1 µg/m³ NH_3 = 7.79 kgN/ha/yr

The modelled N deposition rates associated with both road-NH_3 and road-NO_2 were summed and added to the relevant background to derive a total deposition rate at each receptor.

3.2.2.8 Screening Criteria

The results of the pollutant dispersion modelling at each receptor location were compared to the assessment criteria. These assessment criteria are the worst-case critical level and lower critical loads for the European Sites being studied. The assessment criteria are summarised in Table 6.

Table 6 Assessment Criteria for European Sites

Pollutant	Black Firs and Cranberry Moss SSSI	Oakhanger Moss SSSI
NO_X	30 µg/m³	30 µg/m³
NH_3	1 µg/m³	1 µg/m³
Nutrient nitrogen deposition	Upper CLo (UCLo) 15 kgN/ha/yr	Upper CLo (UCLo) 25 kgN/ha/yr
	Lower CLo (LCLo) 5 kgN/ha/yr	Lower CLo (LCLo) 5 kgN/ha/yr

<u>Screening for Likely Significance</u>

The screening of the outputs from the pollution dispersion model highlights where a change of 1% against the worst-case CLe and LCLo occurs. Where there is a predicted change of 1% change occurs, the Biodiversity Expert, Lepus Consultancy have determined the potential for impact upon the relevant notified features of the European Sites.

The use of the 1% criteria for change is described in DMRB LA105, AQTAG21 and the IAQM Guidance[9] as a standard approach and a matter of professional judgement and is cited in the Wealden Judgement as the only source for the use of the 1% criteria in the NE guidance. It is therefore applied in this assessment as the minimum criteria for which impacts are referred for further assessment by a competent expert ecologist.

3.3 Assumptions and Limitations

The assessment has been carried out in line with the requirements for air quality assessment in the NE letter of 4 October 2024. As such the assessment has quantified predicted rates of nutrient nitrogen deposition and concentrations of NH_3 resulting from the changes in traffic emissions from the implementation of the NULC local plan.

There are inherent uncertainties in the monitoring and modelling undertaken:

- Reduced certainty in traffic flows on peripheral links within the strategic traffic model at European Site locations, however the traffic model has been tested and is accepted by National Highways as valid
- The local plan data provided does not include or take account of the potential for new point emissions sources that may affect local air quality. With the exception of very large point sources, traffic emission impacts at this scale are generally considered larger than those from point sources. Point source emissions are also controlled by environmental permits under The Environmental Permitting (England and Wales) Regulations in a way that traffic emissions are not.
- Reliance on national fleet composition instead of local fleet composition for the prediction of emissions. The use of national fleet composition is considered

appropriate in this instance as the modelling involves a substantial section of the M6 motorway and very few local roads.

- Use of EFT v12 and LAQM tools with a maximum emissions year of 2030. This provides a more conservative output when compared to the latest EFT v12.0
- Use of 2018-based background pollutant concentration datasets with a maximum year of 2030. This provides not only a conservative output but allows use of datasets commensurate with the year of the baseline traffic data provided
- Local NO_2 diffusion tubes used for the model calibration carry an inherent error that is only partially removed through the bias correction procedure, however this type of monitoring and the associated methodologies is accepted by UK local and national government as suitable for use when verifying air quality dispersion models
- Lack of site specific monitored meteorological data prevents the inclusion of local micro-climatic variations, however the monitoring stations listed in Table 4 are considered to be too remote from the dispersion modelling site to be adequately representative. The use of NWP data for a more representative location that has been validated against field observations provides an accepted alternative.
- Whilst the ADMS-Roads software has been validated for use in the UK it is impossible for models to perfectly replicate actual conditions. Therefore there is a small error attached to all model predictions. This can be substantially reduced, but not completely removed, through the model verification process that has been undertaken.
  Generally in air quality modelling predictions are made to one decimal place, however the nature of pollutants (eg. NH_3) and rates of deposition means that often predictions may be required to two or more decimal places as appropriate. Given the accuracy of air quality monitoring used to validate the model and uncertainty in predictions from the model at such small fractions of a microgram any predictions relying on a value to two or more decimal places should be treated with caution when applied to real life situations.

4 Baseline Conditions

4.1 Baseline Air Pollutant Monitoring

Baseline air quality monitoring data used for the model verification process are presented in Table 7.

Table 7 Air Quality Monitoring

Tube	x	y	Nearest European Site	2018	2019	2020	2021	2022	2023
DT3	378116	345488	Black First & Cranberry Moss (5.5 km)	24.8	27.3	18.4	18.3	19.4	Closed
DT28	377994	350105	Black First & Cranberry Moss (2.9 km)	25.2	25.9	18.1	21.3	19.3	Closed
CE146	377367	360934	Oakhanger Moss (5.6 km)	23.0	24.1	Closed	-	-	-

Whilst these air quality monitoring sites are remote from the European Sites, they are close to the M6 motorway which carries far more traffic than other local roads. The M6 is 130 m from Oakhanger Moss SSSI and approximately 2.8 km from Black Firs and Cranberry Moss SSSI. Due to these measured concentrations and the distance of the sites from the M6 motorway, there can be confidence that NO_X concentrations at the European sites will be below the CLe of 30 µg/m³ based on the relationship between NO_2 and NO_X.

Site data from the Defra background maps and the APIS datasets regarding concentrations and rates of deposition across the European Sites are described in the following section.

4.2 Background Air Quality Concentrations and Deposition Rates and Benchmarks

Background concentrations of air pollutant concentrations and rates of nutrient nitrogen are presented as a range of values across the European Sites for the baseline year and future year in Table 8.

NO_X

Future year background concentrations of NO_X across each of the European Sites are substantially below the limit value for the protection of vegetation shown in Table 1. This is backed up by monitoring data adjacent to the M6 Motorway where measured concentrations of NO_2 indicate that NO_X concentrations will be below the limit value at monitoring sites close to the M6 motorway.

NH_3

Background concentrations of NH_3 for the future year at both European Sites are above the limit for the protection of higher plants of 3 µg/m³ detailed in Table 1. The information obtained using the APIS mapping tool indicates that lichens and bryophytes may be present at both sites therefore the lower limit of 1 µg/m³ is highly like to apply and has been used in this assessment.

Nutrient Nitrogen Deposition

Future year background rates of deposition for tall vegetation are in excess of both the LCLo and the UCLo for both European Sites. Both sites are known to contain areas of shrubs and trees.

With respect to the values for short vegetation, background rates of deposition in the future year are above the LCLo for both sites and the UCLo for Black Firs and Cranberry Moss SSSI, however are up to 92% of the UCLo at Oakhanger Moss.

Environmental Benchmarks

Environmental benchmarks for the European Sites have been obtained from the APIS datasets for each site and confirmed with the pre-submission HRA[1]. These are described in Table 9.

Table 8 Background Pollutant Concentrations and Rates of Deposition for European Sites

European Site / Land Parcel	NO_X Annual Mean Background (µg/m^3)**		NH_3 Annual Mean Background (µg/m^3)^		N Deposition Background tall vegetation (kgN/ha/yr)^		N Deposition Background short vegetation (kgN/ha/yr)^	
	2018	**2040**	**2018**	**2040**	**2018**	**2040**	**2018**	**2040**
Black Firs and Cranberry Moss SSSI*	9.3 – 9.8	6.5 – 6.8	3.36 – 3.67	3.39 – 3.69	45.24 – 45.96	40.99 – 41.64	24.96 – 25.34	22.62 – 22.96
Oakhanger Moss SSSI*	13.0 – 13.7	8.5 – 9.1	3.21 – 3.26	3.23 – 3.29	43.86 – 44.19	39.74 – 40.03	24.19 – 24.35	21.92 – 22.06

Notes:

* Land parcels within Midlands Meres & Mosses Phase 2 Ramsar Site.

** Obtained from Defra background maps. Latest projected year is 2030 (used as proxy for 2040 backgrounds in this assessment).

^ APIS three year average (2020-2022) adopted for 2018 Baseline. Backgrounds for future year (2030 as a proxy for 2040) scenarios were adjusted with reference to JNCC's Nitrogen Futures report (2020) based on the 'business as usual' scenario**Error! Bookmark not defined.**.

Table 9 Environmental Benchmarks and Qualifying Features at European Sites

European Site / Land Parcel	Qualifying Habitats	NH_3 Annual Mean Critical Level ($\mu g/m^3$)	N Deposition Critical Load Range** (kgN/ha/yr)	Acid (N) Deposition Critical Load (keq/ha/yr)	Vegetation Type†
Black Firs and Cranberry Moss SSSI*	Raised and blanket bogs	1	5 - 10	0.321	Grassland
	Broadleaved deciduous woodland	1 or 3	10 – 15	0.142	Woodland
	Standing water	1 or 3	Site specific advice from NE	No critical load assigned	-
Oakhanger Moss SSSI*	Broadleaved deciduous woodland	1 or 3	10 – 20	1.946	Woodland
	Rich fens	3	15 – 30	N/A	Grassland
	Valley mires, poor fens and transition mires	1	10 – 15	0.9	Grassland
	Raised and blanket bogs	1	5 – 10	0.573	Grassland
	Moist and wet oligotrophic grasslands: Molinia caerulea meadows	1	15 – 25	1.338	Grassland

Notes:

* Within Midlands Meres & Mosses Phase 2 Ramsar Site.

** Lower critical load value adopted as benchmark. Where multiple qualifying habitats exist with varying critical load ranges, the lowest critical load is adopted.

*** No critical load range is available for inland salt meadows, as such the values for coastal saltmarsh are recommended to be used instead.

† Used to define appropriate deposition velocity for NO_2 and NH_3.

5 Dispersion Modelling Assessment Results

This section presents the results of the in-combination traffic screening and the results of the pollutant dispersion modelling for the European Sites requested by NE in their letter of 04 October 2024.

Traffic screening results are provided in the context of the screening criteria from the NE guidance showing links screened in to the assessment for the relevant European Sites.

The results of the pollutant dispersion modelling show the pollutant concentrations in ambient air at ground level for NO_X and NH_3, and the rates of nutrient nitrogen deposition for both long and short vegetation so that the results may be interpreted together with site surveys of the notified features.

The location and spatial extents of any modelled changes in pollutant concentrations or rates of deposition that exceed the 1% screening criterion of the relevant CLe or LCLo are depicted in **Figure 5** for annual mean NO_X concentrations, **Figure 6** for annual mean NH_3 concentrations, **Figure 7** for nutrient nitrogen deposition to tall vegetation and **Figure 8** for nutrient nitrogen deposition to short vegetation.

The assessment results tables in **Appendix C** report the worst-case concentration or rate of deposition at 10 m intervals from the boundary of each European Site closest to the nearest modelled road up to a distance of 200 m within the site. Full results for all gridded receptors can be made available upon request and are not included here in order to maintain an accessible document size.

5.1 Traffic Screening Results

The screening of traffic flows examined the difference between the 2040 Alternative Baseline scenario and the 2040 With Local Plan scenario following the guidance provided by the IAQM to produce an 'in-combination' impact. The results of the screening of the relevant traffic links are shown in Table 10 and total in-combination 2040 With Local Plan flows are shown in Figure 4.

The results in Table 10 show that links adjacent to the relevant European sites are predicted to experience changes in overall in-combination AADT flows in excess of the 1,000 AADT criteria described in the DMRB and NE guidance.

A number of additional links were included in the model for verification and continuity purpose that were not subject to screening. All links within the dispersion model are listed in **Appendix A**.

The results in Table 11 show that the impact on overall AADT of the NULC plan in isolation still meets the criteria for assessment on some links. The proportion of traffic from the NULC plan in isolation affecting Black Firs and Cranberry Moss SSSI is mixed, however the proportion affecting Oakhanger Moss SSSI is far inferior to the in-combination changes.

Table 10 Summary of In-combination Traffic Flow Screening

European Site / Land Parcel	Transport Model Road Link Ref*	2040 Alternative Future Base		2040 With Partnership Authorities Local Plans		In-combination impact**		Screened in?
		AADT	HDV	AADT	HDV	AADT	HDV	
Black Firs and Cranberry Moss SSSI	1550_1901	3,013	58	4,307	67	**1,294**	9	Yes
	1901_1965	1,385	67	3,261	133	**1,876**	66	Yes
Oakhanger Moss SSSI	1288_1289	52,755	5,838	71,510	9,222	**18,755**	**3,384**	Yes
	1286_1290	57,039	6,489	72,649	9,757	**15,610**	**3,268**	Yes

Notes:
* Traffic data were provided as directions flows. For single carriageway roads these are combined
** Bold indicates exceedance of 1,000 domestic AADT flows or 200 HDV flows criteria.

Table 11 Summary of Local Plan in Isolation Traffic Flow Differences

European Site / Land Parcel	Transport Model Road Link Ref*	2040 Reference		2040 With Partnership Authorities Local Plans		Isolation impact**	
		AADT	HDV	AADT	HDV	AADT	HDV
Black Firs and Cranberry Moss SSSI	1550_1901	4,107	50	4,307	67	200	17
	1901_1965	1,955	118	3,261	133	**1,306**	15
Oakhanger Moss SSSI	1288_1289	70,192	8,298	71,510	9,222	**1,318**	**924**
	1286_1290	72,865	9,128	72,649	9,757	-216	**629**

Notes:
* Traffic data were provided as directions flows. For single carriageway roads these are combined
** Bold indicates exceedance of 1,000 domestic AADT flows or 200 HDV flows criteria.

Legend

Screened Modelled Road Network (showing flows for the With Local Plan scenario)

- >1,000 AADT Change
- European Site 200m Buffer

Designated Nature Conservation Sites

- Wetland of International Importance (Ramsar)
- Site of Special Scientific Interest (SSSI)

Rev	Date	Amendment Details	Dr'n	Chk'	App'
Rev	13.02.2025	FIRST ISSUE	ABC	ABC	ABC

Sweco UK Limited
2nd Floor Quay 2, 139 Fountainbridge
Edinburgh, EH3 9QG
Tel: +44 (0)131 550 6300
www.sweco.co.uk

SWECO

Client

NEWCASTLE UNDER LYME BOROUGH COUNCIL

Project Title

Assessment of Air Quality Impacts on Habitat Sites in Newcastle-under-Lyme

Drawing Title

Figure 4
Predicted In-combination Traffic Flow at European Sites

Project Stage			
n/a			
Status: n/a	Status Description: n/a		
Drawn: LFS	Designed: LFS	Checked: JS	Approved: JS
Sheet Size: A3	Scale: 1:25,000	Sweco Ref: 65212118	Revision: P05

Drawing Number 65212118-SWE-XX-XX-D-AQ-0005

Legend

Screened Modelled Road Network (showing flows for the With Local Plan scenario)

- >1,000 AADT Change
- European Site 200m Buffer

Designated Nature Conservation Sites

- Wetland of International Importance (Ramsar)
- Site of Special Scientific Interest (SSSI)

Rev	13.02.2025	FIRST ISSUE	ABC	ABC	ABC
Rev	Date	Amendment Details	Dr'n	Chk'	App'

Sweco UK Limited
2nd Floor Quay 2, 139 Fountainbridge
Edinburgh, EH3 9QG
Tel: +44 (0)131 550 6300
www.sweco.co.uk

SWECO

Client

NEWCASTLE UNDER LYME BOROUGH COUNCIL

Project Title

Assessment of Air Quality Impacts on Habitat Sites in Newcastle-under-Lyme

Drawing Title

Figure 4
Predicted In-combination Traffic Flow at European Sites

Project Stage			
n/a			
Status	Status Description		
n/a	n/a		
Drawn	Designed	Checked	Approved
LFS	LFS	JS	JS
Sheet Size	Scale	Sweco Ref	Revision
A3	1:25,000	65212118	P05

Drawing Number 65212118-SWE-XX-XX-D-AQ-0006

5.2 Annual Mean NO_X

The pollutant dispersion modelling showed no predicted exceedances of the limit of 30 µg/m³ for the protection of vegetation at either of the relevant European Sites for both scenarios relevant to the in-combination impact. The results are summarised in Table 12 and isopleths of the results as a percentage of the CLe are shown in Figure 5.

Table 12 Summary of the In-combination Results of NO_X Dispersion Modelling

Parameter	Black Firs and Cranberry Moss SSSI		Oakhanger Moss SSSI	
	Future Base	With Plans	Future Base	With Plans
Max. Road Contribution (*Model*) (µg/m³)	0.7	1.5	2.3	3.3
Max. Total Concentration (*Model* + *Background*) (µg/m³)	7.3	8.0	11.3	12.2
Number of receptors exceeding Critical Level (30 µg/m³)	0	0	0	0
Total number of model receptors	578	578	520	520
In-combination Impact (2040 Local Plan – 2040 Alternative Baseline)				
Maximum deterioration (µg/m³)	0.8		0.9	
No. receptors deterioration >1% criterion	30		520	

Black Firs and Cranberry Moss SSSI

Predicted ambient concentrations of ground level NO_X are 24% of the limit under the Future Baseline scenario and 26% of the limit with the NULC Local Plan in place.

A maximum deterioration of 0.8 µg/m³ is predicted, with 30 out of a total of 578 modelled receptors predicted to experience a change in excess of 1% of the limit of 30 µg/m³. This equates to approximately 4% of the total area of the European Site.

Oakhanger Moss SSSI

Predicted ambient concentrations of ground level NO_X are 38% of the limit under the Future Baseline scenario and 41% of the limit with the NULC Local Plan in place.

A maximum deterioration of 0.9 µg/m³ is predicted, with all modelled receptors predicted to experience a change in excess of 1% of the limit of 30 µg/m³. This equates to approximately 100% of the total area of the European Site.

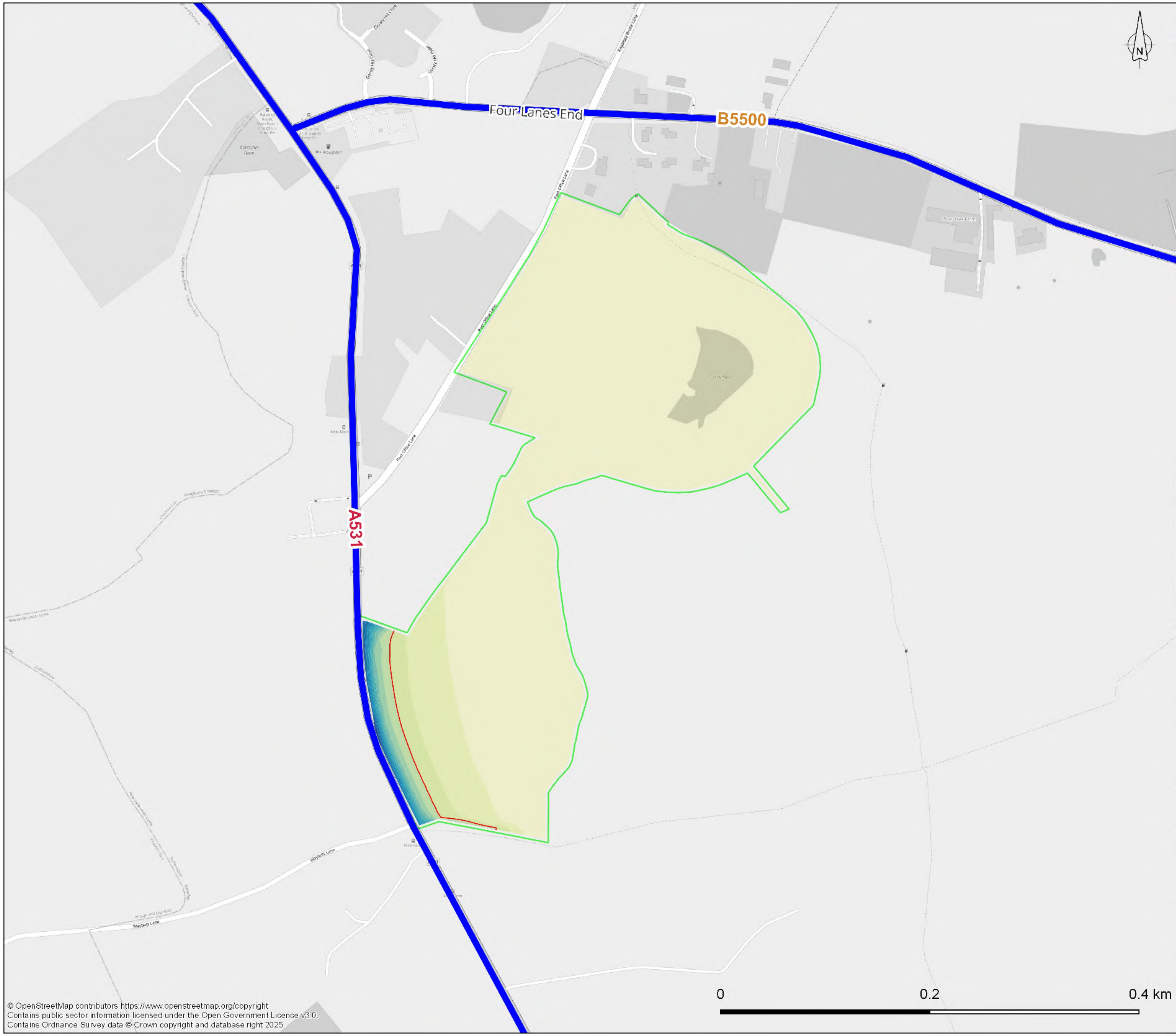
Local Plan In Isolation

The modelling results for the effects of the NULC local plan in isolation show smaller impacts at both European Sites than the in-combination scenario, which is to be expected. In terms of the maximum deterioration the predictions are reduced by 1% of the limit value at Black Firs and Cranberry Moss SSSI and by 2.6% of the limit value at Oakhanger Moss, suggesting that the NULC local plan has a greater proportional impact at Oakhanger Moss. This is reflected in the number of receptors predicted to experience a deterioration of greater than 1% of the limit value, which is reduced from 11 at Black Firs and Cranberry Moss against 30 for the in-combination scenario, but is zero for Oakhanger Moss against 520, the whole site, under the in-combination scenario. This is shown in Table 13.

Table 13 Summary of the In-isolation Results of NOX Dispersion Modelling

Parameter	Black Firs and Cranberry Moss SSSI		Oakhanger Moss SSSI	
	Reference	With Plans	Reference	With Plans
Max. Road Contribution (*Model*) (µg/m³)	1.0	1.5	3.2	3.3

Parameter	Black Firs and Cranberry Moss SSSI		Oakhanger Moss SSSI	
	Reference	With Plans	Reference	With Plans
Max. Total Concentration (*Model* + *Background*) (µg/m^3)	7.6	8.0	12.2	12.2
Number of receptors exceeding Critical Level (30 µg/m^3)	0	0	0	0
Total number of model receptors	578	578	520	520
In-combination Impact (2040 Local Plan – 2040 Alternative Baseline)				
Maximum deterioration (µg/m^3)	0.5		0.1	
No. receptors deterioration >1% criterion	11		0	



Legend

- Modelled Road Network
- Site of Special Scientific Interest (SSSI)
- Limit of In-combination 1% Change

NOx In-Combination Change as a Percentage of the Critical Level (CLe)

- 0.3 - 0.5
- 0.5 - 0.7
- 0.7 - 0.9
- 0.9 - 1.1
- 1.1 - 1.3
- 1.3 - 1.5
- 1.5 - 1.7
- 1.7 - 1.9
- 1.9 - 2.1
- 2.1 - 2.3
- 2.3 - 2.5
- 2.5 - 2.7

Rev	Date	Amendment Details	Dr'n	Chk'	App'
Rev	13.02.2025	FIRST ISSUE	ABC	ABC	ABC

Sweco UK Limited
2nd Floor Quay 2, 139 Fountainbridge
Edinburgh, EH3 9QG
Tel: +44 (0)131 550 6300
www.sweco.co.uk

SWECO

Client

NEWCASTLE UNDER LYME BOROUGH COUNCIL

Project Title

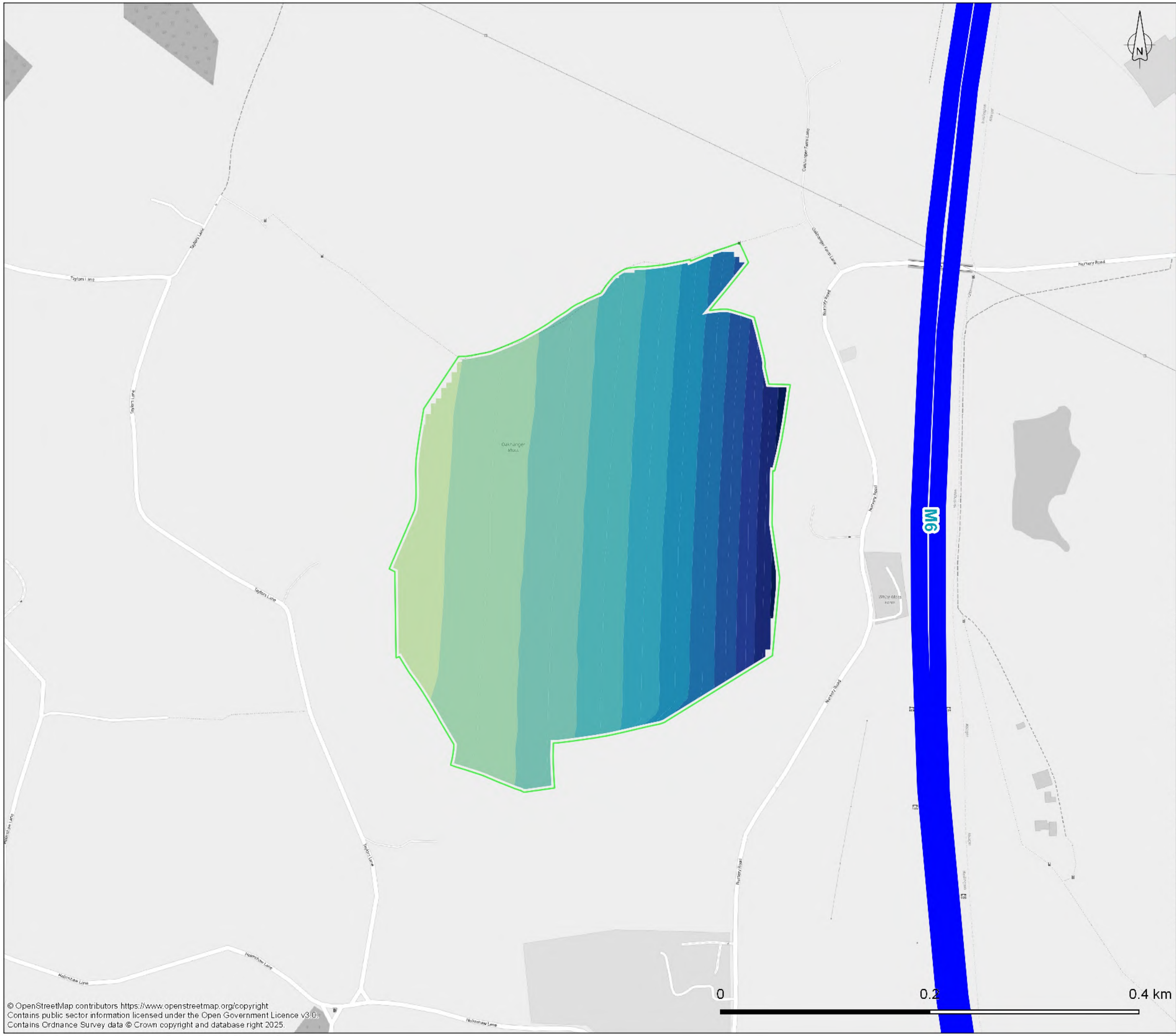
Assessment of Air Quality Impacts on Habitat Sites in Newcastle-under-Lyme

Drawing Title

Figure 5
In-combination Change in NOx Concentrations as a Percentage of the Critical Level

Project Stage			
n/a			
Status	Status Description		
n/a	n/a		
Drawn	Designed	Checked	Approved
LFS	LFS	JS	JS
Sheet Size	Scale	Sweco Ref	Revision
A3	1:3,500	65212118	P05

Drawing Number 65212118-SWE-XX-XX-D-AQ-0007



Legend

- Modelled Road Network
- Site of Special Scientific Interest (SSSI)

NOx In-Combination Change as a Percentage of the Critical Level (CLe)

- 0.9 - 1.1
- 1.1 - 1.3
- 1.3 - 1.5
- 1.5 - 1.7
- 1.7 - 1.9
- 1.9 - 2.1
- 2.1 - 2.3
- 2.3 - 2.5
- 2.5 - 2.7
- 2.7 - 2.9
- 2.9 - 3.1

Rev	13.02.2025	FIRST ISSUE	ABC	ABC	ABC
Rev	Date	Amendment Details	Dr'n	Chk'	App'

Sweco UK Limited
2nd Floor Quay 2, 139 Fountainbridge
Edinburgh, EH3 9QG
Tel: +44 (0)131 550 6300
www.sweco.co.uk

SWECO

Client

NEWCASTLE UNDER LYME
BOROUGH COUNCIL

Project Title

Assessment of Air Quality Impacts on Habitat Sites in Newcastle-under-Lyme

Drawing Title

Figure 5
In-combination Change in NOx Concentrations as a Percentage of the Critical Level

Project Stage
n/a

Status	Status Description
n/a	n/a

Drawn	Designed	Checked	Approved
LFS	LFS	JS	JS

Sheet Size	Scale	Sweco Ref	Revision
A3	1:3,500	65212118	P05

Drawing Number 65212118-SWE-XX-XX-D-AQ-0008

5.3 Annual Mean NH_3

The pollutant dispersion modelling showed exceedances of the CLe of 1 µg/m³ across the entirety of both sites mainly due to the contribution from background. Exceedances would also be predicted across the whole of both European Sites had the predictions been compared to the CLe of 3 µg/m³ for higher plants. The results are summarised in Table 14 and isopleths of the results as a percentage of the CLe are shown in Figure 6.

Table 14 Summary of the In-combination Results of NH_3 Dispersion Modelling

Parameter	**Black Firs and Cranberry Moss SSSI**		**Oakhanger Moss SSSI**	
	Future Base	**With Plans**	**Future Base**	**With Plans**
Max. Road Contribution (*Model*) (µg/m³)	0.11	0.23	0.36	0.50
Max. Total Concentration (*Model* + *Background*) (µg/m³)	3.78	3.89	3.63	3.77
Number of receptors exceeding Critical Level (1 µg/m³)	578	578	520	520
Total number of model receptors	578	578	520	520
In-combination Impact (2040 Local Plan – 2040 Alternative Baseline)				
Maximum worsening (µg/m³)	0.05		0.13	
No. receptors worsening >1% criterion	578		520	

Black Firs and Cranberry Moss SSSI

Predicted ambient ground level concentrations of NH_3 are up to 378% of the CLe of 1 µg/m³ without the NULC local plan in place, and 389% of the CLE with the local plan in place.

A maximum deterioration of 0.05 µg/m³ is predicted at the site boundary closest to the modelled road network. A deterioration of 0.01 µg/m³ is predicted at the furthest boundary from the modelled road network. All receptors across the site are predicted to experience deteriorations in the concentration of NH_3 in excess of 1% of the CLe of 1 µg/m³.

Oakhanger Moss SSSI

Predicted ambient ground level concentrations of NH_3 are up to 363% of the CLe of 1 µg/m³ without the NULC local plan in place, and 377% of the CLE with the local plan in place.

A maximum deterioration of 0.13 µg/m³ is predicted at the site boundary closest to the modelled road network. At 200 m from the site boundary a deterioration of 0.06 µg/m³ is predicted. All receptors across the site are predicted to experience deteriorations in the concentration of NH_3 in excess of 1% of the CLe of 1 µg/m³.

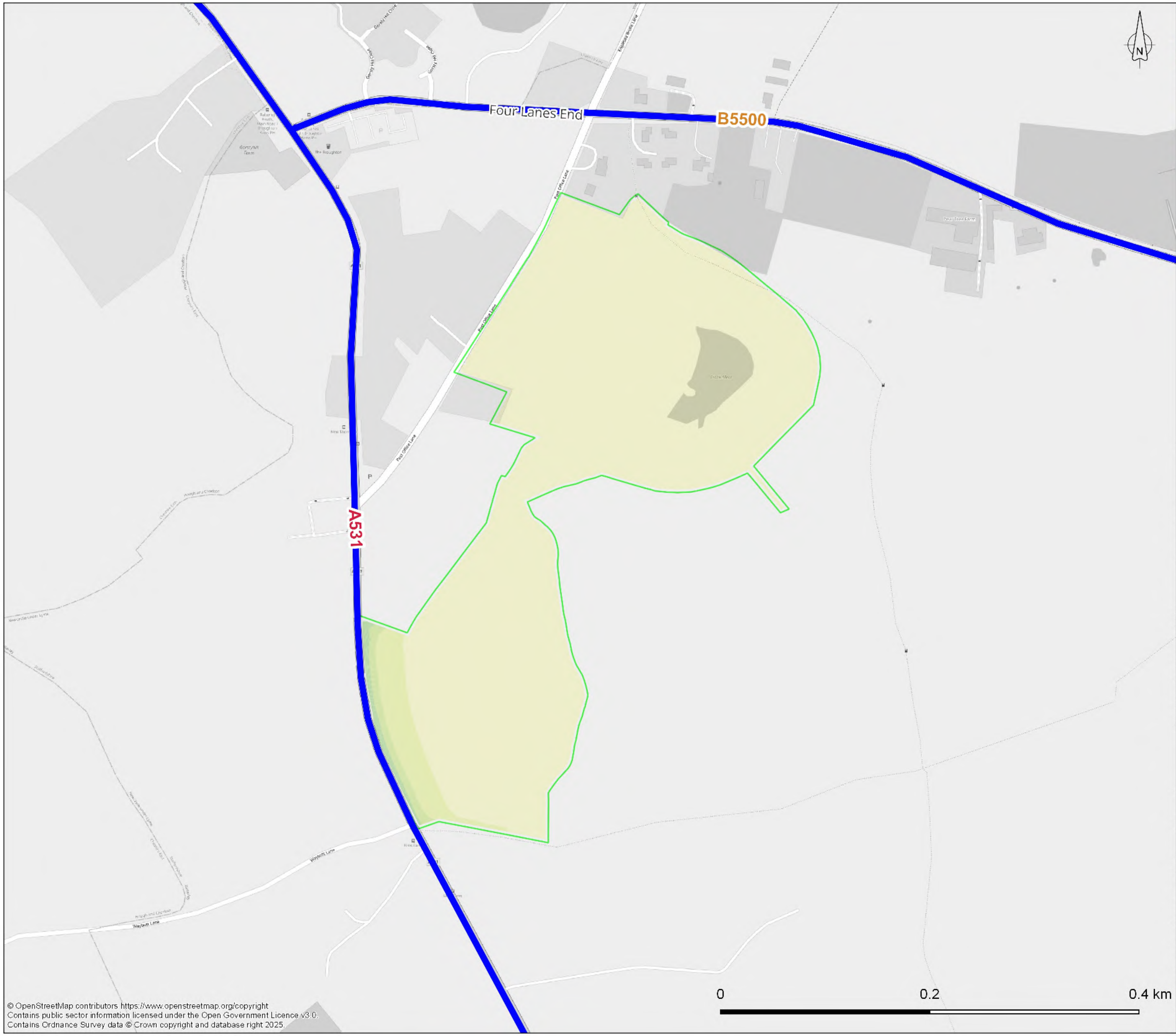
Local Plan In Isolation

The results for the dispersin modelling of NH3 for the NULC local plan in-isolation show that the majority of impacts are predicted at Black Firs and Cranberry Moss SSSI. There are no predicted impacts at Oakhanger Moss SSSI in excess of 1%of the CLe of 1 µg/m³.

The total predicted concentrations at both European Sites are in excess of the CLe which is mainly due to the contribution from background as the road contributions are small in comparison. This is shown in Table 15.

Table 15 Summary of the In-isolation Results of NH3 Dispersion Modelling

Parameter	Black Firs and Cranberry Moss SSSI		Oakhanger Moss SSSI	
	Reference	**With Plans**	**Reference**	**With Plans**
Max. Road Contribution (*Model*) (µg/m^3)	0.16	0.23	0.50	0.50
Max. Total Concentration (*Model* + *Background*) (µg/m^3)	3.82	3.89	3.76	3.77
Number of receptors exceeding Critical Level (1 µg/m^3)	578	578	520	520
Total number of model receptors	578	578	520	520
In-combination Impact (2040 Local Plan – 2040 Alternative Baseline)				
Maximum worsening (µg/m^3)	0.07		0.01	
No. receptors worsening >1% criterion	103		0	



Legend

- Modelled Road Network
- Site of Special Scientific Interest (SSSI)

NH_3 In-Combination Change as a Percentage of the Critical Level (CLe)

- 0.9 - 1.9
- 1.9 - 2.9
- 2.9 - 3.9
- 3.9 - 4.9
- 4.9 - 5.9

Rev	13.02.2025	FIRST ISSUE	ABC	ABC	ABC
Rev	Date	Amendment Details	Dr'n	Chk'	App'

Sweco UK Limited
2nd Floor Quay 2, 139 Fountainbridge
Edinburgh, EH3 9QG
Tel: +44 (0)131 550 6300
www.sweco.co.uk

SWECO

Client

NEWCASTLE UNDER LYME BOROUGH COUNCIL

Project Title

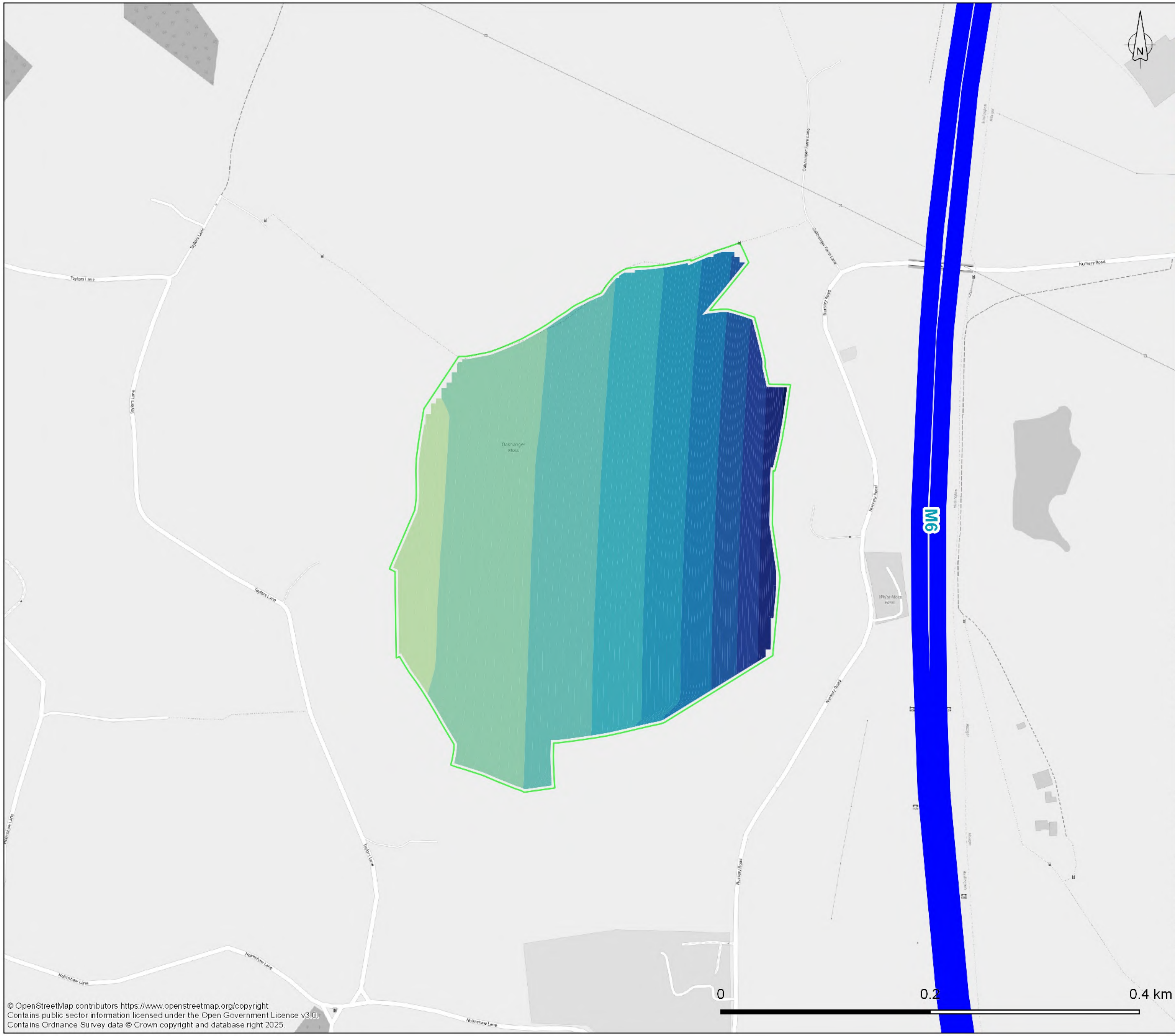
Assessment of Air Quality Impacts on Habitat Sites in Newcastle-under-Lyme

Drawing Title

Figure 6
In-combination Change in NH_3 Concentrations as a Percentage of the Critical Level

Project Stage			
n/a			
Status	Status Description		
n/a	n/a		
Drawn	Designed	Checked	Approved
LFS	LFS	JS	JS
Sheet Size	Scale	Sweco Ref	Revision
A3	1:3,500	65212118	P05

Drawing Number 65212118-SWE-XX-XX-D-AQ-0009



Legend

Modelled Road Network
Site of Special Scientific Interest (SSSI)

NH_3 In-Combination Change as a Percentage of the Critical Level (CLe)

- 3.9 - 4.9
- 4.9 - 5.9
- 5.9 - 6.9
- 6.9 - 7.9
- 7.9 - 8.9
- 8.9 - 9.9
- 9.9 - 10.9
- 10.9 - 11.9
- 11.9 - 12.9
- 12.9 - 13.9

Rev	13.02.2025	FIRST ISSUE	ABC	ABC	ABC
Rev	Date	Amendment Details	Dr'n	Chk'	App'

Sweco UK Limited
2nd Floor Quay 2, 139 Fountainbridge
Edinburgh, EH3 9QG
Tel: +44 (0)131 550 6300
www.sweco.co.uk

SWECO

Client
NEWCASTLE UNDER LYME
BOROUGH COUNCIL

Project Title
Assessment of Air Quality Impacts on Habitat Sites in Newcastle-under-Lyme

Drawing Title
Figure 6
In-combination Change in NH_3 Concentrations as a Percentage of the Critical Level

Project Stage			
n/a			
Status	Status Description		
n/a	n/a		
Drawn	Designed	Checked	Approved
LFS	LFS	JS	JS
Sheet Size	Scale	Sweco Ref	Revision
A3	1:3,500	65212118	P05

Drawing Number 65212118-SWE-XX-XX-D-AQ-0010

5.4 Nitrogen Deposition

Tall Vegetation

The pollutant dispersion modelling for rates of deposition to tall vegetation showed that both the LCLo and UCLo were exceeded across the entirety of both sites for both of the modelled scenarios with the majority of the exceedance from the contribution of background deposition. This is summarised in Table 16 and isopleths of the results are shown in Figure 7 as a percentage of the LCLo.

Table 16 Summary of the Results of Nutrient Nitrogen Deposition Modelling to Tall Vegetation

Parameter	**Black Firs and Cranberry Moss SSSI**		**Oakhanger Moss SSSI**	
	Future Base	**With Plans**	**Future Base**	**With Plans**
Max. Road Contribution (*Model*) (kgN/ha/yr)	0.92	2.01	3.17	4.42
Max. Total Deposition (*Model + Background*) (kgN/ha/yr)	42.55	43.64	43.03	44.29
Lower Critical Load (LCLo) (kgN/ha/yr)	**5**		**5**	
Upper Critical Loda (UCLo) (kgN/ha/yr)	**15**		**25**	
Number of receptors exceeding Lower Critical Load	578	578	520	520
Total number of model receptors	578	578	520	520
In-combination Impact (2040 Local Plan – 2040 Alternative Baseline)				
Maximum worsening (kgN/ha/yr)	0.47		1.21	
No. receptors worsening >1% criterion	578		520	

Black Firs and Cranberry Moss SSSI

Predicted total rates of nutrient nitrogen deposition are in excess of the LCLo in both modelled scenarios, being over 800% of the LCLo both with and without the NULC plan in place. This is mainly due to background contributions to deposition.

A maximum deterioration of 0.50 kgN/ha/yr is predicted at the site boundary closest to the modelled road network. All receptors across the site are predicted to experience a deterioration in the rates of nutrient nitrogen deposition to tall vegetation in excess of 1% of the LCLo of 5 kgN/ha/yr .

Oakhanger Moss SSSI

Due to high background concentrations, the predicted total rates of deposition are well in excess of the LCLo and the UCLo both with and without the NULC plan in place.

A maximum in-combination deterioration of 1.21 kgN/ha/yr is predicted at the site boundary closest to the modelled road network. All receptors across the site are predicted to experience a deterioration in rates of nutrient nitrogen deposition in excess of 1% of the LCLo.

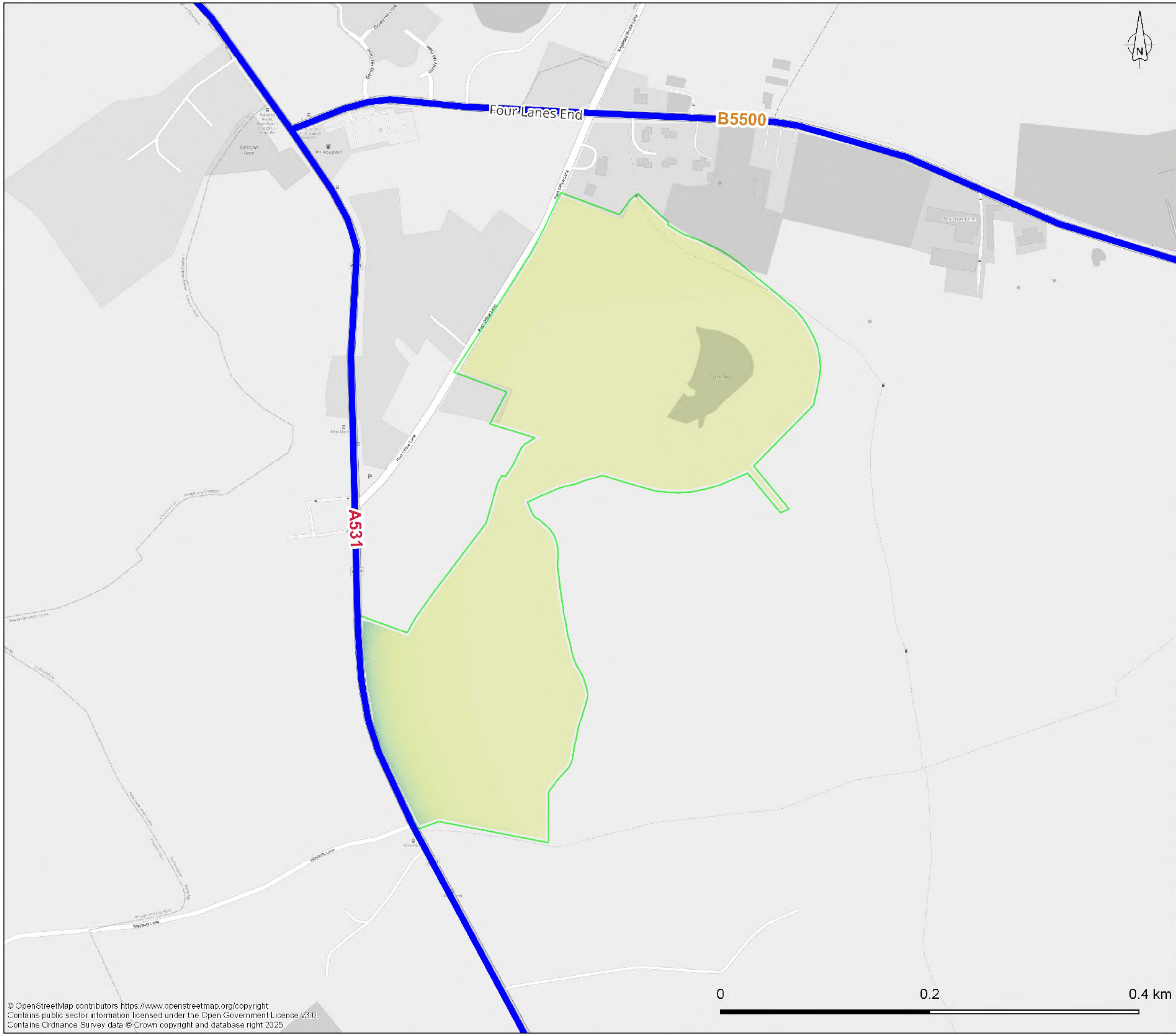
Local Plan In Isolation

The results for the predicted rates of nutrient nitrogen deposition to tall vegetation show that only one receptor point out of 520 at Oakhanger Moss SSSI is predicted to experience a change in excess of 1% of the LCLo of 5 kgN/ha/yr. At Black Firs and Cranberry Moss SSSI 300 out of 578 receptor points are predicted to expereince impacts in excess of 1% of the LCLo.

Predicted total rates of nutrient nitrogen deposition are well in excess of both the LCLo and the UCLo at both sites due to the high background rates of deposition. This is shown in Table 17.

Table 17 Summary of the In-isolation Predicted Rates of Nutrient Nitrogen Deposition to Tall Vegetation

Parameter	**Black Firs and Cranberry Moss SSSI**		**Oakhanger Moss SSSI**	
	Reference	**With Plans**	**Reference**	**With Plans**
Max. Road Contribution (*Model*) (kgN/ha/yr)	1.39	2.01	4.38	4.42
Max. Total Deposition (*Model* + *Background*) (kgN/ha/yr)	43.02	43.64	44.24	44.29
Lower Critical Load (LCLo) (kgN/ha/yr)	**5**		**5**	
Upper Critical Loda (UCLo) (kgN/ha/yr)	**15**		**25**	
Number of receptors exceeding Lower Critical Load	578	578	520	520
Total number of model receptors	578	578	520	520
In-combination Impact (2040 Local Plan – 2040 Alternative Baseline)				
Maximum worsening (kgN/ha/yr)	0.62		0.05	
No. receptors worsening >1% criterion	300		1	



Legend

- Modelled Road Network
- Site of Special Scientific Interest (SSSI)

Nitrogen Deposition In-Combination Change as a Percentage of the Lower Critical Load (LCLo)

- 2.3 - 2.8
- 2.8 - 3.3
- 3.3 - 3.8
- 3.8 - 4.3
- 4.3 - 4.8
- 4.8 - 5.3
- 5.3 - 5.8
- 5.8 - 6.3
- 6.3 - 6.8
- 6.8 - 7.3
- 7.3 - 7.8
- 7.8 - 8.3
- 8.3 - 8.8
- 8.8 - 9.3

Rev	Date	Amendment Details	Dr'n	Chk'	App'
Rev	13.02.2025	FIRST ISSUE	ABC	ABC	ABC

Sweco UK Limited
2nd Floor Quay 2, 139 Fountainbridge
Edinburgh, EH3 9QG
Tel: +44 (0)131 550 6300
www.sweco.co.uk

SWECO

Client

NEWCASTLE UNDER LYME BOROUGH COUNCIL

Project Title

Assessment of Air Quality Impacts on Habitat Sites in Newcastle-under-Lyme

Drawing Title

Figure 7
In-combination Change in Nitrogen Deposition to Tall Vegetation as a Percentage of the Lower Critical Load

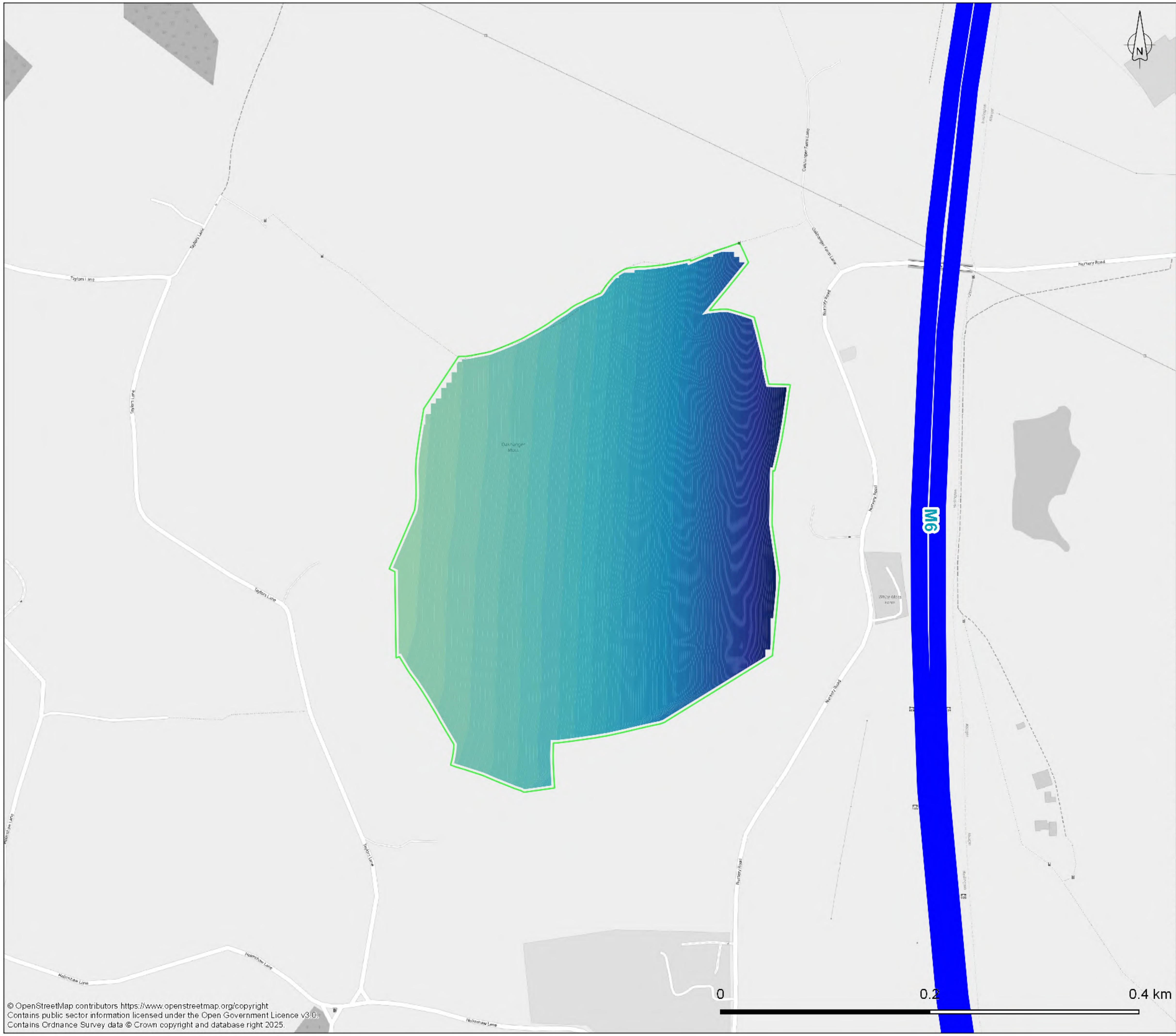
Project Stage: n/a

Status	Status Description
n/a	n/a

Drawn	Designed	Checked	Approved
LFS	LFS	JS	JS

Sheet Size	Scale	Sweco Ref	Revision
A3	1:3,500	65212118	P05

Drawing Number: 65212118-SWE-XX-XX-D-AQ-0011



Legend

- Modelled Road Network
- Site of Special Scientific Interest (SSSI)

Nitrogen Deposition In-Combination Change as a Percentage of the Lower Critical Load (LCLo)

8.3 - 8.8
8.8 - 9.3
9.3 - 9.8
9.8 - 10.3
10.3 - 10.8
10.8 - 11.3
11.3 - 11.8
11.8 - 12.3
12.3 - 12.8
12.8 - 13.3
13.3 - 13.8
13.8 - 14.3
14.3 - 14.8
14.8 - 15.3
15.3 - 15.8
15.8 - 16.3
16.3 - 16.8
16.8 - 17.3
17.3 - 17.8
17.8 - 18.3
18.3 - 18.8
18.8 - 19.3
19.3 - 19.8
19.8 - 20.3
20.3 - 20.8
20.8 - 21.3
21.3 - 21.8
21.8 - 22.3
22.3 - 22.8
22.8 - 23.3
23.3 - 23.8
23.8 - 24.3

Rev	Date	Amendment Details	Dr'n	Chk'	App'
Rev	13.02.2025	FIRST ISSUE	ABC	ABC	ABC

Sweco UK Limited
2nd Floor Quay 2, 139 Fountainbridge
Edinburgh, EH3 9QG
Tel: +44 (0)131 550 6300
www.sweco.co.uk

SWECO

Client
NEWCASTLE UNDER LYME
BOROUGH COUNCIL

Project Title
Assessment of Air Quality Impacts on Habitat Sites in Newcastle-under-Lyme

Drawing Title
Figure 7
In-combination Change in Nitrogen Deposition to Tall Vegetation as a Percentage of the Lower Critical Load

Project Stage: n/a

Status: n/a | Status Description: n/a

Drawn	Designed	Checked	Approved
LFS	LFS	JS	JS

Sheet Size	Scale	Sweco Ref	Revision
A3	1:3,500	65212118	P05

Drawing Number: 65212118-SWE-XX-XX-D-AQ-0012

Short Vegetation

Similar to the predicted results for deposition to tall vegetation, the results of the modelling of nutrient nitrogen deposition to short vegetation also showed a large background component meaning total rates of deposition were in excess of the LCLo across both sites. The UCLo was exceeded at Black Firs and Cranberry Moss SSSI but was not exceeded at Oakhanger Moss SSSI. This is summarised in Table 18 and isopleths of the results are shown in Figure 8 as a percentage of the LCLo.

Table 18 Summary of the Results of Nutrient Nitrogen Deposition Modelling to Short Vegetation

Parameter	**Black Firs and Cranberry Moss SSSI**		**Oakhanger Moss SSSI**	
	Future Base	**With Plans**	**Future Base**	**With Plans**
Max. Road Contribution (*Model*) (kgN/ha/yr)	0.60	1.30	2.06	2.86
Max. Total Deposition (*Model* + *Background*) (kgN/ha/yr)	23.54	24.25	24.04	24.85
Lower Critical Load (LCLo) (kgN/ha/yr)	**5**		**5**	
Upper Critical Loda (UCLo) (kgN/ha/yr)	**15**		**25**	
Number of receptors exceeding Lower Critical Load	578	578	520	520
Total number of model receptors	578	578	520	520
In-combination Impact (2040 Local Plan – 2040 Alternative Baseline)				
Maximum worsening (kgN/ha/yr)	0.30		0.77	
No. receptors worsening >1% criterion	578		520	

Black Firs and Cranberry Moss SSSI

A maximum deterioration of 0.30 kgN/ha/yr was predicted at the nearest point on the site boundary to the modelled road network, which is in excess of 1% of the LCLo at this site. Predicted increases in the rate of nutrient nitrogen deposition to short vegetation were in excess of 1% of the LCLo across the entire site.

Oakhanger Moss SSSI

There were predicted increases to the rate of nutrient nitrogen deposition to short vegetation in excess of 1% of the LCLo across the entire site, with the maximum increase of 0.77 kgN/ha/yr occurring at the site boundary closest to the modelled road network.

Local Plan in Isolation

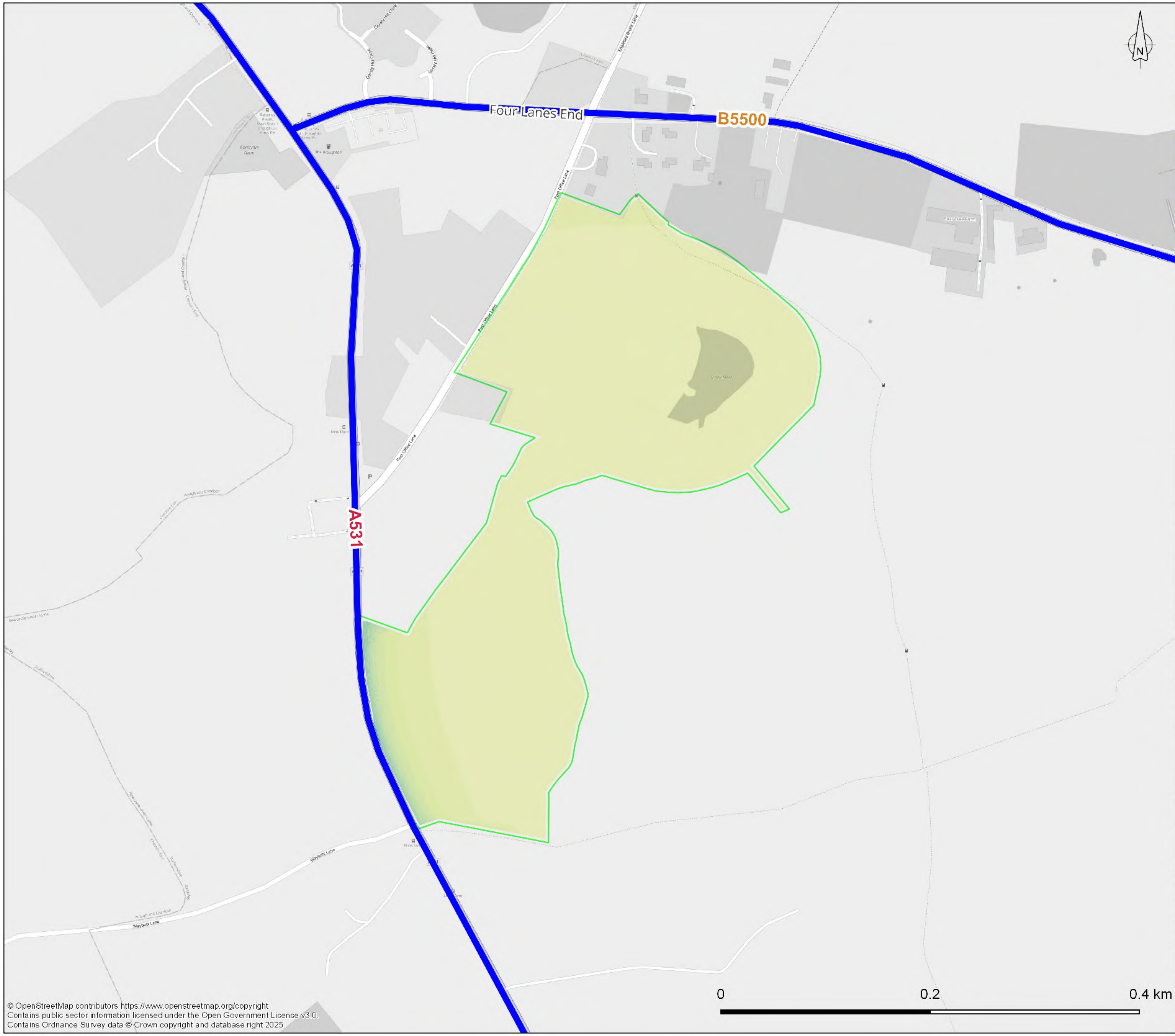
The results for the predicted rates of nutrient nitrogen deposition to short vegetation from the NULC local plan in-isolation show that there are no predicted impacts in excess of 1% of the LCLo of 5 kgN/ha/yr at Oakhanger Moss SSSI. There are 134 out of 578 modelled receptors at Black Firs and Cranberry Moss SSSI predicted to experience impacts in excess of 1% of the LCLo.

Total predicted rates of deposition are in excess of both the LCLo and UCLo at both sites due to elevated rates of background deposition. This is shown in Table 19.

Table 19 Summary of the In-isolation Predicted Rates of Nutrient Nitrogen Deposition to Short Vegetation

Parameter	**Black Firs and Cranberry Moss SSSI**		**Oakhanger Moss SSSI**	
	Reference	**With Plans**	**Reference**	**With Plans**
Max. Road Contribution (*Model*) (kgN/ha/yr)	0.90	1.30	2.83	2.86
Max. Total Deposition (*Model* + *Background*) (kgN/ha/yr)	23.84	24.25	24.82	24.85

Parameter	Black Firs and Cranberry Moss SSSI		Oakhanger Moss SSSI	
	Reference	With Plans	Reference	With Plans
Lower Critical Load (LCLo) (kgN/ha/yr)	**5**		**5**	
Upper Critical Loda (UCLo) (kgN/ha/yr)	**15**		**25**	
Number of receptors exceeding Lower Critical Load	578	578	520	520
Total number of model receptors	578	578	520	520
In-combination Impact (2040 Local Plan – 2040 Alternative Baseline)				
Maximum worsening (kgN/ha/yr)	0.40		0.03	
No. receptors worsening >1% criterion	134		0	



Rev	Date	Amendment Details	Dr'n	Chk'	App'
	13.02.2025	FIRST ISSUE	ABC	ABC	ABC

Sweco UK Limited
2nd Floor Quay 2, 139 Fountainbridge
Edinburgh, EH3 9QG
Tel: +44 (0)131 550 6300
www.sweco.co.uk

SWECO

Client

NEWCASTLE UNDER LYME
BOROUGH COUNCIL

Project Title

Assessment of Air Quality Impacts on Habitat Sites in Newcastle-under-Lyme

Drawing Title

Figure 8
In-combination Change in Nitrogen Deposition to Short Vegetation as a Percentage of the Lower Critical Load

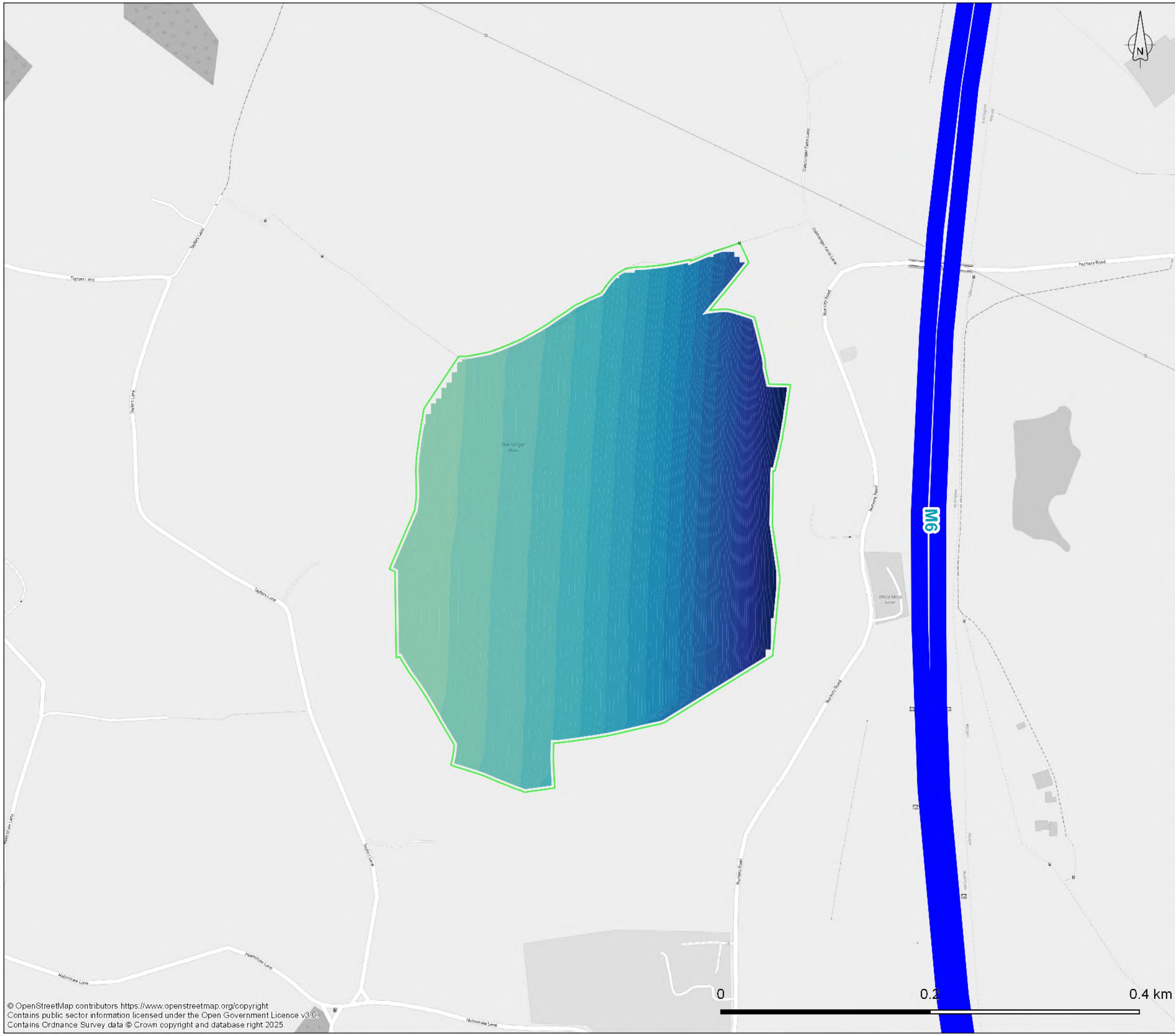
Project Stage
n/a

Status	Status Description
n/a	n/a

Drawn	Designed	Checked	Approved
LFS	LFS	JS	JS

Sheet Size	Scale	Sweco Ref	Revision
A3	1:3,500	65212118	P05

Drawing Number 65212118-SWE-XX-XX-D-AQ-0013



Legend

- Modelled Road Network
- Site of Special Scientific Interest (SSSI)

Nitrogen Deposition In-Combination Change as a Percentage of the Lower Critical Load (LCLo)

- 5.5 - 6
- 6 - 6.5
- 6.5 - 7
- 7 - 7.5
- 7.5 - 8
- 8 - 8.5
- 8.5 - 9
- 9 - 9.5
- 9.5 - 10
- 10 - 10.5
- 10.5 - 11
- 11 - 11.5
- 11.5 - 12
- 12 - 12.5
- 12.5 - 13
- 13 - 13.5
- 13.5 - 14
- 14 - 14.5
- 14.5 - 15
- 15 - 15.5

Rev	Date	Amendment Details	Dr'n	Chk'	App'
Rev	13.02.2025	FIRST ISSUE	ABC	ABC	ABC

Sweco UK Limited
2nd Floor Quay 2, 139 Fountainbridge
Edinburgh, EH3 9QG
Tel: +44 (0)131 550 6300
www.sweco.co.uk

SWECO

Client

NEWCASTLE UNDER LYME BOROUGH COUNCIL

Project Title

Assessment of Air Quality Impacts on Habitat Sites in Newcastle-under-Lyme

Drawing Title

Figure 8
In-combination Change in Nitrogen Deposition to Short Vegetation as a Percentage of the Lower Critical Load

Project Stage			
n/a			
Status: n/a	Status Description: n/a		
Drawn: LFS	Designed: LFS	Checked: JS	Approved: JS
Sheet Size: A3	Scale: 1:3,500	Sweco Ref: 65212118	Revision: P05

Drawing Number 65212118-SWE-XX-XX-D-AQ-0014

6 Summary and Conclusions

A detailed air quality dispersion modelling assessment was undertaken in response to the NE letter of 04 October 2024, concerning the Regulation 19 Habitats Regulations Assessment, that requested an examination of the predicted concentrations of NH_3 and associated rates of nutrient nitrogen deposition. The sites within the Midland Meres and Mosses Phase 2 Ramsar site were:

- Black Firs and Cranberry Moss SSSI
- Oakhanger Moss SSSI.

Emission rates were derived from the outputs of transport modelling that determined the in-combination flows of traffic relevant to the NULC draft local plan. Quantified traffic flows were determined on roads up to 200 m from the relevant European Sites for the following future year scenarios:

- 2040 Alternative Future Baseline
- 2040 With Local Plan.

The difference in traffic flows between the two scenarios was screened according to NE guidance to determine the extent of roads to be included within the pollutant dispersion model.

A review of baseline traffic flows was undertaken which required additional links to be added to the dispersion model to take account of local NO_2 diffusion tube monitoring. This was used to calibrate the outputs of the dispersion model with reference to local environmental conditions. In addition, a review was undertaken of local background pollutant concentrations and rates of nutrient nitrogen deposition.

The baseline review identified the following key points:

- Annual mean concentrations of NO_X were below the limit value of 30 µg/m³ in place for the protection of vegetation
- Annual mean background concentrations of NH_3 at both European Sites exceeded the relevant CLe for both higher and lower plants
- Background rates of nutrient nitrogen deposition were above the LCLo at both sites for both tall vegetation and short vegetation, and were above the UCLo for tall vegetation at both sites.

The dispersion modelling study resulted in the following key findings:

- Whilst **annual mean total predictions for** NO_X **concentrations** were below the limit value of 30 µg/m³, there were predicted deteriorations in excess of 1% of the LCLo at both sites. In the case of Oakhanger Moss SSSI the deteriorations in excess of 1% of the LCLo extended cover the entire site.
- Predicted **annual mean total concentrations of** NH_3 were above the CLe for lower plants of 1 µg/m³ across an area completely covering both sites. Lichens and bryophytes are identified as potentially present at both sites in the APIS datasets used for this assessment. Due to this, deteriorations in excess of 1% of the CLe were identified covering the whole of both designated sites.
- Predicted **rates of nutrient nitrogen deposition** were quantified for both tall and short vegetation. This showed that total rates of deposition exceeded the LCLo at both sites due entirely to high background rates of deposition for both tall and short vegetation. The changes in the rates of deposition showed increases in excess of 1% of the LCLo for both tall and short vegetation covering the whole of both sites.

The results of the study confirm the possibility for increases in the rates of nutrient nitrogen deposition identified in the NE letter of 04 October 2024. The analysis of baseline conditions also confirms the assertion from the HRA that the main source of NH_3 is likely to be from agricultural emissions as background concentrations well in excess of the CLe for lower plants and in excess of the CLe for higher plants were identified. Whilst the changes in concentrations of NH_3 are only a fraction of a microgram they are nevertheless in excess of 1% of the CLe for lower plants used as a criteria for this assessment, confirming the statement in the NE letter of 04 October 2024 that the road contribution to NH_3 concentrations is a concern and should be considered.

As a result of these findings, and in view of the points raised in both the NE letter of 04 October 2024 and the HRA this study concludes that **further Appropriate Assessment of the Newcastle-under-Lyme emerging Local Plan, in terms of in-combination impacts, is necessary and should be conducted by a suitably qualified ecologist**. Full details of this assessment have been provided to NULC in order to facilitate the further assessment.

Whilst this study has been completed in accordance with both NE and IAQM guidance, the potential for changes or revisions to the NULC or neighbouring authority local plans means that this air quality assessment may be subject to future revision.

Appendix A Traffic Data Tables

This section includes the list of traffic data used in the dispersion model. This is shown in Table 20.

Table 20 Traffic Flow Data for the 2018 Baseline, 2040 Alternative Baseline and 2040 With Local Plan Scenarios

Link ID	Link type	Relevant to	2018 Base and 2040 Alternative Base		2040 With Local Plan	
			Total AADT	HDV AADT	Total AADT	HDV AADT
1173_1983	Urban (not London)	Continuity link	14,581	157	17,327	161
1288_1289	Motorway (not London)	Oakhanger Moss SSSI Verification (CE146, CE234)	52,755	5,838	71,510	9,222
1286_1290	Motorway (not London)	Oakhanger Moss SSSI Verification (CE146, CE234)	57,039	6,489	72,649	9,757
1550_1901	Rural (not London)	Black Firs and Cranberry Moss SSSI	3,013	58	4,307	67
1900_1901	Rural (not London)	Black Firs and Cranberry Moss SSSI	4,296	125	6,688	200
1901_1965	Rural (not London)	Continuity link	1,385	67	3,261	133
1964_1965	Rural (not London)	Continuity link	1,385	67	3,261	133
1981_1983	Rural (not London)	Continuity link	14,581	157	17,327	161
1235_1285_3	Motorway (not London)	Verification (DT3)	55,367	5,957	72,445	9,010
1284_2316	Urban (not London)	Verification (DT3)	16,103	604	19,906	889
1291_2351_1	Motorway (not London)	Continuity link	52,496	5,359	70,782	8,024
1550_1969	Rural (not London)	Verification (DT28)	2,661	56	4,508	109
1550_5034	Rural (not London)	Verification (DT28)	5,031	80	7,668	153
1961_2316	Urban (not London)	Verification (DT3)	14,967	538	17,599	760
1963_2316	Urban (not London)	Verification (DT3)	1,385	67	3,261	133
1236_2000	Motorway (not London)	Continuity link	13,844	597	13,848	840
2000_2350	Urban (not London)	Continuity link	9,721	1,359	14,402	1,889
1236_2351	Motorway (not London)	Continuity link	44,429	4,656	59,650	6,795
2000_2351	Motorway (not London)	Continuity link	8,067	703	11,132	1,229
2350_2352	Motorway (not London)	Continuity link	15,455	570	18,506	931
1285_1290	Motorway (not London)	Continuity link	43,627	4,836	56,494	6,739

Link ID	Link type	Relevant to	2018 Base and 2040 Alternative Base		2040 With Local Plan	
			Total AADT	HDV AADT	Total AADT	HDV AADT
1289_1291	Motorway (not London)	Continuity link	39,793	4,114	51,953	5,983
1235_2350	Motorway (not London)	Continuity link	9,721	1,359	14,402	1,889
1173_2158	Urban (not London)	Verification (CE245)	13,474	152	15,397	151
1963_1964	Rural (not London)	Continuity link	1,385	67	3,261	133
2350_2000	Urban (not London)	Continuity link	15,455	570	18,506	931
1235_1285_1	Motorway (not London)	Verification (DT28)	55,367	5,957	72,445	9,010
1291_2351_2	Motorway (not London)	Verification (DT3, DT28)	52,496	5,359	70,782	8,024
1291_2351_3	Motorway (not London)	Continuity link	52,496	5,359	70,782	8,024

Appendix B Dispersion Modelling Approach and Verification

Dispersion Model

The ADMS-Roads v5.0.1 software from Cambridge Environmental Research Consultants is a gaussian plume type dispersion model that is accepted for use and considered fit for purpose by the UK Government and UK local authorities.

The model includes modules for meteorological data processing, dry and wet deposition, surface roughness processing and terrain processing. The dispersion model uses advanced algorithms for the height-dependence of wind speed, turbulence and stability to produce improved predictions of air pollutant concentrations within the given model domain. It can predict long-term and short-term concentrations, as well as calculations of percentile concentrations.

The model has been extensively validated against field conditions within the UK using the UK's automatic and passive monitoring networks, and through the use of validation specific monitoring.

Model Input Parameters

Principle model input parameters have been detailed in Section 3.2.2 within the main report. This section provides additional details and specialist parameters not described in the main report.

Modelled Road Link Geometry

The ADMS-Roads software requires the location of the road links to be modelled along with the width of the road links. The location of the road centrelines was determined through a mix of OpenStreetMap.org highway datasets and Ordnance Survey (OS) Mastermap Topography datasets. A shapefile of the modelled traffic network from the Transport Consultants was snapped to the geolocated road centrelines from OpenStreeMap.org and then visually adjusted or corrected using OS datasets.

Road widths were determined by applying perpendicular transects to the road centrelines and clipping these to the OS Mastermap Topography road polygons. The length of each clipped transect was measured and an average for each road link taken. This average transect length was then applied within the ADMS-Roads software.

Plume Depletion

The model was run with the Dry Deposition option switched on. Under this setting ADMS will make predictions taking account of plume depletion, that is that dispersed emissions are depleted due to deposition with distance from the source.

Surface Roughness

Surface roughness is a measure of the overall presence and size of surface factors such as buildings, earth bunds and vegetation and their capability to affect dispersion through turbulence. Surface roughness is given in metres with 0.0001 m representing flat water, 0.02 m as open grassland and up to 1.5 m for large population centres of 1 million people or more.

The surface roughness was set to 0.3 m across the dispersion modelling study area to reflect the mostly open aspect of the areas around the European Sites.

For the NWP meteorological datasets, the roughness was set at 0.1m as a reflection of the average, open rural aspect for the 4 km x 4 km area the data was taken from.

Monin-Obukhov Length

The Monin-Obukhov length is a measure of the height above ground of the mixing boundary layer, that is where more turbulence is generated by buoyancy than by wind shear. This determines how the model deals with ground level turbulence and how pollutants mix with ambient air close to the ground. The “model calculated” option was selected for both the dispersion site and the meteorological data.

Meteorological data

As stated in the main report there were no appropriately close meteorological monitoring stations considered adequately representative of the area to consider the use of measured data for the assessment, therefore NWP data for the location 53.05°N 2.38°W within the Black Firs and Cranberry Moss SSSI were used. The NWP data is provided for the year 2018 by ADM Ltd with a 4 km x 4 km resolution. An annual wind rose is presented in Figure 9 and seasonal variations are shown in the wind roses in Figure 10.

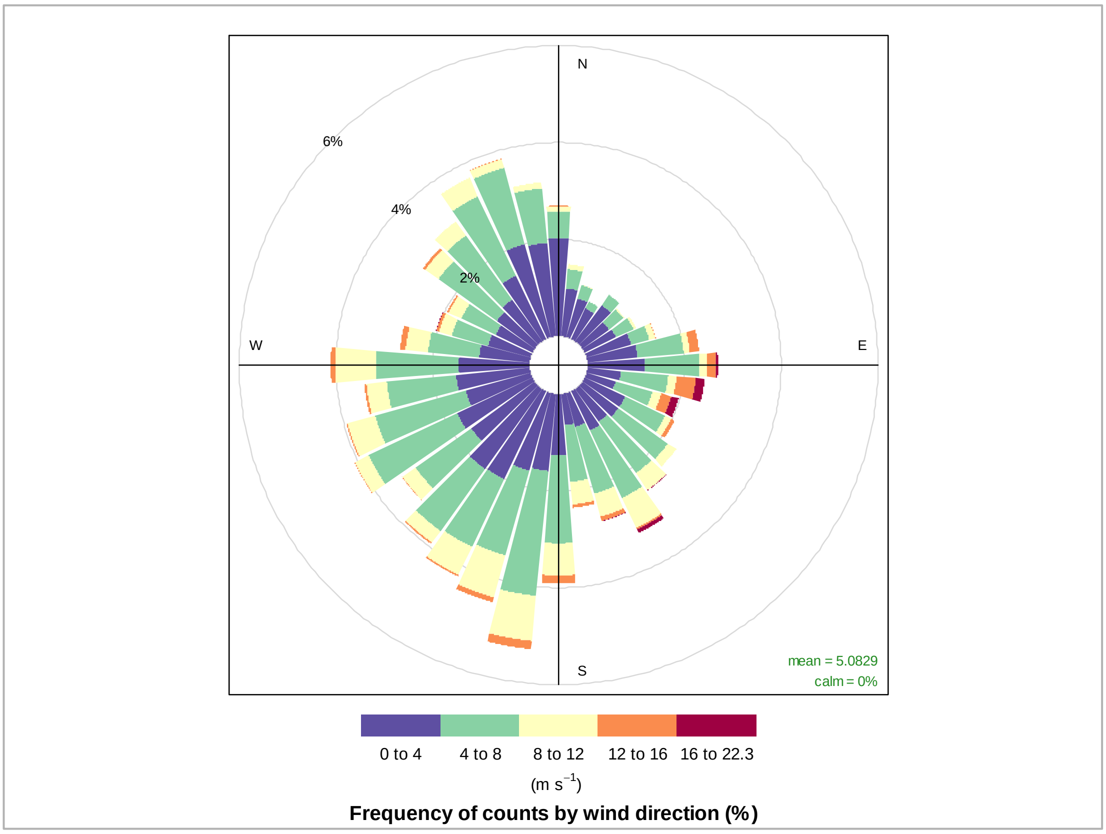


Figure 9 Annual Wind Rose of 2018 NWP Data

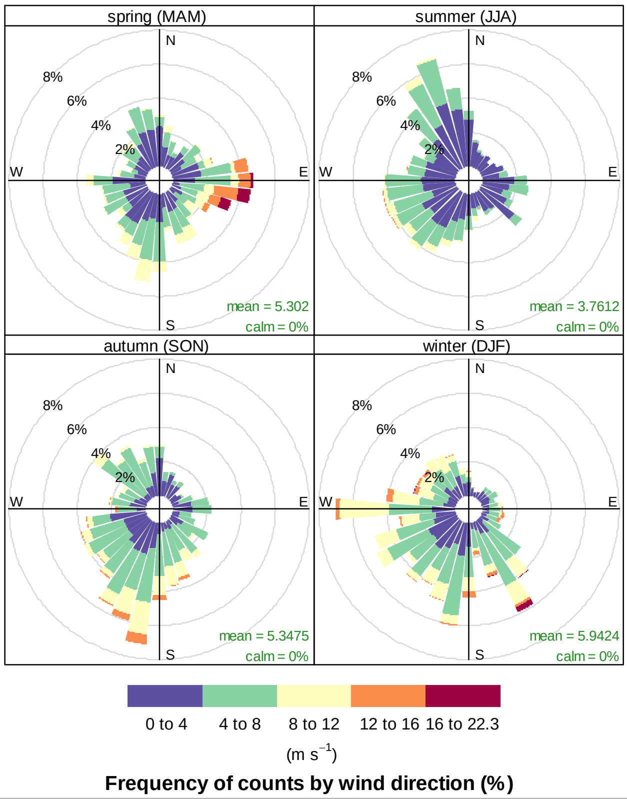


Figure 10 Seasonal Wind Rose of 2018 NWP Data

Dispersion Model Verification

Verification of the pollutant dispersion model outputs involves comparison of the modelled outputs with measured air pollutant concentrations at specific locations, typically locations where local authorities undertake air quality monitoring for comparison against human health objectives. This comparison process involves checking and refining the model input data to try to reduce uncertainties and produce outputs that in better agreement with the monitoring results. This can be followed by adjustment of the modelled results if required.

The guidance provided in LAQM.TG(22) recommends making adjustments to the road-NO_X contribution only and not the background concentrations the road-contribution is combined with. The values are then converted to NO_2 using the Defra NO_X to NO_2 Calculator. The model was verified using monitored data from NULC and Cheshire East local authorities from 2018 at the five locations detailed in Table 5.

Three statistical tests are applied to the data, which are described in Table 21.

Table 21 Model Verification Statistical Tests

Statistical Test	Description	Ideal Value
Correlation Coefficient	This is a measure of the linear relationship between two datasets. A value of zero would indicate no correlation, and a value of 1 means an absolute relationship. Such a statistic is useful for simple comparison of large datasets	1.00
Room Mean Square Error (RMSE)	RMSE is used to define the average error or uncertainty of the model. The units of RMSE are the same as those for the values being studied. This value should ideally be within 10% of the limit or objective value for the pollutants being modelled.	0.00

Statistical Test	Description	Ideal Value
Fractional Bias (FB)	FB is used to identify the systematic tendency of the dispersion model to over- or under-predict. Values can vary between -2 and +2, with an ideal value of zero. Negative FB values suggest the model is over-predicting, and positive FB values suggest a tendency to under-predict.	0.00

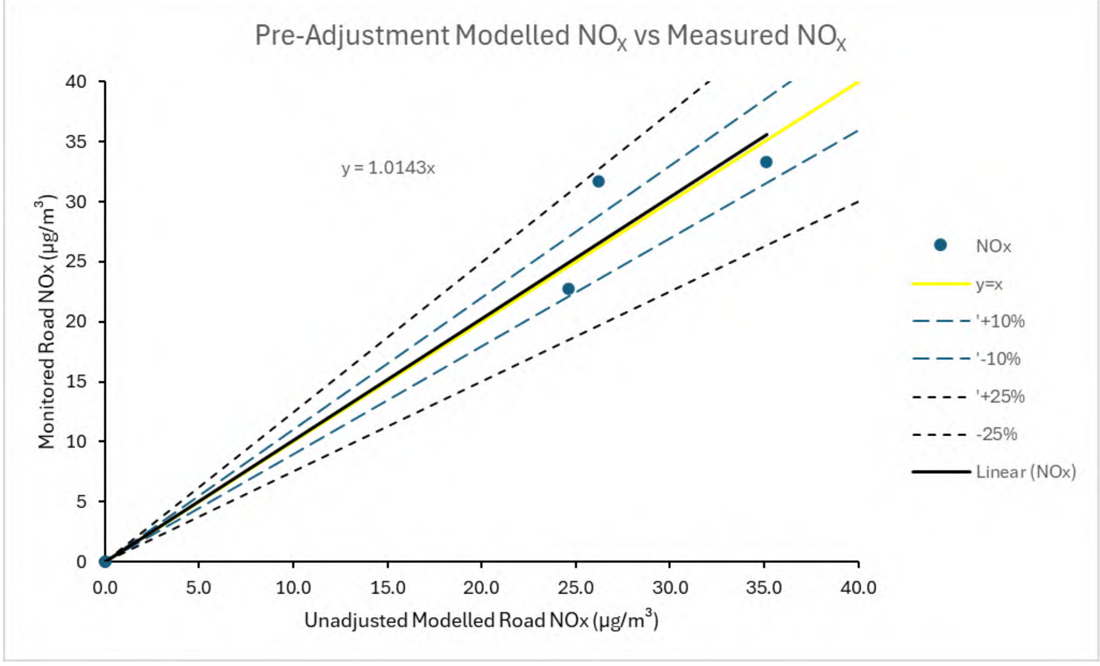
Initial results showed that the model was under-predicting slightly with an unadjusted FB of 0.01, however the RMSE was 6.58µg/m³.

Further investigation showed that a noise barrier had been installed at location CE234 on the M6 during 2018, therefore attempts to include this in the model were undertaken using both the noise barrier module and the advanced street canyon tool. Both modules failed to predict monitored pollutant concentrations within an acceptable level of accuracy. This was determined to be due to the installation of the barrier mid-year, the associated speed restrictions imposed during the works period that were not within the supplied traffic data and the presence of substantial deciduous vegetation. Therefore, the decision was taken to scope out this location.

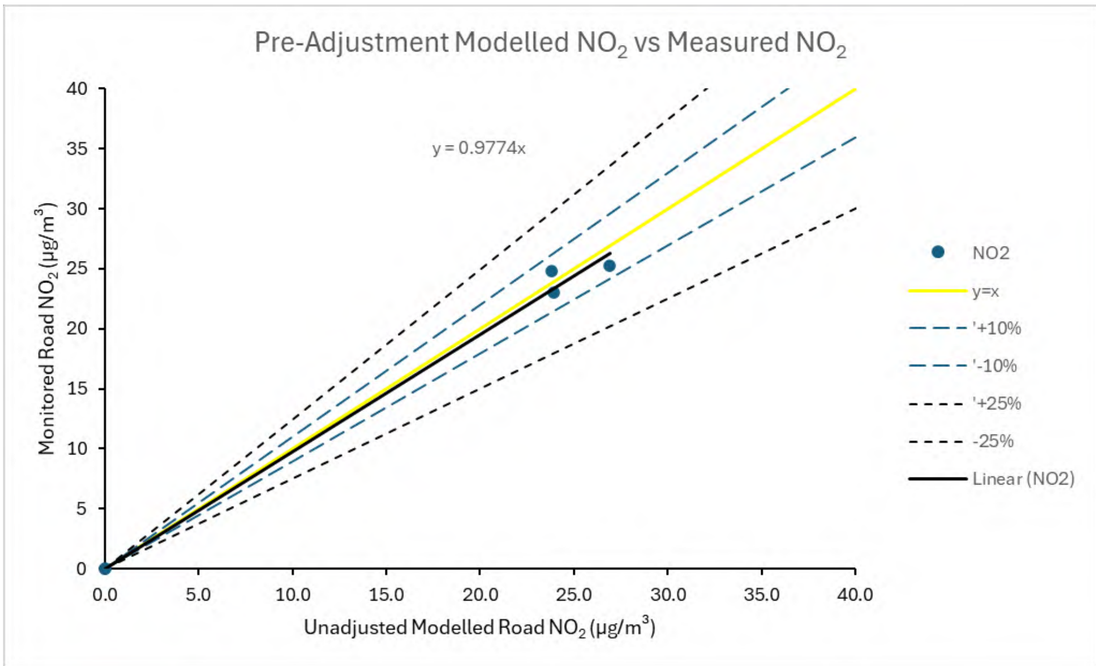
More difficulties were encountered at location CE245 on the B5077 Crewe Road in Alsager. The location was initially modelled flat, however further investigation identified the area as a potential urban street canyon. An attempt to model the location using the advanced street canyon was undertaken, however this failed to predict the monitored concentrations within an acceptable level of accuracy. Due to this and the fact that an urban street canyon was not representative of the locations of the European Sites being monitored, this location was scoped out of the verification process.

Verification was undertaken using the remaining three tubes DT3, DT28 and CE146.

Comparison of the monitored and modelled unadjusted road-NO_X components showed an adjustment factor of 1.014 as shown in Graph 1, and comparison of unadjusted road-NO_2 is shown in Graph 2.



Graph 1 Comparison of Pre-Adjustment Monitored and Modelled Road-NO_X



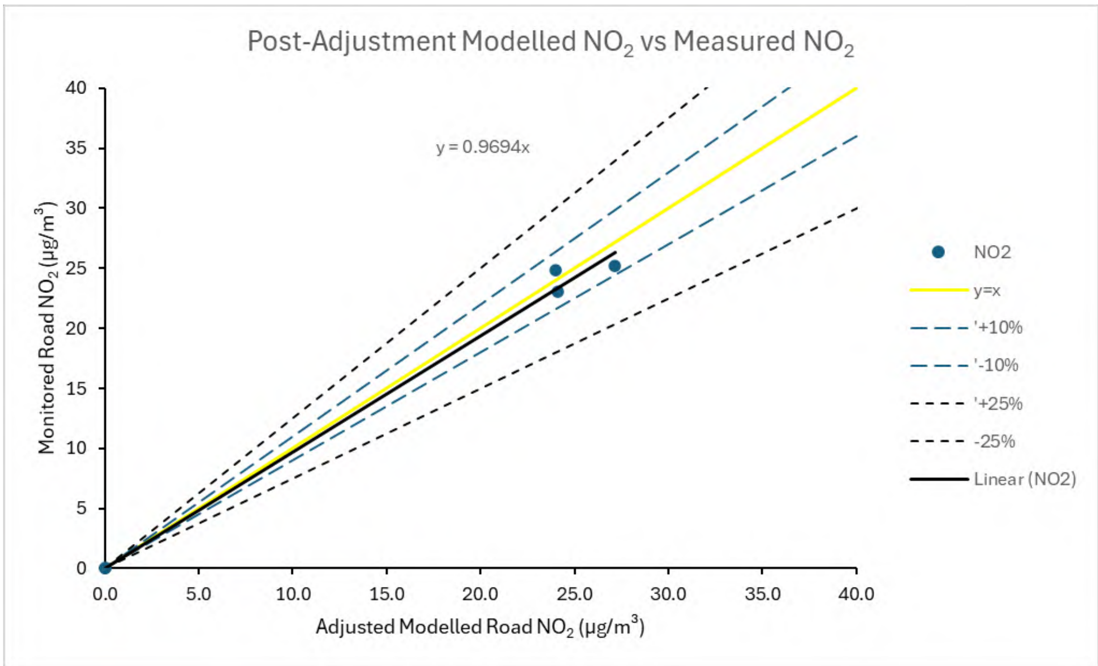
Graph 2 Comparison of Pre-Adjustment Monitored and Modelled Road-NO_2

The comparison of pre-adjustment monitored and modelled outputs is shown in Table 22.

Table 22 Comparison of Pre-Adjustment Monitored and Modelled Outputs

Site ID	Modelled road-NO_X (µg/m³)	Background NO_X (µg/m³)	Background NO_2 (µg/m³)	Total Modelled NO_2 (µg/m³)	Total Monitored NO_2 (µg/m³)	% Difference (Modelled vs Monitored)
DT 3	26.2	13.1	10.0	23.8	24.8	-4.1%
DT 28	35.1	11.2	8.7	26.9	25.2	+6.6%
CE146	24.6	14.5	11.0	23.9	23.0	+4.0%

The model was adjusted using the derived adjustment factor to produce a 1:1 relationship for road-NO_X, with the post-adjustment road-NO_2 shown in Graph 3.



Graph 3 Comparison of Post-Adjustment Monitored and Modelled Road-NO_2

The comparison of post-adjustment monitored and modelled outputs is shown in Table 23.

Table 23 Comparison of Post-Adjustment Monitored and Modelled Outputs

Site ID	Modelled road-NO_X (µg/m³)	Background NOx (µg/m³)	Background NO_2 (µg/m³)	Total Modelled NO_2 (µg/m³)	Total Monitored NO_2 (µg/m³)	% Difference (Modelled vs Monitored)
DT 3	26.2	13.1	10.0	24.0	24.8	-3.4%
DT 28	35.1	11.2	8.7	27.2	25.2	+7.6%
CE146	24.6	14.5	11.0	24.1	23.0	+4.7%

A summary of the model statistics is shown in Table 24.

Table 24 Summary of Model Statistics

Statistical Test	Pre-Adjustment	Adjustment Factor	Post-Adjustment
Correlation Coefficient	0.61	1.014	0.62
RMSE	1.25		1.36
FB	-0.02		-0.03

The summary shown in Table 24 shows that whilst the correlation coefficient shows a slightly increased tendency towards a 1:1 relationship, the average error in the model is increased by adjustment from 1.25 µg/m³ to 1.36 µg/m³. The tendency of the model to over-predict is also increased slightly. Based on these results and the difficulties encountered at the scoped-out monitoring locations it was decided to use the unadjusted model outputs for analysis in this air quality assessment.

Further Note on Dispersion

It is noted in the assessment that there are impacts covering the whole of both sites for the in-combination scenario.

In the case of the M6 motorway the flows of traffic are very high; a total for the in-combination scenario of 144,159 AADT. The result of this is that the rate of emission produced by the traffic is extremely high (0.06 g/km/s) therefore predicted concentrations close to the road are likely to be very high. However, as is pointed out in the ADMS-Roads user guide[14], the relationship between increasing traffic flow and roadside concentrations may not be linear due to the additional dispersion created by vehicle wake turbulence from a large number of vehicles. In the case of the M6 a very high volume of emissions is dispersed through normal dispersion and the additional dispersion from vehicle wake turbulence. This creates significant concentration predictions further from the road than would otherwise be expected. This is shown from the modelled transect in Figure 11 in the graph in Figure 12. Both of these predictions are in excess of the 1% screening criteria used in this assessment.

As can be seen from the further graph in Figure 13 a significant prediction is made up to the ends of the transect 490 m to the west and 420 m to the east, with the impact of the prevailing westerly wind clearly visible. The predictions at these transect end locations are 0.33 µg/m³ and 0.65 µg/m³, both in excess of the 1% criteria for NO_X. Thus, a very large volume of emissions is dispersed creating potentially significant impacts well beyond the 200 m where it is normally assumed that concentrations return to background levels.

Figure 11 M6 Transect at Oakhanger Moss

[14] Cambridge Environmental Research Consultants (2020) AMDS- Roads Air Quality Management System User Guide v5.0. Cambridge Environmental Research Consultants Ltd, Cambridge.

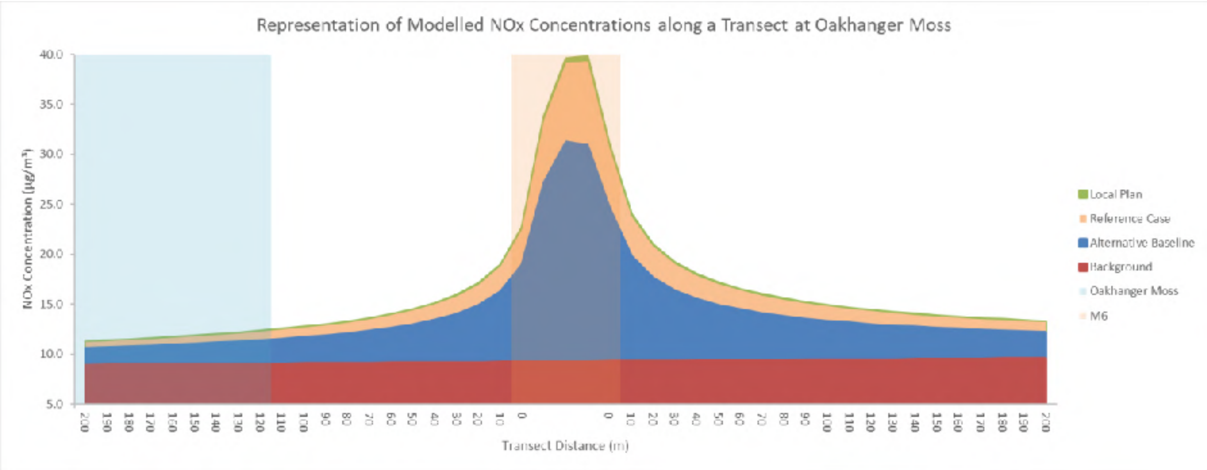


Figure 12 Representation of Modelled NOx Concentrations along a Transect at Oakhanger Moss up to 200 m

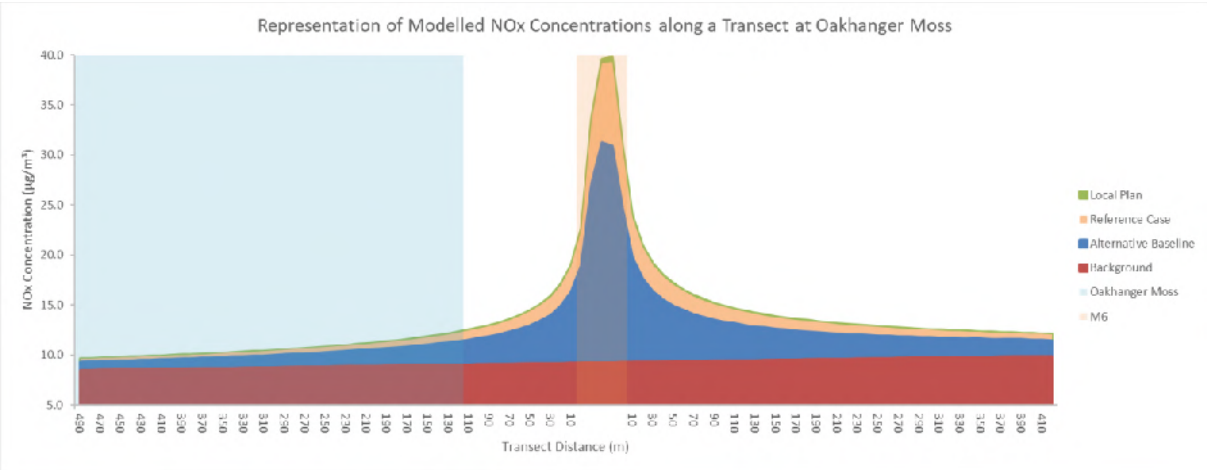


Figure 13 Representation of Modelled NOx Concentrations along a Transect at Oakhanger Moss beyond 200 m

A similar situation occurs at Black Firs and Cranberry Moss SSSI where a transect was modelled that included the site along with the A531 and B5500, shown in Figure 14.

Figure 14 Transect at Black Firs and Cranberry Moss SSSI

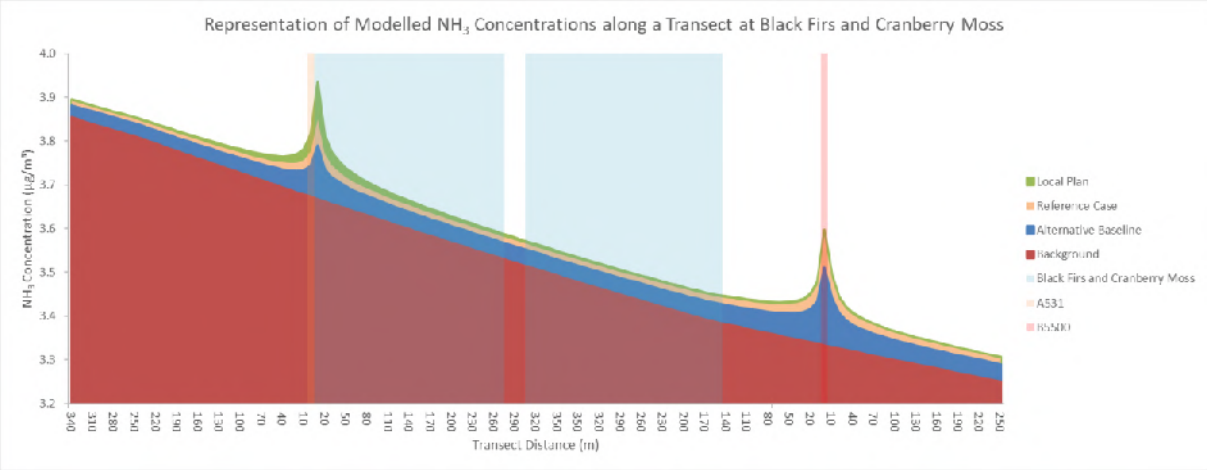


Figure 15 Representation of Modelled NH_3 Concentrations along a Transect at Black Firs and Cranberry Moss beyond 200 m

The graph in Figure 15 shows that there is a significant contribution to NH_3 concentrations at a location furthest from the two modelled road links. The in-combination impact at this location 360 m from both roads is 0.13 µg/m³, making it in excess of the 1% screening criteria for NH_3. The ADMS-Roads model will continue to predict small contributions from a road source for a distance substantially greater than 200 m from the source.

A predicted value of 0.13 µg/m³ is however very small. The ADMS-Roads dispersion model is validated against roadside measurements of NO_2 and thus performs within the acceptable range of 10% of the limit value of 40 µg/m³. It is not validated against roadside measurements of NH_3 and previous experience has shown validation against measured NH_3 to be subject to substantial interference from other NH_3 sources and thus vulnerable to high ranges of error. Arguably, predicting for a 1% change against a Critical Level for NH_3 of 1 µg/m³ is beyond the scope of the reliability of the modelling software. In addition to this, Alpha samplers produced for field measurements of NH_3 by the UK Centre for Ecology and Hydrology are reliable within a range of 0.03 µg/m³ to 100 µg/m³[15] so can be said to monitor accurately enough to quantify field measurements of a 1% change against the CLe, however the reality in areas where pet exercising, livestock farming or fertiliser application may occur is that the precision of readings is likely to be severely impeded.

[15] Centre for Ecology and Hydrology (2024) Air sampler systems for environmental monitoring: Alpha. [Online] https://www.ceh.ac.uk/solutions/equipment/air-sampler-systems-environmental-monitoring

Appendix C Air Quality Assessment Results Tables

This section includes results tables for each of the European Sites for the worst-case predictions at each 10 m interval starting at the site boundary. In interpreting the data in the table it is important to note that the maximum values at each distance are reported, however these may not occur at the same locations.

Table 25 reports the maximum predicted values for Black Firs and Cranberry Moss SSSI.

Table 26 reports the maximum predicted values for Oakhanger Moss SSSI.

Table 25 Black Firs and Cranberry Moss SSSI – In-Combination Modelled Maximum Values at each 10 m Interval

Distance within SSSI from road (m)*	Maximum Annual Mean NO_X (µg/m^3)				Maximum Annual Mean NH_3 (µg/m^3)				Maximum Nitrogen Deposition Rate for Tall Vegetation (kgN/ha/yr)				Maximum Nitrogen Deposition Rate for Short Vegetation (kgN/ha/yr)			
	2042 Alt Base	**2042 With Plans**	**Difference**	**Difference as % of CLe**	**2042 Alt Base**	**2042 With Plans**	**Difference**	**Difference as % CLe**	**2042 Alt Base**	**2042 With Plans**	**Difference**	**Difference as % of LCLo**	**2042 Alt Base**	**2042 With Plans**	**Difference**	**Difference as % LCLo**
0	7.3	8.0	0.8	**2.6%**	3.78	3.89	0.05	**5.2%**	42.55	43.64	0.47	**9.3%**	23.54	24.25	0.30	**6.0%**
10	7.1	7.5	0.4	**1.4%**	3.75	3.81	0.03	**3.1%**	42.21	42.80	0.28	**5.6%**	23.32	23.70	0.18	**3.6%**
20	7.1	7.3	0.3	**1.1%**	3.74	3.78	0.02	**2.4%**	42.09	42.54	0.22	**4.4%**	23.25	23.54	0.14	**2.9%**
30	7.1	7.2	0.3	0.9%	3.73	3.76	0.02	**2.1%**	42.04	42.41	0.19	**3.9%**	23.21	23.45	0.12	**2.5%**
40	7.1	7.2	0.2	0.8%	3.72	3.75	0.02	**1.9%**	41.99	42.32	0.18	**3.6%**	23.19	23.40	0.11	**2.3%**
50	7.0	7.2	0.2	0.7%	3.72	3.75	0.02	**1.8%**	41.96	42.26	0.17	**3.3%**	23.17	23.36	0.11	**2.1%**
60	7.0	7.2	0.2	0.7%	3.71	3.74	0.02	**1.7%**	41.94	42.21	0.16	**3.1%**	23.16	23.33	0.10	**2.0%**
70	7.0	7.2	0.2	0.6%	3.71	3.73	0.02	**1.7%**	41.92	42.17	0.15	**3.0%**	23.15	23.31	0.10	**1.9%**
80	7.0	7.1	0.2	0.6%	3.70	3.73	0.02	**1.6%**	41.89	42.14	0.15	**2.9%**	23.14	23.29	0.09	**1.9%**
90	7.0	7.1	0.2	0.6%	3.70	3.73	0.02	**1.5%**	41.88	42.11	0.14	**2.8%**	23.13	23.27	0.09	**1.8%**
100	7.0	7.1	0.2	0.5%	3.70	3.72	0.02	**1.5%**	41.86	42.08	0.14	**2.8%**	23.12	23.26	0.09	**1.8%**
110	7.0	7.1	0.2	0.5%	3.69	3.71	0.01	**1.5%**	41.85	42.06	0.13	**2.7%**	23.11	23.24	0.09	**1.7%**
120	7.0	7.1	0.2	0.5%	3.68	3.70	0.01	**1.4%**	41.83	42.03	0.13	**2.6%**	23.10	23.23	0.08	**1.7%**
130	7.0	7.1	0.1	0.5%	3.67	3.69	0.01	**1.4%**	41.81	42.01	0.13	**2.6%**	23.09	23.22	0.08	**1.7%**
140	6.9	7.1	0.1	0.5%	3.67	3.69	0.01	**1.4%**	41.80	42.00	0.13	**2.6%**	23.08	23.21	0.08	**1.7%**
150	6.9	7.0	0.1	0.5%	3.66	3.68	0.01	**1.4%**	41.79	41.98	0.13	**2.6%**	23.08	23.20	0.08	**1.6%**
160	6.9	7.0	0.1	0.5%	3.65	3.67	0.01	**1.4%**	41.77	41.96	0.13	**2.5%**	23.07	23.19	0.08	**1.6%**
170	6.8	7.0	0.1	0.5%	3.65	3.67	0.01	**1.4%**	41.76	41.94	0.13	**2.5%**	23.06	23.18	0.08	**1.6%**
180	6.8	6.9	0.1	0.4%	3.64	3.66	0.01	**1.3%**	41.75	41.93	0.13	**2.5%**	23.05	23.17	0.08	**1.6%**
Critical Level / Load	**30**				**1**				**5**				**5**			

Notes: Exceedances of 1% significance screening criterion are highlighted in **bold**. All values are reported to an appropriate accuracy. The maximum predicted values and maximum predicted differences may not occur at the same location.

* Maximum distance from the site boundary is 180 m

Table 26 Oakhanger Moss SSSI – In-Combination Modelled Maximum Values at each 10 m Interval

Distance within SSSI from road (m)*	Maximum Annual Mean NO_X (µg/m^3)				Maximum Annual Mean NH_3 (µg/m^3)				Maximum Nitrogen Deposition Rate for Tall Vegetation (kgN/ha/yr)				Maximum Nitrogen Deposition Rate for Short Vegetation (kgN/ha/yr)			
	2042 Alt Base	**2042 With Plans**	**Difference**	**Difference as % of CLe**	**2042 Alt Base**	**2042 With Plans**	**Difference**	**Difference as % CLe**	**2042 Alt Base**	**2042 With Plans**	**Difference**	**Difference as % of LCLo**	**2042 Alt Base**	**2042 With Plans**	**Difference**	**Difference as % LCLo**
0	11.3	12.2	0.9	**3.1%**	3.63	3.77	0.13	**13.2%**	43.03	44.29	1.21	**24.10%**	24.04	24.85	0.77	**15.5%**
10	11.2	12.1	0.9	**2.9%**	3.61	3.74	0.12	**12.5%**	42.86	44.04	1.14	**22.77%**	23.93	24.69	0.73	**14.6%**
20	11.1	11.9	0.8	**2.8%**	3.59	3.71	0.12	**11.8%**	42.69	43.81	1.08	**21.54%**	23.82	24.54	0.69	**13.8%**
30	11.0	11.8	0.8	**2.7%**	3.57	3.69	0.11	**11.3%**	42.56	43.63	1.03	**20.62%**	23.73	24.42	0.66	**13.2%**
40	10.9	11.7	0.8	**2.6%**	3.56	3.67	0.11	**10.8%**	42.46	43.49	0.99	**19.76%**	23.67	24.33	0.63	**12.7%**
50	10.8	11.5	0.7	**2.5%**	3.55	3.66	0.10	**10.4%**	42.35	43.34	0.95	**18.96%**	23.60	24.23	0.61	**12.2%**
60	10.7	11.4	0.7	**2.4%**	3.54	3.64	0.10	**10.0%**	42.25	43.20	0.91	**18.27%**	23.53	24.14	0.59	**11.7%**
70	10.6	11.3	0.7	**2.3%**	3.52	3.62	0.10	**9.6%**	42.16	43.06	0.88	**17.58%**	23.47	24.06	0.57	**11.3%**
80	10.6	11.2	0.7	**2.2%**	3.51	3.61	0.09	**9.3%**	42.08	42.95	0.85	**16.99%**	23.41	23.98	0.55	**10.9%**
90	10.5	11.1	0.6	**2.1%**	3.51	3.60	0.09	**9.0%**	42.00	42.84	0.82	**16.42%**	23.36	23.92	0.53	**10.5%**
100	10.4	11.0	0.6	**2.1%**	3.50	3.59	0.09	**8.7%**	41.94	42.74	0.79	**15.87%**	23.32	23.85	0.51	**10.2%**
110	10.3	10.9	0.6	**2.0%**	3.49	3.58	0.08	**8.4%**	41.87	42.65	0.76	**15.27%**	23.28	23.79	0.49	**9.8%**
120	10.3	10.9	0.6	**1.9%**	3.49	3.57	0.08	**8.1%**	41.82	42.58	0.74	**14.85%**	23.24	23.74	0.48	**9.5%**
130	10.2	10.8	0.6	**1.9%**	3.48	3.56	0.08	**7.8%**	41.77	42.51	0.71	**14.25%**	23.21	23.68	0.46	**9.2%**
140	10.1	10.7	0.5	**1.8%**	3.47	3.55	0.08	**7.6%**	41.72	42.43	0.70	**13.93%**	23.17	23.64	0.45	**8.9%**
150	10.1	10.6	0.5	**1.7%**	3.47	3.54	0.07	**7.3%**	41.67	42.36	0.67	**13.39%**	23.14	23.59	0.43	**8.6%**
160	10.0	10.5	0.5	**1.7%**	3.46	3.54	0.07	**7.2%**	41.63	42.30	0.66	**13.12%**	23.11	23.55	0.42	**8.4%**
170	10.0	10.5	0.5	**1.6%**	3.46	3.53	0.07	**6.9%**	41.59	42.25	0.63	**12.69%**	23.09	23.51	0.41	**8.1%**
180	9.9	10.4	0.5	**1.6%**	3.45	3.52	0.07	**6.8%**	41.55	42.19	0.62	**12.32%**	23.06	23.47	0.40	**7.9%**
190	9.9	10.3	0.5	**1.6%**	3.45	3.52	0.07	**6.6%**	41.51	42.13	0.60	**12.01%**	23.04	23.44	0.39	**7.7%**
200	9.8	10.3	0.5	**1.5%**	3.44	3.51	0.06	**6.4%**	41.47	42.08	0.59	**11.71%**	23.01	23.40	0.38	**7.5%**
Critical Level / Load	**30**				**1**				**5**				**5**			
Notes: Exceedances of 1% significance screening criterion are highlighted in bold. All values are reported to an appropriate accuracy. The maximum predicted values and maximum predicted differences may not occur at the same location.																
* Maximum distance from the site boundary is 180 m																

Appendix D Natural England Letter (04 October 2024)

Appendix E Transport Modelling

Traffic data was provided from the NSMM (North Staffordshire Multi-Modal Model). This strategic model covers North Staffordshire, including the urban centres of Stoke-on-Trent and Newcastle-under-Lyme and contains 288 zones. The model is implemented using the CUBE modelling software and contains VDM (Variable Demand Model), Highways and Public Transport components.

The model has been used successfully for many significant local transport schemes with approval by the DfT (Department for Transport) and NH (National Highways). Work conducted for the NSLAQP (North Staffordshire Local Air Quality Plan) on behalf of JAQU (Joint Air Quality Group) and the DfT included validation of the base year model against observed 2015 and 2018 vehicle count data as well as a comparison of growth between 2015 and 2022. This analysis of growth indicates that there has been no significant growth in traffic volumes between 2015 and 2018 as is indicated by DfT and NH WebTRIS traffic counts.

The transport modelling work undertaken to support this Air Quality Impact Assessment has been undertaken with close corporation of local stakeholders including NH, NuLBC (Newcastle-under-Lyme Borough Council), SoTCC (Stoke on Trent City Council), CEC (Cheshire East Council) and SCC (Staffordshire County Council). All of which have supplied evidence to support the construction of an Uncertainty Log to support future year forecasts. The transport model results used for the analysis have been derived from work undertaken to provide a Strategic Transport Assessment for the Newcastle-under-Lyme Local Plan. For a detailed description of the modelling process, please review the associated Strategic Transport Assessment report.

The NSMM model has been used to construct two scenarios for use with air quality modelling, these are:

2015 Baseline

- Data analysis shows no growth in traffic between 2015/2018. This scenario does not include any future year developments

2040 Reference Case

- National Trip End Model (NTEM), otherwise known as TEMPro, traffic growth to 2040
- Uncertainty log includes all committed land use developments from Newcastle-under-Lyme and Stoke-on-Trent

2040 Local Plan

- Uncertainty log includes Local Plan allocations from Newcastle-under-Lyme and Stoke-on-Trent (note Cheshire East allocations on the boundary of Newcastle-under-Lyme have also been included)
- Loaded onto the 2040 Reference Case

Each scenario has been modelled for AM, IP and PM time periods and period flows have been converted to Average Annual Daily Traffic (AADT) flows by use of factors derived from vehicle count data.

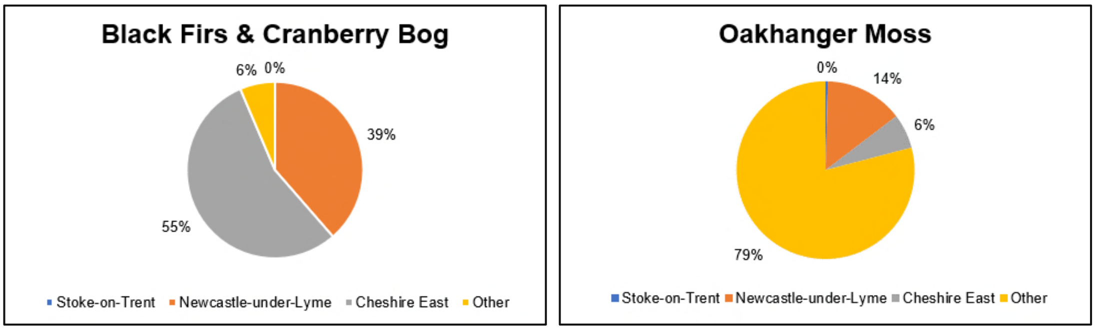
Select Link Analysis

Further analysis was undertaken within the NSMM model to ascertain indicative local authority impacts on Black Firs and Cranberry Bog SSSI and Oakhanger Moss SSSI. The same process was followed for both sites which included:

- A select link assignment on the roads closest to the sites (this shows how vehicles on the interested roads distribute throughout the NSMM model)
- These assignments are done for both the with and without Local Plan scenarios – for the purpose of understanding the change/difference
- Categorised these results by local authority area – removing any local authority areas that are expected to have zero or negative changes in traffic (considering those only seen to be negatively impacting the sites)
- Factoring up of these results to present daily impacts

The results of this assessment are shown in Figure 16 below.

Figure 16: Proportionate impacts at Black Firs & Cranberry Bog and Oakhanger Moss



It should be noted that this is indicative, and so the results should be used with caution. To understand the true impact by local authority area, various scenarios would need to be modelled in the NSMM model. These scenarios would consist of modelling each local authorities Local Plan in isolation. There also few limitations of the model such as:

- The model is known by Sweco and National Highways to not accurately reflect current day trends at the M6 junction 16, so there are likely to be contributions particularly from Stoke-on-Trent that are not captured (because trips are rerouting via J17 and Talke). In the same way Cheshire East's contribution at Black Firs & Cranberry Bog is likely to be overestimated due to Cheshire East trips rerouting away from junction 16
- The model is dated pre-Covid, so by its nature does overpredict demand
- The model focuses on North Staffordshire and so Sweco and National Highways are aware of partial representation of some external-to-external demand (trips starting and ending outside of North Staffordshire)
- This assessment is purely looking at vehicle distribution on the links of interest (e.g., home to work trips from Cheshire East to Newcastle)