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-016-00003

Ecology and biodiversity

Designated site assessment for Rostherne Mere Ramsar site and Midland Meres and Mosses Phase 1 Ramsar site (The Mere, Mere)

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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 Rostherne Mere Ramsar site (hereafter referred to as Rostherne Mere) and the Mere, Mere Site of Special Scientific Interest (SSSI) component of the Midland Meres and Mosses Phase 1 Ramsar site (hereafter referred to as The Mere, Mere).

1.1.3 This report provides the background assessment for identifying any likely significant effects on Rostherne Mere and The Mere, 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 and SES1 and AP1 ES included a draft assessment to inform a Habitats Regulations Assessment for Rostherne Mere and The Mere, 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 reports: Hulseheath to Manchester Airport area (MA06) and Pickmere to Agden and Hulseheath area (MA03).

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[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 Rostherne Mere Ramsar site and Midland Meres and Mosses Phase 1 Ramsar Site,* Volume 5, Appendix: EC-016-00003. Available online at: https://www.gov.uk/government/publications/document-to-inform-a-habitats-regulations-assessment-for-rostherne-mere-ramsar-site-and-midland-meres-and-mosses-phase-1-ramsar-site-ec-016-00003.

[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.

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:

- '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 Rostherne Mere and The Mere, 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 Rostherne Mere lies immediately adjacent to, and The Mere, Mere is located approximately 750m from, land required for the construction of the AP2 revised scheme in the Hulseheath to Manchester Airport area (MA06) and the Pickmere to Agden and Hulseheath area (MA03) respectively.

2.1.2 The construction of the AP2 revised scheme will include cuttings, embankments and tunnels extending in an arc from the west to the north of both European sites. At Rostherne Mere, the A556 Chester Road and the (unnumbered) 'old' Chester Road are planned construction traffic routes and these, along with (unnumbered) Cherry Tree Lane will also carry workforce traffic. Construction activities along A556 Chester Road will lead to traffic movements between 2026 and 2036, whereas traffic movements along the Cherry Tree Lane are anticipated to be just over a year between April 2028 and July 2029. At The Mere, Mere, workforce traffic as well as redistributed background traffic is anticipated to make use of the A50 Warrington Road during construction, with two distinct busy periods between April 2028 and July 2029 and July 2032 to April 2036.

2.1.3 The A556 Chester Road will also experience changes in traffic flows during operation, which will arise as a consequence of the redistribution of vehicles in the area caused the AP2 revised scheme and the general growth in traffic volumes over time. Use of the A50 Warrington Road by redistributed traffic is anticipated to persist into the operational phase.

2.1.4 The A556 Chester Road lies approximately 170m to the west of Rostherne Mere, the old Chester Road is located approximately 165m to the west and Cherry Tree Lane is, at its closest, located immediately adjacent to the north.

2.2 Site description and nature conservation targets

Rostherne Mere Ramsar site

2.2.1 Rostherne Mere Ramsar site extends over 79.76ha comprising, amongst other features, 45.8ha of open water and 3.3ha of fringing reed swamp. It is wholly contained within the larger Rostherne Mere SSSI (152.9ha), which is also designated as a National Nature Reserve (NNR). The location of Rostherne Mere is shown in Figure 1 and its location relevant to the AP2 revised scheme is provided in Figure 2.

2.2.2 It is listed under Ramsar Criterion 1[5] because it is one of the deepest and largest of the meres (lakes) of the Shropshire-Cheshire Plain. The Ramsar description adds that Rostherne Mere supports little submerged vegetation, but its shoreline is fringed with common reed swamp for over half its circumference. As in the case here, Ramsar qualifying features are often broadly described in the formal 'Information Sheet' and to provide clarity, Natural England has relied on the descriptions and objectives provided by the Favourable Condition Tables (FCT)[6] for the underpinning SSSI (Annex A). This confirms the qualifying features are:

- standing open water habitat: natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation; and
- fen, marsh and swamp habitat (edge component of the above standing open water): water-fringe vegetation.

2.2.3 Unlike Special Protection Areas (SPA) and Special Areas of Conservation (SAC), Ramsar sites do not benefit from the production of formal conservation objectives, Site Improvement Plans (SIP) or Supplementary advice. Consequently, Natural England also draws on the objectives from the FCT, relevant extracts of which are provided below.

Habitat extent

2.2.4 To maintain the designated features in favourable condition, which is defined in part in relation to a balance of habitat extents (extent attribute). Favourable condition is defined at this site in terms of the following site-specific standards:

- no permanent change in lake area (48.7ha); and
- no significant loss (>5%) in fringing reed swamp (3.3ha).

Site specific habitat condition objectives for open water

2.2.5 To maintain the standing open water and canals at Rostherne Mere in favourable condition, with particular reference to relevant specific designated interest features. Favourable condition is defined at this site in terms of the following site-specific standards:

- presence of at least six characteristic species;
- presence of characteristic zones of vegetation. No deterioration in extent from baseline situation;
- the maximum depth of plant colonisation should be at least 3.5m;
- total nitrogen TN annual mean 0.6mg L^{1}. This is a site-specific target;
- no deterioration in hydrological regime compared with baseline; and
- no loss of [hydrological] connectivity (between lake and surrounding areas).

[5] Joint Nature Conservation Committee (1981), *Ramsar Information Sheet (RIS). Rostherne Mere.* Available online at: https://jncc.gov.uk/jncc-assets/RIS/UK11060.pdf.

[6] Natural England (2016), *Conservation Objectives and Definitions of Favourable Condition for designated features of interest. Rostherne Mere.*

2.2.6 It should be noted that FCT were designed to facilitate monitoring activities and so where quantitative parameters are described (e.g. no loss in habitat extent above 5%) this should be viewed in the context of natural change; it does not mean that losses below 5% as a consequence of development would be acceptable.

Condition assessment

2.2.7 Natural England's condition monitoring programme evaluates the status of SSSI against these objectives. The last assessment for Rostherne Mere was carried out in 2009[7] and found that 48.2% was in 'favourable' condition, 15.1% 'unfavourable recovering' and 36.7% 'unfavourable no change'. Whilst this encompassed a wider area than the Ramsar site, the division by habitat clearly shows that the entire unfavourable component comprised the open water within the Ramsar boundary. In contrast, all terrestrial habitats were favourable or unfavourable recovering.

2.2.8 Natural England undertook a site check on 03 March 2022[7] and concluded that, where the mere (Unit 5 of the SSSI) was considered to be 'unfavourable' during the 2009 Condition Assessment, the habitat was moving into a 'recovering' condition. This was determined as being as a result of recent work; namely, wetland restoration work carried out on watercourses and in several fields adjacent to the mere. This wetland restoration work was described as involving the installation of features such as leaky dams and shallow ponds designed to strip sediment and nutrients from the water before it flows into Rostherne Mere.

Midland Meres and Mosses Phase 1 Ramsar site (The Mere, Mere)

2.2.9 The Midland Meres and Mosses Phase 1 Ramsar site (total area 510.88ha) is composed of a series of 16 discrete sites across the north-west Midlands[8]. These sites, which include 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), are individually designated as SSSI for their characteristic habitats, flora and fauna. The location of the constituent SSSI of Midland Meres and Mosses Phase 1 Ramsar is shown in Figure 1 and the location of The Mere, Mere relevant to the AP2 revised scheme is provided in Figure 2.

[7] Natural England (2009), *SSSI Condition Summary: Rostherne Mere SSSI*. Available online at: https://designatedsites.naturalengland.org.uk/SiteFeatureCondition.aspx?SiteCode=S1003353&SiteName=Rostherne%20Mere%20SSSI.

[8] Joint Nature Conservation Committee (1994), *Ramsar Information Sheet (RIS): Midland Meres and Mosses Phase 1*. Available online at: https://jncc.gov.uk/jncc-assets/RIS/UK11043.pdf.

2.2.10 The main interest of the Ramsar site is the wide range of lowland wetland types and successional stages present within a distinct biogeographical area. The FCT[9] for the nearest component of the Ramsar site to the AP2 revised scheme, 'The Mere, Mere SSSI' identifies that the qualifying features of this component are:

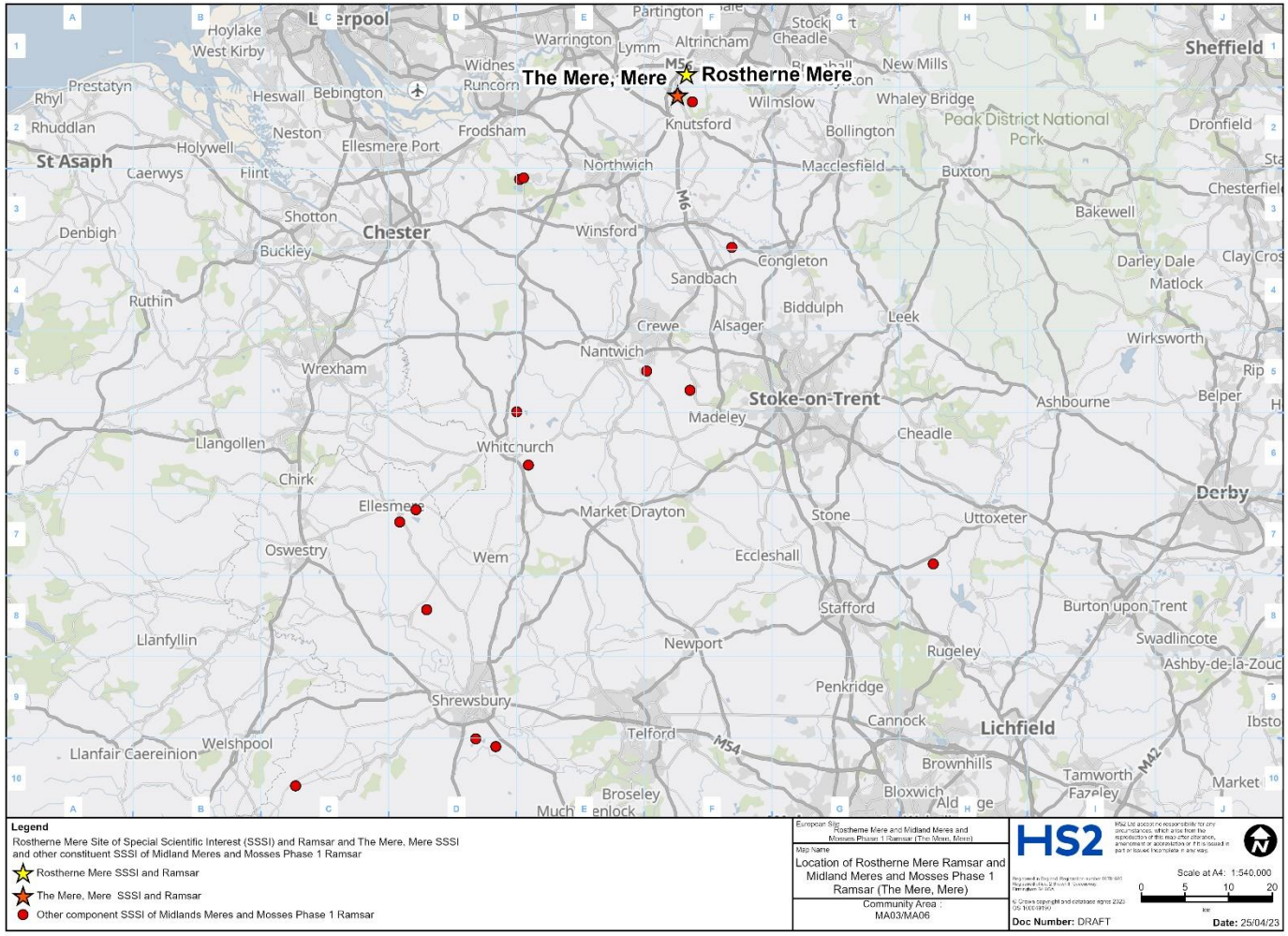
- fen, marsh and swamp: S4 *Phragmites australis* reedbed and S6 *Carex riparia* swamp; and
- standing open water: Standing water on sedimentary rock, eutrophic pH >7: A8 *Nuphar lutea* community.

2.2.11 As described for Rostherne Mere above, the FCT were designed to facilitate monitoring activities and so where quantitative parameters are described (e.g. no loss in habitat extent above 5%) this should be viewed in the context of natural change; it does not mean that losses below 5% as a consequence of development would be acceptable.

2.2.12 The Mere, Mere SSSI comprises two discrete water bodies, The Mere and Little Mere, separated by a narrow spillway. These once comprised a single water body with a fluctuating water level that left large expanses of bare mud exposed in late summer/autumn. This supported the best examples of the site's interest features. Exposure of the lake sediments now occurs less frequently since the removal of a sluice around 30 years ago. In its absence, the primary interest comprises the beds of water lilies, marginal sedge and reed swamp and the populations of red-eyed damselfly.

[9] Natural England (2008), *Conservation Objectives and Definitions of Favourable Condition for Designated Features of Interest. The Mere, Mere.*

Figure 1: Locations of Rostherne Mere and the constituent SSSI forming the Midland Meres and Mosses Phase 1 Ramsar (The Mere, Mere)



2.2.13 The Ramsar description for the entire Midland Meres and Mosses also includes 'an assemblage of rare wetland invertebrates'. This does not mean that all components of the assemblage are present at each of the 16 component sites, but rather that together they support the overall assemblage. Although not listed as a feature within the FCT for the Mere, Mere, the red-eyed damselfly is present and comprises part of the assemblage and is described as 'should be present' as a component of the standing open water community. Given the limited knowledge surrounding the abundance and distribution of this species, it is not assessed specifically in this report, but its requirements are considered to be addressed satisfactorily in the assessment of its supporting habitat.

2.2.14 Conservation objectives are taken from the FCT for The Mere, Mere SSSI; relevant extracts are provided below.

Habitat extent

2.2.15 To maintain the designated features in favourable condition, which is defined in part in relation to a balance of habitat extents (extent attribute). Favourable condition is defined at this site in terms of the following site-specific standards:

- the lake needs to fluctuate on an annual basis in order to maintain the habitat and vegetation; and
- there should be no reduction in the combined area of open water and drawdown zone habitat that is exposed to full sunlight.

Site-specific definitions of favourable condition for fen, marsh and swamp

2.2.16 'To maintain the fen, marsh and swamp at The Mere, Mere in favourable condition, with particular reference to relevant specific designated interest features:

- no reduction in the total combined extent of swamp in relation to the established baseline;
- the total extent of emergent swamp should not exceed 50% of the shoreline and should not be less than 10%;
- no loss of the following components of the wetland/swamp: *Typha latifolia* swamp; *Phragmites australis* swamp; *Carex riparia* swamp. Presence of some *Typha angustifolia* swamp desirable;
- the Mere should significantly dry up at least one summer each decade and have less than 50% shading around the margin;
- for the S4 *Phragmites australis* reedbed:
  - *Phragmites australis* to form a closed or open stand of >90% cover; and

- for the S6 *Carex riparia* swamp:
  - *Carex riparia* cover >70%; and
  - at least two of the following associated species to be present with a combined cover less than 30% (*Phragmites australis*, *Equisetum fluviatile, E. palustre, Phalaris arundinacea, Epilobium hirsutum, Filipendula ulmaria*).'

Site-specific definitions of favourable condition for open water

2.2.17 'To maintain the open water at The Mere, Mere in favourable condition, with particular reference to relevant specific designated interest features:

- no loss of extent of standing water;
- no loss of characteristic species recorded from the site;
- characteristic zones of vegetation should be present;
- there should be a natural hydrological regime; and
- red-eyed damselfly should be present.'

Condition assessment

2.2.18 Natural England's condition monitoring programme evaluates the status of SSSI against the objectives listed above. The last assessment at The Mere, Mere was carried out in 2008[10] and evaluated the SSSI against the 2008 conservation objectives. This found that the condition of the entire site was considered 'unfavourable no change'. There has been no condition assessment against the more recent objectives described in the FCT.

Botanical survey

2.2.19 Botanical surveys of accessible habitats at Rostherne Mere and The Mere, Mere were carried out by HS2 Ltd. in 2019 and 2020, respectively[11]. The Mere, Mere was also surveyed in 2021. Both surveys identified the presence, extent and composition of the qualifying features.

2.2.20 The Rostherne Mere survey confirmed the presence of 'reedbed swamp vegetation' along almost the entire extent of the eastern shoreline, comprising an almost monospecific stand

[10] Natural England (2009), *SSSI Condition Summary: The Mere, Mere SSSI*. Available online at: https://designatedsites.naturalengland.org.uk/SiteFeatureCondition.aspx?SiteCode=S1001818&SiteName=The%20Mere,%20Mere%20SSSI.

[11] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Background Information and Data*, *Ecological baseline data – National Vegetation Classification and ancient woodland,* BID EC-004-00001. Available online at: https://www.gov.uk/government/collections/hs2-phase2b-crewe-manchester-environmental-statement.

of common reed (S4a *Phragmites australis* swamp and reed-beds, *Phragmites australis* subcommunity), grading into more diverse swamp vegetation in the south-east. Although still dominated by common reed *Phragmites australis*, Himalayan balsam *Impatiens glandulifera*, common nettle *Urtica dioica* and other species noticeable components though at a low frequency. Overall, it was identified to represent an example of the common reed-common nettle fen community (S26 *Phragmites australis-Urtica dioica* fen). Both southern and northern shores displayed restricted examples of swamp vegetation, closely allied to adjacent swamp and fen described above but characterised by the dominance of lesser reedmace (S13 *Typha angustifolia* swamp community). The south-western shore supported a small, more discrete stand of swamp vegetation dominated by great reedmace (S12 *Typha latifolia* swamp). Habitats in the south were surveyed via binoculars as access was not allowed so restricting further scrutiny. Isolated examples were also observed in discrete locations on the western shore.

2.2.21 The northern shore of Rostherne Mere also supported woodland in an area known as Gale Bog. Grey willow *Salix cinerea* was dominant with crack willow *Salix fragilis* and goat willow *Salix caprea* frequent. There was no understorey, but lesser pond sedge *Carex acutiformis* and reed canary grass *Phalaris arundinacea* dominated the field layer. There was no evidence of the peat bog vegetation once known to occupy this area. This was therefore considered to represent a wet woodland community (W1 *Salix cinerea-Galium palustre* woodland).

2.2.22 In a clearing within Gale Bog, a more diverse and variable wetland community was present with components either common and frequent (e.g. bittersweet *Solanum dulcamara*, purple loosestrife *Lythrum salicaria* and common reed) or locally abundant (lesser pond sedge and reed canary grass). Again, there was no evidence of the presence of the raised bog. Overall, this was considered to represent an example of the common reed – common nettle community (S26 *Phragmites australis-Urtica dioica* fen).

2.2.23 Away from the shoreline, two similar areas of secondary woodland (Mere Covert and Wood Bongs) were surveyed. Although subtle differences were apparent between the two, in general terms, the canopies of both were dominated by pedunculate oak *Quercus robur* and the understorey by sycamore *Acer pseudoplatanus* and birch *Betula sp.* with rhododendron *Rhododendron ponticum*. The field layers were dominated by bramble *Rubus fruticosus* with bracken and broad buckler fern *Dryopteris dilatata*. Both are examples of W10 *Quercus robur-Pteridium aquilinum-Rubus fruticosus* woodland.

2.2.24 Other habitats, including grassland and scrub within the Ramsar site were not surveyed as these did form part of the qualifying features.

2.2.25 For The Mere, Mere surveys identified a number of discrete, small stands supporting a variable marginal and emergent flora. In extent, common reed dominated swamp considered a transitional community between reedbed and swamp/mire (S4 *Phragmites*

reedbed and S7 *Carex acutiformis* swamp, respectively) is found largely to the south. Elsewhere, a number of small, discrete stands dominated by yellow flag iris *Iris pseudacorus*, great reedmace *Typha latifolia* and common spike rush *Eleocharis palustris*, respectively, were considered representative of S28 *Iris pseudacorus-Filipendula ulmaria* mire, S12 *Typha latifolia* swamp and S19 *Eleocharis palustris* swamp. In addition, a small but markedly different stand dominated by great willowherb with gypsywort *Lycopus europaeus* was considered to represent an example of OV26b *Epilobium hirsutum community Phragmites australis-Iris pseudacorus* sub-community.

2.3 Basis of preparing a joint assessment

2.3.1 The rationale for pursuing a joint report primarily reflects the hydrological linkages between Rostherne Mere and The Mere, Mere. The Mere, Mere (itself comprising two water bodies, The Mere and Little Mere), lies within the same hydrological catchment as Rostherne Mere. This connection has led to the production of a hydrological assessment and mitigation proposals that address the potential for hydrological change for both sites (see Section 3).

2.3.2 Similarly, for both sites, the proximity of nearby roads requires consideration of the impact of air pollution and has prompted production of an air quality assessment (Annex B and C).

2.3.3 In addition, Rostherne Mere and all 16 components of the Midland Meres and Mosses Phase 1 Ramsar site display similar reasons for designation: highly characteristic water bodies with distinctive hydrological regimes, water chemistry and vegetation communities. Although Ramsar site selection criteria are quite broadly described, this report assumes that both Rostherne Mere and all components of the Midland Meres and Mosses Phase 1 Ramsar sites share similar features. Confidence in this approach can be drawn from the relatively standardised wording of the relevant FCT.

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 Rostherne Mere and The Mere, 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 reports: Hulseheath to Manchester Airport area (MA06) and Pickmere to Agden and Hulseheath area (MA03).

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[12] and impacts related to traffic emissions arising from the SES2 changes and AP2 amendments.

3.2 Scope, assumptions and limitations

Rostherne Mere

3.2.1 The land required for construction of the AP2 revised scheme includes sections of Cherry Tree Lane adjacent to Rostherne Mere and areas immediately adjacent to Cherry Tree Lane to the south. Therefore, there are plausible impacts to the Ramsar site including from pollution of surface and sub-surface flows from spillages, siltation and dust.

3.2.2 Rostherne Mere lies in the same hydrological catchment as the land required for the construction of the AP2 revised scheme. Consequently, there are plausible impacts on ground and surface water flows as a result of construction.

3.2.3 In addition, the Cherry Tree Lane construction traffic route runs within 50m of Rostherne Mere along much of the northern boundary, and lies directly adjacent, at one point. Therefore, there is a plausible impact 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.

[12] 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.

The Mere, Mere

3.2.4 The Mere, Mere lies approximately 750m from any land required for construction of the AP2 revised scheme. Given the distance from The Mere, Mere, impacts from nearby construction can be ruled out. Therefore, the only plausible impacts that could arise relate to air quality and hydrology.

3.2.5 The Mere, Mere lies in the same hydrological catchment as the land required for the construction of the AP2 revised scheme. Consequently, there are plausible impacts as a result of construction on surface and sub-surface flows.

3.2.6 In addition, there is a plausible impact 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.

3.2.7 The potential for likely significant effects as a result of these impacts is discussed below.

Hydrology assessment methodology

3.2.8 The potential long-term hydrological impacts on surface and sub-surface flows resulting from drainage to cuttings excavated along the route of the AP2 revised scheme were considered in the Document to inform a Habitats Regulations Assessment for Rostherne Mere Ramsar site and Midland Meres and Mosses Phase 1 Ramsar site, that accompanied the High-Speed Rail (Crewe – Manchester) Environmental Statement published in 2022[2] (the main ES). As there has been no meaningful change to the assessment, these have not been reported here.

Air pollution assessment methodology

3.2.9 The assessment of air pollution is informed by established best practice provided by National Highways[13,14], Natural England[15,16], and the Institute for Air Quality Management (IAQM)[17].

3.2.10 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.

3.2.11 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.

3.2.12 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.

[13] 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.

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

[15] 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: http://publications.naturalengland.org.uk/publication/4720542048845824.

[16] 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...'.

[17] Institute of Air Quality Management (2020), *A guide to the assessment of air quality impacts on designated nature conservation sites*, *v1.1*. Available online at: https://iaqm.co.uk/guidance/.

3.2.13 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)[18] 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[18] (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.

3.2.14 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.

3.2.15 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.

3.2.16 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.

3.2.17 Traffic flows are assessed by calculating AADT figures using established models[19]. Should increases in traffic be less than 1,000 AADT[20] 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.

3.2.18 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

[18] 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.

[19] It should be noted that traffic data used in the air quality assessment presented in the SES2 and AP2 ES is based on daily peak derived traffic data. The assessment presented in this appendix is based on annualised traffic data which is considered more appropriate for the purposes of the Designated Site Assessment.

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

relevant critical levels for NOx and NH3 and the critical loads for the deposition of nitrogen and acid, as described by the Air Pollution Information System (APIS)[21], as follows:

- 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"[22];
- 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.

3.2.19 Natural England best practice guidance[15] 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.

3.2.20 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.

3.2.21 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.

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

[22] 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.

3.3 Assessment of impact and effects

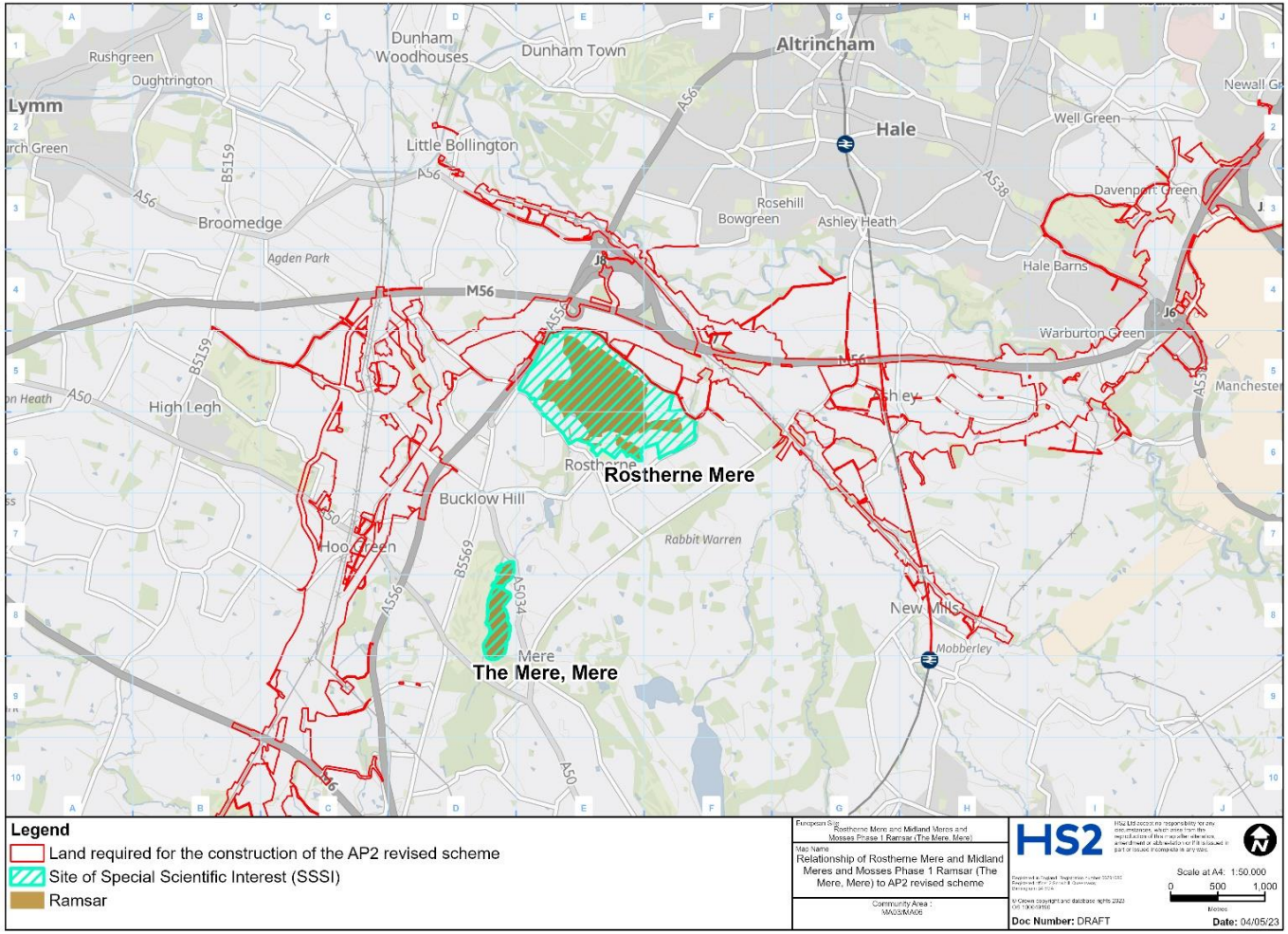
Construction-related impacts and mitigation at Rostherne Mere

3.3.1 As there has been no meaningful change to the assessment of construction-related impacts and mitigation, these have not been reported here. For full details, reference should be made to the main ES.

Hydrological impacts and mitigation at Rostherne Mere and The Mere, Mere

3.3.2 As there has been no meaningful change to the assessment of hydrological impacts and mitigation, these have not been reported here. For full details, reference should be made to the main ES.

Figure 2: Relationship of Rostherne Mere and The Mere, Mere to the AP2 revised scheme



Assessment of traffic flows and air pollution during construction

Rostherne Mere

3.3.3 Rostherne Mere lies adjacent, at its closest, to Cherry Tree Lane, which is within the 200m threshold described in Section 3.2. Consequently, an assessment of traffic flows is required. The traffic analysis (see Section 5.1, Annex B) indicates that the construction of the AP2 revised scheme will exceed the AADT or HDV traffic thresholds described in Section 3.2. Therefore, an air quality assessment is required.

3.3.4 The air quality assessment of traffic flows is summarised in Annex B. This has been undertaken in accordance with the Volume 5, Appendix: CT-001-00001, Environmental Impact Assessment Scope and Methodology Report (SMR)[23] and 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.

3.3.5 The following assessment 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.

3.3.6 Six transects (T3, T4, T5, T6, T7 and T9), each 200m long, were established around the circumference of Rostherne Mere: T3 and T4 in the west near the A556 Chester Road; T5 in the north-west near Cherry Tree Lane; and, T6, T7 and T9 to the north and north-east, again near Cherry Tree Lane. Each transect started from the kerbside and intercepted the boundary of the European site at 194m, 184m, 53m, 86m, 72m and 0m, respectively. All subsequent points fell within the Ramsar site. The transects in Figure 3 were located to reflect the greatest air quality impact as well as to take account of the most sensitive habitat features.

Critical loads and levels

3.3.7 Background NOx, NH_3 and nitrogen deposition rates were obtained from APIS. Several habitat types were identified within the European site and are listed below with the appropriate critical loads:

[23] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement, Environmental Impact Assessment Scope and Methodology Report,* Volume 5, Appendix: CT-001-00001. Available online at: https://www.gov.uk/government/collections/hs2-phase2b-crewe-manchester-environmental-statement.

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

3.3.8 The allocation of critical loads merits clarification. Best practice guidance encourages the use of the lowest value in the critical load range as a precautionary measure, as it will emphasise any negative outcomes. However, in addition to the semi-natural habitats, Rostherne Mere also includes substantial areas of woodland including Harpers Bank Wood to the west, Mere Covert (excluding Gale Bog) to the north and Wood Bongs to the south-east. These do not represent qualifying features and it is understood these were included within the Ramsar site and SSSI boundary to provide influence over surrounding land management with the FCT describing their role 'as a buffer to the mere'. Consequently, each is regarded as 'site fabric'[24] but in reflection of its semi-natural character and as a precautionary measure, it has been classified as broadleaved woodland with a critical load of 10kg N/ha/yr – 20kg N/ha/yr though. Reflecting its status as site fabric, the highest value in the range has been used.

3.3.9 Given that bryophytes are an integral component of wetland habitat, a critical level for NH_3 of 1µg/m^3 has been applied to poor fen. Similarly, as lichens are an important part of woodland ecosystem functioning, a critical level of 1µg/m^3 has been applied to the broadleaved woodland. However, given its status as site fabric any exceedances will not be significant. The neutral grassland has, however, been assigned the 'higher plant' critical level of 3µg/m^3, commensurate with its community composition.

3.3.10 The critical level for NOx is a constant (30µg/m^3).

3.3.11 Assigning the qualifying feature at Rostherne Mere that best represents the Ramsar criteria is of fundamental importance, as the differing critical loads will directly influence the overall outcome of this assessment. Table 2 of the FCT identifies that the National Vegetation Classification (NVC) communities that comprise the fen, marsh and swamp community at Rostherne Mere comprise the following:

- S4 – *Phragmites australis* swamp and reed-beds;
- S13 – *Typha angustifolia* swamp; and
- S26 – *Phragmites australis-Urtica dioica* tall-herb fen.

[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.'

3.3.12 This has been confirmed by site survey in July 2019. Based on Natural England's advice (Annex A), these three communities, despite occupying neutral, eutrophic locations and dominated by tall emergent vegetation and more akin to the late successional stages of swamp vegetation, are considered to represent 'poor fen' communities. When compared with previous surveys, the extent, distribution and composition of these communities appears to be little changed over the last decade or so.

3.3.13 Importantly, although Gale Bog is undeniably wet woodland today, management objectives seek to restore this to fen, marsh and swamp or similar vegetation and so, again on the advice on Natural England, this too is evaluated as a component of this poor fen community. Similarly, and importantly, the standing open water is also evaluated under the critical loads used for poor fen.

Air pollution impacts

3.3.14 Table B5 of Annex B 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). In addition, NOx concentrations are predicted to be within the air quality standard at all modelled receptors with or without the AP2 revised scheme. Nonetheless, there is a greater than 1% exceedance of the NOx critical level brought about by the AP2 revised scheme. The maximum change is 5.4% at the roadside on Transect 9; however, this is located within the woodland habitat, which is considered to be site fabric. Where the transects intercept with the poor fen habitat there is a less than 1% exceedance of the critical level at all modelled receptors. Therefore, likely significant effects can be ruled out.

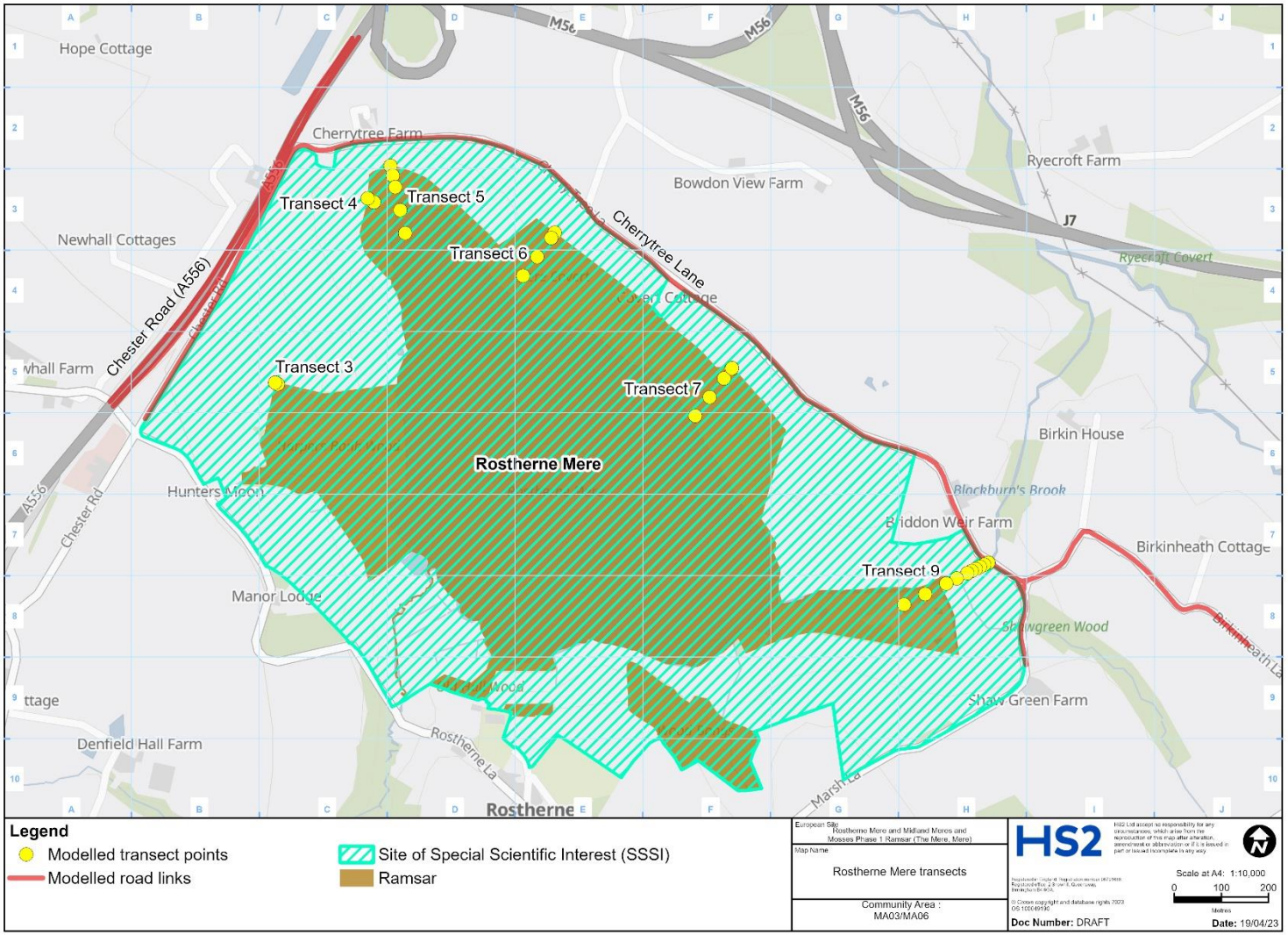
3.3.15 Table B6 of Annex B shows that predicted NH_3 concentrations with the AP2 revised scheme are higher than the 2018 baseline rates at all modelled receptors. In addition, NH_3 concentrations are predicted to be above the relevant air quality standard with or without the AP2 revised scheme. Further, there is a greater than 1% exceedance of the critical level brought about by the AP2 revised scheme. The maximum change is 14.1% at the roadside on Transect 9; however, this is located within the woodland habitat, which is considered to be site fabric. On Transects 4 and 5 where these intercept with the poor fen habitat, there is also a greater than 1% exceedance of the critical level across all modelled receptors; with a maximum change of 2% on Transect 5 at 53m from the road. Therefore, likely significant effects cannot be ruled out.

3.3.16 Table B7 of Annex B shows that predicted nitrogen deposition rates with the AP2 revised scheme are similar to 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 lower critical load brought about by the AP2 revised scheme. The maximum change is 6.8% at the roadside on Transect 9; however, this is located within the

woodland habitat, which is considered to be site fabric. There is a 1% exceedance on Transect 4 from 184m where this intercepts with the poor fen habitat, which continues to the end of the transect. On Transect 5, the maximum change within the poor fen habitat is 1.2% at 53m from the road; this falls to1% at 100m, declining to below 1% throughout the remainder of the transect. Therefore, likely significant effects cannot be ruled out.

3.3.17 Table B8 of Annex B shows that predicted acid deposition rates with the AP2 revised scheme, are similar to 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. In addition, the changes brought about by the AP2 revised scheme exceed 1% of the critical load. The maximum change is 16.1% at the roadside on Transect 9; however, this is located within the woodland habitat, which is considered to be site fabric. There is a 1.3% exceedance on Transect 4 from 184m where this intercepts with the poor fen habitat, which falls to 1.2% at the end of the transect. On Transect 5, the maximum change within the poor fen habitat is 1.5% at 53m from the road; this falls to 1% at 200m. Therefore, likely significant effects cannot be ruled out.

Figure 3: Location of Rostherne Mere and the modelled transects



The Mere, Mere

3.3.18 The Mere, Mere lies approximately 193m north of the A50 Warrington Road and 10m south of Mereside Road, both of which are located within the 200m threshold described in Section 3.2. Consequently, an assessment of traffic flows is required. The traffic analysis (see Section 5.1, Annex C) indicates that the construction of the AP2 revised scheme will exceed the AADT or HDV traffic thresholds described in Section 3.2 on the A50 Warrington Road. Therefore, an air quality assessment is required.

3.3.19 The air quality assessment of traffic flows is summarised in Annex C. This has been undertaken in accordance with the Volume 5, Appendix: CT-001-00001, Environmental Impact Assessment Scope and Methodology Report (SMR)[25] and 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.

3.3.20 The following assessment 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.

3.3.21 A single transect was established at The Mere, Mere to reflect the greatest air quality impact as well as to take account of the most sensitive habitat features. This extended northwards from the kerbside of the A50 Warrington Road before intercepting the boundary of the site at 193m. The location and distribution of the transect is shown in Figure 4.

Critical loads and levels

3.3.22 Only one habitat type, 'poor fen' with a critical load of 10kg N/ha/yr – 15kg N/ha/yr was of relevance. Drawing on the findings of the Rostherne Mere assessment, critical loads of 10kg N/ha/yr – 15kg N/ha/yr were applied for nitrogen deposition. Unusually, APIS does not provide a critical load for acid deposition. Consequently, and as agreed with Natural England, the critical loads from the transition mire/quaking bog community at Oak Mere SAC/Midlands Meres and Mosses Phase 2 Ramsar site, were applied as a reasonable surrogate (i.e. 0.321keq/ha/yr – 0.540keq/ha/yr). Whilst occupying a comparable position on the interface between terrestrial and aquatic habitats (so sharing some characteristics of the important shoreline community at The Mere, Mere, it is markedly different in others)

[25] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement, Environmental Impact Assessment Scope and Methodology Report,* Volume 5, Appendix: CT-001-00001. Available online at: https://www.gov.uk/government/collections/hs2-phase2b-crewe-manchester-environmental-statement.

it is considered to be more sensitive to acidification and represents a precautionary approach. The critical level for NOx is a constant (30µg/m^3) and remains unaltered. Given that bryophytes are an integral component of wetland habitats, a critical level of 1µg/m^3 has been applied to the poor fen habitat.

Air quality impacts

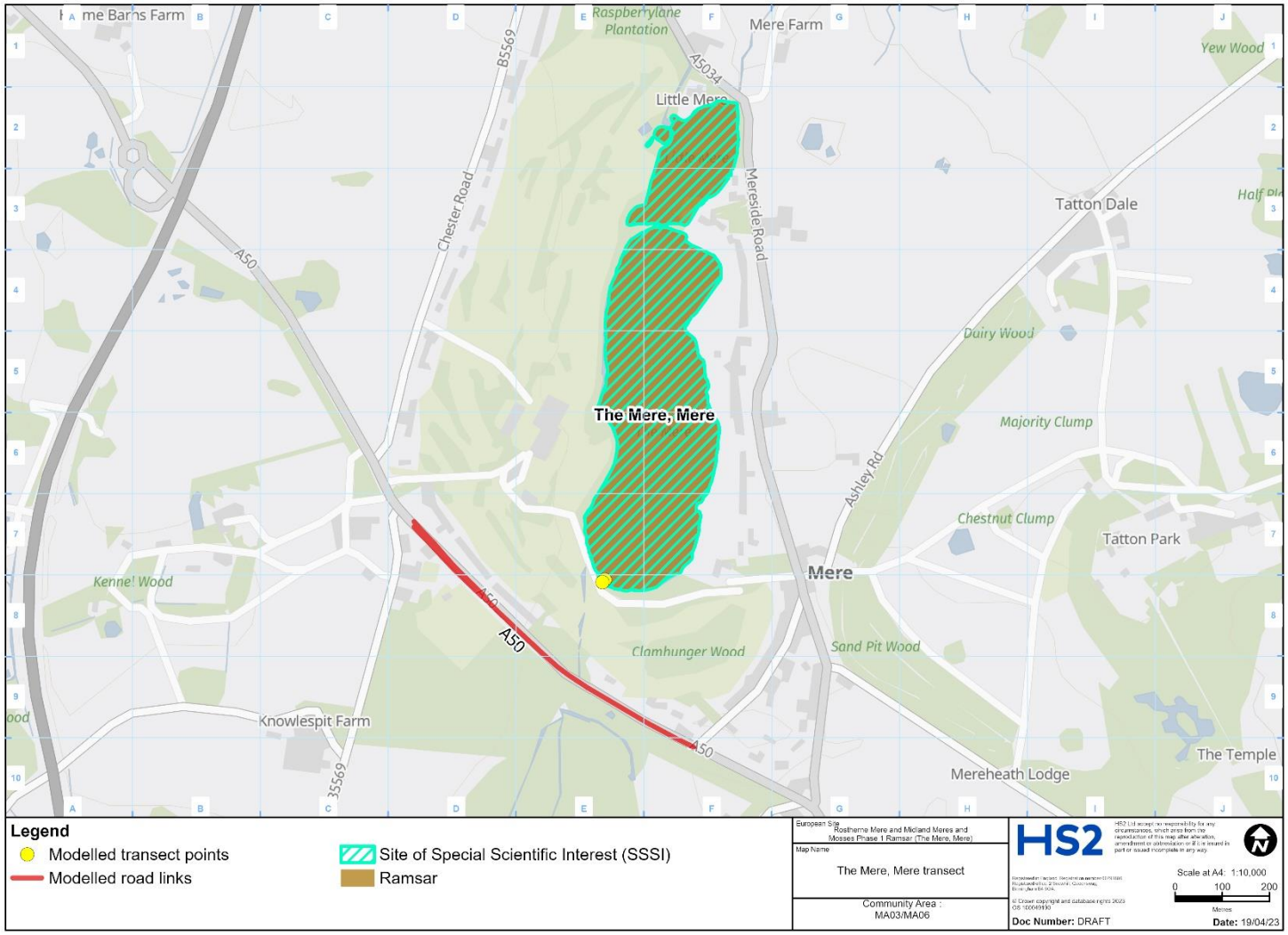
3.3.23 Table C5 of Annex C shows that predicted NOx concentrations with the AP2 revised scheme are lower than the 2018 baseline rates at all modelled receptors. In addition, NOx concentrations are predicted to be within the air quality standard at all modelled receptors with or without the AP2 revised scheme. In addition, the changes brought about by the AP2 revised scheme do not exceed 1% of the NOx critical level. Therefore, likely significant effects can be ruled out.

3.3.24 Table C6 of Annex C shows that predicted NH_3 concentrations with the AP2 revised scheme are marginally higher than the 2018 baseline rates at all modelled receptors. In addition, 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. The maximum change is 1.5% at 193m from the roadside. Therefore, likely significant effects cannot be ruled out.

3.3.25 Table C7 of Annex C shows that predicted nitrogen deposition rates with the AP2 revised scheme are below 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. Nonetheless, the changes brought about by the AP2 revised scheme do not exceed 1% of the critical load. Therefore, likely significant effects can be ruled out.

3.3.26 Table C8 of Annex C shows that predicted acid deposition rates with the AP2 revised scheme are the same as 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. In addition, the changes brought about by the AP2 revised scheme exceed 1% of the critical load. The maximum change is 1.1% at 193m from the roadside and remains at this rate at 200m. Therefore, likely significant effects cannot be ruled out.

Figure 4: Location of the Mere, Mere and the modelled transect



Assessment of traffic flows and air pollution during operation

Rostherne Mere

3.3.27 The assessment of operational air quality impacts follows the same approach as described above for construction phase impacts with the exception that only the A556 Chester Road triggers the screening threshold described in Section 3.2.

3.3.28 Table B16 of Annex B shows that predicted NOx concentrations with the AP2 revised scheme are lower than the 2018 baseline rates at all modelled receptors. In addition, NOx concentrations are predicted to be within the air quality standard at all modelled receptors with or without the AP2 revised scheme. In addition, the changes brought about by the AP2 revised scheme do not exceed 1% of the NOx critical level. Therefore, likely significant effects can be ruled out.

3.3.29 Table B17 of Annex B shows that predicted NH_3 concentrations with the AP2 revised scheme are marginally higher 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. Nonetheless, the changes brought about by the AP2 revised scheme do not exceed 1% of the NH_3 critical level. Therefore, likely significant effects can be ruled out.

3.3.30 Table B18 of Annex B shows that predicted nitrogen deposition rates with the AP2 revised scheme are below 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. Nonetheless, the changes brought about by the AP2 revised scheme do not exceed 1% of the critical load. Therefore, likely significant effects can be ruled out.

3.3.31 Table B19 of Annex B shows that predicted acid deposition rates with the AP2 revised scheme are marginally 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. Nonetheless, the changes brought about by the AP2 revised scheme do not exceed 1% of the critical load. Therefore, likely significant effects can be ruled out.

The Mere, Mere

3.3.32 The assessment of operational air quality impacts follows the same approach as described above for construction phase impacts.

3.3.33 Table C16 of Annex C shows that predicted NOx concentrations with the AP2 revised scheme are lower than the 2018 baseline rates at all modelled receptors. In addition, NOx concentrations are predicted to be within the air quality standard at all modelled receptors

with or without the AP2 revised scheme. In addition, the changes brought about by the AP2 revised scheme do not exceed 1% of the NOx critical level. Therefore, likely significant effects can be ruled out.

3.3.34 Table C17 of Annex C 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. Nonetheless, the changes brought about by the AP2 revised scheme do not exceed 1% of the NH_3 critical level. Therefore, likely significant effects can be ruled out.

3.3.35 Table C18 of Annex C shows that predicted nitrogen deposition rates with the AP2 revised scheme are below 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. Nonetheless, the changes brought about by the AP2 revised scheme do not exceed 1% of the critical load. Therefore, likely significant effects can be ruled out.

3.3.36 Table C19 of Annex C shows that predicted acid deposition rates with the AP2 revised scheme are the marginally 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. Nonetheless, the changes brought about by the AP2 revised scheme do not exceed 1% of the critical load. Therefore, likely significant effects can be ruled out.

3.4 Mitigation measures

3.4.1 The likely significant effects identified above have been identified on a precautionary basis.

3.4.2 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.

3.5 Summary of likely significant effects

Rostherne Mere

3.5.1 The assessment of construction-related and hydrological impacts concluded that, with mitigation, in the form of a CoCP and the installation of gravel-filled trenches respectively, likely significant effects can be ruled out.

3.5.2 The air quality assessment demonstrates that, in the absence of mitigation, the relevant air quality standards are exceeded for NH_3 and both nitrogen and acid deposition during construction of the AP2 revised scheme. In addition, there is a greater than 1% exceedance

of the critical level for NH_3 and the critical loads for nitrogen and acid deposition. Therefore, likely significant effects cannot be ruled out as a result of these pollutants.

3.5.3 There are no likely significant effects for NOx during construction of the AP2 revised scheme nor for NOx, NH_3, nitrogen and acid deposition during operation.

The Mere, Mere

3.5.4 The assessment of hydrological impacts concluded that, with mitigation, through the installation of gravel-filled trenches respectively, likely significant effects can be ruled out. There will be no non-significant impacts.

3.5.5 The air quality assessment demonstrates that, in the absence of mitigation, the relevant air quality standards are exceeded for NH_3 and both nitrogen and acid deposition during construction of the AP2 revised scheme. In addition, there is a greater than 1% exceedance of the critical level for NH_3 and the critical load for acid deposition. Therefore, likely significant effects cannot be ruled out as a result of these pollutants.

3.5.6 There are no likely significant effects for NOx during construction of the AP2 revised scheme nor for NOx, NH_3, nitrogen and acid deposition during operation.

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 B and C.

4.2 Air quality assessment of traffic flows in combination

Methodology

4.2.1 The same transects and critical loads and levels, as described in Section 3, were utilised.

4.2.2 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 Rostherne Mere and The Mere, Mere.

4.2.3 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 B and C.

Construction phase impacts in combination

Rostherne Mere

4.2.4 The assessment of in combination construction air quality impacts follows the same approach as described above for construction phase impacts.

4.2.5 Table B9 of Annex B shows that predicted NOx concentrations with the AP2 revised scheme are lower than the 2018 baseline rates at all modelled receptors. In addition, NOx concentrations are predicted to be within the air quality standard at all modelled receptors with or without the AP2 revised scheme. Nonetheless, 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 6% at the roadside on Transect 9; however, this is located within the woodland habitat, which is considered to be site fabric. Where the transects intercept with the poor fen habitat there is also a greater than 1% exceedance of the critical level at all modelled receptors. The maximum change is 2.4% at 53m from the road on Transect 5 and 184m on Transect 4. Therefore, likely significant effects in combination cannot be ruled out.

4.2.6 Table B10 of Annex B shows that predicted NH_3 concentrations with the AP2 revised scheme are higher than the 2018 baseline rates at all modelled receptors. In addition, 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 15.7% at the roadside on Transect 9; however, this is located within the woodland habitat, which is considered to be site fabric. There is also a greater than 1% exceedance on Transects 4 and 5 where these intercept with the poor fen habitat. The maximum change within the poor fen habitat is 5.8% on Transect 5, 53m from the road; this falls to 3.7% at 200m. Therefore, likely significant effects in combination cannot be ruled out.

4.2.7 Table B11 of Annex B shows that predicted nitrogen deposition rates with the AP2 revised scheme are similar to 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 lower critical load brought about by the AP2 revised scheme in combination. The maximum change is 7.5% at the roadside on Transect 9; however, this is located within the woodland habitat, which is considered to be site fabric. There is also a greater than 1% exceedance on Transects 4 and 5 where these intercept with the poor fen habitat. The maximum change within the poor fen habitat is 3.6% on Transect 5, 53m from the road; this falls to 2.3% at 200m. Therefore, likely significant effects in combination cannot be ruled out.

4.2.8 Table B12 of Annex B shows that predicted acid deposition rates with the AP2 revised scheme are similar to 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. In addition, the changes brought about by the AP2 revised scheme in combination exceed 1% of the critical load. The maximum change is 17.9% at the roadside on Transect 9; however, this is located within the woodland habitat, which is considered to be site fabric. There is also a greater than 1% exceedance on Transects 4 and 5 where these intercept with the poor fen habitat. The maximum change within the poor fen habitat is 4.4% on Transect 5, 53m from the road; this falls to 2.9% at 200m. Therefore, likely significant effects in combination cannot be ruled out.

The Mere, Mere

4.2.9 The assessment of in combination construction air quality impacts follows the same approach as described above for construction phase impacts.

4.2.10 Table C9 of Annex C shows that predicted NOx concentrations with the AP2 revised scheme are lower than the 2018 baseline rates at all modelled receptors. In addition, NOx concentrations are predicted to be within the air quality standard at all modelled receptors with or without the AP2 revised scheme in combination. Furthermore, there is a less than 1% exceedance of the NOx critical level brought about by the AP2 revised scheme. Therefore, likely significant effects in combination can be ruled out.

4.2.11 Table C10 of Annex C shows that predicted NH_3 concentrations with the AP2 revised scheme are similar to the 2018 baseline rates at all modelled receptors. In addition, 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. The maximum change is 1.9% at 193m from the roadside, which remains at this level at 200m. Therefore, likely significant effects in combination cannot be ruled out.

4.2.12 Table C11 of Annex C 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 lower critical load brought about by the AP2 revised scheme in combination. The maximum change is 1.2% at 193m from the roadside, which falls to 1.1% at 200m. Therefore, likely significant effects in combination cannot be ruled out.

4.2.13 Table C12 of Annex C shows that predicted acid deposition rates with the AP2 revised scheme are the same as 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. In addition, the changes brought about by the AP2 revised scheme exceed 1% of the critical load. The maximum change is 1.5% at 193m from the roadside, which falls to 1.4% at 200m. Therefore, likely significant effects in combination cannot be ruled out.

Operational phase impacts in combination

Rostherne Mere

4.2.14 The assessment of operational air quality impacts follows the same approach as described above for construction phase impacts with the exception that only the A556 Chester Road triggers the screening threshold described in Section 3.2.

4.2.15 Table B20 of Annex B shows that predicted NOx concentrations with the AP2 revised scheme are lower than the 2018 baseline rates at all modelled receptors. In addition, NOx concentrations are predicted to be within the air quality standard at all modelled receptors with or without the AP2 revised scheme. Nonetheless, 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 1.2% on Transect 4 where the transects intercept with the poor fen habitat at 184m from the road; this falls to 1.1% at 200m. Therefore, likely significant effects in combination cannot be ruled out.

4.2.16 Table B21 of Annex B shows that predicted NH_3 concentrations with the AP2 revised scheme are higher than the 2018 baseline rates at all modelled receptors. In addition, 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 5.1% on Transect 4 where the transects intercept with the poor fen habitat at 184m from the road; this falls to 4.7% at 200m. Therefore, likely significant effects in combination cannot be ruled out. Table B22 of Annex B 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 lower critical load brought about by the AP2 revised scheme in combination. The maximum change is 3% on Transect 4 where the transects intercept with the poor fen habitat at 184m from the road; this falls to 2.7% at 200m. Therefore, likely significant effects in combination cannot be ruled out.

4.2.17 Table B23 of Annex B shows that predicted acid deposition rates with the AP2 revised scheme are similar to 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. In addition, the changes brought about by the AP2 revised scheme in combination exceed 1% of the critical load. The maximum change is 3.6% on Transect 4 where the transects intercept with the poor fen habitat at 184m from the road; this falls to 3.3% at 200m. Therefore, likely significant effects in combination cannot be ruled out.

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4.2.18 The assessment of operational air quality impacts follows the same approach as described above for construction phase impacts.

4.2.19 Table C20 of Annex C shows that predicted NOx concentrations with the AP2 revised scheme are lower than the 2018 baseline rates at all modelled receptors. In addition, NOx concentrations are predicted to be within the air quality standard at all modelled receptors with or without the AP2 revised scheme. In addition, there is a less than 1% exceedance of

the NOx critical level brought about by the AP2 revised scheme in combination across all modelled receptors. Therefore, likely significant effects in combination can be ruled out.

4.2.20 Table C21 of Annex C shows that predicted NH_3 concentrations with the AP2 revised scheme are lower than the 2018 baseline rates at all modelled receptors. In addition, 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 1.1% where the transects intercept with the poor fen habitat at 193m from the road; this falls to 1% at 200m. Therefore, likely significant effects in combination cannot be ruled out.

4.2.21 Table C22 of Annex C 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. Nonetheless, there is a less than 1% exceedance of the lower critical load brought about by the AP2 revised scheme in combination at all modelled receptors. Therefore, likely significant effects in combination can be ruled out.

4.2.22 Table C23 of Annex C shows that predicted acid deposition rates with the AP2 revised scheme are marginally 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. Nonetheless, there is a less than 1% exceedance of the lower critical load brought about by the AP2 revised scheme in combination at all modelled receptors. Therefore, likely significant effects in combination can be ruled out.

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 cannot be ruled out as a result of the AP2 revised scheme in combination during both construction and operation.

4.3.2 Therefore, 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: Natural England advice

See the Document to inform a Habitats Regulations Assessment for Rostherne Mere Ramsar site and Midland Meres and Mosses Phase 1 Ramsar site, that accompanied the High-Speed Rail (Crewe – Manchester) Environmental Statement published in 2022 (the main ES).

Annex B: Additional air quality information – Rostherne Mere

1 Purpose

This Annex provides additional air quality information in relation to impacts from vehicle emissions to support the Rostherne Mere Ramsar site assessment.

2 Scope, assumptions and limitations

The scope, assumptions and limitations for the air quality assessment are set out in full in Volume 1 (Section 8) of the SMR (see Volume 5, Appendix: CT-001-00001) and accompanying SMR Technical note – Air quality: Guidance on the assessment methodology[26], and 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[13], to identify where assessment is required;
- these criteria are the following for assessing the impacts of the scheme:
  - 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[17]. Data on ammonia, nitrogen deposition and acid deposition has been taken from the most recent information available on the APIS[21] 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.

[26] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement, Environmental Impact Assessment Scope and Methodology Report,* Volume 5, Appendix: CT-001-00001. Available online at: https://www.gov.uk/government/collections/hs2-phase2b-crewe-manchester-environmental-statement.

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 annual average traffic data, refined from the peak period traffic data, 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[27]; Air Quality and include Euro VI for HGV, and Euro 6 and Euro 4 for diesel and petrol Light Duty Vehicles (LDV) 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 (TAG) 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

[27] High Speed Two Ltd (2022), *High Speed Two Phase 2b Information Paper E14: Air Quality.* Version 2.0. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1084183/E14_Air_quality_v2.pdf.

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[28];
- Cheshire West and Chester Local Plan (Part Two) Land Allocations and Detailed Policies, November 2017[29];
- Winsford Transport Strategy Recommendations Report, June 2016[30];
- Northwich Transport Strategy Recommendations Report, April 2018[31];
- Regional Investment Programme (RIP) M6 Junction 19 Improvement PCF Stage 3 Transport Forecasting Report, January 2019[32]; 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))[33] dataset and the National Transport Model (NTM) 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. 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[15]:

- combustion and energy < 20MW (within 5km);
- combustion and energy > 20MW;
- farming, livestock and poultry;

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[28] Cheshire East Council (2022), *Local Plan Strategy 2010 – 2030. Adopted 17 July 2017*. Available online at: https://www.cheshireeast.gov.uk/pdf/planning/local-plan/local-plan-strategy-web-version-1.pdf.

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

[30] Mott MacDonald (2016), *Winsford Transport Strategy: Recommendations Report.* Available online at: https://cmttpublic.cheshirewestandchester.gov.uk/documents/s48945/Appendix%20B%20Winsford%20Transport%20Strategy.pdf.

[31] Mott MacDonald (2018), *Northwich Transport Strategy: Recommendations Report*. Available online at: https://www.cheshirewestandchester.gov.uk/documents/parking-roads-and-travel/public-transport/transport-strategies/northwich-transport-strategy/northwich-transport-strategy-recommendation-report-130318.pdf.

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

[33] 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.

- waste, e.g. landfill gas; and
- minerals activities.

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' will be 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 B1 sets out the air quality standard for NOx.

Table B1: 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[34], critical level or relevant standard for the site, as above or as provided by APIS.

[34] 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 – 20 kg 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[35], 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[34] 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.

[35] 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 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 B2.

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

- the A556 Chester Road;
- Chester Road; and
- Cherry Tree Lane.

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

Figure B1 presents a detailed map of the modelled area including assessed roads (Modelled Road Links in red) and Modelling Transect Points (yellow dots).

Table B2: Traffic data summary – Rostherne Mere (construction phase, AP2 revised scheme)

Road ID	Road name	Annual Average Daily Traffic (AADT)					Heavy Duty Vehicles (HDV)				
		2018 baseline	2026 without the AP2 revised scheme	2026 with the AP2 revised scheme	AP2 revised scheme change (2026 with AP2 revised scheme – 2026 without AP2 revised scheme)	In combination change (2039 with AP2 revised scheme – 2018 baseline)	2018 baseline	2026 without the AP2 revised scheme	2026 with the AP2 revised scheme	AP2 revised scheme change (2026 with AP2 revised scheme – 2026 without AP2 revised scheme)	In combination change (2039 with AP2 revised scheme – 2018 baseline)
8013_5006, 5006_8013	Cherry Tree Lane	228	339	1,541	**1,202**	**1,313**	6	16	70	55	64
8013_8011, 8011_8013	Marsh Lane	123	109	149	40	27	22	13	12	0	-10
8012_5005, 5005_8012	Rostherne Lane	47	67	223	156	175	0	0	0	0	0
5006_5005, 5005_5006	Chester Road	228	339	1,541	**1,202**	**1,313**	6	16	70	55	64
96018_96016, 96015_96017	A556 Chester Road	58,610	78,990	81,758	**2,769**	**23,148**	3,814	4,023	5,259	**1,236**	**1,445**
RM_D	On-site Haul Route	-	-	481	481	481	-	-	481	**481**	**481**

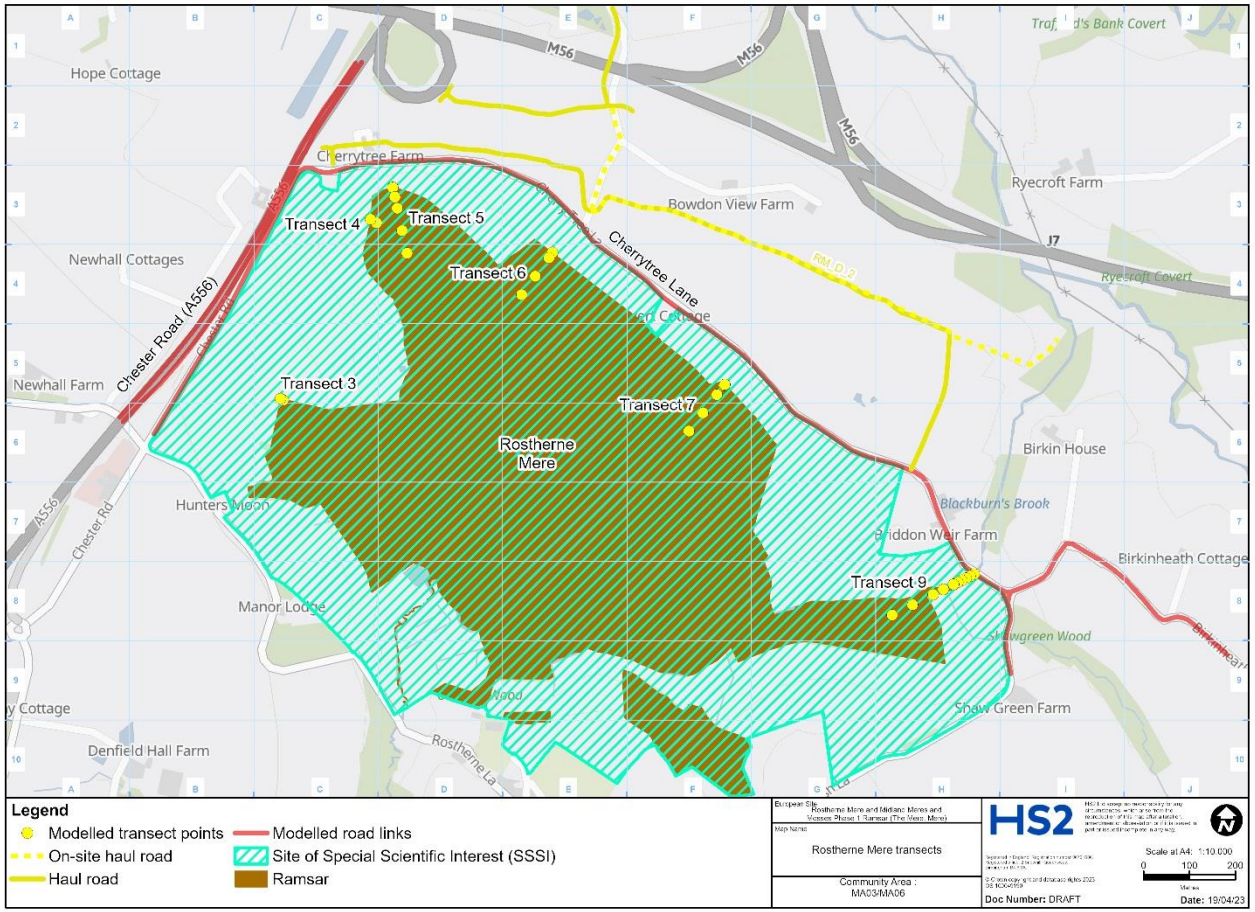
Note: Values in bold indicate change in traffic flow triggering for assessment.

5.2 Receptors assessed and background concentrations

Table B3 shows the background concentrations for NOx, background nitrogen deposition and critical loads.

Table B4 shows the background acid deposition, critical loads and background ammonia concentrations. The yellow modelling transect points in Figure B1 represent the closest point to the road for each of the three sensitive habitat types.

Figure B1: Map of construction transect, including modelled links and modelled ecological receptor points



Note: Transects 1, 2 and 8 reported in main ES Volume 5, Appendix: AQ-002-0MA06, are not deemed relevant to this assessment.

Table B3: Modelled ecological receptor NOx and nitrogen deposition backgrounds and critical loads (construction phase)

Receptor	Sensitive habitat	2018 NOx background concentration (µg/m³)	2026 NOx background concentration (µg/m³)	APIS data[21] of average total nitrogen deposition (kg/ N/ha/yr)	APIS critical load (kg N/ha/yr)
Rostherne Mere across all transects	Broadleaved deciduous woodland	16.7	11.4	47.1	20
	Poor fen	16.7	11.4	28.0	10
	Poor fen	19.1	12.8	27.5	10
	Broadleaved deciduous woodland	19.1	12.8	46.3	20
	Broadleaved deciduous woodland	30.8	19.1	45.6	20
	Broadleaved deciduous woodland	16.0	11.2	45.7	20

Table B4: 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/m³)
Rostherne Mere across all transects	Broadleaved deciduous woodland	3.5	0.3	0.6	3.3
	Poor fen	2.1	0.2	0.6	3.3
	Broadleaved deciduous woodland	3.4	0.3	0.6	3.3

5.3 Assessment results

Table B5 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/m³).

Table B6 presents a summary of the ammonia concentration results taken from the National Highways Ammonia N Deposition Tool[14], change in concentration and percentage change in relation to the critical level.

Table B7 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 B8 presents a summary of the modelled acid deposition, with an additional ammonia component applied using the National Highways Ammonia N Deposition Tool[14], and percentage change in deposition and percentage change in relation to the critical load.

Table B5: Assessment of NOx concentrations at ecological sites (construction phase, AP2 revised scheme)

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 without the AP2 revised scheme	2026 with the AP2 revised scheme			
Rostherne Mere Transect 3	Broadleaved deciduous woodland	194	19.14	12.68	12.73	0.05	Within standard	0.2%
	Broadleaved deciduous woodland	200	19.06	12.63	12.73	0.10	Within standard	0.3%
Rostherne Mere Transect 4	Poor fen	184	20.40	13.40	13.60	0.20	Within standard	0.7%
	Poor fen	200	22.46	14.68	14.87	0.19	Within standard	0.6%
Rostherne Mere Transect 5	Poor fen	53	22.50	14.72	14.94	0.22	Within standard	0.7%
	Poor fen	75	22.28	14.59	14.80	0.21	Within standard	0.7%
	Poor fen	100	22.05	14.46	14.65	0.19	Within standard	0.6%
	Poor fen	150	21.68	14.25	14.42	0.17	Within standard	0.6%
	Poor fen	200	21.38	14.08	14.22	0.14	Within standard	0.5%
Rostherne Mere Transect 6	Broadleaved deciduous woodland	86	20.53	13.61	13.92	0.31	Within standard	1.0%
	Broadleaved deciduous woodland	100	20.53	13.62	13.90	0.28	Within standard	0.9%
	Broadleaved deciduous woodland	150	20.56	13.63	13.85	0.22	Within standard	0.7%

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 without the AP2 revised scheme	2026 with the AP2 revised scheme			
	Broadleaved deciduous woodland	200	20.58	13.64	13.82	0.18	Within standard	0.6%
Rostherne Mere Transect 7	Broadleaved deciduous woodland	72	19.73	13.17	13.40	0.23	Within standard	0.8%
	Broadleaved deciduous woodland	75	19.73	13.17	13.39	0.22	Within standard	0.7%
	Broadleaved deciduous woodland	100	19.72	13.16	13.35	0.19	Within standard	0.6%
	Broadleaved deciduous woodland	150	19.71	13.15	13.31	0.16	Within standard	0.5%
	Broadleaved deciduous woodland	200	19.70	13.15	13.28	0.13	Within standard	0.4%
Rostherne Mere Transect 9	Broadleaved deciduous woodland	0	31.83	19.68	21.29	1.61	Within standard	5.4%
	Broadleaved deciduous woodland	10	31.39	19.38	19.98	0.60	Within standard	2.0%

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 without the AP2 revised scheme	2026 with the AP2 revised scheme			
	Broadleaved deciduous woodland	30	31.26	19.30	19.61	0.31	Within standard	1.0%
	Broadleaved deciduous woodland	40	31.23	19.28	19.54	0.26	Within standard	0.9%
	Broadleaved deciduous woodland	75	16.41	11.44	11.62	0.18	Within standard	0.6%
	Broadleaved deciduous woodland	150	16.39	11.43	11.55	0.12	Within standard	0.4%
	Broadleaved deciduous woodland	200	16.38	11.42	11.53	0.11	Within standard	0.4%

Table B6: Assessment of ammonia (NH_3) concentrations at ecological sites (construction phase, AP2 revised scheme)

Ecological site	Sensitive habitat	Distance to road (m)	NH³ concentrations (µg/m³)			Change in NH³ 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	2039 do nothing	2039 with the AP2 revised scheme			
Rostherne Mere Transect 3	Broadleaved deciduous woodland	194	3.41	3.42	3.43	<0.01	Above standard	0.4%

Ecological site	Sensitive habitat	Distance to road (m)	NH^3 concentrations (µg/m^3)			Change in NH^3 concentrations (µg/m^3)	Comparison against critical level (3µg/m^3 for low and 1µg/m^3 high vegetation)	Percent change in relation to critical level
			2018 baseline	2039 do nothing	2039 with the AP2 revised scheme			
	Broadleaved deciduous woodland	200	3.41	3.42	3.43	<0.01	Above standard	0.8%
Rostherne Mere Transect 4	Poor fen	184	3.46	3.48	3.50	0.02	Above standard	1.7%
	Poor fen	200	3.40	3.42	3.43	0.01	Above standard	1.6%
Rostherne Mere Transect 5	Poor fen	53	3.40	3.42	3.44	0.02	Above standard	2.0%
	Poor fen	75	3.39	3.41	3.43	0.02	Above standard	1.9%
	Poor fen	100	3.39	3.40	3.42	0.02	Above standard	1.7%
	Poor fen	150	3.37	3.38	3.40	0.02	Above standard	1.5%
	Poor fen	200	3.36	3.37	3.38	0.01	Above standard	1.3%
Rostherne Mere Transect 6	Broadleaved deciduous woodland	86	3.34	3.34	3.37	0.03	Above standard	2.9%
	Broadleaved deciduous woodland	100	3.34	3.34	3.37	0.03	Above standard	2.6%
	Broadleaved deciduous woodland	150	3.34	3.34	3.36	0.02	Above standard	2.0%
	Broadleaved deciduous woodland	200	3.34	3.34	3.36	0.02	Above standard	1.7%
Rostherne Mere Transect 7	Broadleaved deciduous woodland	72	3.30	3.30	3.32	0.02	Above standard	2.1%

Ecological site	Sensitive habitat	Distance to road (m)	NH^3 concentrations ($\mu g/m^3$)			Change in NH^3 concentrations ($\mu g/m^3$)	Comparison against critical level (3$\mu g/m^3$ for low and 1$\mu g/m^3$ high vegetation)	Percent change in relation to critical level
			2018 baseline	2039 do nothing	2039 with the AP2 revised scheme			
	Broadleaved deciduous woodland	75	3.30	3.30	3.32	0.02	Above standard	2.1%
	Broadleaved deciduous woodland	100	3.30	3.30	3.32	0.02	Above standard	1.8%
	Broadleaved deciduous woodland	150	3.30	3.30	3.32	0.02	Above standard	1.4%
	Broadleaved deciduous woodland	200	3.30	3.30	3.31	0.01	Above standard	1.2%
Rostherne Mere Transect 9	Broadleaved deciduous woodland	0	3.27	3.27	3.42	0.15	Above standard	14.1%
	Broadleaved deciduous woodland	10	3.25	3.25	3.30	0.05	Above standard	5.3%
	Broadleaved deciduous woodland	30	3.24	3.24	3.27	0.03	Above standard	2.8%
	Broadleaved deciduous woodland	40	3.24	3.24	3.26	0.02	Above standard	2.3%
	Broadleaved deciduous woodland	75	3.27	3.27	3.28	0.01	Above standard	1.6%

Ecological site	Sensitive habitat	Distance to road (m)	NH^3 concentrations ($\mu g/m^3$)			Change in NH^3 concentrations ($\mu g/m^3$)	Comparison against critical level (3$\mu g/m^3$ for low and 1$\mu g/m^3$ high vegetation)	Percent change in relation to critical level
			2018 baseline	2039 do nothing	2039 with the AP2 revised scheme			
	Broadleaved deciduous woodland	150	3.27	3.27	3.28	0.01	Above standard	1.2%
	Broadleaved deciduous woodland	200	3.27	3.27	3.28	0.01	Above standard	1.0%

Table B7: Assessment of nitrogen deposition with ammonia at ecological sites (construction phase, AP2 revised scheme)

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 without the AP2 revised scheme	2026 with the AP2 revised scheme			
Rostherne Mere Transect 3	Broadleaved deciduous woodland	194	48.19	48.08	48.12	0.04	20	0.2%
	Broadleaved deciduous woodland	200	48.16	48.05	48.13	0.08	20	0.4%
Rostherne Mere Transect 4	Poor fen	184	29.01	28.96	29.06	0.10	10	1.0%
	Poor fen	200	28.49	28.44	28.54	0.10	10	1.0%
Rostherne Mere Transect 5	Poor fen	53	28.50	28.46	28.58	0.12	10	1.2%
	Poor fen	75	28.43	28.40	28.51	0.11	10	1.1%
	Poor fen	100	28.37	28.34	28.44	0.10	10	1.0%
	Poor fen	150	28.27	28.24	28.33	0.09	10	0.9%
	Poor fen	200	28.18	28.15	28.23	0.08	10	0.8%
Rostherne Mere Transect 6	Broadleaved deciduous woodland	86	47.12	47.03	47.31	0.28	20	1.4%
	Broadleaved deciduous woodland	100	47.12	47.03	47.28	0.25	20	1.3%

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 without the AP2 revised scheme	2026 with the AP2 revised scheme			
	Broadleaved deciduous woodland	150	47.14	47.05	47.24	0.19	20	1.0%
	Broadleaved deciduous woodland	200	47.15	47.06	47.22	0.16	20	0.8%
Rostherne Mere Transect 7	Broadleaved deciduous woodland	72	46.70	46.66	46.86	0.20	20	1.0%
	Broadleaved deciduous woodland	75	46.70	46.66	46.86	0.20	20	1.0%
	Broadleaved deciduous woodland	100	46.69	46.65	46.82	0.17	20	0.9%
	Broadleaved deciduous woodland	150	46.69	46.65	46.78	0.13	20	0.7%
	Broadleaved deciduous woodland	200	46.69	46.64	46.76	0.12	20	0.6%
Rostherne Mere Transect 9	Broadleaved deciduous woodland	0	46.14	46.12	47.48	1.36	20	6.8%

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 without the AP2 revised scheme	2026 with the AP2 revised scheme			
	Broadleaved deciduous woodland	10	45.90	45.88	46.39	0.51	20	2.5%
	Broadleaved deciduous woodland	30	45.83	45.81	46.07	0.26	20	1.3%
	Broadleaved deciduous woodland	40	45.82	45.79	46.02	0.23	20	1.1%
	Broadleaved deciduous woodland	75	45.86	45.83	45.99	0.16	20	0.8%
	Broadleaved deciduous woodland	150	45.84	45.82	45.93	0.11	20	0.6%
	Broadleaved deciduous woodland	200	45.84	45.81	45.91	0.10	20	0.5%

Table B8: Assessment of acid deposition with ammonia at ecological sites (construction phase, AP2 revised scheme)

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 without the AP2 revised scheme	2026 with the AP2 revised scheme			
Rostherne Mere Transect 3	Broadleaved deciduous woodland	194	3.62	3.61	3.61	<0.01	0.5%	606.2%
	Broadleaved deciduous woodland	200	3.62	3.61	3.61	<0.01	1.0%	606.2%
Rostherne Mere Transect 4	Poor fen	184	2.21	2.21	2.22	<0.01	1.3%	384.8%
	Poor fen	200	2.18	2.17	2.18	<0.01	1.2%	378.8%
Rostherne Mere Transect 5	Poor fen	53	2.18	2.18	2.18	<0.01	1.5%	379.3%
	Poor fen	75	2.17	2.17	2.18	<0.01	1.4%	378.4%
	Poor fen	100	2.17	2.17	2.17	<0.01	1.3%	377.5%
	Poor fen	150	2.16	2.16	2.17	<0.01	1.1%	376.1%
	Poor fen	200	2.16	2.15	2.16	<0.01	1.0%	374.9%
Rostherne Mere Transect 6	Broadleaved deciduous woodland	86	3.54	3.54	3.56	0.02	3.3%	596.8%
	Broadleaved deciduous woodland	100	3.54	3.54	3.56	0.02	3.0%	596.5%
	Broadleaved deciduous woodland	150	3.54	3.54	3.55	0.01	2.3%	596.0%

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 without the AP2 revised scheme	2026 with the AP2 revised scheme			
	Broadleaved deciduous woodland	200	3.55	3.54	3.55	0.01	1.9%	595.7%
Rostherne Mere Transect 7	Broadleaved deciduous woodland	72	3.51	3.51	3.53	0.02	2.4%	591.4%
	Broadleaved deciduous woodland	75	3.51	3.51	3.52	0.01	2.3%	591.4%
	Broadleaved deciduous woodland	100	3.51	3.51	3.52	0.01	2.0%	591.0%
	Broadleaved deciduous woodland	150	3.51	3.51	3.52	<0.01	1.6%	590.5%
	Broadleaved deciduous woodland	200	3.51	3.51	3.52	<0.01	1.4%	590.2%
Rostherne Mere Transect 9	Broadleaved deciduous woodland	0	3.48	3.47	3.57	0.10	16.1%	599.2%
	Broadleaved deciduous woodland	10	3.46	3.46	3.49	0.03	6.0%	586.1%

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 without the AP2 revised scheme	2026 with the AP2 revised scheme			
	Broadleaved deciduous woodland	30	3.45	3.45	3.47	0.02	3.2%	582.4%
	Broadleaved deciduous woodland	40	3.45	3.45	3.47	0.02	2.7%	581.7%
	Broadleaved deciduous woodland	75	3.45	3.45	3.46	0.01	1.9%	580.1%
	Broadleaved deciduous woodland	150	3.45	3.45	3.45	<0.01	1.3%	579.4%
	Broadleaved deciduous woodland	200	3.45	3.44	3.45	<0.01	1.2%	579.2%

5.4 Assessment of significance

NOx concentrations at Rostherne Mere are predicted to be within the air quality standard in all scenarios. Changes in NOx concentrations are greater than 1% of the air quality standard at some locations. Potentially significant effects are therefore predicted, and this is addressed further in Section 3.3 of the main report.

NH_3 concentrations at Rostherne Mere are predicted to be above the air quality critical level in all scenarios. Changes in NH_3 concentrations are greater than 1% of the air quality standard at some locations. Potentially significant effects are therefore predicted, and this is addressed further in Section 3.3 of the main report.

Nitrogen deposition rates are predicted to be above the relevant critical load at all modelled receptors in the baseline and future scenarios with or without the AP2 revised scheme. The changes in nitrogen deposition due to the AP2 revised scheme are greater than 1% of the relevant critical load at some locations. Potentially significant effects are therefore predicted, and this is addressed further in Section 3.3 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 due to the AP2 revised scheme are greater than 1% of the maximum critical load at some locations. Potentially significant effects are therefore predicted, and this is addressed further in Section 3.3 of the main report.

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

6.1 Screening of traffic data

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

- the A556 Chester Road;
- Chester Road; and
- Cherry Tree Lane.

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

Table B2 presents the traffic data used in the assessment.

6.2 Non-road plans and projects

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

6.3 Receptors assessed and background concentrations

Receptors assessed, and background concentrations are as presented previously in the Assessment of construction traffic effects – AP2 revised scheme section.

6.4 Assessment results

Table B9 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 B10 presents a summary of the ammonia concentration results taken from the National Highways Ammonia N Deposition Tool[14], change in concentration and percentage change in relation to the critical level.

Table B11 presents a summary of the modelled nitrogen deposition, with an additional ammonia component applied using the National Highways Ammonia N Deposition Tool[14], change in deposition and percentage change in relation to the lower critical load.

Table B12 presents a summary of the modelled acid deposition, with an additional ammonia component applied using the National Highways Ammonia N Deposition Tool[14], and percentage change in deposition and percentage change in relation to the critical load.

Table B9: 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/m^3)			Change in NOx concentrations (µg/m^3)	Comparison against air quality standard (30µg/m^3)	Percent change in relation to air quality standard
			2018 baseline	2026 do nothing	2026 with the AP2 revised scheme			
Rostherne Mere Transect 3	Broadleaved deciduous woodland	194	19.14	12.36	12.73	0.37	Within standard	1.2%
	Broadleaved deciduous woodland	200	19.06	12.32	12.73	0.41	Within standard	1.4%
Rostherne Mere Transect 4	Poor fen	184	20.40	12.88	13.60	0.72	Within standard	2.4%
	Poor fen	200	22.46	14.21	14.87	0.66	Within standard	2.2%
Rostherne Mere Transect 5	Poor fen	53	22.50	14.22	14.94	0.72	Within standard	2.4%
	Poor fen	75	22.28	14.13	14.80	0.67	Within standard	2.2%
	Poor fen	100	22.05	14.04	14.65	0.61	Within standard	2.0%
	Poor fen	150	21.68	13.89	14.42	0.53	Within standard	1.8%
	Poor fen	200	21.38	13.76	14.22	0.46	Within standard	1.5%
Rostherne Mere Transect 6	Broadleaved deciduous woodland	86	20.53	13.41	13.92	0.51	Within standard	1.7%
	Broadleaved deciduous woodland	100	20.53	13.41	13.90	0.49	Within standard	1.6%
	Broadleaved deciduous woodland	150	20.56	13.42	13.85	0.43	Within standard	1.4%

Ecological site	Sensitive Habitat	Distance to road (m)	NOx concentrations (µg/m^3)			Change in NOx concentrations (µg/m^3)	Comparison against air quality standard (30µg/m^3)	Percent change in relation to air quality standard
			2018 baseline	2026 do nothing	2026 with the AP2 revised scheme			
	Broadleaved deciduous woodland	200	20.58	13.43	13.82	0.39	Within standard	1.3%
Rostherne Mere Transect 7	Broadleaved deciduous woodland	72	19.73	13.08	13.40	0.32	Within standard	1.1%
	Broadleaved deciduous woodland	75	19.73	13.07	13.39	0.32	Within standard	1.1%
	Broadleaved deciduous woodland	100	19.72	13.07	13.35	0.28	Within standard	0.9%
	Broadleaved deciduous woodland	150	19.71	13.07	13.31	0.24	Within standard	0.8%
	Broadleaved deciduous woodland	200	19.70	13.06	13.28	0.22	Within standard	0.7%
Rostherne Mere Transect 9	Broadleaved deciduous woodland	0	31.83	19.50	21.29	1.79	Within standard	6.0%
	Broadleaved deciduous woodland	10	31.39	19.30	19.98	0.68	Within standard	2.3%

Ecological site	Sensitive Habitat	Distance to road (m)	NOx concentrations (µg/m^3)			Change in NOx concentrations (µg/m^3)	Comparison against air quality standard (30µg/m^3)	Percent change in relation to air quality standard
			2018 baseline	2026 do nothing	2026 with the AP2 revised scheme			
	Broadleaved deciduous woodland	30	31.26	19.24	19.61	0.37	Within standard	1.2%
	Broadleaved deciduous woodland	40	31.23	19.23	19.54	0.31	Within standard	1.0%
	Broadleaved deciduous woodland	75	16.41	11.40	11.62	0.22	Within standard	0.7%
	Broadleaved deciduous woodland	150	16.39	11.39	11.55	0.16	Within standard	0.5%
	Broadleaved deciduous woodland	200	16.38	11.38	11.53	0.15	Within standard	0.5%

Table B10: Assessment of NH_3 concentrations 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			
Rostherne Mere Transect 3	Broadleaved deciduous woodland	194	3.41	3.40	3.43	0.03	Above standard	2.9%
	Broadleaved deciduous woodland	200	3.41	3.40	3.43	0.03	Above standard	3.2%
Rostherne Mere Transect 4	Poor fen	184	3.46	3.44	3.50	0.06	Above standard	5.7%
	Poor fen	200	3.40	3.38	3.43	0.05	Above standard	5.3%
Rostherne Mere Transect 5	Poor fen	53	3.40	3.38	3.44	0.06	Above standard	5.8%
	Poor fen	75	3.39	3.37	3.43	0.06	Above standard	5.4%
	Poor fen	100	3.39	3.37	3.42	0.05	Above standard	4.9%
	Poor fen	150	3.37	3.35	3.40	0.05	Above standard	4.3%
	Poor fen	200	3.36	3.34	3.38	0.04	Above standard	3.7%
Rostherne Mere Transect 6	Broadleaved deciduous woodland	86	3.34	3.32	3.37	0.05	Above standard	4.7%
	Broadleaved deciduous woodland	100	3.34	3.32	3.37	0.05	Above standard	4.4%
	Broadleaved deciduous woodland	150	3.34	3.33	3.36	0.03	Above standard	3.8%

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			
	Broadleaved deciduous woodland	200	3.34	3.33	3.36	0.03	Above standard	3.5%
Rostherne Mere Transect 7	Broadleaved deciduous woodland	72	3.30	3.29	3.32	0.03	Above standard	2.9%
	Broadleaved deciduous woodland	75	3.30	3.29	3.32	0.03	Above standard	2.9%
	Broadleaved deciduous woodland	100	3.30	3.29	3.32	0.03	Above standard	2.6%
	Broadleaved deciduous woodland	150	3.30	3.29	3.32	0.03	Above standard	2.2%
	Broadleaved deciduous woodland	200	3.30	3.29	3.31	0.02	Above standard	2.0%
Rostherne Mere Transect 9	Broadleaved deciduous woodland	0	3.27	3.26	3.42	0.16	Above standard	15.7%
	Broadleaved deciduous woodland	10	3.25	3.24	3.30	0.06	Above standard	6.0%
	Broadleaved deciduous woodland	30	3.24	3.24	3.27	0.03	Above standard	3.3%

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			
	Broadleaved deciduous woodland	40	3.24	3.24	3.26	0.02	Above standard	2.8%
	Broadleaved deciduous woodland	75	3.27	3.26	3.28	0.02	Above standard	2.0%
	Broadleaved deciduous woodland	150	3.27	3.26	3.28	0.02	Above standard	1.5%
	Broadleaved deciduous woodland	200	3.27	3.26	3.28	0.02	Above standard	1.4%

Table B11: 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			
Rostherne Mere Transect 3	Broadleaved deciduous woodland	194	48.19	47.84	48.12	0.28	20	1.4%
	Broadleaved deciduous woodland	200	48.16	47.82	48.13	0.31	20	1.6%
	Poor fen	184	29.01	28.71	29.06	0.35	10	3.5%

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			
Rostherne Mere Transect 4	Poor fen	200	28.49	28.22	28.54	0.32	10	3.3%
Rostherne Mere Transect 5	Poor fen	53	28.50	28.23	28.58	0.35	10	3.6%
	Poor fen	75	28.43	28.18	28.51	0.33	10	3.3%
	Poor fen	100	28.37	28.14	28.44	0.30	10	3.0%
	Poor fen	150	28.27	28.06	28.33	0.27	10	2.6%
	Poor fen	200	28.18	28.00	28.23	0.23	10	2.3%
Rostherne Mere Transect 6	Broadleaved deciduous woodland	86	47.12	46.86	47.31	0.45	20	2.2%
	Broadleaved deciduous woodland	100	47.12	46.86	47.28	0.42	20	2.1%
	Broadleaved deciduous woodland	150	47.14	46.87	47.24	0.37	20	1.8%
	Broadleaved deciduous woodland	200	47.15	46.88	47.22	0.34	20	1.7%
Rostherne Mere Transect 7	Broadleaved deciduous woodland	72	46.70	46.58	46.86	0.28	20	1.4%

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			
	Broadleaved deciduous woodland	75	46.70	46.58	46.86	0.28	20	1.4%
	Broadleaved deciduous woodland	100	46.69	46.58	46.82	0.24	20	1.2%
	Broadleaved deciduous woodland	150	46.69	46.57	46.78	0.21	20	1.0%
	Broadleaved deciduous woodland	200	46.69	46.57	46.76	0.19	20	0.9%
Rostherne Mere Transect 9	Broadleaved deciduous woodland	0	46.14	45.98	47.48	1.50	20	7.5%
	Broadleaved deciduous woodland	10	45.90	45.81	46.39	0.58	20	2.9%
	Broadleaved deciduous woodland	30	45.83	45.76	46.07	0.31	20	1.6%
	Broadleaved deciduous woodland	40	45.82	45.75	46.02	0.27	20	1.3%

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			
	Broadleaved deciduous woodland	75	45.86	45.79	45.99	0.20	20	1.0%
	Broadleaved deciduous woodland	150	45.84	45.78	45.93	0.15	20	0.7%
	Broadleaved deciduous woodland	200	45.84	45.78	45.91	0.13	20	0.7%

Table B12: 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			
Rostherne Mere Transect 3	Broadleaved deciduous woodland	194	3.62	3.59	3.61	0.02	3.4%	606.2%
	Broadleaved deciduous woodland	200	3.62	3.59	3.61	0.02	3.7%	606.2%
Rostherne Mere Transect 4	Poor fen	184	2.21	2.19	2.22	0.03	4.3%	384.8%
	Poor fen	200	2.18	2.16	2.18	0.02	4.0%	378.8%
	Poor fen	53	2.18	2.16	2.18	0.02	4.4%	379.3%
	Poor fen	75	2.17	2.16	2.18	0.02	4.1%	378.4%

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			
Rostherne Mere Transect 5	Poor fen	100	2.17	2.15	2.17	0.02	3.8%	377.5%
	Poor fen	150	2.16	2.15	2.17	0.02	3.3%	376.1%
	Poor fen	200	2.16	2.14	2.16	0.02	2.9%	374.9%
Rostherne Mere Transect 6	Broadleaved deciduous woodland	86	3.54	3.53	3.56	0.03	5.3%	596.8%
	Broadleaved deciduous woodland	100	3.54	3.53	3.56	0.03	5.0%	596.5%
	Broadleaved deciduous woodland	150	3.54	3.53	3.55	0.02	4.4%	596.0%
	Broadleaved deciduous woodland	200	3.55	3.53	3.55	0.02	4.0%	595.7%
Rostherne Mere Transect 7	Broadleaved deciduous woodland	72	3.51	3.51	3.53	0.02	3.3%	591.4%
	Broadleaved deciduous woodland	75	3.51	3.51	3.52	0.01	3.3%	591.4%
	Broadleaved deciduous woodland	100	3.51	3.50	3.52	0.02	2.9%	591.0%
	Broadleaved deciduous woodland	150	3.51	3.50	3.52	0.02	2.5%	590.5%

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			
	Broadleaved deciduous woodland	200	3.51	3.50	3.52	0.02	2.3%	590.2%
Rostherne Mere Transect 9	Broadleaved deciduous woodland	0	3.48	3.46	3.57	0.11	17.9%	599.2%
	Broadleaved deciduous woodland	10	3.46	3.45	3.49	0.04	6.9%	586.1%
	Broadleaved deciduous woodland	30	3.45	3.45	3.47	0.02	3.7%	582.4%
	Broadleaved deciduous woodland	40	3.45	3.45	3.47	0.02	3.2%	581.7%
	Broadleaved deciduous woodland	75	3.45	3.44	3.46	0.02	2.3%	580.1%
	Broadleaved deciduous woodland	150	3.45	3.44	3.45	0.01	1.7%	579.4%
	Broadleaved deciduous woodland	200	3.45	3.44	3.45	<0.01	1.6%	579.2%

6.5 Assessment of significance

NOx concentrations at Rostherne Mere are predicted to be within the air quality standard in all scenarios. 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. Potentially significant effects are therefore predicted, and this is addressed further in Section 4.2 of the main report.

NH3 concentrations at Rostherne Mere are predicted to be above the air quality critical level in all scenarios. Changes in NH3 concentrations are greater than 1% of the air quality standard. 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 relevant critical load at all modelled receptors in the baseline and future scenarios with or without the AP2 revised scheme in combination. The changes in nitrogen deposition between the 2026 do nothing scenario and with the AP2 revised scheme in combination scenario are greater than 1% of the relevant critical load. 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 critical load at all modelled receptors in all scenarios with or without the AP2 revised scheme in combination. The changes in acid deposition between the 2026 do nothing scenario and with the AP2 revised scheme in combination scenario are greater than 1% of the maximum critical load. 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

7.1 Screening of traffic data

The assessment of operational traffic impacts has used traffic data based on an estimate of the average daily flows in 2039. Traffic data is presented in Table B13.

The screening process identified one road in the area exceeding the screening thresholds:

- the A556 Chester Road.

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

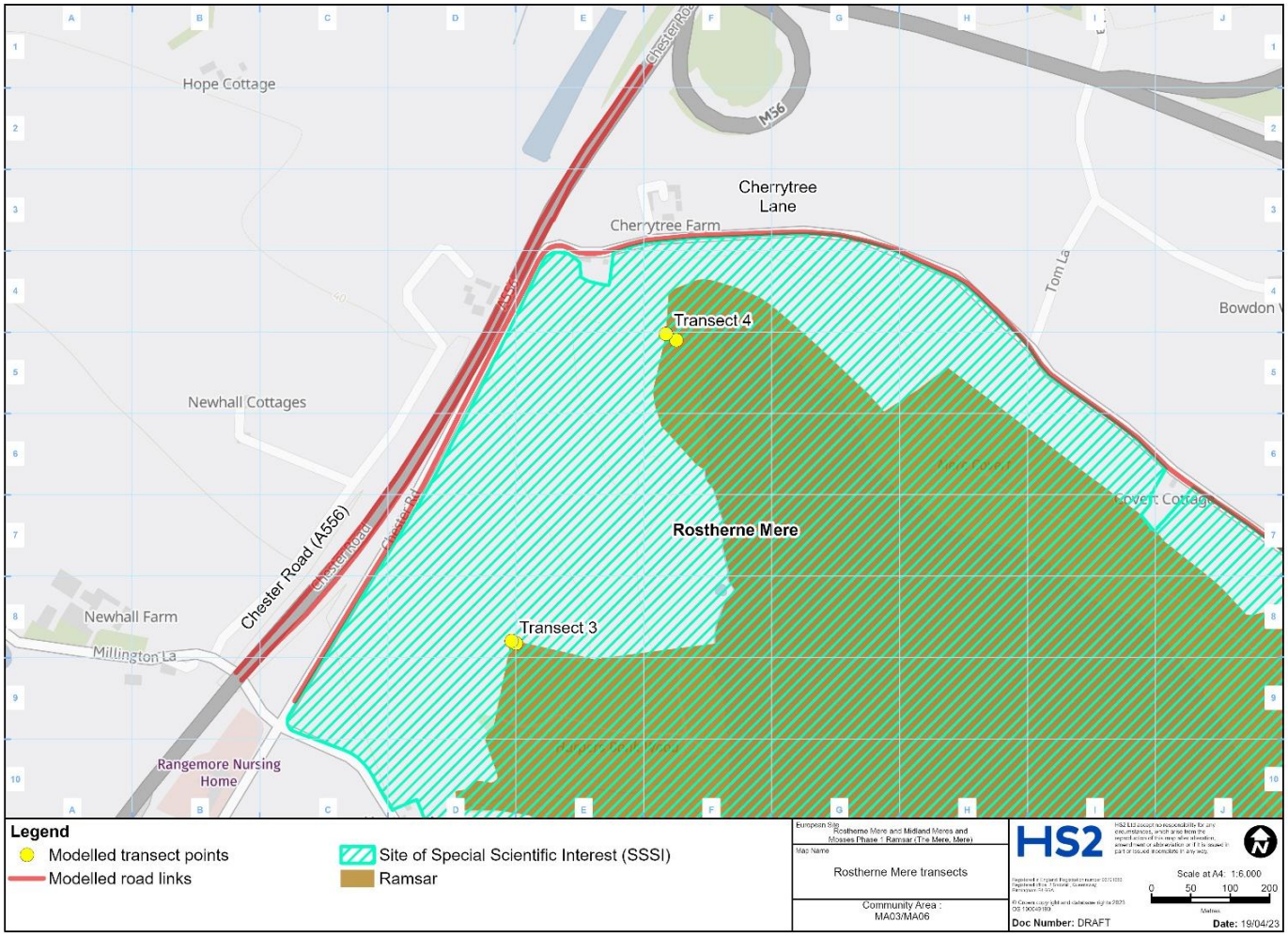
Figure B2 presents a detailed map of the modelled area including assessed roads (Modelled Road Links in red) and Modelling Transect Points (yellow dots).

Table B13: Traffic data summary – Rostherne Mere (operational phase, AP2 revised scheme)

Road ID	Road names	Annual Average Daily Traffic (AADT)					Heavy Duty Vehicles (HDV)				
		2018 baseline	2039 without the AP2 revised scheme	2039 with the AP2 revised scheme	AP2 revised scheme change (2039 with AP2 revised scheme – 2039 without AP2 revised scheme)	In combination change (2039 with the Proposed Scheme – 2018 baseline)	2018 baseline	2039 without the AP2 revised scheme	2039 with the AP2 revised scheme	AP2 revised scheme change (2039 with AP2 revised scheme – 2039 without AP2 revised scheme)	In combination change (2039 with the Proposed Scheme – 2018 baseline)
8013_5006, 5006_8013	Cherry Tree Lane	228	572	820	248	592	6	13	17	4	10
8013_8011, 8011_8013	Marsh Lane	123	127	106	-21	-16	22	15	12	-3	-10
8012_5005, 5005_8012	Rostherne Ln	47	92	126	34	78	0	0	0	0	0
5006_5005, 5005_5006	Chester Road	228	572	820	248	592	6	13	17	4	10
96018_96016, 96015_96017	A556 Chester Road	58,610	83,542	85,737	**2,195**	**27,126**	3,814	4,028	4,075	47	**261**

Note: Values in bold indicate change in traffic flow triggering for assessment.

Figure B2: Map of the site, assessed roads and modelled receptors



7.2 Receptors assessed and background concentrations

Table B14 shows the background concentrations for NOx, background nitrogen deposition and critical loads. Table B15 shows the background acid deposition, critical loads and background ammonia concentrations. Figure B2 presents a map of the site assessed roads and modelled receptors.

Table B14: Modelled ecological receptor NOx and nitrogen deposition backgrounds and critical loads (operational phase)

Receptor	Sensitive habitat	2018 NOx background concentration (µg/m^3)	2039 NOx background concentration (µg/m^3)	APIS data[21] of average total nitrogen deposition (kg/ N/ha/yr)	APIS critical load (kg N/ha/yr)
Rostherne Mere Transect 3	Broadleaved deciduous woodland	16.7	10.1	47.1	20
Rostherne Mere Transect 4	Poor fen	16.7	10.1	28.0	10
	Poor fen	19.1	11.2	27.5	10

Table B15: Modelled ecological receptor acid deposition backgrounds, critical loads and ammonia background concentrations (operational 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)
Rostherne Mere Transect 3	Broadleaved deciduous woodland	3.5	0.3	0.6	3.3
Rostherne Mere Transect 4	Poor fen	2.1	0.2	0.6	3.3

7.3 Assessment results

Table B16 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 B17 presents a summary of the ammonia concentration results taken from the National Highways Ammonia N Deposition Tool[14], change in concentration and percentage change in relation to the critical level.

Table B18 presents a summary of the modelled nitrogen deposition, with an additional ammonia component applied using the National Highways Ammonia N Deposition Tool[14], change in deposition and percentage change in relation to the lower critical load.

Table B19 presents a summary of the modelled acid deposition, with an additional ammonia component applied using the National Highways Ammonia N Deposition Tool[14], and percentage change in deposition and percentage change in relation to the critical load.

Table B16: Assessment of NOx concentrations at ecological sites (operational phase, AP2 revised scheme)

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	2039 without the AP2 revised scheme	2039 with the AP2 revised scheme			
Rostherne Mere Transect 3	Broadleaved deciduous woodland	194	19.14	10.85	10.87	0.02	Within standard	0.1%
	Broadleaved deciduous woodland	200	19.06	10.83	10.85	0.02	Within standard	0.1%
Rostherne Mere Transect 4	Poor fen	184	20.40	11.27	11.30	0.03	Within standard	0.1%
	Poor fen	200	22.46	12.24	12.27	0.03	Within standard	0.1%

Table B17: Assessment of ammonia (NH_3) at ecological sites (operational phase, AP2 revised scheme)

Ecological site	Sensitive habitat	Distance to road (m)	NH³ concentrations (µg/m³)			Change in NH³ 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	2039 without the AP2 revised scheme	2039 with the AP2 revised scheme			
Rostherne Mere Transect 3	Broadleaved deciduous woodland	194	3.41	3.42	3.42	<0.01	Above standard	0.3%
	Broadleaved deciduous woodland	200	3.41	3.42	3.42	<0.01	Above standard	0.3%
Rostherne Mere Transect 4	Poor fen	184	3.46	3.48	3.48	<0.01	Above standard	0.5%
	Poor fen	200	3.40	3.42	3.42	<0.01	Above standard	0.4%

Table B18: Assessment of nitrogen deposition with ammonia at ecological sites (operational phase, AP2 revised scheme)

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	2039 without the AP2 revised scheme	2039 with the AP2 revised scheme			
Rostherne Mere Transect 3	Broadleaved deciduous woodland	194	48.19	47.97	48.00	0.03	20	0.1%
	Broadleaved deciduous woodland	200	48.16	47.94	47.97	0.03	20	0.1%
Rostherne Mere Transect 4	Poor fen	184	29.01	28.88	28.91	0.03	10	0.3%
	Poor fen	200	28.49	28.37	28.39	0.02	10	0.2%

Table B19: Assessment of acid deposition with ammonia at ecological sites (operational phase, AP2 revised scheme)

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	2039 without the AP2 revised scheme	2039 with the AP2 revised scheme			
Rostherne Mere Transect 3	Broadleaved deciduous woodland	194	3.62	3.60	3.60	<0.01	0.3%	604.6%
	Broadleaved deciduous woodland	200	3.62	3.60	3.60	< 0.01	0.3%	604.3%
Rostherne Mere Transect 4	Poor fen	184	2.21	2.20	2.21	0.01	0.3%	382.9%
	Poor fen	200	2.18	2.17	2.17	< 0.01	0.3%	376.9%

7.4 Assessment of significance

NOx concentrations at Rostherne Mere are predicted to be within the air quality standard in all scenarios. Changes in NOx concentrations are less than 1% of the air quality standard and therefore not significant.

NH_3 concentrations at Rostherne Mere are predicted to be above the critical level in all scenarios. Changes in NH_3 concentrations are less than 1% of the air quality standard and therefore not significant.

Nitrogen deposition rates are predicted to be above the lower critical load at all modelled receptors in the baseline and future scenarios with or without the AP2 revised scheme. The change in nitrogen deposition due to the AP2 revised scheme is predicted to be less than 1% of the lower critical load and therefore not significant.

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 due to the AP2 revised scheme are less than 1% of the critical load and therefore not significant.

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

8.1 Screening of traffic data

The assessment of operational traffic impacts has used traffic data based on an estimate of the average daily flows in the first year of operation (2039). Traffic data is presented in Table B13.

The screening process identified one road in the area exceeding the screening thresholds:

- the A556 Chester Road.

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

Figure B2 presents a detailed map of the modelled area including assessed roads (Modelled Road Links in red) and Modelling Transect Points (yellow dots).

8.2 Non-road plans and projects

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

8.3 Receptors assessed and background concentrations

Receptors assessed, and background concentrations are as presented previously in the Assessment of operational traffic effects – AP2 revised scheme section.

8.4 Assessment results

Table B20 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 B21 presents a summary of the ammonia concentration results taken from the National Highways Ammonia N Deposition Tool[14], change in concentration and percentage change in relation to the critical level.

Table B22 presents a summary of the modelled nitrogen deposition, with an additional ammonia component applied using the National Highways Ammonia N Deposition Tool[14], change in deposition and percentage change in relation to the lower critical load.

Table B23 presents a summary of the modelled acid deposition, with an additional ammonia component applied using the National Highways Ammonia N Deposition Tool[14], and percentage change in deposition and percentage change in relation to the critical load.

Table B20: Assessment of NOx concentrations at ecological sites (operational 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	2039 do nothing	2039 with the AP2 revised scheme			
Rostherne Mere Transect 3	Broadleaved deciduous woodland	194	19.14	10.65	10.87	0.22	Within standard	0.7%
	Broadleaved deciduous woodland	200	19.06	10.63	10.85	0.22	Within standard	0.7%
Rostherne Mere Transect 4	Poor fen	184	20.40	10.93	11.30	0.37	Within standard	1.2%
	Poor fen	200	22.46	11.93	12.27	0.34	Within standard	1.1%

Table B21: Assessment of NH³ concentrations at ecological sites (operational phase, AP2 revised scheme in combination)

Ecological site	Sensitive habitat	Distance to road (m)	NH³ concentrations (µg/m³)			Change in NH³ 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	2039 do nothing	2039 with the AP2 revised scheme			
Rostherne Mere Transect 3	Broadleaved deciduous woodland	194	3.41	3.39	3.42	0.03	Above standard	3.1%
	Broadleaved deciduous woodland	200	3.41	3.39	3.42	0.03	Above standard	3.0%
Rostherne Mere Transect 4	Poor fen	184	3.46	3.43	3.48	0.05	Above standard	5.1%
	Poor fen	200	3.40	3.37	3.42	0.05	Above standard	4.7%

Table B22: Assessment of nitrogen deposition with ammonia at ecological sites (operational 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	2039 do nothing	2039 with the AP2 revised scheme			
Rostherne Mere Transect 3	Broadleaved deciduous woodland	194	48.19	47.72	48.00	0.28	20	1.4%
	Broadleaved deciduous woodland	200	48.16	47.70	47.97	0.27	20	1.4%
Rostherne Mere Transect 4	Poor fen	184	29.01	28.61	28.91	0.30	10	3.0%
	Poor fen	200	28.49	28.12	28.39	0.27	10	2.7%

Table B23: Assessment of acid deposition with ammonia at ecological sites (operational 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	2039 do nothing	2039 with the AP2 revised scheme			
Rostherne Mere Transect 3	Broadleaved deciduous woodland	194	3.62	3.58	3.60	0.02	3.3%	604.6%
	Broadleaved deciduous woodland	200	3.62	3.58	3.60	0.02	3.2%	604.3%
Rostherne Mere Transect 4	Poor fen	184	2.21	2.18	2.21	0.03	3.6%	382.9%
	Poor fen	200	2.18	2.15	2.17	0.02	3.3%	376.9%

8.5 Assessment of significance

NOx concentrations at Rostherne Mere are predicted to be within the air quality standard in 2039. Changes in NOx concentrations are greater than 1% of the air quality standard. Potentially significant effects are therefore predicted, and this is addressed further in Section 4.2 of the main report.

NH_3 concentrations at Rostherne Mere are predicted to be above the critical level in 2039. Changes in NH_3 concentrations are greater than 1% of the critical level. 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 the baseline and future scenarios with or without the AP2 revised scheme in combination. The changes in nitrogen deposition between the 2039 do nothing scenario and with the AP2 revised scheme in combination scenario are greater than 1% of the relevant critical load and are therefore potentially significant. 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 in combination. The changes in acid deposition between the 2039 do nothing scenario and with the AP2 revised scheme in combination scenario are greater than 1% of the relevant critical load. Potentially significant effects are therefore predicted, and this is addressed further in Section 4.2 of the main report.

Annex C: Additional air quality information – The Mere, Mere

1 Purpose

This Annex provides additional air quality information in relation to impacts from vehicle emissions to support the Midland Meres and Mosses Phase 1 Ramsar site (The Mere, Mere) assessment.

For simplicity, it is referred to as The Mere, Mere throughout the rest of this report except where specific mention is required of the Ramsar site.

2 Scope, assumptions and limitations

The scope, assumptions and limitations for the air quality assessment are set out in full in Volume 1 (Section 8) of the SMR (see Volume 5: Appendix CT-001-00001) and accompanying SMR Technical note – Air quality: Guidance on the assessment methodology[26].

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[13], to identify where assessment is required;
- these criteria are the following for assessing the impacts of the scheme:
  - 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;
- a deposition velocity relevant to the habitat of each site has been used, as detailed in the IAQM ecological guidance[17]. Data on nitrogen, ammonia and acid deposition has been taken from the most recent information available on the APIS[21] 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 annual average traffic data, refined from the peak period traffic data, 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 worse-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's policy on construction vehicle emissions standards. These standards are published in Information Paper E14[27]; Air Quality and include Euro VI for HGV, and Euro 6 and Euro 4 for diesel and petrol LDV respectively.

For MA01 to MA08 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 TAG 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[28];
- Cheshire West and Chester Local Plan (Part Two) Land Allocations and Detailed Policies, November 2017[29];
- Winsford Transport Strategy Recommendations Report, June 2016[30];
- Northwich Transport Strategy Recommendations Report, April 2018[31];
- RIP M6 Junction 19 Improvement PCF Stage 3 Transport Forecasting Report, January 2019[32]; 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))[33] dataset and the National Transport Model (NTM) 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 The Mere, 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[15]:

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

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 C1 sets out the air quality standard for NOx.

Table C1: 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[36], critical level or relevant standard for the site, as above or as provided by APIS.

[36] 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 – 20 kg 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 Section 3.3 of 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[37], 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 Section 3.3 of the main report.

For the assessment of nitrogen deposition, if the change is predicted to be less than 1% of the lower critical load[36] 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 Section 3.3 of 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 Section 3.3 of the main report.

[37] 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 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 C2.

The screening process identified one road in the area exceeding the screening thresholds:

- the A50 Warrington Road, Mere.

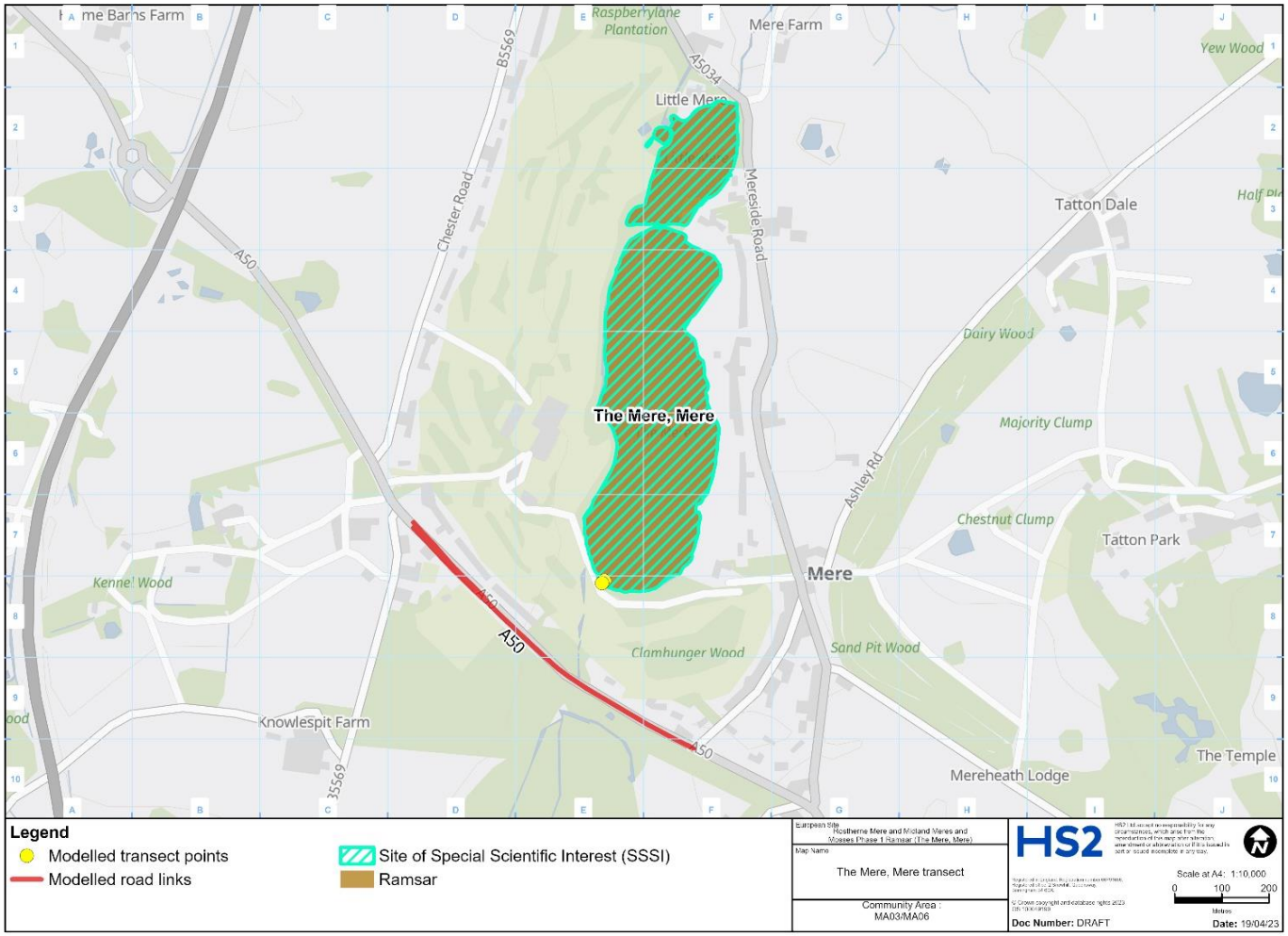
Figure C1 presents a detailed map of the modelled area including assessed roads (Modelled Road Links in red) and Modelling Transect Points (yellow dots).

Table C2: Traffic data summary – The Mere, Mere (construction phase, AP2 revised scheme)

Road ID	Road name	Annual Average Daily Traffic (AADT)					Heavy Duty Vehicles (HDV)				
		2018 baseline	2026 without the AP2 revised scheme	2026 with the AP2 revised scheme	AP2 revised scheme change (2026 with AP2 revised scheme –2026 without AP2 revised scheme)	In combination change (2026 with AP2 revised scheme – 2018 baseline)	2018 baseline	2026 without the AP2 revised scheme	2026 with the AP2 revised scheme	AP2 revised scheme change (2026 with AP2 revised scheme – 2026 without AP2 revised scheme)	In combination change (2026 with AP2 revised scheme – 2018 baseline)
8003_8005, 8005_8003	A50 Warrington Road	12,964	13,723	16,112	**2,389**	**3,148**	387	299	609	**310**	**221**

Note: Values in bold indicate change in traffic flow triggering for assessment.

Figure C1: Map of Rostherne, including modelled road links and modelled transect points



5.2 Receptors assessed and background concentrations

Table C3 shows the background concentrations for NOx, background nitrogen deposition and critical loads. Table C4 shows the background acid deposition, critical loads and background ammonia concentrations. The yellow transect points in Figure C1 represent the closest point to the road for each of the three sensitive habitat types.

Table C3: 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 of average total nitrogen deposition (kg N/ha/yr)	Lower critical load (kg N/ha/yr)
The Mere, Mere	Poor fen	15.3	10.7	28.9	10

Table C4: Modelled ecological receptor acid deposition backgrounds, critical loads and ammonia background concentrations (construction phase)

Receptor	Sensitive habitat	APIS data[21] 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)
The Mere, Mere	Poor fen	2.2	0.2	0.6	3.6

5.3 Assessment results

Table C5 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 C6 presents a summary of the ammonia concentration results taken from the National Highways Ammonia N Deposition Tool[14], change in concentration and percentage change in relation to the critical level.

Table C7 presents a summary of the modelled nitrogen deposition, with an additional ammonia component applied using the National Highways Ammonia N Deposition Tool[14], change in deposition and percentage change in relation to the lower critical load.

Table C8 presents a summary of the modelled acid deposition, with an additional ammonia component applied using the National Highways Ammonia N Deposition Tool[14], and percentage change in deposition and percentage change in relation to the critical load.

Table C5: Assessment of NOx concentrations at ecological sites (construction phase, AP2 revised scheme)

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 without the AP2 revised scheme	2026 with the AP2 revised scheme			
The Mere, Mere Transect 1	Poor fen	193	17.16	11.55	11.73	0.18	Within standard	0.6%
	Poor fen	200	17.08	11.52	11.68	0.16	Within standard	0.5%

Table C6: Assessment of ammonia (NH_3) at ecological sites (construction phase, AP2 revised scheme)

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 without the AP2 revised scheme	2026 with the AP2 revised scheme			
The Mere, Mere Transect 1	Poor fen	193	3.66	3.64	3.66	0.02	Above standard	1.5%
	Poor fen	200	3.65	3.64	3.66	0.02	Above standard	1.5%

Table C7: Assessment of nitrogen deposition with ammonia at ecological sites (construction phase, AP2 revised scheme)

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 without the AP2 revised scheme	2026 with the AP2 revised scheme			
The Mere, Mere Transect 1	Poor fen	193	29.47	29.31	29.41	0.10	10	0.9%
	Poor fen	200	29.44	29.30	29.39	0.09	10	0.9%

Table C8: Assessment of acid deposition with ammonia at ecological sites (construction phase, AP2 revised scheme)

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 without the AP2 revised scheme	2026 with the AP2 revised scheme			
The Mere, Mere Transect 1	Poor fen	193	2.23	2.22	2.23	<0.01	1.1%	387.1%
	Poor fen	200	2.23	2.22	2.23	<0.01	1.1%	386.8%

5.4 Assessment of significance

NOx concentrations at The Mere, Mere are predicted to be within the air quality standard in all scenarios. Changes in NOx concentrations are less than 1% of the air quality standard and therefore not significant.

NH_3 concentrations at The Mere, Mere are predicted to be above the air quality critical level in all scenarios. Changes in NH_3 concentrations are greater than 1% of the critical level. Potentially significant effects are therefore predicted, and this is addressed further in Section 3.3 of the main report.

Nitrogen deposition rates are predicted to be above the lower critical load at all modelled receptors in the baseline and future scenarios with or without the AP2 revised scheme. The change in nitrogen deposition due to the AP2 revised scheme is predicted to be less than 1% of the lower critical load and therefore not significant.

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 due to the AP2 revised scheme are greater than 1% of the maximum critical load. Potentially significant effects are therefore predicted, and this is addressed further in Section 3.3 of the main report.

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

6.1 Screening of traffic data

The screening process identified one road in the area exceeding the screening thresholds:

- the A50 Warrington Road, Mere.

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

Table C2 presents the traffic data used in the assessment.

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

Receptors assessed, and background concentrations are as presented previously in the Assessment of construction traffic effects – AP2 revised scheme section.

6.4 Assessment results

Table C9 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 C10 presents a summary of the ammonia concentration results taken from the National Highways Ammonia N Deposition Tool[14], change in concentration and percentage change in relation to the critical level.

Table C11 presents a summary of the modelled nitrogen deposition, with an additional ammonia component applied using the National Highways Ammonia N Deposition Too[14], change in deposition and percentage change in relation to the lower critical load.

Table C12 presents a summary of the modelled acid deposition, with an additional ammonia component applied using the National Highways Ammonia N Deposition Tool[14], and percentage change in deposition and percentage change in relation to the critical load.

Table C9: Predicted annual mean 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			
The Mere, Mere Transect 1	Poor fen	193	17.16	11.50	11.73	0.23	Within standard	0.8%
	Poor fen	200	17.08	11.47	11.68	0.21	Within standard	0.7%

Table C10: Assessment of NH_3 concentrations at ecological sites (construction phase, AP2 revised scheme in combination)

Ecological site	Sensitive habitat	Distance to road (m)	NH³ concentrations (µg/m³)			Change in NH³ 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			
The Mere, Mere Transect 1	Poor fen	193	3.66	3.64	3.66	0.02	Above standard	1.9%
	Poor fen	200	3.65	3.64	3.66	0.02	Above standard	1.9%

Table C11: 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			
The Mere, Mere Transect 1	Poor fen	193	29.47	29.29	29.41	0.12	10	1.2%
	Poor fen	200	29.44	29.27	29.39	0.12	10	1.1%

Table C12: 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			
The Mere, Mere Transect 1	Poor fen	193	2.23	2.22	2.23	<0.01	1.5%	387.1%
	Poor fen	200	2.23	2.22	2.23	<0.01	1.4%	386.8%

6.5 Assessment of significance

NOx concentrations at The Mere, Mere are predicted to be within the air quality standard in all scenarios. Changes in NOx concentrations are less than 1% of the air quality standard and therefore not significant.

NH_3 concentrations at The Mere, Mere are predicted to be above the air quality critical level in all scenarios. Changes in NH_3 concentrations are greater than 1% of the air quality standard. 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 relevant critical load at all modelled receptors in the baseline and future scenarios with or without the AP2 revised scheme in combination. Predicted nitrogen deposition rates in 2026, with the AP2 revised scheme in combination, are lower than the 2018 baseline rates at all modelled locations. The changes in nitrogen deposition between the 2026 do nothing scenario and with the AP2 revised scheme in combination scenario are greater than 1% of the relevant critical load. 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 critical load at all modelled receptors in all scenarios with or without the AP2 revised scheme in combination. The changes in acid deposition between the 2026 do nothing scenario and with the AP2 revised scheme in combination scenario are greater than 1% of the maximum critical load. 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 assessment of operational traffic impacts has used traffic data based on an estimate of the average daily flows in 2039. Traffic data is presented in Table C13.

The screening process identified one road in the area exceeding the screening thresholds:

- the A50 Warrington Road.

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

Figure C1 presents a detailed map of the modelled area including assessed roads (Modelled Road Links in red) and Modelling Transect Points (yellow dots).

Table C13: Traffic data summary – The Mere, Mere (operational phase, AP2 revised scheme)

Road ID	Road names	Annual Average Daily Traffic (AADT)					Heavy Duty Vehicles (HDV)				
		2018 baseline	2039 without the AP2 revised scheme	2039 with the AP2 revised scheme	AP2 revised scheme change (2039 with AP2 revised scheme – 2039 without AP2 revised scheme)	In combination change (2039 with AP2 revised scheme – 2018 baseline)	2018 baseline	2039 without the AP2 revised scheme	2039 with the AP2 revised scheme	AP2 revised scheme change (2039 with AP2 revised scheme – 2039 without AP2 revised scheme)	In combination change (2039 with AP2 revised scheme – 2018 baseline)
8003_8005, 8005_8003	A50 Warrington Road	12,964	14,144	15,221	**1,076**	**2,257**	387	296	320	24	-67
8051_5003, 5003_8051	A5034 Mereside Road	6,719	6,047	6,645	597	-74	80	62	61	0	-19

Note: Values in bold indicate change in traffic flow triggering for assessment.

7.2 Receptors assessed and background concentrations

Table C14 shows the background concentrations for NOx, background nitrogen deposition

shows the background acid deposition, critical loads and background ammonia concentrations. Figure C1 presents map of the site assessed roads and modelled receptors.

Table C14: Modelled ecological receptor NOx and nitrogen deposition backgrounds and critical loads (operational phase)

Receptor	Sensitive habitat	2018 NOx background concentration (µg/m^3)	2039 NOx background concentration (µg/m^3)	APIS data[21] of average total nitrogen deposition (kg/ N/ha/yr)	APIS critical load (kg N/ha/yr)
The Mere, Mere	Poor fen	15.3	9.6	28.9	10

Table C15: Modelled ecological receptor acid deposition backgrounds, critical loads and ammonia background concentrations (operational 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)
The Mere, Mere	Poor fen	2.2	0.2	0.6	3.6

7.3 Assessment results

Table C16 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 C17 presents a summary of the ammonia concentration results taken from the National Highways Ammonia N Deposition Tool[14], change in concentration and percentage change in relation to the critical level.

Table C18 presents a summary of the modelled nitrogen deposition, with an additional ammonia component applied using the National Highways Ammonia N Deposition Tool[14], change in deposition and percentage change in relation to the lower critical load.

Table C19 presents a summary of the modelled acid deposition, with an additional ammonia component applied using the National Highways Ammonia N Deposition Tool[14], and percentage change in deposition and percentage in relation to the critical load.

Table C16: Assessment of NOx concentrations at ecological sites (operational phase, AP2 revised scheme)

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	2039 without the AP2 revised scheme	2039 with the AP2 revised scheme			
The Mere, Mere Transect 1	Poor fen	193	17.16	10.09	10.12	0.03	Within standard	0.1%
	Poor fen	200	17.08	10.07	10.10	0.03	Within standard	0.1%

Table C17: Assessment of ammonia (NH_3) at ecological sites (operational phase, AP2 revised scheme)

Ecological site	Sensitive habitat	Distance to road (m)	NH³ concentrations (µg/m³)			Change in NH³ 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	2039 without the AP2 revised scheme	2039 with the AP2 revised scheme			
The Mere, Mere Transect 1	Poor fen	193	3.66	3.64	3.64	< 0.01	Above standard	0.5%
	Poor fen	200	3.65	3.64	3.64	< 0.01	Above standard	0.5%

Table C18: Assessment of nitrogen deposition with ammonia at ecological sites (operational phase, AP2 revised scheme)

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	2039 without the AP2 revised scheme	2039 with the AP2 revised scheme			
The Mere, Mere Transect 1	Poor fen	193	29.47	29.26	29.29	0.03	10.0	0.3%
	Poor fen	200	29.44	29.24	29.27	0.03	10.0	0.3%

Table C19: Assessment of acid deposition with ammonia at ecological sites (operational phase, AP2 revised scheme)

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	2039 without the AP2 revised scheme	2039 with the AP2 revised scheme			
The Mere, Mere Transect 1	Poor fen	193	2.23	2.22	2.22	< 0.01	0.4%	385.6%
	Poor fen	200	2.23	2.22	2.22	< 0.01	0.4%	385.4%

7.4 Assessment of significance

NOx concentrations at The Mere, Mere are predicted to be within the air quality standard in all scenarios. Changes in NOx concentrations are less than 1% of the air quality standard and therefore not significant.

NH_3 concentrations at The Mere, Mere are predicted to be above the critical level in all scenarios. Changes in NH_3 concentrations are less than 1% of the critical level and therefore not significant.

Nitrogen deposition rates are predicted to be above the lower critical load at all modelled receptors in the baseline and future scenarios with or without the AP2 revised scheme. The change in nitrogen deposition due to the AP2 revised scheme is predicted to be less than 1% of the lower critical load and therefore not significant.

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 due to the AP2 revised scheme are less than 1% of the critical load and therefore not significant.

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 one road in the area exceeding the screening thresholds:

- the A50 Warrington Road, Mere.

Table C13 presents the traffic data used in the assessment.

8.2 Non-road plans and projects

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

8.3 Receptors assessed and background concentrations

Receptors assessed, and background concentrations are as presented previously in the Assessment of operational traffic effects – AP2 revised scheme section.

8.4 Assessment results

Table C20 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 C21 presents a summary of the ammonia concentration results taken from the National Highways Ammonia N Deposition Tool[14], change in concentration and percentage change in relation to the critical level.

Table C22 presents a summary of the modelled nitrogen deposition, with an additional ammonia component applied using the National Highways Ammonia N Deposition Tool[14] change in deposition and percentage change in relation to the lower critical load.

Table C23 presents a summary of the modelled acid deposition, with an additional ammonia component applied using the National Highways Ammonia N Deposition Tool[14], and percentage change in deposition and percentage change in relation to the critical load.

Table C20: Assessment of NOx concentrations at ecological sites (operational 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	2039 do nothing	2039 with the AP2 revised scheme			
The Mere, Mere Transect 1	Poor fen	193	17.16	10.05	10.12	0.07	Within standard	0.2%
	Poor fen	200	17.16	10.05	10.12	0.07	Within standard	0.2%

Table C21: Assessment of NH_3 concentrations at ecological sites (operational phase, AP2 revised scheme in combination)

Ecological site	Sensitive habitat	Distance to road (m)	NH³ concentrations (µg/m³)			Change in NH³ 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	2039 do nothing	2039 with the AP2 revised scheme			
The Mere, Mere Transect 1	Poor fen	193	3.66	3.63	3.64	0.01	Above standard	1.1%
	Poor fen	200	3.65	3.63	3.64	0.01	Above standard	1.0%

Table C22: Assessment of nitrogen deposition with ammonia at ecological sites (operational 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	2039 do nothing	2039 with the AP2 revised scheme			
The Mere, Mere Transect 1	Poor fen	193	29.47	29.22	29.29	0.07	10	0.6%
	Poor fen	200	29.44	29.21	29.27	0.06	10	0.6%

Table C23: Assessment of acid deposition with ammonia at ecological sites (operational 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	2039 do nothing	2039 with the AP2 revised scheme			
The Mere, Mere Transect 1	Poor fen	193	2.23	2.22	2.22	< 0.01	0.8%	385.6%
	Poor fen	200	2.23	2.22	2.22	< 0.01	0.7%	385.4%

8.5 Assessment of significance

NOx concentrations at The Mere, Mere are predicted to be within the air quality standard in 2039. Changes in NOx concentrations are less than 1% of the air quality standard and therefore not significant.

NH_3 concentrations at The Mere, Mere are predicted to be above the air quality critical level in 2039. Changes in NH_3 concentrations are greater than 1% of the critical level at 193m 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 the baseline and future scenarios with or without the AP2 revised scheme in combination. The change in nitrogen deposition due to the AP2 revised scheme in combination is predicted to be less than 1% of the lower critical load and therefore not significant.

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 in combination. The changes in acid deposition due to the AP2 revised scheme in combination are less than 1% of the critical load and therefore not significant.

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