In Parliament – Session 2022 - 2023

HS2

# High Speed Rail (Crewe – Manchester)

## Supplementary Environmental Statement 2 and Additional Provision 2 Environmental Statement

### Volume 5: Appendix EC-016-00001

**Ecology and biodiversity**

Designated site assessment for the Midland Meres and Mosses Phase 2 Ramsar site (Oak Mere) and Oak Mere Special Area of Conservation

S61

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Department for Transport

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# 1 Introduction

## 1.1 Purpose of this appendix

1.1.1 This report is an appendix to the ecology and biodiversity assessment which forms part of Volume 5 of the Supplementary Environmental Statement 2 (SES2) and Additional Provision 2 Environmental Statement (AP2 ES).

1.1.2 It provides an assessment to enable the identification of likely significant effects on the Oak Mere Site of Special Scientific Interest (SSSI) component of the Midland Meres and Mosses Phase 2 Ramsar site and Oak Mere Special Area of Conservation (SAC) (hereafter referred to as Oak Mere).

1.1.3 This report provides the background assessment for identifying any likely significant effects on Oak Mere as a result of the AP2 revised scheme to be reported under the EIA Regulations 2017 (as amended)[1]. This background assessment is provided in Section 3 of this report.

1.1.4 The High Speed Two (HS2) High Speed Rail (Crewe – Manchester) Environmental Statement (ES) was published in 2022[2] (the main ES). Volume 5 of the main ES included a draft assessment to inform a Habitats Regulations Assessment for Oak Mere[3]. Further and separate assessment is being carried out in line with Regulation 63 of the Conservation of Habitats and Species Regulations 2017 (as amended)[4]. Section 4 of this report provides the emerging results at this current stage of design and assessment, which will be finalised as part of the further and separate assessment.

1.1.5 This report should be read in conjunction with the SES2 and AP2 ES Volume 2, Community Area report: Wimboldsley to Lostock Gralam (MA02).

1.1.6 In order to differentiate between the original scheme and the subsequent changes, the following terms are used in the SES2 and AP2 ES:

[1] *The Town and Country Planning (Environmental Impact Assessment) Regulations 2017. SI 2017 No. 571.* Her Majesty's Stationery Office, London. Available online at: http://www.legislation.gov.uk/uksi/2017/571/pdfs/uksi_20170571_en.pdf.

[2] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement.* Available online at: https://www.gov.uk/government/collections/hs2-phase2b-crewe-manchester-environmental-statement.

[3] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement*, *Document to inform a Habitats Regulations Assessment for the Midland Meres and Mosses Phase 2 Ramsar site (Oak Mere) and Oak Mere SPA,* Volume 5, Appendix: EC-016-00001. Available at: https://www.gov.uk/government/collections/hs2-phase2b-crewe-manchester-environmental-statement.

[4] *The Conservation of Habitats and Species Regulations 2017 (2017/1012),* as amended by The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 (2019/579). Her Majesty's Stationery Office, London.

- 'the original scheme' – the Bill scheme submitted to Parliament in 2022, which was assessed in the main ES;
- 'the SES1 scheme' – the original scheme with any changes described in SES1 that are within the existing powers of the Bill;
- 'the AP1 revised scheme' – the original scheme as amended by SES1 changes and AP1 amendments;
- 'the SES2 scheme' – the original scheme with any changes described in SES1 (submitted in July 2022) and the SES2; and
- 'the AP2 revised scheme' – the original scheme as amended by SES1 and SES2 changes (as relevant) and AP2 amendments.

1.1.7 This report assesses the impacts on Oak Mere using an updated methodology for the assessment of air pollution arising from traffic flows. Further details are provided in the SES2 and AP2 ES Volume 5, Appendix: CT-001-00003 Air Quality – Technical note – Updated guidance on the assessment methodology for Phase 2b SES2 and AP2 ES.

# 2 Context

## 2.1 AP2 revised scheme

2.1.1 Oak Mere is situated approximately 9.7km west of the land required for the construction of the AP2 revised scheme in the Wimboldsley to Lostock Gralam (MA02) community area. The AP2 revised scheme will result in a change to traffic flows during construction and operation along the A49 Tarporley Road and A54 Middlewich Road which lie adjacent to the eastern and southern boundaries of Oak Mere, respectively.

2.1.2 Neither the A49 Tarporley Road nor the A54 Middlewich Road are planned construction traffic routes; changes in traffic flows will arise as a consequence of the redistribution of vehicles in the area caused by construction of the AP2 revised scheme and the general growth in traffic volumes over time.

## 2.2 Site description and nature conservation targets

### The Midland Meres and Mosses Phase 2 Ramsar site

2.2.1 The Midland Meres and Mosses Phase 2 Ramsar site extends over 2,365ha across 18 discrete sites[5] distributed throughout the North-West Midlands and North-East Wales, over an area that extends 75km from north to south and 60km from west to east. Figure 1 shows the location and extent of the Phase 2 Ramsar site and Figure 2 shows the location of Oak Mere relevant to the AP2 revised scheme. The Ramsar Information Sheet[6] identifies that Oak Mere qualifies for Ramsar status under criteria (1) and (2) on account of the presence of 'a diverse range of habitats from open water to raised bog' and the presence of a number of rare plants and invertebrates. Elsewhere, it describes the entire Ramsar site as comprising open water (meres) and their associated fringing habitats (for example, reed swamps, fen, carr and damp pasture) and a smaller number of nutrient poor peat bogs (mosses). However, not all features are present on all sites. Although the Ramsar-qualifying features are quite broadly described, together they encompass a distinctive group of water bodies

[5] Note that the favourable condition table for Oakhanger Moss and Abbots Moss amongst others suggests that there are 19 components and includes Rostherne Mere in the list of sites. This appears to be an error. Rostherne Mere is a standalone Ramsar site. Confirmation of this can be gained by accessing the following site: https://designatedsites.naturalengland.org.uk/SiteGeneralDetail.aspx?SiteCode=UK11080&SiteName=&countyCode=&responsiblePerson=&unitId=&SeaArea=&IFCAArea=.

[6] Joint Nature Conservation Committee (1997), *Ramsar Information Sheet (RIS): Midland Meres and Mosses Phase 2.* Available online at: https://jncc.gov.uk/jncc-assets/RIS/UK11080.pdf.

with characteristic hydrological regimes, water chemistry and animal and plant communities. However, the Ramsar Information Sheet confirms its primary interest remains the 'wide range of lowland wetland types and successional stages within a distinct biogeographical area.'

# Oak Mere SAC

2.2.2 The citation[7] for Oak Mere SAC describes the site as occupying a shallow lake which supports a unique water chemistry and outstanding assemblage of aquatic plants including shore weed (*Littorella uniflora*) and (the nationally rare) narrow small-reed (*Calamagrostis stricta*) together with a broad range of invertebrates. A series of bog pools and basin mires are associated with the main lake and the entire site has a complex hydrological regime. The Supplementary advice[8] confirms this and adds that the water is acidic, helping to support a fauna more typical of upland pools, though mesotrophic. Peat is still being actively formed in pools to the north, though the Supplementary advice notes that much of the surrounding land is drier. Much of the site is wooded with wet carr woodland dominating around the wetter areas though this shifts to a community dominated by birch (*Betula pubescens*) and oak (*Quercus spp*) with an understorey of heather (*Calluna vulgaris*) and bilberry (*Vaccinium myrtillus*) to the south. The southern catchment is under agricultural management.

2.2.3 The qualifying habitats are listed as follows:

- oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*); and
- transition mires and quaking bogs.

2.2.4 Further information is provided in the Favourable Condition Tables (FCT)[9] for Oak Mere SSSI. Whilst providing broadly similar targets to those described above, it should be noted that its description of the SAC features differs slightly from the formal conservation objectives, introducing a range of fen/marsh/swamp and mixed habitat communities alongside the oligotrophic waters. However, the latter is taken to embrace quaking bogs as explained in the FCT audit trail. Annex 1 of the FCT also provides 'Habitat and vegetation maps'.

[7] Department for Environment, Food and Rural Affairs (2005), *Citation for Special Area of Conservation Oak Mere.* Available online at: http://publications.naturalengland.org.uk/file/5022779573272576.

[8] Natural England (2019), *European Site Conservation Objectives: Supplementary advice on conserving and restoring site features, Oak Mere Special Area of Conservation*. Available online at: http://publications.naturalengland.org.uk/publication/4577218189590528.

[9] Natural England (2009), *Conservation Objectives and Definitions of Favourable Condition for Designated Features of Interest, Oak Mere.*

**Figure 1: Location of Oak Mere SAC and the constituent SSSI forming the Midland Meres and Mosses Phase 2 Ramsar**

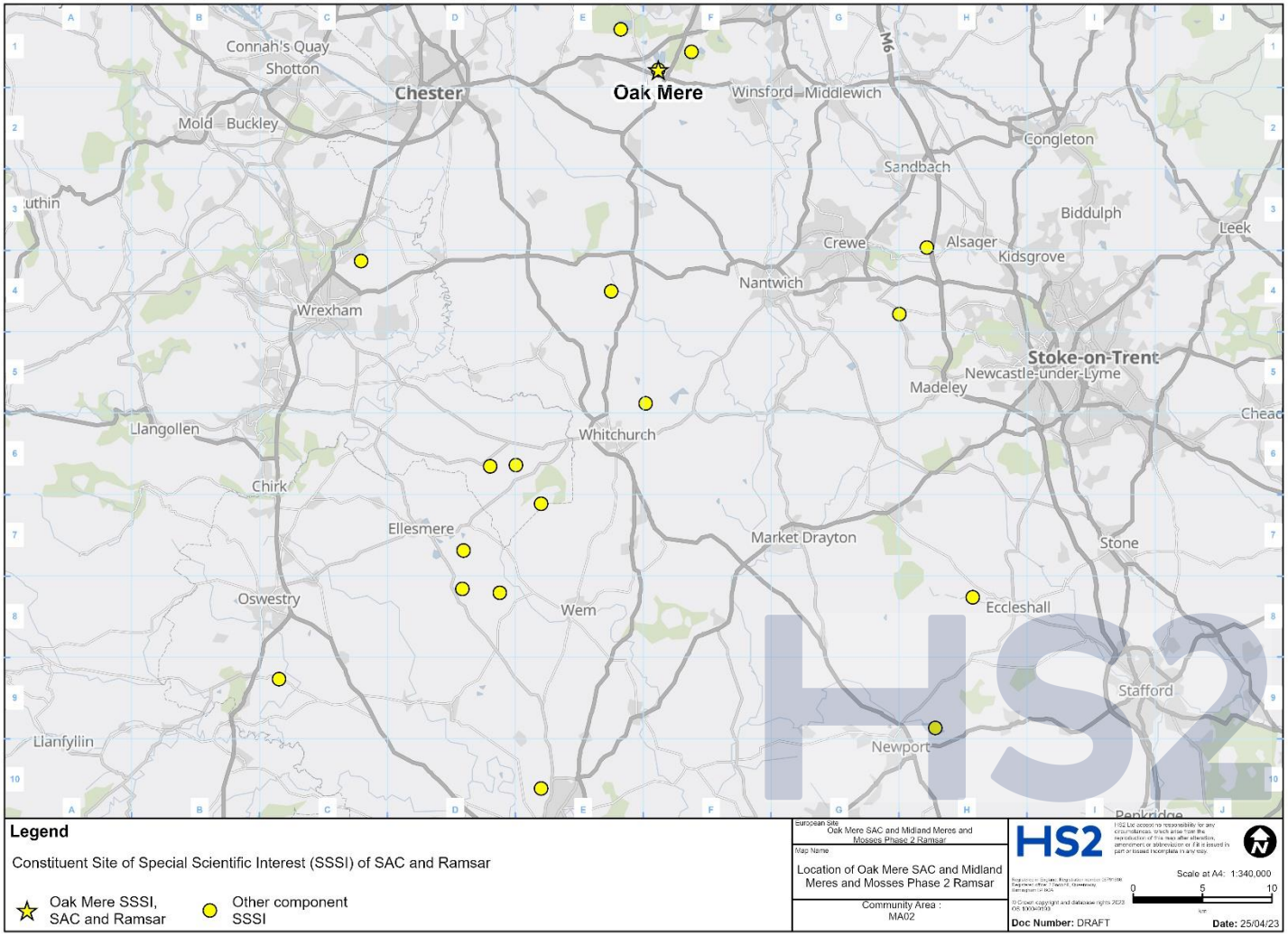
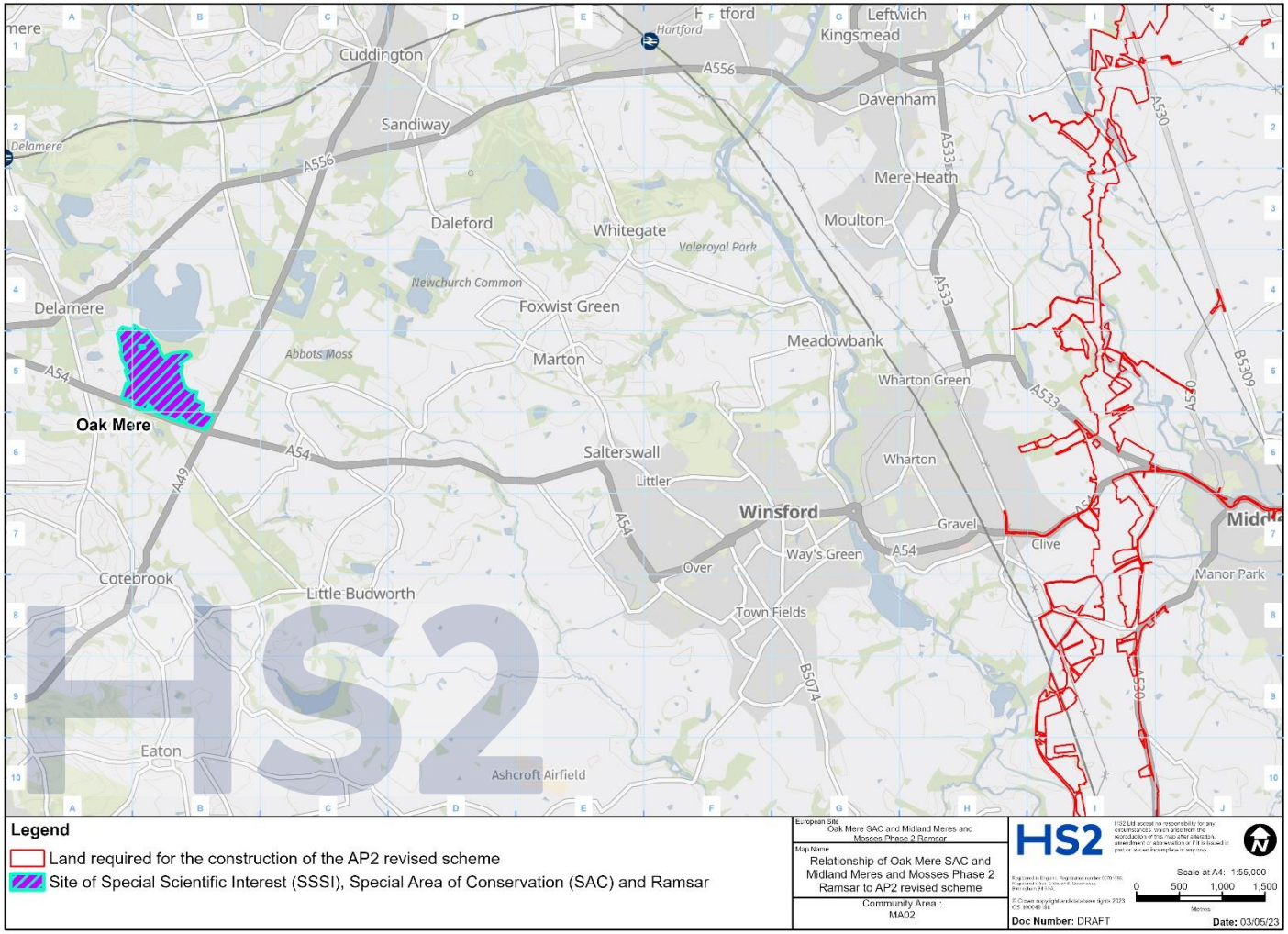


**Figure 2: Relationship of Oak Mere to the AP2 revised scheme**



# Conservation objectives

2.2.5 The conservation objectives[10] for Oak Mere SAC state:

'Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring:

- the extent and distribution of qualifying natural habitats;
- the structure and function (including typical species) of qualifying natural habitats; and
- the supporting processes on which qualifying natural habitats rely'.

2.2.6 These are given greater expression in the associated 'Supplementary advice' and Site Improvement Plan (SIP)[11]. Both identify physical modification and 'air pollution' as negative factors. In addressing air pollution, the Supplementary advice aims to:

'Restore as necessary the concentrations and deposition of air pollutants at or below the site-relevant Critical Load or Level values…'.

2.2.7 It provides other objectives relating to water quality and acidity for both qualifying features.

2.2.8 Given that Natural England does not produce conservation objectives for Ramsar sites, reliance on those provided for the SAC habitats is regarded as a reasonable surrogate. This is confirmed in Table 1 of the FCT which shows all Ramsar features are accommodated within those of the SAC. This includes the rare fauna and flora highlighted in the Ramsar description which are considered to be embraced by the 'typical species' of the SAC. Consequently, this report will rely solely on the SAC objectives.

# Condition assessment

2.2.9 The most recent formal condition monitoring assessment of Oak Mere SSSI was carried out by Natural England in 2012[12] although this pre-dated, and so would not have taken account of, the objectives described above. This found that overall, the entire site was considered to be in an 'unfavourable no change' condition primarily, it appears, because of the high mineral content and pH of the surface waters. However, no threats were identified. In terms

[10] Natural England (2018), *European Site Conservation Objectives for Oak Mere Special Area of Conservation, Version 3.* Available online at: http://publications.naturalengland.org.uk/file/6099038630051840.

[11] Natural England (2014), *Site Improvement Plan*, Oak Mere, *Version 1.0*. Available online at: http://publications.naturalengland.org.uk/publication/5056911862923264.

[12] Natural England (2012), *Condition of SSSI Units for Site Oak Mere SSSI.* Available online at: https://designatedsites.naturalengland.org.uk/ReportUnitCondition.aspx?SiteCode=S1002780&ReportTitle=Oak%20Mere%20SSSI.

of the SAC features, this was interpreted as 'unfavourable no change' for the oligotrophic water community and 'unfavourable recovering' for the transition mires and quaking bogs[13].

2.2.10 Whilst this assessment was carried out 11 years ago, there is little to suggest circumstances have changed and, overall, it is assumed that Oak Mere remains in an unfavourable condition and vulnerable to external influences. Given this, the objectives are interpreted not as 'to maintain' but 'to restore' the qualifying features.

[13] Natural England, *Oak Mere SAC Site Features.* Available online at: https://designatedsites.naturalengland.org.uk/SiteSACFeaturesMatrix.aspx?SiteCode=UK0012970&SiteName=Oak%20Mere%20SAC.

# 3 Assessment of the AP2 revised scheme

## 3.1 Introduction

3.1.1 This section provides the background assessment for identifying any likely significant effects on Oak Mere to be reported under the EIA Regulations 2017 (as amended). The conclusions of this assessment are summarised in the SES2 and AP2 ES Volume 2, Community Area report: Wimboldsley to Lostock Gralam (MA02).

3.1.2 This assessment identifies the likely significant effects as a result of the AP2 revised scheme. In addition, the air quality modelling, from which the impacts and effects reported below are derived, has taken into account cumulative effects from background traffic growth, committed developments[14] and impacts related to traffic emissions arising from the SES2 changes and AP2 amendments.

## 3.2 Scope, assumptions and limitations

3.2.1 Oak Mere lies approximately 9.7km away from land required for construction of the AP2 revised scheme in the Wimboldsley to Lostock Gralam (MA02) community area. Given the distance from Oak Mere, direct impacts can be ruled out. The only potential impacts that could arise as a result of the AP2 revised scheme are restricted to changes in air quality and hydrology.

3.2.2 Oak Mere is located in a different hydrological catchment (Sandyford Brook) to the AP2 revised scheme and occupies higher ground. Making the reasonable assumption that groundwater flow in the superficial deposits follows topography, there would be no hydraulic connection between the site and the AP2 revised scheme. Therefore, potential impacts from changes in hydrology can be ruled out.

3.2.3 Consequently, the only plausible impact is from air pollution caused by changes in traffic brought about by the AP2 revised scheme, allied with the general growth in traffic in the area. This single issue is assessed below.

[14] Committed developments relevant to the AP2 revised scheme are reported in Volume 5 Planning data report of the SES2 and AP2 ES (see SES2 and AP2 ES Volume 5, Appendix: CT-004-00000). Committed developments are defined as developments with planning permission and sites allocated for development in adopted development plans, on or close to the land required for the scheme.

# 3.3 Air pollution assessment methodology

3.3.1 The assessment of air pollution is informed by established best practice provided by National Highways[15,16], Natural England[17,18], and the Institute for Air Quality Management (IAQM)[19].

3.3.2 These provide evidence that natural or semi-natural habitats can be harmed by vehicle emissions through two intimately linked pathways: via the concentration of nitrogen oxides (NOx) and ammonia ($NH_3$) and the subsequent deposition of nitrogen and acid. The assessment of the impact of air pollution therefore comprises the analysis of the dispersal of these compounds.

3.3.3 In sufficient concentrations, airborne NOx and $NH_3$ can result in direct toxic effects on vegetation. Further, the subsequent deposition of nitrogen compounds can lead to the acidification and nutrient enrichment of land and water. Over time, this may not only hinder the growth, abundance and distribution of plants, and especially, bryophytes and lichens, but can also prompt the growth of ruderal species or algal blooms which can lead to changes in the structure and function of qualifying or supporting habitats. Whilst certain species and communities are less susceptible to harm than others, increases in the airborne concentration of pollutants or the rate of their deposition can also exacerbate the effects of other factors such as climate change or pathogens leading to negative, synergistic effects.

3.3.4 The concentrations and/or rates of the deposition of nitrogen compounds fall quickly in the first few metres from the roadside before gradually levelling out; beyond 200m, it becomes difficult to distinguish from background levels. This means that impacts at 10m, 50m or 200m or more can be very different from those at the roadside.

[15] Highways Agency (2019), *Design Manual for Roads and Bridges (DMRB), Sustainability and Environmental Appraisal, LA 105 Air Quality,* Highways Agency, London. Available online at: https://www.standardsforhighways.co.uk/dmrb/search/10191621-07df-44a3-892e-c1d5c7a28d90.

[16] National Highways (2021), *Ammonia N Deposition Tool V2.*

[17] Natural England (2018), *Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations.* Available online at: https://publications.naturalengland.org.uk/publication/4720542048845824.

[18] Although designed for Habitats Regulations Assessments, Natural England (2018) guidance is applicable for the assessment under the EIA Regulations, 2017 (as amended). Section 1.1.6 states: '...this guidance does not specifically cover nationally significant sites, which are covered by a different regulatory framework. However, the general principles for air quality assessment outlined here for European Sites are likely to be equally relevant for this and other designations...'.

[19] Institute of Air Quality Management (2020), *A guide to the assessment of air quality impacts on designated nature conservation sites, Version 1.1*. Available online at: https://iaqm.co.uk/guidance/.

3.3.6 The assessment of air pollution impacts for ecologically sensitive sites within 200m of roads is undertaken where one or more of the following Design Manual for Roads and Bridges (DMRB)[15] criteria are met:

- change in road alignment by 5m or more;
- change in daily traffic flows by 1,000 vehicles or more as Annual Average Daily Traffic (AADT);
- change in daily flows of Heavy Duty Vehicles[20] (HDV) by 200 AADT or more;
- change in daily average speed by 10kph or more; or
- change in peak hour speed by 20kph or more.

3.3.7 It can be seen, therefore, that the additional emissions that might arise from increased traffic are only likely to be significant where:

- a designated site lies within 200m of a road;
- traffic flows are expected to increase (or other DMRB criteria are met); and
- a qualifying feature is known to be sensitive to such impacts.

3.3.8 Should all three criteria be met, best practice guidance recommends that the ecological characteristics of the site should be explored and, if necessary, traffic and/or air quality assessments carried out to evaluate any impacts during construction or operation.

3.3.9 The ecological characteristics of a site are derived from the formal citations, condition assessments, conservation objectives, FCT, SIP, supplementary advice and any other surveys and management plans where available.

3.3.10 Traffic flows are assessed by calculating AADT figures using established models. Should increases in traffic be less than 1,000 AADT[21] or 200 HDV, the risk of a significant effect can be ruled out and no further assessment is required. Should flows exceed these values, air quality analysis is necessary.

3.3.11 The air quality analysis typically models any changes at fixed points on a 200m transect extending from the roadside. Impacts identified through the air quality analysis are assessed by calculating the relative contribution of the plan or project in relation to the relevant critical levels for NOx and $NH_3$ and the critical loads for the deposition of nitrogen and acid, as described by the Air Pollution Information System (APIS)[22], as follows:

[20] HDV are defined as those with an unladen weight of greater than 3.5 tonnes, including: large vans; medium goods vehicles (rigid and artic); heavy goods vehicles (rigid and artic); and, buses/coaches.

[21] These values are utilised as there is evidence to show that these equate approximately to a 1% change in critical loads.

[22] UK Centre for Ecology and Hydrology (2021), *Air Pollution Information System*. Available online at: http://www.apis.ac.uk/.

- the critical level for NOx is fixed and is expressed as a concentration: 30µg/m$^3$. It is a precautionary threshold below which there is confidence that harmful effects on vegetation communities will not arise, and further assessment may not be necessary;
- the critical level for $NH_3$ is also expressed as a concentration and is set at 3µg/m$^3$ for higher plants and at 1µg/m$^3$ where bryophytes or lichens are present and are considered to '…form a key part of the ecosystem integrity"[23];
- the critical loads for nitrogen deposition vary and are specific to each qualifying feature. These are presented as a range of values (expressed as a rate, e.g. 10kg N/ha/yr – 20kg N/ha/yr) and typically, only the lowest value is used (unless there are compelling reasons to do otherwise) as this will emphasise any negative outcomes; and
- acid deposition is also assessed via critical loads, though measured in keq/ha/yr.

3.3.12 Natural England best practice guidance specifies that should nitrogen deposition increase by less than 1% of the lower critical load or concentrations of NOx or $NH_3$ increase by less than 1% of the critical level, likely significant effects can be ruled out. However, should the 1% threshold be exceeded, a likely significant effect cannot be ruled out.

3.3.13 The assessment of significance of acid deposition differs. If the total concentration is predicted to be less than the lower critical load, then the effect is considered not to be significant. However, a likely significant effect cannot be ruled out when: the change in concentration is more than 1% of the maximum critical load and the total for acid deposition is also greater than the maximum critical load.

3.3.14 The 1% threshold, set at two orders of magnitude below the critical load or level, is highly precautionary. Account must also be taken of the type of habitats (some are more resilient than others) and the distribution of the designated features as not all will be distributed evenly across sites, and other factors may be at play.

## 3.4 Assessment of impact and effects

3.4.1 Oak Mere lies adjacent to the A49 Tarporley Road and A54 Middlewich Road, within the 200m threshold described in Section 3.3. Consequently, an assessment of traffic flows is required.

3.4.2 The following assessment utilises relevant traffic and air quality analysis as set out in Annex A and reports any likely significant effects on a precautionary basis. HS2 Ltd is continuing to identify suitable measures to mitigate or compensate for potential significant effects identified on designated sites.

[23] Air Pollution Information System (2016), *Critical Loads and Critical Levels – a guide to the data provided in APIS.* Available online at: https://www.apis.ac.uk/critical-loads-and-critical-levels-guide-data-provided-apis#_Toc279788054.

### Assessment of traffic flows and air pollution during construction

3.4.3 The traffic analysis (see Section 5.1, Annex A) indicates that the construction of the AP2 revised scheme will not exceed the AADT or HDV traffic thresholds described in Section 3.2. Therefore, no air quality assessment is required.

### Assessment of traffic flows and air pollution during operation

3.4.4 The traffic analysis (see Section 7.1, Annex A) indicates that the operation of the AP2 revised scheme will not exceed the AADT or HDV traffic thresholds described in Section 3.2. Therefore, no air quality assessment is required.

## 3.5 Mitigation measures

3.5.1 The likely significant effects assessment above has been undertaken on a precautionary basis.

3.5.2 Where necessary, HS2 Ltd is continuing to seek to identify suitable measures to mitigate or compensate for potential significant effects identified on designated sites. In doing so HS2 Ltd will continue to engage with stakeholders to fully understand the receptors and the suitability of the measures.

## 3.6 Summary of likely significant effects

3.6.1 Traffic flows as a result of the AP2 revised scheme during construction and operation do not trigger the requirement for an air quality assessment and therefore, likely significant effects can be ruled out.

# 4 Ongoing work

## 4.1 Introduction

4.1.1 A further and separate assessment is being carried out to meet the needs of Regulation 63 of the Conservation of Habitats and Species Regulations 2017 (as amended) ('Habitats Regulations')[4]. This section provides the emerging results at this current stage of design and assessment, which will be finalised as part of the further and separate assessment.

4.1.2 This section uses language that will be applicable to the further assessment carried out under the Habitats Regulations.

4.1.3 This section considers the AP2 revised scheme in combination with other plans and projects that fall within a 10km radius of the designated site. The other plans and projects relevant to this assessment have been identified in Section 2 of Annex A.

## 4.2 Air quality assessment of traffic flows in combination

### Methodology

4.2.1 The scope of the in combination assessment has been limited to those plans or projects that could contribute to a cumulative increase in air pollution at Oak Mere.

4.2.2 In combination effects are taken into account in the traffic and the non-traffic related emission sources used for the assessment, which incorporate likely changes brought about by other proposed and committed developments. The approach to this assessment, which has been agreed with Natural England, is provided in Section 2 of Annex A.

### Critical loads and levels

4.2.3 The only location that triggered the AADT thresholds under this scenario was the eastern link of the A49 Tarporley Road and A54 Middlewich Road intersection. Given this, only one (200m) air quality modelling transect (represented by yellow dots) was employed, situated at the junction of both roads in the south-eastern corner of the site (Figure 3). This was located to reflect the greatest air quality impact as well as to take account of the most sensitive habitat features. Beyond the junction, traffic flows fall to below the screening thresholds and so there is no need to apply the outcomes to any other parts of Oak Mere. Reflecting the proximity of Oak Mere to the junction, the transect enters the site after a distance of just 2m and remains within it to the full extent of the 200m transect.

4.2.4 Drawing on the types and distribution of habitats provided in Annex 1 of the FCT, and evidence derived from APIS, the habitat types found within Oak Mere in order of distance

from the road comprise woodland, grassland, poor fen (which includes transition mires and quaking bogs) and open (oligotrophic) water.

4.2.5 Importantly, the woodland and the grassland adjacent to the A49 Tarporley Road/A54 Middlewich Road junction do not represent qualifying features of the SAC, Ramsar site or SSSI and are, therefore, considered to represent 'site-fabric'[24], where the conservation objectives do not apply. However, to make the assessment more meaningful, conservative thresholds were used.

4.2.6 APIS values for Oak Mere SSSI, where woodland is a qualifying feature, were reviewed. Three values are provided on APIS for the differing types of woodland of special scientific interest reflecting their different sensitivities to air pollution: 10kg N/ha/yr – 20kg N/ha/yr, 10kg N/ha/yr – 20kg N/ha/yr, and 15kg N/ha/yr – 20kg N/ha/yr. These all relate to the woodlands clustered around the open water and far distant from the A49 Tarporley Road and A54 Middlewich Road. In contrast, the woodland intercepted by the transect lies adjacent to the road. Whilst in the middle of the range of the three woodland types, the values for the broad-leaved, mixed and yew woodland (*Betula pubescens – Molinia caerulea*) woodland were adopted (i.e. 10kg N/ha/yr – 20kg N/ha/yr). This is considered to be a highly precautionary measure.

4.2.7 Values were taken from APIS for the closest lowland hay meadow SAC, Mottey Meadows to apply to the grassland. This represents a far more sensitive habitat than the agricultural grassland now present and is considered to be a highly precautionary measure.

4.2.8 Consequently, the air quality analysis has adopted the following critical loads:

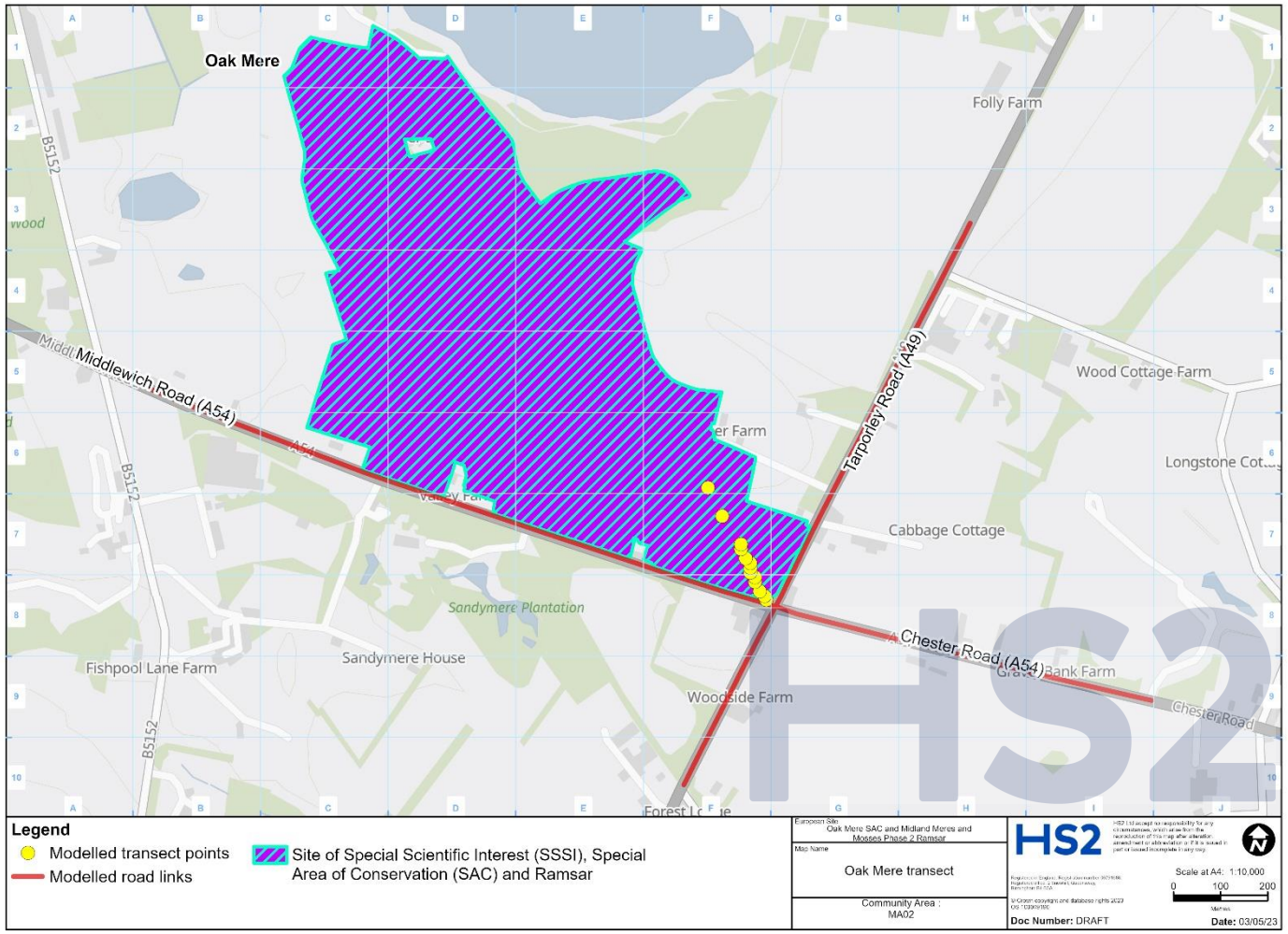
- woodland (10kg N/ha/yr – 20kg N/ha/yr);
- grassland (20kg N/ha/yr – 30kg N/ha/yr);
- poor fen (10kg N/ha/yr – 15kg N/ha/yr); and
- open water (5kg N/ha/yr – 10kg N/ha/yr).

4.2.9 A critical level for $NH_3$ of 1µg/$m^3$ has been applied to the poor fen habitat and a value of 3µg/$m^3$ has been used for all other habitats. As described above, the critical level for NOx is a constant (30µg/$m^3$).

[24] Site fabric is defined in Natural England (2018) as '… land and or permanent structures present within a designated site boundary which are not and never have been, part of the special interest of the site, nor do they contribute towards supporting a special interest feature in any way, but which have been unavoidably included within a boundary for convenience or practical reasons. Areas of site fabric … will not be expected to make a contribution to the achievement of conservation objectives.'

4.2.11 Acid deposition indicative values of 0.438keq/ha/yr – 1.328keq/ha/yr were taken from APIS for the lowland hay meadow habitat at Mottey Meadows SAC, which was used as a surrogate. Values for the poor fen community were taken from APIS as 0.223keq/ha/yr – 0.576keq/ha/yr. Given that APIS does not provide an acid deposition critical load for open water habitat, the same acidity values were also applied here, as a suitable surrogate.

**Figure 3: Location of Oak Mere and the modelled transect**



# Construction phase impacts in combination

4.2.12 Table A5 of Annex A shows that predicted NOx concentrations with the AP2 revised scheme are lower than the 2018 baseline rates at all modelled receptors (i.e. transect points). However, NOx concentrations are predicted to be above the air quality standard at one of the modelled receptors with or without the AP2 revised scheme. In addition, there is a greater than 1% exceedance of the NOx critical level brought about by the AP2 revised scheme in combination. The maximum change is 5.8% at 2m from the road within the woodland habitat. The exceedances remain above or equal to 1% up to 93m within the grassland habitat. However, both woodland and grassland are considered to be site fabric; the transect does not intercept with any of the qualifying features of the site. Therefore, likely significant effects in combination can be ruled out.

4.2.13 Table A6 of Annex A shows that predicted $NH_3$ concentrations with the AP2 revised scheme are lower than the 2018 baseline rates at all modelled receptors. However, $NH_3$ concentrations are predicted to be above the relevant air quality standard with or without the AP2 revised scheme. Further, there is a greater than 1% exceedance of the critical level brought about by the AP2 revised scheme in combination. The maximum change is 22% at 2m from the road within the woodland habitat. The exceedances remain above or equal to 1% up to 102m within the grassland habitat. However, both woodland and grassland are considered to be site fabric; the transect does not intercept with any of the qualifying features of the site. Therefore, likely significant effects in combination can be ruled out.

4.2.14 Table A7 of Annex A shows that predicted nitrogen deposition rates with the AP2 revised scheme are lower than the 2018 baseline rates at all modelled receptors. However, nitrogen deposition rates are predicted to be above the relevant air quality standard at all modelled receptors with or without the AP2 revised scheme. In addition, there is a greater than 1% exceedance of the critical load brought about by the AP2 revised scheme in combination. The maximum change is 13.6% at 2m from the road within the woodland habitat. The exceedances remain above or equal to 1% up to 93m within the grassland habitat. However, both woodland and grassland are considered to be site fabric; the transect does not intercept with any of the qualifying features of the site. Therefore, likely significant effects in combination can be ruled out.

4.2.15 Table A8 of Annex A shows that predicted acid deposition rates with the AP2 revised scheme are lower than the 2018 baseline rates at all modelled receptors. However, acid deposition rates are predicted to be above the relevant air quality standard across all modelled receptors with or without the AP2 revised scheme. Further, there is a greater than 1% exceedance of the critical level brought about by the AP2 revised scheme in combination. The maximum change is 14.7% at 2m from the road within the woodland habitat. The exceedances remain above or equal to 1% up to 93m within the grassland habitat. However, both woodland and grassland are considered to be site fabric; the transect does not intercept with any of the qualifying features of the site. Therefore, likely significant effects in combination can be ruled out.

### Operational phase impacts in combination

4.2.16 The traffic analysis (see Section 8.1, Annex A) indicates that the operation of the AP2 revised scheme in combination will not exceed the AADT or HDV traffic thresholds described in Section 3.2. Therefore, no air quality assessment is required.

## 4.3 Current status of the ongoing work

4.3.1 At this current stage of design and assessment, it is considered that likely significant effects can be ruled out from the AP2 revised scheme in combination during construction and operation.

4.3.2 Further and separate assessment of the AP2 revised scheme is being carried out to meet the needs of Regulation 63 of the Habitats Regulations. This will confirm the assessment conclusions at that stage of the design and assessment.

# Annex A: Additional air quality information

## 1 Purpose

This annex provides additional air quality information in relation to impacts from vehicle emissions to support the Midland Meres and Mosses Phase 2 Ramsar site and Oak Mere SAC assessment.

This annex assesses the impact of air pollution on the Oak Mere SSSI component of the Midland Meres and Mosses Phase 2 Ramsar site and Oak Mere SAC. For simplicity, it is referred to as Oak Mere throughout the rest of this annex except where specific mention is required of the Ramsar site or SAC.

# 2 Scope, assumptions and limitations

The scope, assumptions and limitations for the air quality assessment are set out in full in the SES2 and AP2 ES Volume 5, Appendix: CT-001-00003 Air Quality – Technical note – Updated guidance on the assessment methodology for Phase 2b SES2 and AP2 ES.

Key elements in relation to the assessment of vehicle emissions on ecologically sensitive sites are:

- screening of traffic data using the criteria set out in the SMR, which is based on the DMRB criteria[15] to identify where assessment is required;
- these criteria are the following for assessing the impacts of the scheme alone:
  - change in road alignment by 5m or more;
  - change in daily traffic flows by 1,000 vehicles or more as AADT;
  - change in daily flows of HDV by 200 AADT or more;
  - change in daily average speed by 10kph or more; or
  - change in peak hour speed by 20kph or more.
- the following criteria are used for assessing the impacts of the scheme in combination with other plans and projects:
  - change in daily traffic flows by 1,000 vehicles or more as AADT; or
  - change in daily flows of HDV by 200 AADT or more.
- ecological receptors included in the air quality assessment are designated sites with habitats sensitive to nitrogen. These could include SAC, Special Protection Areas (SPA) and Ramsar sites;
- transects have been used within a designated site with modelled points at 0m, 10m, 20m, 30m, 40m, 50m, 75m, 100m, 150m and 200m from the edge of the road unless the shape of the site and potential impacts require different distances to characterise the impacts; and
- a deposition velocity relevant to the habitat of each site has been used, as detailed in the IAQM ecological guidance[19]. Data on ammonia, nitrogen deposition and acid deposition has been taken from the most recent information available on the APIS[22] website. No plume depletion for ammonia dispersion modelling has been included. No reduction in future background deposition rates or background pollutant concentrations has been applied to the APIS data.

The following scenarios were assessed:

- baseline;
- selected year(s) within the construction period for the assessment of the effects of construction. The year(s) of assessment were selected based on the worse case peak period traffic during the construction programme and when significant effects might be expected; and
- a scenario for the first full operational year after construction is completed.

The baseline scenario represents 2018.

For the construction assessments, emission factors and backgrounds (with the exception of the APIS data) used the earliest construction year (i.e., 2026). This is a worst case assumption as emissions from road vehicles are improving year-on-year (e.g. due to increasing numbers of electric vehicles) and the worst case construction period may not fall in the first year of construction.

For each assessment year, both the scenario without the AP2 revised scheme in place and the scenario with the AP2 revised scheme in place have been modelled, with background pollutant concentrations, deposition rates and emission factors representing the future year being assessed (with the exception of the APIS data). This comparison was used to assess the impacts of the AP2 revised scheme.

For the assessment of the AP2 revised scheme in combination with other plans and projects, a different 'without' scheme scenario was used and described as the 'do nothing' scenario. This uses traffic data from the 2018 baseline, but background pollutant concentrations, deposition rates and emission factors representing the future year being assessed (with the exception of the APIS data).

The assessment incorporated HS2 Ltd policy on construction vehicle emissions standards. These standards are published in Information Paper E14[25]; Air Quality and include Euro VI for HGV, and Euro 6 and Euro 4 for diesel and petrol Light Duty Vehicles respectively.

The traffic forecasts that underpin this report were derived from strategic traffic models that have been sourced from key stakeholders, including Local Highway Authorities and National Highways. In combination, these models cover the areas that are expected to be affected by the AP2 revised scheme and have been used as the basis of assessment for traffic flow analysis. The models have been developed by the relevant stakeholders in accordance with Transport Analysis Guidance provided by the Department for Transport, with each model representing a base year position between 2016 and 2018. It is understood that the strategic traffic models supplied to HS2 Ltd take account of the core development growth scenarios set out in the relevant local plan documents, transport strategy documents and model forecasting reports published at that time. Information about these development growth scenarios can be found in the following documents:

- Cheshire East Local Plan Strategy 2010-2030, July 2017[26];

[25] High Speed Two Ltd (2022*), High Speed Two Phase 2b Information Paper E14: Air Quality.* Version 2.0. Available online at: https://www.gov.uk/government/publications/hs2-phase-2b-information-papers-environment-e-series.

[26] Cheshire East Council (2022), *Local Plan Strategy 2010 – 2030. Adopted 17 July 2017*. Available at: https://www.cheshireeast.gov.uk/planning/spatial-planning/cheshire_east_local_plan/local-plan-strategy/local_plan_strategy.aspx.

- Cheshire West and Chester Local Plan (Part Two) Land Allocations and Detailed Policies, November 2017[27];
- Winsford Transport Strategy Recommendations Report, June 2016[28];
- Northwich Transport Strategy Recommendations Report, April 2018[29];
- Regional Investment Programme (RIP) M6 Junction 19 Improvement PCF Stage 3 Transport Forecasting Report, January 2019[30]; and
- GMVDM4A Uncertainty Log for NTEM GMSF Full Scenario, Version 2, November 2018.

In all cases, the traffic growth forecasts have been constrained to TEMPro version 7.2 which uses the National Trip End Model (NTEM 7.2 (2017))[31] dataset and the National Transport Model 2015. TEMPro inherently incorporates future planned development, being based on approved plans, irrespective of whether it is approved, committed, or simply included in approved plans.

Consideration was also given to relevant non-road plans and projects that could contribute to a cumulative increase in air pollution at Oak Mere. Searches were carried out for the following non-traffic related emission sources (which were also included in the air quality model) within a 10km radius (unless stated otherwise below). This is considered to be reasonable and proportionate and meets the expectations in Section 4.48 of Natural England's guidance[17].

- combustion and energy < 20MW (within 5km);
- combustion and energy > 20MW;
- farming, livestock and poultry;
- waste, e.g., landfill gas; and
- minerals activities.

[27] Cheshire West and Chester Council (2019), *Local Plan (Part Two) Land Allocations and Detailed Policies*. *Adopted 18 July 2019*. Available at: https://consult.cheshirewestandchester.gov.uk/kse/event/34617/section/.

[28] Mott MacDonald (2016), *Winsford Transport Strategy: Recommendations Report*. Available at: https://www.cheshirewestandchester.gov.uk/residents/transport-and-roads/public-transport/transport-strategy.

[29] Mott MacDonald (2018), *Northwich Transport Strategy: Recommendations Report*. Available at: https://www.cheshirewestandchester.gov.uk/residents/transport-and-roads/public-transport/transport-strategy.

[30] Highways England (2019), *Regional Investment Programme (RIP) M6 Junction 19 Improvement*. *Issue Number 1.0*. Available at: https://assets.highwaysengland.co.uk/roads/road-projects/M6+junction+19/Statement+of+Reasons.pdf.

[31] Department for Transport, *TEMPro version 7.2*. Available online at: https://www.data.gov.uk/dataset/11bc7aaf-ddf6-4133-a91d-84e6f20a663e/national-trip-end-model-ntem.

# 3 Air quality standards

Air quality limit values and objectives are quality standards for clean air and to protect human health or harm to vegetation. The term 'air quality standards' has been used to refer to both the English air quality objectives and the air quality limit values and critical levels introduced in the UK based on EU Directives. Table A1 sets out the air quality standard for NOx.

**Table A1: Air quality standards**

| Pollutant | Averaging period | Standard |
|---|---|---|
| NOx (for protection of vegetation) | Annual mean | 30µg/m$^3$ |

In the context of air pollution impacts on ecological sites (e.g., in this case SAC, SPA and Ramsar sites), road traffic emits NOx and ammonia, which both contribute to nitrogen and acid deposition. Therefore, this assessment considers changes in NOx and ammonia as well as changes in nitrogen and acid deposition. Comparisons have been made against the applicable critical loads[32], critical level or relevant standard for the site, as above or as provided by APIS.

[32] The critical loads for deposition vary and are specific to each qualifying feature. These are presented as a range of values (expressed as a rate, e.g., 10kg N/ha/yr – 20kg N/ha/yr) and typically, as a precautionary approach, only the lowest value is used (unless there are compelling reasons to do otherwise) as this will emphasise any negative outcomes.

# 4 How significance is assessed

For the assessment of NOx concentrations, if the change is predicted to be less than 1% of the air quality standard then the effect is considered to be not significant. However, should the NOx concentration change by more than 1% then the assessment of significance will be undertaken by an ecologist and reported within the main report.

For the assessment of ammonia ($NH_3$), if the change is predicted to be less than 1% of the air quality critical level[33], then the effect is considered to be not significant. However, should the concentration change by more than 1%, then the assessment of significance will be undertaken by an ecologist and reported within the main report.

For the assessment of nitrogen deposition, if the change is predicted to be less than 1% of the lower critical load[32], then the effect is considered to be not significant. However, should the deposition change by more than 1%, then the assessment of significance will be undertaken by an ecologist and reported within the main report.

For the assessment of acid deposition, if the total concentration is predicted to be less than the lower critical load, then the effect is considered to be not significant. If the change in concentration is more than 1% of the maximum critical load and the total for acid deposition is greater than the maximum critical load, then the assessment of significance will be undertaken by an ecologist and reported within the main report.

[33] The critical level for $NH_3$ is 3µg/$m^3$ for low level vegetation and 1µg/$m^3$ high vegetation (e.g., trees).

# 5 Assessment of construction traffic effects – AP2 revised scheme

## 5.1 Screening of traffic data

The screening process identified no roads in the area exceeding the screening thresholds, therefore no further assessment of scheme alone impacts during construction is required.

# 6 Assessment of construction traffic effects – AP2 revised scheme in combination with other plans and projects

## 6.1 Screening of traffic data

The assessment of construction traffic impacts has used traffic data based on an estimate of the average daily flows in the peak year during the construction period (2026 – 2039). Traffic data is presented in Table A2.

The screening process identified two roads in the area exceeding the screening thresholds:

- the A54 Chester Road E of junction with Tarporley Road; and
- the A49 Tarporley Road S of junction with Chester Road.

Further roads have been included in the assessment to account for their emissions at nearby receptors.

Figure A1 presents a detailed map of the modelled area including assessed roads (Modelled road links in red) and modelling transect points (yellow dots).

Oak Mere is located approximately 10km west of the land required for construction of the AP2 revised scheme. There are no planned construction traffic routes running adjacent to the site. Traffic impacts are primarily a result of traffic re-routing due to the scheme in combination with traffic growth from the baseline year.

**Table A2: Traffic data summary (construction phase, AP2 revised scheme in combination)**

| Road ID | Road names | Annual Average Daily Traffic (AADT) | | | Heavy Duty Vehicles (HDV) | | |
|---|---|---|---|---|---|---|---|
| | | 2018 baseline | 2026 with the AP2 revised scheme | In combination change (2026 with the AP2 revised scheme – 2018 baseline) | 2018 baseline | 2026 with the AP2 revised scheme | In combination change (2026 with the AP2 revised scheme – 2018 baseline) |
| 2048_2130 | A54 Chester Road E of junction with Tarporley Road | 12,507 | 15,168 | **2,661** | 189 | 198 | 9 |
| 2048_2217 | A54 Middlewich Road | 2,213 | 2,345 | 132 | 128 | 144 | 16 |
| 2045_2048 | A49 Tarporley Road N of junction with Chester Road | 9,879 | 9,137 | -742 | 364 | 291 | -73 |
| 2048_2056 | A49 Tarporley Road S of junction with Chester Road | 18,782 | 20,309 | **1,527** | 678 | 633 | -45 |

## 6.2 Non-road plans and projects

No non-road plans or projects have been identified that require further consideration within the in combination assessment.

## 6.3 Receptors assessed and background concentrations

Table A3 shows the background concentrations for NOx, background nitrogen deposition and critical loads. Table A4 shows the background acid deposition, critical loads and background ammonia concentrations. The yellow modelling transect points in Figure A1 represent the closest point to the road for each of the two sensitive habitat types.

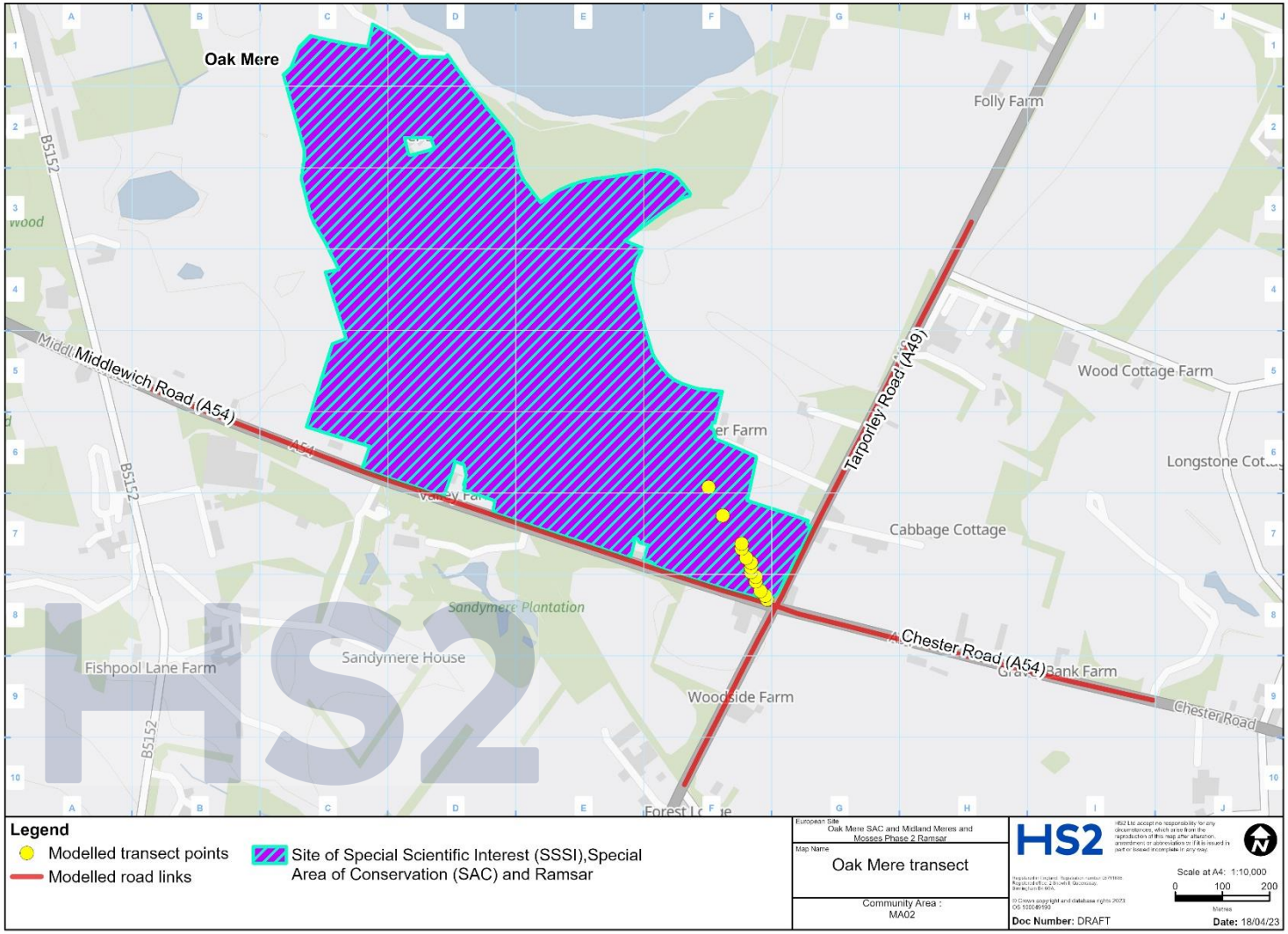
**Table A3: Modelled ecological receptor NOx and nitrogen deposition backgrounds and critical loads (construction phase)**

| Receptor | Sensitive habitat | 2018 NOx background concentration (µg/m$^3$) | 2026 NOx background concentration (µg/m$^3$) | APIS data[23] of average total nitrogen deposition (kg/N/ha/yr) | APIS Critical load (kg N/ha/yr) |
|---|---|---|---|---|---|
| Oak Mere | Deciduous woodland | 8.6 | 6.4 | 53.5 | 15 |
| | Lowland hay meadow | 8.6 | 6.4 | 32.0 | 20 |

**Table A4: Modelled ecological receptor acid deposition backgrounds, critical loads and ammonia background concentrations (construction phase)**

| Receptor | Sensitive habitat | APIS data of average total acid deposition (k eq/ha/yr) | APIS Critical load nitrogen (k eq/ha/yr) (min) | APIS Critical load nitrogen (k eq/ha/yr) (max) | APIS Ammonia background concentration (µg/m$^3$) |
|---|---|---|---|---|---|
| Oak Mere | Deciduous woodland | 3.9 | 0.1 | 0.3 | 3.9 |
| | Lowland hay meadow | 2.4 | 0.4 | 1.3 | 3.9 |

**Figure A1: Map of Oak Mere, including modelled road links and modelled transect points**



## 6.4 Assessment results

Table A5 presents a summary of the modelled NOx concentrations for the ecological site, the change in concentration and a comparison against the air quality standard (30µg/$m^3$).

Table A6 presents a summary of the ammonia concentration results taken from the National Highways Ammonia N Deposition Tool[16], change in concentration and percentage change in relation to the critical level.

Table A7 presents a summary of the modelled nitrogen deposition, with an additional ammonia component applied using the National Highways Ammonia N Deposition Tool, change in deposition and percentage change in relation to the lower critical load.

Table A8 presents a summary of the modelled acid deposition, with an additional ammonia component applied using the National Highways Ammonia N Deposition Tool, and percentage change in deposition and percentage change in relation to the critical load.

**Table A5: Assessment of NOx concentrations at ecological sites (construction phase, AP2 revised scheme in combination)**

| Ecological site | Sensitive habitat | Distance to road (m) | NOx concentrations (µg/m³) | | | Change in NOx concentrations (µg/m³) | Comparison against air quality standard (30µg/m³) | Percent change in relation to air quality standard |
|---|---|---|---|---|---|---|---|---|
| | | | 2018 baseline | 2026 do nothing | 2026 with the AP2 revised scheme | | | |
| Oak Mere | Deciduous woodland | 2 | 70.31 | 33.44 | 35.18 | 1.74 | Above standard | 5.8% |
| | Deciduous woodland | 9 | 54.20 | 26.40 | 27.64 | 1.24 | Within standard | 4.1% |
| | Deciduous woodland | 16 | 40.85 | 20.51 | 21.38 | 0.87 | Within standard | 2.9% |
| | Deciduous woodland | 32 | 30.19 | 15.85 | 16.43 | 0.58 | Within standard | 1.9% |
| | Deciduous woodland | 42 | 27.90 | 14.87 | 15.37 | 0.50 | Within standard | 1.7% |
| | Lowland hay meadow | 50 | 24.71 | 13.47 | 13.89 | 0.42 | Within standard | 1.4% |
| | Lowland hay meadow | 60 | 23.41 | 12.91 | 13.28 | 0.37 | Within standard | 1.2% |
| | Lowland hay meadow | 69 | 22.32 | 12.43 | 12.77 | 0.34 | Within standard | 1.1% |

| Ecological site | Sensitive habitat | Distance to road (m) | NOx concentrations (µg/m³) | | | Change in NOx concentrations (µg/m³) | Comparison against air quality standard (30µg/m³) | Percent change in relation to air quality standard |
|---|---|---|---|---|---|---|---|---|
| | | | 2018 baseline | 2026 do nothing | 2026 with the AP2 revised scheme | | | |
| | Lowland hay meadow | 76 | 20.58 | 11.67 | 11.97 | 0.30 | Within standard | 1.0% |
| | Lowland hay meadow | 93 | 18.63 | 10.82 | 11.07 | 0.25 | Within standard | 0.8% |
| | Lowland hay meadow | 102 | 18.11 | 10.59 | 10.83 | 0.24 | Within standard | 0.8% |
| | Lowland hay meadow | 148 | 14.80 | 9.14 | 9.30 | 0.16 | Within standard | 0.5% |
| | Lowland hay meadow | 196 | 13.25 | 8.47 | 8.58 | 0.11 | Within standard | 0.4% |

**Table A6: Assessment of ammonia ($NH_3$) at ecological sites (construction phase, AP2 revised scheme in combination)**

| Ecological site | Sensitive habitat | Distance to road (m) | $NH_3$ concentrations (µg/m³) | | | Change in $NH_3$ concentrations (µg/m³) | Comparison against critical level (3µg/m³ for low and 1µg/m³ high vegetation) | Percent change in relation to critical level |
|---|---|---|---|---|---|---|---|---|
| | | | 2018 baseline | 2026 do nothing | 2026 with the AP2 revised scheme | | | |
| Oak Mere | Deciduous woodland | 2 | 6.77 | 6.30 | 6.52 | 0.22 | Above standard | 22.0% |
| | Deciduous woodland | 9 | 6.04 | 5.68 | 5.83 | 0.15 | Above standard | 15.1% |
| | Deciduous woodland | 16 | 5.43 | 5.16 | 5.27 | 0.11 | Above standard | 10.8% |
| | Deciduous woodland | 32 | 4.94 | 4.75 | 4.82 | 0.07 | Above standard | 6.8% |
| | Deciduous woodland | 42 | 4.83 | 4.67 | 4.72 | 0.05 | Above standard | 5.7% |

| Ecological site | Sensitive habitat | Distance to road (m) | $NH_3$ concentrations (µg/m³) | | | Change in $NH_3$ concentrations (µg/m³) | Comparison against critical level (3µg/m³ for low and 1µg/m³ high vegetation) | Percent change in relation to critical level |
|---|---|---|---|---|---|---|---|---|
| | | | 2018 baseline | 2026 do nothing | 2026 with the AP2 revised scheme | | | |
| | Lowland hay meadow | 50 | 4.69 | 4.54 | 4.59 | 0.05 | Above standard | 1.6% |
| | Lowland hay meadow | 60 | 4.63 | 4.49 | 4.54 | 0.05 | Above standard | 1.4% |
| | Lowland hay meadow | 69 | 4.57 | 4.45 | 4.49 | 0.04 | Above standard | 1.3% |
| | Lowland hay meadow | 76 | 4.49 | 4.38 | 4.42 | 0.04 | Above standard | 1.2% |
| | Lowland hay meadow | 93 | 4.40 | 4.31 | 4.34 | 0.03 | Above standard | 1.0% |
| | Lowland hay meadow | 102 | 4.38 | 4.29 | 4.32 | 0.03 | Above standard | 0.9% |
| | Lowland hay meadow | 148 | 4.22 | 4.16 | 4.18 | 0.02 | Above standard | 0.6% |
| | Lowland hay meadow | 196 | 4.15 | 4.10 | 4.12 | 0.02 | Above standard | 0.4% |

**Table A7: Assessment of nitrogen deposition with ammonia at ecological sites (construction phase, AP2 revised scheme in combination)**

| Ecological site | Sensitive habitat | Distance to road (m) | Dry deposition (kg N/ha/yr) | | | Change in nitrogen deposition (kg N/ha/yr) | Lower critical load (kg N/ha/yr) | Percent Change in relation to lower critical load |
|---|---|---|---|---|---|---|---|---|
| | | | 2018 baseline | 2026 do nothing | 2026 with the AP2 revised scheme | | | |
| Oak Mere | Deciduous woodland | 2 | 84.40 | 76.09 | 78.13 | 2.04 | 15 | 13.6% |
| | Deciduous woodland | 9 | 76.62 | 70.22 | 71.64 | 1.42 | 15 | 9.4% |

| Ecological site | Sensitive habitat | Distance to road (m) | Dry deposition (kg N/ha/yr) | | | Change in nitrogen deposition (kg N/ha/yr) | Lower critical load (kg N/ha/yr) | Percent Change in relation to lower critical load |
|---|---|---|---|---|---|---|---|---|
| | | | 2018 baseline | 2026 do nothing | 2026 with the AP2 revised scheme | | | |
| | Deciduous woodland | 16 | 70.03 | 65.29 | 66.31 | 1.02 | 15 | 6.8% |
| | Deciduous woodland | 32 | 64.69 | 61.39 | 62.03 | 0.64 | 15 | 4.3% |
| | Deciduous woodland | 42 | 63.54 | 60.56 | 61.10 | 0.54 | 15 | 3.6% |
| | Lowland hay meadow | 50 | 37.20 | 35.75 | 36.05 | 0.30 | 20 | 1.5% |
| | Lowland hay meadow | 60 | 36.79 | 35.45 | 35.71 | 0.26 | 20 | 1.3% |
| | Lowland hay meadow | 69 | 36.44 | 35.20 | 35.43 | 0.23 | 20 | 1.2% |
| | Lowland hay meadow | 76 | 35.89 | 34.79 | 35.00 | 0.21 | 20 | 1.1% |
| | Lowland hay meadow | 93 | 35.27 | 34.33 | 34.51 | 0.18 | 20 | 0.9% |
| | Lowland hay meadow | 102 | 35.10 | 34.21 | 34.37 | 0.16 | 20 | 0.8% |
| | Lowland hay meadow | 148 | 34.03 | 33.44 | 33.54 | 0.10 | 20 | 0.5% |
| | Lowland hay meadow | 196 | 33.52 | 33.07 | 33.16 | 0.09 | 20 | 0.4% |

**Table A8: Assessment of acid deposition with ammonia at ecological sites (construction phase, AP2 revised scheme in combination)**

| Ecological Site | Sensitive habitat | Distance to road (m) | Acid deposition (k eq/ha/yr) | | | Change in acid deposition (k eq/ha/yr) | Change in acid deposition as percent of CLmax | Total with AP2 revised scheme acid deposition as percent of CLmax |
|---|---|---|---|---|---|---|---|---|
| | | | 2018 baseline | 2026 do nothing | 2026 with the AP2 revised scheme | | | |
| Oak Mere | Deciduous woodland | 2 | 8.32 | 7.73 | 7.87 | 0.14 | 14.7% | 797.5% |
| | Deciduous woodland | 9 | 7.76 | 7.31 | 7.41 | 0.10 | 10.2% | 750.7% |
| | Deciduous woodland | 16 | 7.30 | 6.96 | 7.03 | 0.07 | 7.3% | 712.2% |
| | Deciduous woodland | 32 | 6.91 | 6.68 | 6.73 | 0.05 | 4.6% | 681.4% |
| | Deciduous woodland | 42 | 6.83 | 6.62 | 6.66 | 0.04 | 3.9% | 674.7% |
| | Lowland hay meadow | 50 | 4.20 | 4.10 | 4.12 | 0.02 | 1.6% | 310.0% |
| | Lowland hay meadow | 60 | 4.17 | 4.07 | 4.09 | 0.02 | 1.4% | 308.2% |
| | Lowland hay meadow | 69 | 4.14 | 4.06 | 4.07 | 0.01 | 1.3% | 306.7% |
| | Lowland hay meadow | 76 | 4.11 | 4.03 | 4.04 | 0.01 | 1.1% | 304.4% |
| | Lowland hay meadow | 93 | 4.06 | 3.99 | 4.01 | 0.02 | 0.9% | 301.7% |
| | Lowland hay meadow | 102 | 4.05 | 3.99 | 4.00 | 0.01 | 0.9% | 301.0% |
| | Lowland hay meadow | 148 | 3.97 | 3.93 | 3.94 | 0.01 | 0.6% | 296.6% |

| Ecological Site | Sensitive habitat | Distance to road (m) | Acid deposition (k eq/ha/yr) | | | Change in acid deposition (k eq/ha/yr) | Change in acid deposition as percent of CLmax | Total with AP2 revised scheme acid deposition as percent of CLmax |
|---|---|---|---|---|---|---|---|---|
| | | | 2018 baseline | 2026 do nothing | 2026 with the AP2 revised scheme | | | |
| | Lowland hay meadow | 196 | 3.94 | 3.90 | 3.91 | 0.01 | 0.4% | 294.5% |

## 6.5 Assessment of significance

NOx concentrations at Oak Mere are predicted to be above the air quality standard in 2018 just above 32m from the road and in 2026 just above 2m from the road both with or without the AP2 revised scheme. The changes in NOx concentrations between the 2026 do nothing scenario and with the AP2 revised scheme in combination scenario are greater than 1% of the air quality standard at the deciduous woodland habitat up to a distance of 42m from the road and at the lowland hay meadow habitat up to 93m from the road. Potentially significant effects are therefore predicted, and this is addressed further in Section 4.2 of the main report.

$NH_3$ concentrations at Oak Mere are predicted to be above the relevant air quality critical level in all scenarios. Changes in $NH_3$ concentrations between the 2026 do nothing scenario and with the AP2 revised scheme in combination scenario are greater than 1% of the relevant air quality critical level at the deciduous woodland habitat up to a distance of 42m from the road and at the lowland hay meadow habitat up to 102m from the road. Potentially significant effects are therefore predicted, and this is addressed further in Section 4.2 of the main report.

Nitrogen deposition rates are predicted to be above the lower critical load at all modelled receptors in all scenarios with or without the AP2 revised scheme. The changes in nitrogen deposition between the 2026 do nothing scenario and with the AP2 revised scheme in combination scenario are predicted to be greater than 1% of the lower critical load at the deciduous woodland habitat up to a distance of 42m from the road and at the lowland hay meadow habitat up to 93m from the road. Potentially significant effects are therefore predicted, and this is addressed further in Section 4.2 of the main report.

Acid deposition rates are predicted to be above the lower critical load at all modelled receptors in all scenarios with or without the AP2 revised scheme. The changes in acid deposition between the 2026 do nothing scenario and with the AP2 revised scheme in combination scenario are predicted to be greater than 1% of the lower critical load at the deciduous woodland habitat up to a distance of 42m from the road and at the lowland hay meadow habitat up to 93m from the road. Potentially significant effects are therefore predicted, and this is addressed further in Section 4.2 of the main report.

# 7 Assessment of operational traffic effects – AP2 revised scheme

## 7.1 Screening of traffic data

The screening process identified no roads in the area exceeding the screening thresholds, therefore no further assessment of scheme alone impacts during operation is required.

# 8 Assessment of operational traffic effects – AP2 revised scheme in combination with other plans and projects

## 8.1 Screening of traffic data

The screening process identified no roads in the area, around Oak Mere, exceeding the screening thresholds in the operation phase and therefore no further assessment is required.

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