In Parliament – Session 2022 - 2023

HS2

High Speed Rail (Crewe – Manchester)

Supplementary Environmental Statement 1 and Additional Provision 1 Environmental Statement

Volume 5: Appendix EC-016-00006

Ecology and biodiversity

Document to inform a Habitats Regulations Assessment for the Midland Meres and Mosses Phase 2 Ramsar site (Oakhanger Moss)

MA01: Hough to Walley's Green

MA02: Wimboldsley to Lostock Gralam

MA03: Pickmere to Agden and Hulseheath

Q51

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Department for Transport

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1 Introduction

1.1 Purpose of report

1.1.1 There are certain ecological sites that are designated for their international importance and to which special considerations attach under the Conservation of Species and Habitats Regulations 2017 ('the Habitats Regulations')[1], either through operation of law or government policy.

1.1.2 These sites include Special Areas of Conservation (SAC) that have been designated to protect certain species and habitats; Special Protection Areas (SPA), designated to protect certain species of wild birds; and Ramsar sites designated to protect internationally important wetland areas.

1.1.3 These sites are subject to special legal protection that imposes restrictions on a 'competent authority' from granting consent permission or authorisations for any plan or project that may affect the conservation status and integrity of these designations. In the case of the hybrid Bill, the responsible competent authority is Parliament as it is the enactment of the Bill as legislation that grants consent for the hybrid Bill scheme to be undertaken.

1.1.4 The Habitats Regulations require the competent authority, before deciding to undertake, or give any consent, permission or other authorisation for, a plan or project which is likely to have a significant effect on these designated sites (either alone or in combination with other plans or projects) to make an appropriate assessment of the implications of the plan or project for potentially affected sites in view of those sites' conservation objectives.

1.1.5 There are normally two stages in the process of discharging the duties imposed by the Habitats Regulations. The first is to undertake a 'screening' exercise to determine whether there is no reasonable scientific doubt that the plan or project will be likely to have a significant effect on the conservation objectives of Oakhanger Moss. If no such likelihood is identified, the competent authority may proceed to grant consent for the plan or project in question. If, on the other hand, there remains a reasonable scientific doubt as to its effects on the integrity of Oakhanger Moss at this stage, the competent authority must move to a second stage and undertake a more detailed assessment, commonly referred to as an 'appropriate assessment' to determine whether, having regard to any mitigation measures that are proposed to be adopted in the delivery of the scheme, there will be an adverse effect on the integrity of Oakhanger Moss.

[1] *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 If the appropriate assessment does not identify an adverse effect on the integrity of Oakhanger Moss, the competent authority may proceed to grant the consent. If an adverse effect cannot be ruled out, consent can only be granted on the basis that there are: no alternative solutions; there are imperative reasons of overriding public importance for the plan or project to proceed; and appropriate compensatory measures have been secured.

1.1.7 It is Parliament as legislator (and not High Speed Two (HS2) Ltd as the prospective developer) that is the competent authority and the body which is required to comply with the requirements of the Habitats Regulations. The purpose of this Habitats Regulations Assessment (HRA) report is, however, to provide information to Parliament, based on HS2 Ltd's assessment of the hybrid Bill scheme, in order to inform and assist Parliament in complying with its obligations under the Habitats Regulations.

1.2 Background

1.2.1 This report is an updated version of the document to inform an HRA for the Midland Meres and Mosses Phase 2 Ramsar site (Oakhanger Moss) which accompanied the High Speed Rail (Crewe – Manchester) Environmental Statement published in 2022 (the main ES)[2]. The updated report takes into account proposed changes to the scheme since publication of the main ES.

1.2.2 In order to differentiate between the original scheme and the subsequent changes, the following terms are used:

- the 'original scheme' – the Bill scheme submitted to Parliament in January 2022, which was assessed in the main ES; and
- 'the AP1 revised scheme' – the original scheme as amended by the SES1 changes and AP1 amendments.

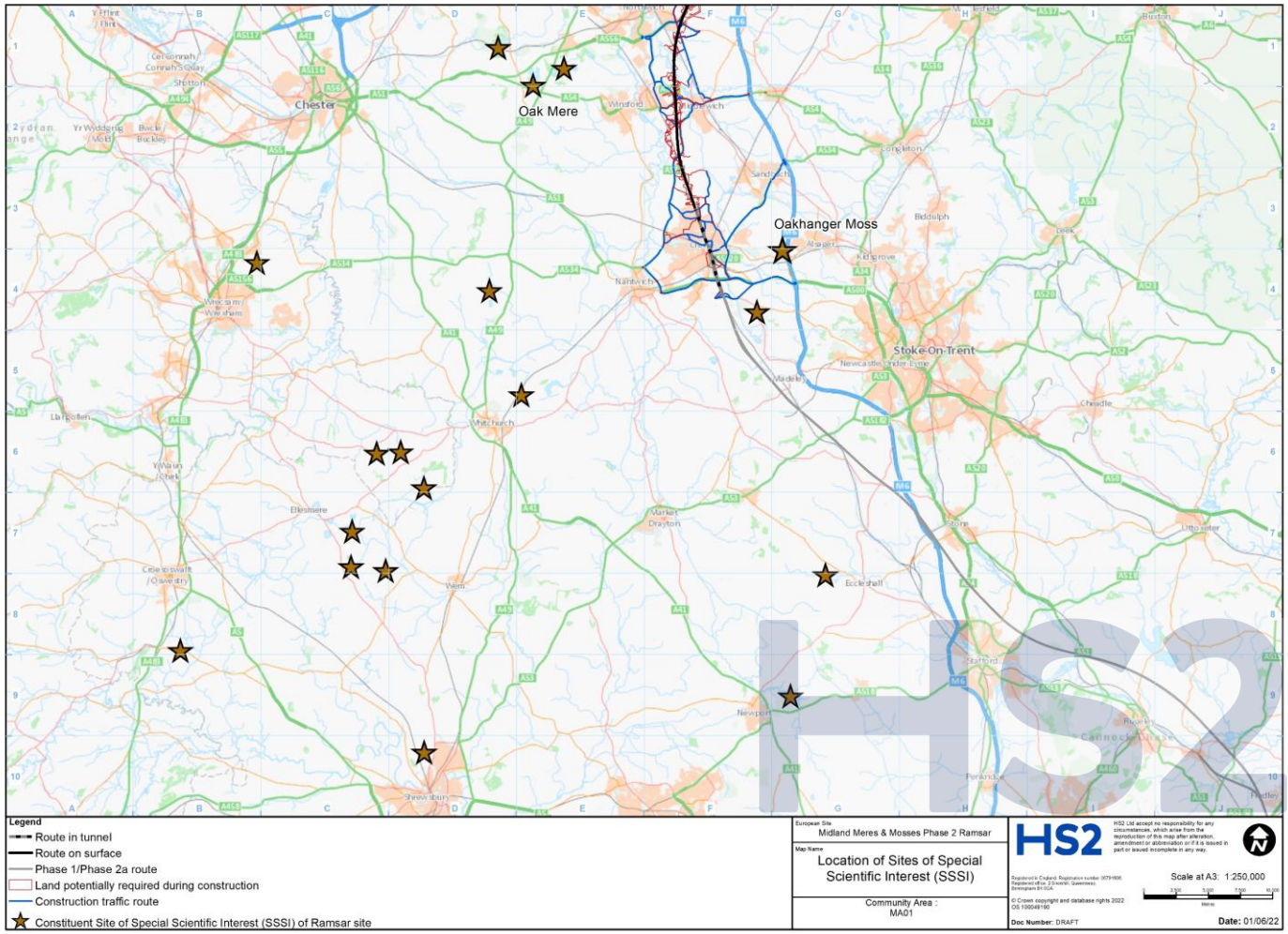
1.2.3 This report forms part of the supporting information that accompanies the High Speed Rail (Crewe – Manchester) Supplementary Environmental Statement 1 (SES1) and Additional Provision 1 Environmental Statement (AP1 ES).

1.2.4 Heavy Goods Vehicles (HGV) and other traffic associated with the construction of the AP1 revised scheme will make use of the M6 where it lies in proximity to Oakhanger Moss Site of Special Scientific Interest (SSSI). It is one of 18 component SSSI of the Midland Meres and Mosses Phase 2 Ramsar site (or European site), distributed across Cheshire, Shropshire, Powys and beyond (Figure 1). The risk of pollution from this traffic prompted production of this report to inform HRA. This report is required to assess the findings of ongoing traffic

[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.

and air quality analysis. The latter found that air pollution will increase between Junctions 16 and 17 of the M6 where it lies within 200m of Oakhanger Moss.

Figure 1: Location of the constituent sites of the Midland Meres and Mosses Phase 2 Ramsar site



1.2.5 The potential effects of air pollution arising from the AP1 revised scheme has required the preparation of a new document to inform the HRA for a further component of the Midland Meres and Mosses Phase 2 Ramsar site: Oak Mere SSSI (see Volume 5, Appendix: EC-016-00001 of the SES1 and AP1 ES).

1.2.6 This report has been prepared to provide all the necessary information for the competent authority to carry out an HRA under Regulation 63 of the Conservation of Habitats and Species Regulations 2017, as amended by the Conservation of Habitats and Species (amendment) (EU Exit) Regulations 2019[3]. It is informed by contemporary Department for Environment, Food and Rural Affairs (Defra)[4], and Department for Levelling Up, Housing and Communities guidance[5] and best practice. Where relevant, it takes full account of case law including the People Over Wind[6] and Wealden[7] judgements amongst others.

[3] The amending regulations generally seek to retain the requirements of the 2017 Regulations but with adjustments for the UK's exit from the European Union. See Regulation 4, which also confirms that the interpretation of these Regulations as they had effect, or any guidance as it applied, before exit day, shall continue to do so.

[4] Department for Environment, Food and Rural Affairs (2021), *Habitats regulations assessments: protecting a European site.* Available online at: https://www.gov.uk/guidance/habitats-regulations-assessments-protecting-a-european-site.

[5] Department for Levelling Up, Housing and Communities (2019), *Planning Practice Guidance*. Available online at: https://www.gov.uk/guidance/appropriate-assessment.

[6] People Over Wind and Peter Sweetman v Coillte Teoranta (2018), High Court (Ireland), Case C-323/17 (also referred to as the Sweetman II judgement).

[7] Wealden District Council v SS Communities and Local Government, Lewes District Council and South Downs National Park Authority (2016), High Court of Justice, Case CO/3943/2016.

2 Context

2.1 Description of the AP1 revised scheme

2.1.1 The AP1 revised scheme comprises the construction and operation of a new high speed railway between Crewe and Manchester with a connection onto the West Coast Main Line (WCML) north of Crewe. The connection to the WCML near Golborne, proposed in the original scheme, will be removed. Oakhanger Moss is situated approximately 4.4km east of land required for the construction of the AP1 revised scheme in the Hough to Walley's Green area (MA01). Here, the route of the AP1 revised scheme will be approximately 10.8km long, extending from its southern connection with HS2 Phase 2a northwards in tunnel beneath Crewe and on to the Wimboldsley to Lostock Gralam area (MA02). The route of the AP1 revised scheme will consist of 813m of cutting, 3.5km of embankments and 6.5km of tunnel (including portals).

2.1.2 The AP1 revised scheme will result in a change to traffic flows, and associated emissions, along the M6 which lies approximately 120m to the east of Oakhanger Moss. The change in traffic flows is a result of HS2 construction traffic (including construction HGV and workforce vehicles) using the M6, as well as traffic re-distributed from other routes in the area by the AP1 revised scheme. Construction traffic is anticipated to make use of the M6 from 2027 to 2038, although peak flows will be limited to 2027 to 2031 with flows declining markedly thereafter.

2.2 Site description and conservation objectives

The Midland Meres and Mosses Phase 2 Ramsar site

2.2.1 The Midland Meres and Mosses Phase 2 Ramsar site extends over 2,365ha across 18 discrete sites[8] distributed throughout the north-west Midlands and north-east Wales, over a land area that extends 75km from north to south and 60km from west to east. Figure 1 shows the extent of the Ramsar site and the location of Oakhanger Moss and the other

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

constituent SSSIs relevant to the AP1 revised scheme. The Ramsar Information Sheet[9] identifies that Oakhanger Moss qualifies for Ramsar status under criteria (1) and (2) on account of the presence of 'a diverse range of habitats from open water to raised bog' and the presence of a number of rare plants and invertebrates. Elsewhere, it describes the entire Ramsar site as comprising open water (meres) and their associated fringing habitats (for example, reed swamps, fen, carr and damp pasture) and a smaller number of nutrient poor peat bogs (mosses). However, not all features are present on all sites. Although the Ramsar-qualifying features are quite broadly described, together they encompass a distinctive group of water bodies with characteristic hydrological regimes, water chemistry and animal and plant communities. However, the Ramsar Information Sheet confirms its primary interest remains the 'wide range of lowland wetland types and successional stages within a distinct biogeographical area'.

Oakhanger Moss SSSI

2.2.2 As Natural England does not produce conservation objectives, supplementary advice or site improvement plans (SIPs) for Ramsar sites, evidence is drawn from the citation[10] for Oakhanger Moss SSSI (which was notified for broadly similar reasons) and its Favourable Condition Tables (FCT)[11]. The citation (1994) describes Oakhanger Moss as one of the shallowest water bodies in the area, though of great importance for its range of mire communities and range of successional stages, from open water to raised bog. Four different mire communities are present, each with a well-developed shrub layer. Whilst swamp dominates much of Oakhanger Moss, more diverse fen communities are found along the eastern boundary 'where nutrient levels are at their highest'. An 'incipient raised bog' (higher than the surrounding fen) is present in the centre. The location and local setting of Oakhanger Moss is shown in Figures 1 and 2, respectively, and the broad distribution of habitats is shown in Figure 3. Further detail is provided in the FCT and in accompanying notes.

2.2.3 At a broad level, the more recent FCT defines the complex of habitats at Oakhanger Moss as fen, marsh and swamp, but it is the range of mire communities that present the primary interest in terms of the Ramsar site although only two communities, M2 and M18, are now thought to remain. Despite succession to woodland, fen, marsh, swamp and mire communities persist beneath the canopy and in clearings and continue to represent a

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

[10] English Nature (1994), *Citation for Oakhanger Moss, SSSI*. Available online at: https://designatedsites.naturalengland.org.uk/PDFsForWeb/Citation/1006639.pdf.

[11] Natural England (2015), *Conservation Objectives and Definitions of Favourable Condition for Designated Features of Interest. Oakhanger Moss.*

valuable component of the overall Ramsar site. The FCT lists the following features that are considered to represent features of the Ramsar site:

- basin fen (lowland): M2 *Sphagnum cuspidatum/recurvum* bog pool community (or Basin fen: ombrogenous nuclei (topogenous bog));
- basin fen (lowland): M18 *Erica tetralix-Sphagnum papillosum* raised and blanket mire (or Basin fen: ombrogenous nuclei (topogenous bog));
- basin fen (lowland): S3 *Carex paniculata* swamp (or base-poor and base-rich sump wetland);
- basin fen (lowland): S7 *Carex acutiformis* swamp (or base-poor and base-rich sump wetland);
- basin fen (lowland): S27 *Carex rostrata-Potentilla palustris* swamp (or base-poor and base-rich sump wetland);
- wet woodland: W1 *Salix cinerea-Galium palustre* fen woodland (or Fen woodland);
- wet woodland: W4 *Betula pubescens-Molinia caerulea* fen woodland (or Fen woodland); and
- wet woodland: W5 *Alnus glutinosa-Carex paniculata* woodland (or Fen woodland).

2.2.4 Natural or near-natural examples of mires and bogs are nutrient-poor (or ombrotrophic) habitats and, as such, are sensitive to changes in the hydrological regime and eutrophication (including via atmospheric inputs of nitrogen see Section 3.3) which can prompt changes in species composition, abundance and distribution at the community scale. This is perhaps manifested most clearly at Oakhanger Moss, which can be considered to be nutrient-rich, by the dominance of woodland communities and the loss of the natural, surrounding 'lagg fen'. The FCT also provides evidence to show that Oakhanger Moss is impacted by ditches which may not only drain the site but also introduce nutrient enriched water from surrounding farmland. Whilst ditch blocking and other measures to re-wet Oakhanger Moss have been implemented, it would appear to be in a state of flux. For instance, the M18 and M25 communities were once considered by Natural England to have been lost from the site. However, the M18 community now appears to be in the process of becoming re-established. In 2014, Natural England estimated that the mire communities occupied just 0.2ha, swamp 0.3ha whilst woodland extended across the remaining 12.8ha. Consequently, Oakhanger Moss can be considered to be far from a natural system and in an unfavourable condition (see condition assessment below).

Conservation objectives

2.2.5 In lieu of formal Ramsar conservation objectives, the targets set out in the FCT have been considered. Whilst it is acknowledged that the FCT was designed for monitoring purposes and not HRA, and any thresholds in the FCT refer primarily to site management and monitoring, they identify key features and aspirations which other plans or projects should address, and which can be considered with caution for the purposes of this HRA. Therefore,

the FCT is regarded as a reasonable surrogate for Ramsar conservation objectives for Oakhanger Moss. An extract of the most relevant higher-level targets from the FCT is provided below, but reference to the entire document is encouraged for additional detail.

Habitat extent

2.2.6 '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 site-specific standards for lowland fens (basin mire): there should be no reduction in the total combined extent of wetland in relation to the established baseline.'

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

2.2.7 'To maintain the fen, marsh and swamp at Oakhanger Moss in favourable condition, with particular reference to relevant specific designated interest features:

- basin fen – Habitat extent: There should be no reduction in the total combined extent of wetland, including all associated pools and lagg fen, in relation to the established baseline;
- wet woodland – Habitat extent: At least current area (as surveyed in 2014) of recent semi-natural stands maintained, although their location may alter; and
- basin fen – Habitat composition: There should be no loss of the component types M2, M18, S3, S7 and S27. Balance between open fen and wet woodland W1, W4 and W5 maintained at current levels and in roughly the current locations. Community and habitat transitions are maintained at current levels and in current locations.'

2.2.8 While it is clear the above communities represent elements of the 'diverse range of habitats' described in the Ramsar Information Sheet, it is noted that there is no specific reference to the assemblage of rare plants and invertebrates provided in either the FCT or SSSI citation. Consequently, these are considered to be absent, and no consideration is given to these in this report to inform the HRA. If, however, they are shown to be present, their requirements are considered to be satisfactorily addressed by the assessment of the supporting habitats.

2.2.9 Similarly, although the W1 woodland community is referred to throughout the FCT, it is not shown in habitat maps produced by Natural England and it is assumed it is accommodated within references to W4 and W5, which are more fully described throughout.

Condition assessment

2.2.10 The most recent formal condition monitoring assessment of Oakhanger Moss was carried out by Natural England in 2012[12], although this pre-dated, and so would not have taken account of, the objectives embedded in the current FCT. This found that the entire site was considered to be in an 'unfavourable declining' condition. It described Oakhanger Moss (including the mire) as 'very dry', with both the wetland and woodland communities failing their respective objectives due to the lack of positive, or presence of negative, indicator species. It added that management measures did 'not seem to be effective', concluding that the key interest feature (basin fen (lowland), M18) had been lost in 2007 and, though subject to restoration management, was 'unlikely to reappear'. In addition, Natural England confirmed that the woodland (W10) and bracken community along the edges of Oakhanger Moss were only included within the designated site as a 'hydrological buffer'.

2.2.11 However, the FCT includes site visit notes that describe Oakhanger Moss in 2007 and 2014, respectively, after scrub had been removed to restore the mire communities (referred to above):

- in 2007, Oakhanger Moss was regarded as being in 'unfavourable recovering' condition. However, all M18 communities were recorded as 'lost'. Enrichment of Oakhanger Moss was put down to nutrient rich surface waters flowing through the site; and
- in 2014, Oakhanger Moss was regarded as 'very dry', despite a wet summer, and the dams did not appear to be working. The area cleared of scrub in 2007 was reverting to woodland. As in 2012, it failed its FCT objectives.

2.2.12 While the most recent assessment was carried out eight years ago, there is little to suggest circumstances have changed and, overall, it is assumed that Oakhanger Moss remains in an unfavourable condition and vulnerable to external influences. Given this, the objectives are interpreted not as 'to maintain' but 'to restore' the qualifying features.

2.3 Case law

2.3.1 In recent years, there have been a number of important rulings made by both domestic and European courts which could influence this HRA. The most relevant are described below.

[12] Natural England, *Condition of SSSI Units for Site Oakhanger Moss SSSI*. Available online at: https://designatedsites.naturalengland.org.uk/ReportUnitCondition.aspx?SiteCode=S1006639&ReportTitle=Oakhanger%20Moss%20SSSI.

People Over Wind judgement

2.3.2 The People Over Wind judgement drew a distinction between incorporated mitigation measures which are represented by the essential characteristics of a scheme and those added specifically to avoid or reduce an impact on qualifying features. The former, such as the general alignment of the AP1 revised scheme, can be considered at screening whereas the latter are reserved for consideration in an appropriate assessment.

Wealden judgement

2.3.3 The Wealden judgement clarifies a limitation on the use of thresholds when used to rule out the likelihood of significant effects alone or in combination with other plans or projects, specifically the use of Annual Average Daily Traffic (AADT) figures. The Court concluded that where the likely effect of an individual plan or project does not itself exceed the threshold of 1,000 AADT, its impact must still be considered alongside the similar effects of other plans and projects to assess whether the combined effect could be significant. Where the in-combination effect is greater than this threshold, an appropriate assessment is typically required. In line with Regulation 63(1), the need to consider in-combination assessment, is also carried through into the appropriate assessment if one is necessary.

Dutch Nitrogen case

2.3.4 Here, the Court of Justice of the European Union (CJEU)[13] confirmed that an appropriate assessment is not to take into account the future benefits of mitigation measures if those benefits are uncertain, including where the procedures needed to accomplish them have not yet been carried out or because the level of scientific knowledge does not allow them to be identified or quantified with certainty.

Compton case

2.3.5 This case[14] explored how exceedances of the critical loads should be assessed. The Court ruled that when considering what approach is required in order to conclude no adverse effect on the integrity of a site:

[13] Coöperatie Mobilisation for the Environment UA, Vereniging Leefmilieu v College van gedeputeerde staten van Limburg, College van gedeputeerde staten van Gelderland, European Court of Justice, (C 293/17, C 294/17) [2019] Env. L.R. 27 at paragraph 30.

[14] Compton Parish Council, Julian Cranwell and Ockham Parish Council v Guildford Borough Council, SoS for Housing, Communities and Local Government (2019), High Court of Justice, EWHC 3242. CO/2173,2174,2175/2019.

> 'That could not be answered, one way or the other, by simply considering whether there were exceedances of critical loads or levels, albeit rather lower than currently. What was required was an assessment of the significance of the exceedances for the SPA birds and their habitats …'.

3 Likely significant effects

3.1 The likely significant effects test

3.1.1 Regulation 63(1) identifies whether the proposed development will result in a 'likely significant effect … (either alone or in-combination)' on a European site. An 'in-combination' assessment is only required where an impact is identified which would not result in a significant effect on its own but where significant effects may arise when combined with other plans or projects. The screening test is seen only as a 'trigger'[15] and identifies whether the greater scrutiny of an 'appropriate assessment' is necessary. Case law informs how Regulation 63(1) should be interpreted, as follows:

- 'significant' means 'any effect that would undermine the conservation objectives of a European site'[16];
- 'likely' is a low threshold and simply means that there is a 'risk' or 'doubt' regarding such an effect that 'cannot be excluded on the basis of objective information'[17]; and
- [it] '… is not that significant effects are probable, a risk is sufficient'… and there must be 'credible evidence that there was a real, rather than a hypothetical, risk'[18].

3.2 Potential impacts on Oakhanger Moss

3.2.1 Oakhanger Moss lies 4.4km away from any construction work associated with the AP1 revised scheme and located upgradient from the AP1 revised scheme. Making the reasonable assumption that groundwater follows topography it can be assumed that groundwater would flow from Oakhanger Moss towards the AP1 revised scheme. This, combined with the distance from the AP1 revised scheme means groundwater levels at Oakhanger Moss would not be affected by the AP1 revised scheme. Therefore, the only credible risk results from air pollution (in terms of changes in the airborne concentration of nitrogen oxides (NOx), and the deposition of nitrogen and acid) associated with the changes in vehicle movements. This has been brought about by use of the M6 motorway by construction traffic during the construction phase of the AP1 revised scheme. Consequently, this single factor is addressed below.

[15] Bagmoor Wind Limited v The Scottish Ministers (2012), CSIH 93.

[16] Landelijke Vereniging tot Behoud van de Waddenzee and Nederlandse Vereniging tot Bescherming van Vogels v Staatssecretaris van Landbouw, Natuurbeheer en Visserij (2004), European Court of Justice, C-127/02 (referred to as the Waddenzee judgement) at paragraphs 44, 47 and 48.

[17] Waddenzee at paragraphs 44 and 45.

[18] Peter Charles Boggis and Easton Bavants Conservation v Natural England and Waveney District Council (2009), High Court of Justice Court of Appeal case. C1/2009/0041/QBACF.

3.3 Screening test on Oakhanger Moss

Methodology

3.3.1 Natural or semi-natural habitats can be harmed by airborne pollution from cars and heavy vehicles through two, intimately linked pathways: via the concentration of gaseous nitrogen oxides (collectively referred to as NOx), and via the subsequent deposition of nitrogen and acid. The assessment of the impact of air pollution therefore comprises the analysis of these compounds.

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

3.3.3 The assessment of air pollution is influenced by established best practice provided by National Highways (the Design Manual for Roads and Bridges (DMRB))[19], Natural England[20] and the Institute for Air Quality Management (IAQM)[21].

3.3.4 Importantly, all affirm that impacts are only possible where a European site lies within 200m of a road. This is because the rate of deposition of airborne pollution falls quickly in the first few metres from the roadside before gradually levelling out; beyond 200m, and frequently across shorter distances, the rate of deposition becomes difficult to distinguish from background levels. A similar pattern can be found with the concentration of airborne NOx though the decline can be less pronounced. Therefore, it is clear that impacts at 10m, 50m or more can be very different from those at the roadside. Beyond 200m, significant effects can be ruled out.

[19] 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/.

[20] 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.

[21] 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/text/guidance/air-quality-impacts-on-nature-sites-2020.pdf.

3.3.5 Where a European site lies within 200m of a road, established guidance recommends that detailed assessment should take place where one or more of the following criteria are met:

- 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 Heavy Duty Vehicles (HDV)[22] by 200 AADT or more;
- change in daily average speed by 10kph or more; or
- change in peak hour speed by 20kph or more.

3.3.6 As no changes in road alignments or speed is proposed, the only criterion that could possibly apply would be the change in daily traffic flows brought about by the construction or operation of the AP1 revised scheme.

3.3.7 It can be seen, therefore, that an increase in the airborne concentration of NOx and/or nitrogen and acid deposition is only likely to be significant where marked increases in traffic flows are expected on a road within 200m of a European site. Should these circumstances be met, best practice guidance recommends that the ecological characteristics of the European site should be explored and, if necessary, traffic and/or air quality assessments carried out to evaluate any impacts during construction or operation as necessary.

3.3.8 The ecological characteristics of Oakhanger Moss, presented in Section 2.2, are derived from the formal citations, condition assessments, conservation objectives, FCT, SIP, supplementary advice and any other surveys and management plans where available.

3.3.9 Traffic flows are assessed by calculating AADT figures using established models. Should increases in traffic (alone or in-combination) be less than 1,000 AADT[23] 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 required. Here, impacts are assessed by calculating the relative contribution of the plan or project in relation to the relevant critical level for NOx and the critical loads for the deposition of nitrogen and acid. The air quality analysis typically models any changes at fixed points on a 200m transect extending from the roadside.

3.3.10 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. If exceeded, assessment of nitrogen and acid deposition is required. The critical loads for nitrogen deposition vary and are specific to each qualifying feature. These are presented as a range

[22] HDVs 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.

[23] These values are utilised as there is evidence to show that these equate approximately to a 1% change in critical loads (see paragraph 4.2.4).

of values (expressed as a rate, e.g. 10kg N/ha/yr – 20kg N/ha/yr) and typically, as a precautionary approach, only the lowest value is used (unless there are compelling reasons to do otherwise) as this will emphasise any negative outcomes.

3.3.11 Acid deposition is also assessed via critical loads though measured in kq/ha/yr. As it shares a direct, linear relationship with nitrogen deposition, acidity is not always assessed as its impact can be assumed. However, following feedback by Natural England, this was also evaluated.

3.3.12 For NOx and nitrogen deposition, where background values prior to development lie below the critical levels or loads, significant effects can be ruled out for any increases in pollution brought about by a new plan or project, provided they do not lead to an exceedance of the critical level (NOx) or the lower critical load (nitrogen deposition).

3.3.13 However, it is important to recognise that these thresholds do not represent the points where harm will arise. Consequently, exceedance of these thresholds does not necessarily mean that harm will occur. Indeed, in circumstances where background values already exceed the critical values or loads, which is typically the case across much of lowland England, an increase of less than 1% of the critical level or the lower critical load also allows significant effects to be ruled out though each case should be assessed on the particular circumstances. This is because the 1% threshold, at two orders of magnitude below the critical level or load, is set at a level where measurable impacts would be difficult to detect. It is, therefore, considered to be highly precautionary.

3.3.14 In contrast, should increases in pollution from a new plan or project be greater than 1% of the lower critical level or load, the risk of a significant effect cannot be ruled out and an appropriate assessment will be required. Again, however, an exceedance of the 1% threshold, does not necessarily mean that an adverse effect on the integrity of a European site will automatically occur. This emphasises that assessment is not about establishing a simple mathematical relationship. Account must be taken of the type of qualifying feature (some are more resilient than others), their location, (as not all will be distributed evenly across sites), and other factors that may be at play.

3.3.15 The assessment of acid deposition differs because 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 the 1% of the maximum critical load and the total for acid deposition is greater than the maximum critical load, then an appropriate assessment will be required.

3.3.16 Natural England adds that where the existing background levels of NOx or rates of deposition already exceed these values prior to implementation of a plan or project, the conservation objectives shift from seeking to maintain the qualifying features to securing their restoration to a favourable conservation status. This reflects the greater challenge of restoring a site that could already be suffering harm from air pollution. It also makes clear that the impact assessment should focus on those objectives related to the structure and

function of a site; those objectives most relevant to the impacts that could arise from air pollution are provided in Section 2.2.

3.3.17 Whilst assessment should, in the first instance, evaluate the plan or project in isolation, the Wealden decision makes clear that should insignificant outcomes arise alone, the outcomes should also be assessed in combination with other plans or projects. This test is also carried through to the appropriate assessment (if one is required). As Oakhanger Moss also forms one of the 18 discrete components of the Midland Meres and Mosses Phase 2 Ramsar site (which, in straightforward terms, is regarded as the sum of its parts), there is a separate need to assesses the impact of air pollution on all other components as well.

3.3.18 To determine whether a formal screening exercise is required, this document to inform the HRA firstly assesses the preliminary criteria: proximity of the European site to a road and the volume of anticipated traffic. If necessary, it then screens the construction and/or operational phase either alone or in-combination. An appropriate assessment follows subsequently, if required. An assessment of any impacts on the entire Midland Meres and Mosses Phase 2 Ramsar site concludes the assessment.

Initial assessment

Background

3.3.19 Key information is presented in Annex A which summarises the associated air quality analysis. The following assessment draws on best practice (from Natural England, DMRB and IAQM) and utilises selected information from Annex A though reference to the latter is encouraged. Whilst not explicitly following the five tests laid out in the Natural England Guidance, all the information required is provided so that the steps are followed sequentially, and the conclusions drawn are consistent with that advice.

Proximity

3.3.20 Oakhanger Moss lies approximately 120m from the M6, well within the 200m threshold. Consequently, a traffic assessment is required.

Traffic assessment

3.3.21 The air quality assessment of traffic flows at Oakhanger Moss has been undertaken in accordance with the Volume 5, Appendix: CT-001-00001, Environmental Impact Assessment Scope and Methodology Report (SMR) and is summarised in Annex A.

3.3.22 The AP1 revised scheme will result in a change to traffic flows, and associated emissions, along the M6 which lies approximately 120m to the east of Oakhanger Moss. The change in traffic flows is a result of HS2 construction traffic (including construction HDV and workforce

vehicles) using the M6, as well as traffic re-distributed from other routes in the area by the AP1 revised scheme.

3.3.23 Traffic analysis (see Table A2 and Table A8 of Annex A) indicates that the construction of the AP1 revised scheme will result in traffic flows that exceed the screening thresholds (of 200 HDV or 1,000 for all vehicles), both alone and in combination with other plans or projects. Consequently, it is considered that likely significant effects cannot be ruled out alone or in-combination. Accordingly, the evidence to inform the air quality assessment of traffic flows and subsequent screening assessment for this scenario is provided in Section 3.4 below.

3.3.24 Importantly, this analysis confirms that the AP1 revised scheme will not change traffic movements in the operational phase and, therefore, no further assessment of that component is required. No other criteria (see paragraph 3.3.5 above) are triggered.

3.4 Screening assessment (construction) alone on Oakhanger Moss

Air quality assessment of traffic flows

3.4.1 The only road that triggered the AADT thresholds under this scenario was the M6. The change in traffic flows is a result of HS2 construction traffic (including construction HGV and workforce vehicles) using the M6. Given the orientation of Oakhanger Moss and the M6, only one air quality modelling transect (represented by yellow dots) was employed, situated at a location in the north-eastern corner to capture the worst possible outcome (Figure 2). However, the outcome of the analysis should be applied to the entire eastern section of Oakhanger Moss that lies within 200m of the M6.

3.4.2 Reflecting the distance of Oakhanger Moss from the motorway, the transect initially crosses agricultural land and a minor road (Nursey Lane) before crossing the SSSI/Ramsar site boundary at a distance of 122m and remaining within it to the full extent of the transect, though the European site extends beyond this.

3.4.3 Drawing on the type and distribution of habitats provided in Annex 1 of the FCT, and evidence derived from the Air Pollution Information System (APIS)[24], the habitat types found within 200m of the M6 comprised, in order from the road, 'W10' woodland, 'W5' fen or alluvial woodland and 'W4' fen or bog woodland. Importantly, the maximum extent of the transect fell just short of the important mire ('M2' and 'M18') and swamp ('S3' and 'S7') communities that occupy the centre of Oakhanger Moss.

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

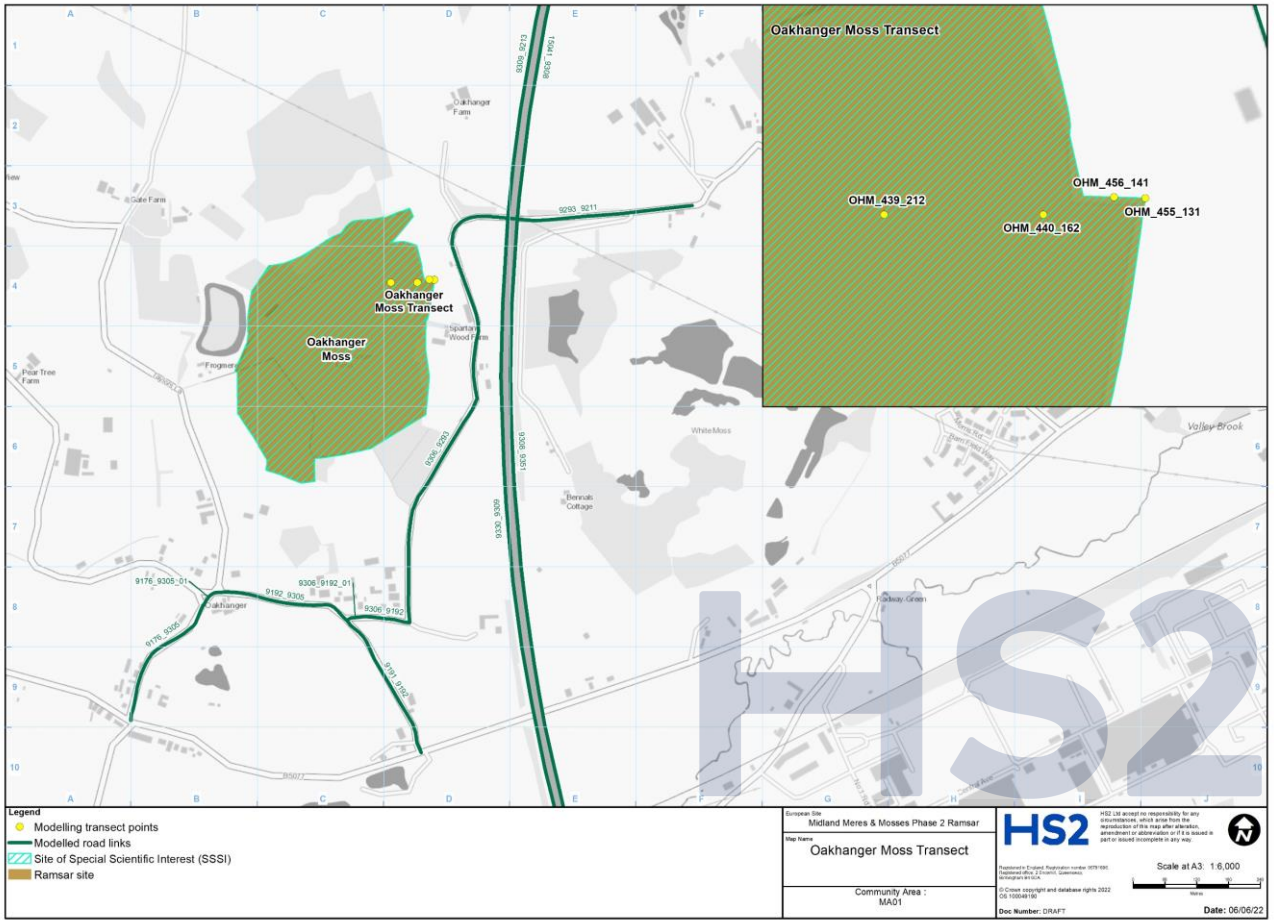
3.4.4 Consequently, the air quality analysis adopted the following critical loads as provided by APIS:

- W10 broadleaved deciduous woodland (15kg N/ha/yr – 20kg N/ha/yr);
- W5 alluvial woodland (10kg N/ha/yr – 20kg N/ha/yr); and
- W4 bog woodland (10kg N/ha/yr – 20kg N/ha/yr).

3.4.5 Importantly, APIS did not provide critical loads for the W10 community at Oakhanger Moss. W10 is a relatively widespread habitat across lowland England but one that is more typical of base-poor brown earth soils. W10 is typically dominated by pedunculate oak and silver birch, other components including ash, sycamore and wych elm become more frequent in the north. It lacks the characteristic woodland ground flora of bluebell and dog's mercury, instead being characterised by the presence of brambles and bracken though a wide range of other species can be found. Though undeniably of ecological interest, and a qualifying feature of other SSSIs in the Phase 2 Ramsar site (e.g. Oak Mere), it is not regarded to be of special interest at Oakhanger. In this case, it was included within the boundary of the SSSI (and Phase 2 Ramsar site) as a 'hydrological buffer' to provide some influence over the hydrological management of the surrounding land as water levels in the W10 community will no doubt have some influence on water levels in the centre of Oakhanger Moss. Indeed, Natural England has recommended that it should be considered part of the 'lagg fen'. Reflecting these circumstances, the critical loads from Oak Mere were adopted for use in the air quality assessment of this report. The distribution of these habitats is shown in Figure 3. The transect first intercepted each community as follows: W10 at 122m from the roadside, W5 at 165m and W4 at 200m.

3.4.6 Key outputs are summarised below and in Annex A. The location of the transect is shown on Figure 2.

Figure 2: Location of M6, Oakhanger Moss and the modelled transect



3.4.7 The air pollution assessment used traffic data based on an estimate of the average daily flows in the peak year during the construction period. In this instance, the worst case peak period for construction traffic is from 2027 to 2031. The construction scenarios assessed therefore use 2027 emission factors as a worst case (see Section 2 of Annex A for further explanation). Beyond 2031, the flow of HDVs (and, correspondingly workforce traffic) decline considerably. It should be noted that the air quality model takes a conservative approach and assumes that the highest flows in any one year are applied to the entire construction period. In reality, there will be considerable periods, perhaps years, where traffic flows and hence air pollution are less than this. However, the approach adopted meets the precautionary principle embedded in the Habitats Regulations.

3.4.8 Table A5 of Annex A describes the change in NOx concentrations brought about by the AP1 revised scheme during construction alone. Whilst this is not repeated here, it interpreted the data as follows:

'NOx concentrations at the Oakhanger Moss are predicted to be within the air quality standard in all scenarios. Changes in NOx concentrations are less than 1% of the critical level and therefore not significant.'

3.4.9 This evidence shows that the predicted change in NOx brought about by the AP1 revised scheme is modest and fails to exceed the critical level at any point in time. This means that likely significant effects can be ruled out for NOx for construction impacts alone.

3.4.10 Table 1 and Table A6 of Annex A describe the change in nitrogen deposition brought about by construction of the AP1 revised scheme alone[25].

Table 1: Assessment of nitrogen deposition at Oakhanger Moss (construction, AP1 revised scheme alone)

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	2027 without the AP1 revised scheme	2027 with the AP1 revised scheme			
122	56.45	55.34	55.35	0.01	10	0.12%
165	55.98	55.07	55.08	0.01	10	0.12%
200	55.68	54.91	54.92	0.01	10	0.12%

3.4.11 With reference to these tables, Annex A states:

'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 AP1 revised scheme. The

[25] Note that all tables in this HRA are drawn from Annex A. While minor changes have been made to the layout and naming of columns, the data remains unchanged.

change in nitrogen deposition due to the AP1 revised scheme is predicted to be less than 1% of the lower critical load and therefore not significant.'

3.4.12 The data show that background rates of nitrogen deposition currently exceed the lower critical load at all points along the transect although, reflecting anticipated improvements in air quality, the degree of exceedance was slightly less at the start of construction than in 2018. In addition, the data also show that the rate of nitrogen deposition brought about by the AP1 revised scheme alone is modest, and less than 0.2% of the lower critical load at all modelled points within Oakhanger Moss. Consequently, likely significant effects can be ruled out for nitrogen deposition alone because the predicted increase falls below the 1% threshold. However, the need remains to consider potential impacts in-combination.

3.4.13 Table A7 (repeated below as Table 2) describes the change in acid deposition brought about by construction of the AP1 revised scheme alone.

Table 2: Assessment of acid deposition at Oakhanger Moss (construction, AP1 revised scheme alone)

Distance to road (m)	Acid deposition (k eq/ha/yr)			Change in acid deposition as percent of CLmax	With AP1 revised scheme acid deposition as percent of CLmax
	2018 baseline	2027 without the AP1 revised scheme	2027 with the AP1 revised scheme		
122	3.90	3.90	3.90	0.29%	1,368.7%
165	3.90	3.90	3.90	0.14%	654.5%
200	3.90	3.90	3.90	0.14%	654.5%

3.4.14 With reference to these tables, Annex A states:

'Acid deposition rates are predicted to be above the lower critical load at all modelled receptors in all scenarios with or without the AP1 revised scheme. The changes in acid deposition due to the AP1 revised scheme are less than 1% of the maximum critical load and therefore not significant.'

3.4.15 The data show that the background rate of acid deposition is currently extremely high, with values ranging from over 650% to approximately 1,369% of the lower critical load and remains so in 2027 despite anticipated improvements in air quality. In contrast, however, the data also show that the rate of deposition brought about by the AP1 revised scheme alone is modest, and less than 0.3% of the higher critical load across all modelled points within Oakhanger Moss. Consequently, likely significant effects can be ruled out for acid deposition alone because the predicted change falls below the 1% threshold. However, the need remains to consider potential impacts in-combination.

Screening opinion for Oakhanger Moss alone

3.4.16 It is considered that there is no credible risk that changes in NOx, or nitrogen or acid deposition during the construction phase could undermine the conservation objectives of

Oakhanger Moss and likely significant effects (alone) can be ruled out. Therefore, it is also considered there is no need for an appropriate assessment (alone).

3.5 Screening assessment (construction) in-combination on Oakhanger Moss

Rationale

3.5.1 Although likely significant effects during construction alone were ruled out in Section 3.4, an assessment of the AP1 revised scheme during construction in combination with other plans or projects is also required. As the Directive[26] makes clear, the in-combination test seeks to identify cumulative effects, and consequently they are limited to those that can affect the same feature. Therefore, the in-combination assessment was limited to those plans or projects that had the potential to increase nitrogen deposition on the qualifying features of Oakhanger Moss; all other potential impacts were ruled out. The range and scope of in-combination assessments has been addressed in various settings; relevant examples include:

- Regulation 63(2) states:

[the developer] 'must provide such information as the competent authority may reasonably require for the purposes of such an assessment.'

- Furthermore, on 22 April 2005, the European Commission stated, in response to a parliamentary question (P-0917/05):

'The [in-] combination provision must be applied in a manner that is proportionate…'

- In Foster and Langton[27], the Court stated:

'There is no basis to carry out an assessment of the in-combination effects when there are no effects to take into account.' (paragraph 36).

3.5.2 This evidence has determined the need for and scope of any in-combination assessment required for this European site as explained in Section 4.2.

[26] *Directive 92/43/EEC of the European Parliament and of the Council of 21st May 1992 on the conservation of natural habitats and of wild fauna and flora aims to promote the maintenance of biodiversity, taking account of economic, social, cultural and regional requirements.* Strasbourg, European Parliament and European Council.

[27] R (Foster and Langton) v Forest of Dean DC and Homes and Communities Agency (2015), High Court of Justice, EWHC 2684.

Methodology

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

3.5.4 In order to comply with the Wealden decision, 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 Oakhanger Moss. Annex A details how development that could cause traffic emission related in-combination effects have been accounted for within the traffic data used in the air quality assessment of traffic flows. Searches were also carried out for the following non-traffic related emission sources (which are also included in the air quality model) within a 5km radius:

- combustion and energy >1MW;
- farming, livestock and poultry (any);
- waste, e.g. landfill gas (any); and
- minerals activities.

3.5.5 This is considered to be reasonable and proportionate and meets the expectations laid down in Section 4.48 of Natural England's guidance[20].

Air quality assessment of traffic flows

3.5.6 The M6 remains the only road under scrutiny. The same broad approach employed in the assessment alone (above) was utilised as modified by the need to consider other plans or projects. However, no non-road plans or projects have been identified that require further consideration within the in-combination assessment. As with the assessment of the AP1 revised scheme alone, changes in NOx are summarised first followed by an assessment of nitrogen and acid deposition.

3.5.7 Table A11 of Annex A describes the change in NOx concentrations brought about by the AP1 revised scheme during construction in combination with other plans or projects. Whilst this is not repeated here, it interpreted the data as follows:

'NOx concentrations at Oakhanger Moss are predicted to be within the air quality standard in all scenarios. The changes in NOx concentrations between the 2027 do nothing scenario and with the AP1 revised scheme in-combination scenario are greater than 1% of the air quality standard. Potentially significant effects are therefore predicted'

3.5.8 Although marked increases in the airborne concentration of NOx are predicted (up to a maximum 4.83% where the transect enters Oakhanger Moss) as a consequence of the AP1 revised scheme, in combination with other plans or projects, the critical level is not exceeded

at any point with values consistently well below this threshold by 2027. Consequently, likely significant effects can be ruled out for NOx in-combination.

3.5.9 Table 3 and Table A12 of Annex A describe the change in nitrogen deposition brought about by construction of the AP1 revised scheme in combination with other plans or projects.

Table 3: Assessment of nitrogen deposition at Oakhanger Moss (construction, AP1 revised scheme in-combination)

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	2027 do nothing	2027 with the AP1 revised scheme			
122	56.45	55.13	55.35	0.22	10	2.22%
165	55.98	54.90	55.08	0.18	10	1.78%
200	55.68	54.76	54.92	0.16	10	1.55%

3.5.10 With reference to this data, Annex A states:

'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 AP1 revised scheme in-combination. Predicted nitrogen deposition rates in 2027, with the AP1 revised scheme in-combination, are lower than the 2018 baseline rates at all modelled locations. The changes in nitrogen deposition between the 2027 do nothing scenario and with the AP1 revised scheme in-combination scenario are greater than 1% of the lower critical load. Potentially significant effects are therefore predicted.'

3.5.11 The data show that again, the background rates of nitrogen deposition continue to exceed the lower critical load across all points on the transect to a considerable degree. Furthermore, and in contrast to the assessment of the AP1 revised scheme alone, the impact of other plans or projects in combination, results in exceedances of 2.22% where the transect enters Oakhanger Moss though this declines to 1.78% where it meets the W5 woodland and 1.55% where it encounters the W4 woodland. All represent increases of greater than 1% of the lower critical load for nitrogen deposition. Whilst this means that likely significant effects cannot be ruled out in-combination, the data clearly shows that anticipated improvements in air quality ensure the degree of exceedance at the start of construction is lower than in 2018. The impact of the AP1 revised scheme and all other plans or projects only has the effect of slowing down the rate of improvement rather than causing a real increase in the rate of deposition. Furthermore, the model applies the impact of all other plans or projects to the year 2027 even though many will not be completed until after this date. The model therefore represents a conservative assessment. However, likely significant effects (in-combination) cannot be ruled out and an appropriate assessment is required.

3.5.12 Table 4 and Table A13 describe the change in acid deposition brought about by construction of the AP1 revised scheme in-combination with other plans or projects.

Table 4: Assessment of acid deposition at Oakhanger Moss (construction, AP1 revised scheme in-combination)

Distance to road (m)	Acid deposition (kg eq/ha/yr)			Change in acid deposition as percent of CLmax	With AP1 revised scheme acid deposition as percent of CLmax
	2018 baseline	2027 do nothing	2027 with the AP1 revised scheme		
122	3.90	3.90	3.92	5.54%	1,374.0%
165	3.90	3.90	3.91	2.13%	656.5%
200	3.90	3.90	3.91	1.86%	656.2%

3.5.13 With reference to this data, Annex A states:

'Acid deposition rates are predicted to be above the lower critical load at all modelled receptors in all scenarios with or without the AP1 revised scheme in combination. The changes in acid deposition between the do nothing scenario and with the AP1 revised scheme in-combination scenario are greater than 1% of the maximum critical load. Potentially significant effects are therefore predicted.'

3.5.14 The data again shows that the background rates of acid deposition are extremely high and, when combined with the impact of other plans or projects, show increases of between approximately 5.5% at the edge of the SSSI/Ramsar site to approximately 1.9% at the end of the transect. In turn, these lead to overall exceedances ranging from around 656% at the end of the transect to 1,374% at the SSSI/Ramsar site boundary. Therefore, likely significant effects cannot be ruled out and an appropriate assessment is required. It should be noted, however, that the same conservative assumptions that informed the assessment of nitrogen deposition also apply to this assessment.

3.5.15 It should also be noted that as Table 3 and Table 4 confirm that background rates of nitrogen deposition currently exceed the lower critical loads for all affected communities along the transect, allied with the unfavourable declining condition of Oakhanger Moss, the conservation objectives must shift from the maintenance of the qualifying features to their restoration to a favourable conservation status, to 'restore the designated features to favourable condition …' (see Section 2.2).

Screening opinion for Oakhanger Moss in combination

3.5.16 It is considered that there is a credible risk that changes in NOx, or nitrogen or acid deposition during the construction phase could undermine the conservation objectives of Oakhanger Moss and likely significant effects (in-combination) cannot be ruled out. Therefore, it is also considered that an appropriate assessment is required (in-combination).

4 Appropriate assessment

4.1 The appropriate assessment test

4.1.1 The appropriate assessment is defined in Regulation 63(5). The following definitions are applied as necessary to the subsequent assessment of likely significant effects.

4.1.2 Regulation 63(5) states where a project is 'likely to have a significant effect alone or in combination', it can only be consented if the competent authority can ascertain (following an appropriate assessment) that it 'will not adversely affect the integrity of the European site'. Drawing on Waddenzee, the 'in-combination test' is also carried forward into the appropriate assessment.

4.1.3 In Sweetman[28], 'integrity' is defined as:

'... the lasting preservation of the constitutive characteristics of the site ... whose preservation was the objective justifying the designation of the site'.

4.1.4 In the Advocate General's opinion on the above case (Sweetman)[29], she stated that a plan or project involving '... some strictly temporary loss of amenity which is capable of being fully undone ...' would avoid an adverse effect on the integrity of a site. This was supported by the Court which ruled that '... the lasting and irreparable loss...' of part of a European site would represent an adverse effect on its integrity.

4.1.5 In Planning Practice Guidance[5], 'integrity' is described as:

'... the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was designated.'

4.1.6 The burden of proof is made clear in Waddenzee and where:

'... doubt remains as to the absence of adverse effects ... the competent authority will have to refuse authorisation'[30] [and] 'that is the case where no reasonable scientific doubt remains as to the absence of such effects'[31].

4.1.7 However, absolute certainty is not required. In Champion, while referring to Advocate General Kokott in Waddenzee at paragraph 107, the Supreme Court found that:

[28] Sweetman v An Bord Pleanála (C 258-11) [2014] PTSR 1092 at paragraph 39.

[29] Minister for the Environment, Heritage and Local Government v An Bord Pleanála (2013), Sweetman reference for a preliminary ruling from the Supreme Court of Ireland, Peter Sweetman Ireland Attorney General (together with the opinion of the Advocate General delivered on 22 November 2012). C-258/11.

[30] Waddenzee at paragraph 57.

[31] Waddenzee at paragraph 59.

'... absolute certainty' is not required as: '... the necessary certainty cannot be construed as meaning absolute certainty since that is almost impossible to attain ...'.

4.2 Appropriate assessment in-combination

Assessment

4.2.1 Where likely significant effects cannot be ruled out, alone or in combination with other plans or projects, an appropriate assessment is required to determine whether a competent authority is able to ascertain that it 'will not adversely affect the integrity of the European site'. This is the fundamental test of an HRA.

4.2.2 The screening assessment has shown that the risk of significant effects can be ruled out for NOx, nitrogen deposition and acid deposition alone (and for NOx in-combination). In contrast, likely significant effects could not be ruled out in combination with other plans or projects in terms of changes in nitrogen or acid deposition, and an appropriate assessment is required (in-combination). This is addressed below.

4.2.3 Section 3.3 describes how the air pollution impacts are assessed. Key elements of that process include the following considerations.

4.2.4 Best practice guidance is consistent in affirming that beyond a distance of 200m from a road, the risk of significant and (by extension) adverse effects can be ruled out. This is because the behaviour of airborne pollutants means that aerial concentrations and/or the rate of deposition will have effectively returned to and be indistinguishable from background levels by this distance, and any changes brought about by a project would be so small that they become difficult to detect even where the result of modelling suggest such an impact may arise.

4.2.5 Similarly, where background levels already exceed the lower critical load for nitrogen deposition and/or the higher critical load for acid deposition, significant or adverse effects can also be ruled out where new contributions are less than 1% of the critical loads. This reflects that the 1% threshold is set two orders of magnitude below the critical loads and so is regarded a very precautionary threshold.

4.2.6 Furthermore, even exceedance of the critical loads does not mean that adverse effects will necessarily arise. Instead, exceedance of the critical loads represents a trigger where further scrutiny is required. This decision is ultimately the product of several factors including the increase brought about by a project, the length of time it will persist, the type of feature(s) affected, the condition or resilience of the feature(s) and the aim or wording of the conservation objectives, amongst others. However, where background critical loads are already exceeded, as in the case of Oakhanger Moss, the objectives shift from 'maintain' to 'restore' in order to reflect the greater challenges of avoiding an adverse effect if the features

have already suffered or are suffering harm, and that there should be a clear focus on the impacts that may affect the 'structure and function' of the European site.

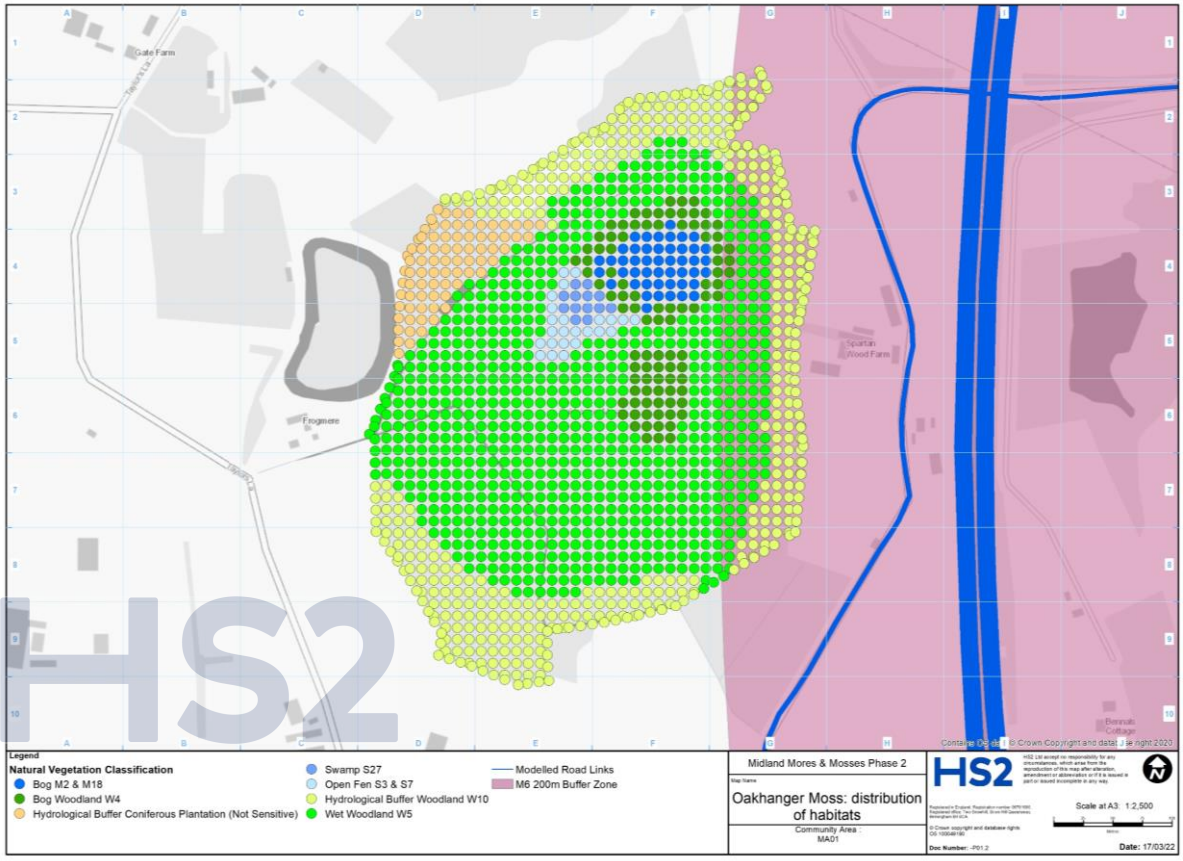
4.2.7 Finally, drawing these approaches together, it is considered reasonable to conclude that small exceedances above the 1% threshold would not necessarily be sufficient for a competent authority to ascertain that an adverse effect would automatically arise.

4.2.8 This appropriate assessment first considers the potential impacts of nitrogen deposition before addressing the same for acid deposition. The distribution of the habitats across the entire site is shown in Figure 1. This draws on information provided in Natural England's FCT of 2015.

4.2.9 APIS estimates that 95% of UK woodlands exceed the critical load for nitrogen deposition, a function of the inherent surface roughness of the vegetation. Nitrogen deposition can lead to greater sensitivity to natural stresses, a shift in dominance from lower plants and typical ground flora to grasses and ruderals, reduced diversity of the ground flora and the loss of lichens and bryophytes, amongst others. Given the types of wet woodland present at Oakhanger Moss, the clear potential for harm (and conflicts with the objectives) to arise where bryophytes dominate the ground flora is clear and it will be important to assess what effect this may have on the restoration of the mire underneath the W4 canopy as noted in the FCT.

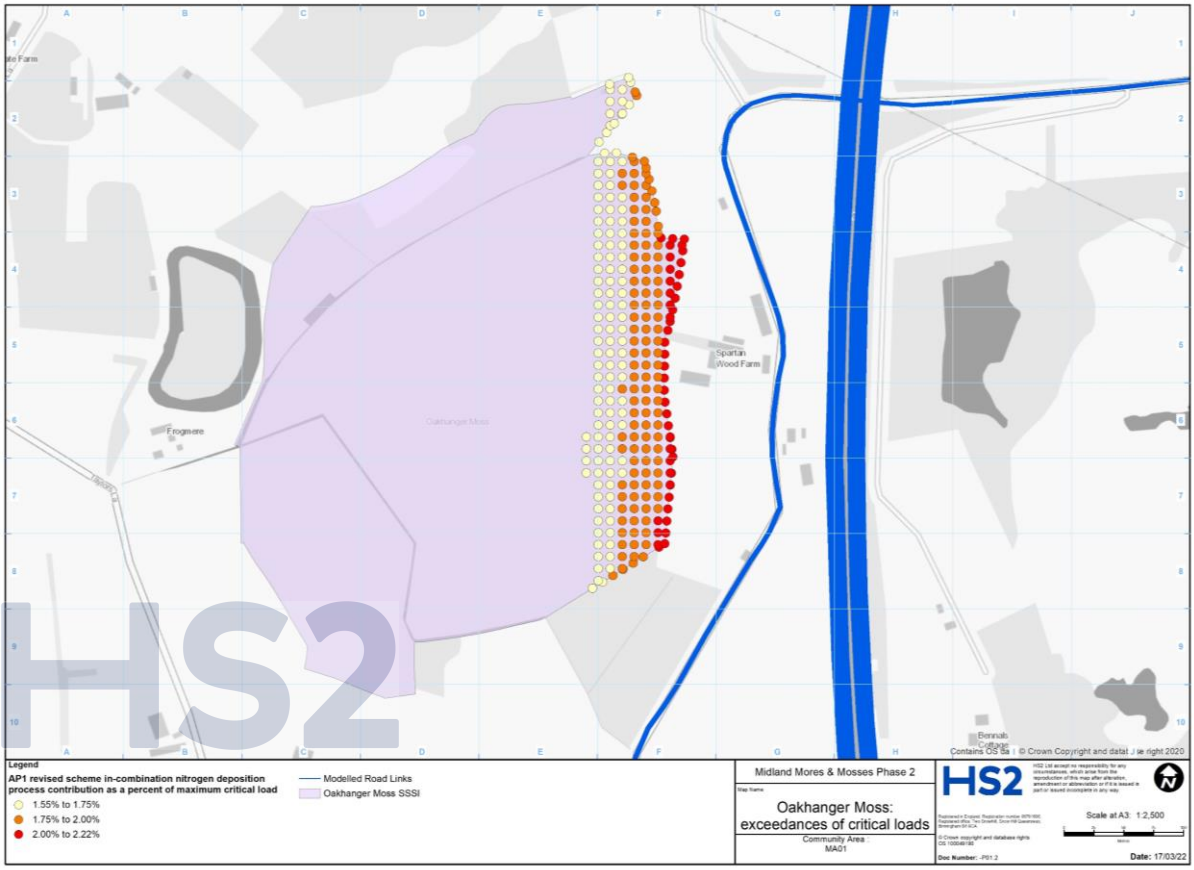
4.2.10 The distribution of the habitat types is shown in Figure 3. It can be seen that the habitats present within 200m of the M6 are restricted to the W4, W5 and W10 communities.

Figure 3: Distribution of habitats across Oakhanger Moss with 200m threshold



4.2.11 Figure 4 shows where rates of nitrogen deposition exceeded 1% of the lower critical load within 200m of the M6. Maximum rates of deposition predicted were as follows: 2.22% at a distance of 122m (at the boundary of Oakhanger Moss) where the transect intercepted the W10 community; 1.78% (at 165m) where the transect entered the W5 community; and, 1.55% at the maximum extent of the transect where it encountered the W4 community. The transect fell short of the M2/M18 and S3/S7 swamp communities.

Figure 4: Rates of nitrogen deposition that exceed the 1% threshold within 200m of the M6



4.2.12 Whilst it is acknowledged that deposition rates above the lower critical load may persist beyond the maximum extent of the transect, best practice effectively discount such potential impacts as they become difficult to differentiate from background levels. Consequently, impacts above 200m are put to one side and potential impacts on the mire and swamp communities can be ruled out.

4.2.13 W10 woodland is regarded by APIS to be sensitive to nitrogen deposition, having a higher critical load than W4 and W5, although possible evidence of enrichment (from airborne and/or aquatic sources) is visible in the abundance of brambles. However, harmful impacts on the woodland community are dismissed as the W10 woodland is only included within the Oakhanger Moss to provide a hydrological buffer. Therefore, it is considered implausible that a modest exceedance of 2.2% of the lower critical load could compromise the achievement of the conservation objectives listed in the FCT for Oakhanger Moss (of which the most relevant higher-level targets are listed in Sections 2.2 above). Confidence in this outcome can be drawn from Section 3.4 which explains why the W10 community is not considered to be a qualifying feature of the SSSI or Phase 2 Ramsar site at Oakhanger Moss. Therefore, it is considered that adverse effects on the integrity of Oakhanger Moss can be ruled out from any increases in air pollution on the W10 community.

4.2.14 W4 is dominated by downy birch and found on moderately acidic, though not necessarily highly oligotrophic, peaty soils; silver birch can be found on drier substrates. The understory can be sparse, though frequently dominated by willows and purple moor grass. *Sphagnum* mosses are usually present, though restricted to the wetter hollows between tussocks of *Molinia*. It is often found at the edges of mires especially as a product of succession where the mire has dried out.

4.2.15 W5 is considered a community of base-rich, moderately eutrophic, wet to waterlogged soils, on topogenous or soligenous mires, particularly associated with open water transitions and basin mires with a strong influence from base-rich groundwater. The canopy typically comprises alder, willows and silver birch. The ground flora reflects the wet conditions, typically dominated by a range of sedges, marsh thistle, yellow-flag, common reed and nettle amongst others. *Sphagnum* mosses are considered to be a rare component suggesting a distinction with W4 which is more closely associated with more active mires. However, the two communities are closely related and frequently occur together with W5 occupying slightly higher ground with better developed soils.

4.2.16 The FCT clearly shows that both W4 and W5 are considered to be qualifying features of the Phase 2 Ramsar site. In particular, W4 can be considered to represent a transitional feature with the mire communities.

4.2.17 Oakhanger Moss is in unfavourable declining condition, heavily wooded (though some clearance work has been carried out), affected by drainage perhaps both off and onto the site, and has been subjected to consistent additions of nitrogen since the M6 opened in the 1960s and, more recently from other sources, such as agriculture. Consequently, some of the most fragile components of the vegetation community can be expected to already have suffered declines in vigour, species composition, abundance and distribution; the abundance of brambles amongst the W10 community is, perhaps, an example of the latter. Moreover, the high background levels of nitrogen require that the conservation objectives should shift from the maintenance of the features to their restoration. This has prompted active restoration work by Natural England in recent years, including the clearance of elements of the W4 woodland. However, it remains that both W4 and W5 represent complex vegetation communities highly adapted to a specialised, low nutrient environment that are vulnerable to eutrophication.

4.2.18 Reflecting the greater distances from the M6, smaller exceedances (than those experienced by W10) are predicted for the W5 and W4 communities; 1.78% and 1.55% respectively, despite both being regarded as sensitive to nitrogen deposition and characterised by a lower critical load than W10.

4.2.19 At this point it is useful to consider that values below the 1% threshold allow even the risk of a significant effect to be dismissed. Although the values predicted would clearly exceed this, and background levels are considerably above the lower critical load, both values remain two orders of magnitude below the lower critical load. The predicted increases are therefore

small, close to being regarded as insignificant and so unlikely to result in visible or measurable impacts on the ground.

4.2.20 Importantly, the contribution of the AP1 revised scheme itself is modest, comprising only 0.2% of the total in-combination impact. Furthermore, although the AP1 revised scheme will last for a prolonged period, from 2027 to 2038, the greatest impact (modelled in this report) would only last for four years (2027 to 2031). In this case, reference to Section 5.43 of Natural England's guidance[20] is relevant and states:

'... it may be possible to consider some increases as temporary and reversible, which would be unlikely to undermine site objectives.'

4.2.21 Whilst these circumstances apply to the AP1 revised scheme, a conclusion based solely on the magnitude of the scheme alone and its limited duration, may not be entirely robust as it will act alongside the impacts of other plans or projects which can be considered more or less permanent and of a much greater magnitude.

4.2.22 As part of a precautionary approach, the model therefore assumes that all other plans or projects assessed as part of the in-combination exercise which extends up to 2038 will have been implemented at the start of the construction period. This is plainly implausible. The result will be that during the period from 2027 to 2031 when impacts from the AP1 revised scheme will be greatest (though still modest alone), the contribution, or volume of traffic generated from other plans or projects, will be less than that assumed in the model. Had the actual growth in traffic from other plans or projects completed between 2027 and 2031 been modelled, it is reasonable to predict that the airborne concentration of NOx, and the rates of deposition of nitrogen and acid would be less than those currently predicted.

4.2.23 In contrast, even though the model presents a reasonable worst-case scenario, and assumes traffic related to all anticipated growth in the area will apply from the start of the construction period, it still predicts that rates of nitrogen deposition (even in combination with other plans or projects) will be less at the end of the modelled period than in the 2018 baseline. The effect of any increase in nitrogen deposition will at worst simply slow down the rate of improvement. Even so, this may also delay progress towards restoration and so conflict with the conservation objectives to 'restore the designated features to favourable condition...'. This is given greater expression at various points within the FCT.

4.2.24 The above assessment addresses the impacts on Oakhanger Moss in its current state. However, the impacts of the AP1 revised scheme, though temporary and modest, will last for four years. More importantly, the impact of other plans or projects can be considered to be permanent. Since Natural England has already undertaken some management to improve Oakhanger Moss and is expected to continue to do so in future, it is necessary to consider how the site may change until 2038, when any impacts from the AP1 revised scheme will cease.

4.2.25 To date, management has focused on the restoration of the mire communities and the important transitions to the surrounding woodland. In brief, this has comprised ditch blocking, to raise water tables, and the clearance of small areas of W4 woodland. It can be expected that these measures will continue, and the area of mire could expand to the extent that it encroaches within the 200m threshold. This community has a lower critical load range of 5kgN ha/yr – 10kgN ha/yr, half that of the surrounding woodland. Consequently, the exceedances could be expected to double should expansion of the mire take place. For instance, the current exceedance of 1.55% currently predicted for the W4 woodland could increase to 3.10%. However, the rate of deposition of nitrogen and other pollutants is intimately related to dry deposition velocities. The dry deposition velocities used in this assessment were those recommended by Air Quality Advisory Group technical guidance AQTAG06[32]. Woodland has a dry deposition velocity double that of open communities (i.e. grassland), and so any clearings can be expected to halve the rate of deposition. Therefore, should further woodland clearance and expansion of the mire communities take place, the exceedance would not change as one variable would cancel out the other. Consequently, it is considered that the conclusion of the assessment can be applied throughout the entire period of the AP1 revised scheme.

4.2.26 In addition, the impact of incremental increases in nitrogen deposition on various semi-natural habitats has been addressed for Natural England in 'NECR 210'[33]. Although woodlands were not included in this work, bogs (or mires) were. Given the intimate relationship between the mire and W4 communities at Oakhanger Moss, it was considered valid to explore its findings.

4.2.27 Table 21 of NECR210 shows that for the species richness of bogs to decline by one (species) would require an increase in nitrogen deposition of 3.3kg N/ha/yr regardless of the background rate. Yet even the highest rate of deposition (attributed to the AP1 revised scheme in combination with other plans or projects) experienced on the SSSI/Ramsar site boundary in closest proximity to the M6 was only 0.22kg N/ha/yr (see Table A11). Taking this to its conclusion, this would suggest the amount of nitrogen being added to Oakhanger Moss would be an order of magnitude less than that required to result in the loss of one species from the bog or mire community and provide strong evidence regarding the absence of any credible impact.

4.2.28 However, considerable caution must be exercised. The report makes clear that the relationship is not linear and that a 'loss' should be taken as a decline in frequency (as this can represent a better indicator of change). Further, the report assesses the impacts of

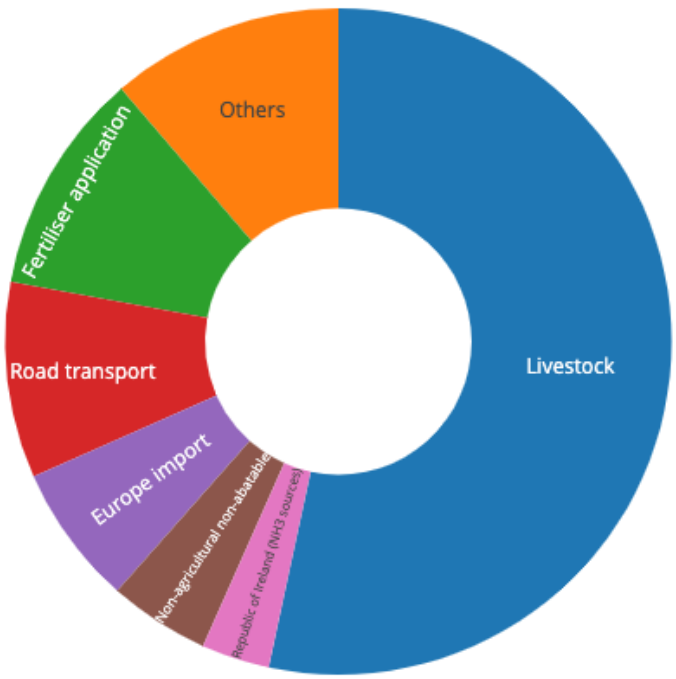
[32] Air Quality Advisory Group (2014), *AQTAG06 Technical guidance on detailed modelling approach for an appropriate assessment for emissions to air*.

[33] Caporn, S., et al. (2016), *Assessing the effects of small increments of atmospheric nitrogen deposition (above the critical load) on semi-natural habitats of conservation importance*. Natural England Commissioned Reports, Number 210.

increased deposition over considerable periods of time. Perhaps most importantly, it doesn't indicate which species of the community would suffer such a decline. So, whilst it is possible to conclude that increased deposition in the amounts predicted would be unlikely to lead to measurable change in the community, there is perhaps more certainty that nitrogen deposition from the M6 over several decades could have resulted in the decline in frequency of several typical components of the bog or mire community of Oakhanger Moss; it should be noted that background rates of deposition clearly exceed the lower critical load. In turn, this could help contribute to the unfavourable condition of the SSSI reported in 2012. On the other hand, whilst the most sensitive species may have declined or been lost completely, the same evidence suggests that the more tolerant or residual species remain and are less likely to be harmed by the modest (further) increases predicted. Whilst providing useful context, this evidence is not considered sufficiently robust to rely on alone.

4.2.29 The Source Attribution Models on APIS (see Figure 5[24]) show that transport currently contributes less than 10% of the nitrogen deposition to Oakhanger Moss. In contrast, agricultural sources, including livestock and fertiliser application, provide over 64%. The latter, captured in the background levels of the modelling exercise, makes it clear that increases in traffic in the volumes predicted alone or in-combination, will make very little difference to the overall nitrogen load. In contrast with the AP1 revised scheme, agricultural inputs and the majority of all other plans or projects can be considered to be permanent, at least for the foreseeable future.

Figure 5: Source attribution model for local contributions of nitrogen deposition



4.2.30 The circumstances described in the previous paragraphs also relate to acid deposition. In this case, exceedances of 5.54% apply to the W10 community, 2.13% to the W5 and 1.86% to the W4. Although impacts are described on APIS to be more likely to affect bryophytes, the similarity of outcomes is not surprising given the direct, linear relationship between nitrogen and acid deposition (since the decline in airborne sulphur that has resulted from the move away from fossil-fuelled power generation). Although assessed against the higher critical load, exceedances are, and impacts can be expected to be of the same order of magnitude or significance. Consequently, the same outcome for nitrogen deposition can be assumed for acid deposition. This applies even when the extremely high background rates of acid deposition are considered.

4.2.31 Overall, therefore, our conclusions are as follows:

- impacts on the W10 community can be dismissed given that it does not represent a qualifying feature of the Ramsar site;
- the contribution by the AP1 revised scheme alone is small, approximately 0.2% of the cumulative values;
- even though background rates of nitrogen and acid deposition far exceed the relevant critical loads, and the predicted increases (in combination with other plans or projects) exceed the 1% threshold for both, they remain modest, and do not exceed 2% for nitrogen deposition on the W5 and W4 communities, or 2.13% for acid deposition;
- the model presents a worst case scenario and assumes very precautionary criteria. Consequently, it is reasonable to consider that the impact of the AP1 revised scheme will be less than that predicted;
- the AP1 revised scheme will be temporary with peak impacts expected to be limited to a four-year period which is likely to be before the bulk of other plans or projects have been implemented;
- the contribution of nitrogen deposition from other sources, especially agriculture, far outweigh any contribution from traffic; and
- increased nitrogen and acid deposition will not compromise ongoing or future management.

4.2.32 Consequently, it is considered implausible that the increases in airborne pollutants brought about by the AP1 revised scheme in combination with other plans or projects could:

- reduce the total extent of the wetland, including all associated pools and lagg fen;
- reduce the extent of the wet woodland; or
- cause the loss of any of the mire or swamp communities.

4.2.33 Therefore, conflicts with the primary, high-level conservation objectives or their subordinate objectives can be ruled out.

4.2.34 Accordingly, it is considered there is no reasonable scientific doubt that adverse effects on the integrity of the Midland Meres and Mosses Phase 2 Ramsar site can be avoided. No mitigation is required.

Impacts on other components of the Midland Meres and Mosses Phase 2 Ramsar site

4.2.35 It is recognised that as the Ramsar site comprises multiple components, should the AP1 revised scheme, following an appropriate assessment, be found to be likely to cause adverse effects to arise on one, this could require the consideration of whether the AP revised scheme or other plans or projects had caused adverse effects to arise on other components. The cumulative impact of these could result in a greater adverse effect.

4.2.36 However, it is considered that the potential for adverse effects on the integrity of Oakhanger Moss has been ruled out, alone or in-combination. Furthermore, a separate report (as part of the AP1 revised scheme) ruled out the risk of a significant effect on Oak Mere, the only other component of the Phase 2 Ramsar site also considered to be potentially at risk from air pollution. Therefore, it is considered there is no potential for any cumulative impacts with any other plans or projects on this or any other component of the Phase 2 Ramsar site and there is no need for any further assessment.

4.3 Integrity test for Oakhanger Moss

4.3.1 On the basis of the assessment above it is considered that the competent authority is able to ascertain that an adverse effect on the integrity of the European site can be ruled out in-combination.

5 Conclusions

5.1.1 This document provides all the necessary information for the competent authority to carry out an HRA for the purposes of Regulation 63 of the Habitats Regulations 2017, as amended, should one be required. The outcomes allow the following conclusions to be drawn for the Oakhanger Moss component of the Midland Meres and Mosses Phase 2 Ramsar site:

- it is considered there is no credible risk that changes in NOx, nitrogen deposition or acid deposition, during construction of the AP1 revised scheme alone, could undermine the conservation objectives of Oakhanger Moss and likely significant effects could be ruled out (alone). Therefore, it is considered there is no need for an appropriate assessment (alone);
- it is considered there is no credible risk that changes in NOx, during construction of the AP1 revised scheme in combination with other plans or projects, could undermine the conservation objectives of Oakhanger Moss and likely significant effects could be ruled out (in-combination). Therefore, it is considered there is no need for an appropriate assessment (in-combination); and
- the appropriate assessment above has determined that there is no credible risk that changes in nitrogen deposition or acid deposition, during construction of the AP1 revised scheme in combination with other plans or projects, could undermine the conservation objectives of Oakhanger Moss and likely significant effects could be ruled out (in-combination). Therefore, it is considered that no further assessment (in-combination) is required.

Annex A: Additional air quality information to inform a Habitats Regulations Assessment

1 Purpose

This Annex provides additional air quality information in relation to impacts from vehicle emissions to support the document to inform a HRA for the Midland Meres and Mosses Phase 2 Ramsar site (Oakhanger Moss SSSI).

This report assesses the impact of air pollution on the Oakhanger Moss SSSI component of the Midland Meres and Mosses Phase 2 Ramsar site (Oakhanger Moss). For simplicity, it is referred to as Oakhanger Moss 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[34] in the main 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[19], to identify where assessment is required;
- these criteria are the following for assessing the impacts of the scheme alone:
  - change in road alignment by 5m or more;
  - change in daily traffic flows by 1,000 vehicles or more as AADT;
  - change in daily flows of HDV by 200 AADT or more;
  - change in daily average speed by 10kph or more; or
  - change in peak hour speed by 20kph or more.
- these criteria are the following 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, 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 necessitates 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[21]. Data on nitrogen and acid deposition has been taken from the most recent information available on the APIS[24] website. No reduction in future background deposition rates has been applied;
- the following scenarios were assessed:
  - baseline;
  - selected year(s) within the construction period for the assessment of the effects of construction. The year(s) of assessment were selected based on the worse case peak period during the construction programme and on when significant effects might be

[34] 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.

expected. For this area, the worst case peak period for construction traffic is from 2027 to 2031. The construction scenarios assessed therefore use 2027 emission factors as a worst case; and

  - an operational scenario was assessed for the first full operational year after construction is completed.

- the baseline scenario represents 2018 including when temporary construction works associated with the M6 J16 to 19 smart motorway were underway;
- for each assessment year, both the scenario without the AP1 revised scheme in place and the scenario with the AP1 revised scheme in place have been modelled. This comparison was used to assess the impacts of the AP1 revised scheme alone;
- for the assessment of the AP1 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 a baseline proxy scenario representing the M6 J16 to 19 smart motorway and traffic demand for 2018. This is considered to be more appropriate for the do-nothing scenario than using the 2018 baseline traffic data because traffic flows were temporarily affected by construction works associated with the smart motorway. The 'do nothing' scenario uses background pollutant concentrations and emission factors representing the future year being assessed which in this area is 2027;
- the assessment incorporated HS2 Ltd's policy on construction vehicle emissions standards. These standards are published in Information Paper E31[35]; Air Quality and include Euro VI for HGV, and Euro 6 and Euro 4 for diesel and petrol Light Duty Vehicles (LDV), respectively;
- in-combination effects were taken into account in the traffic data used for the assessment which incorporates likely changes brought about by other proposed and committed developments[36]; and

[35] High Speed Two Ltd (2017), *High Speed Two Phase One Information Paper E31: Air Quality.* Version 1.5. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/672406/E31_-_Air_Quality_v1.5.pdf.

[36] A number of strategic traffic models 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 AP 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.

Forecast year models have also been supplied by the above stakeholders which reflect committed and planned changes to the transport network and growth associated with committed and planned developments that are sufficiently certain to be introduced after the base year of the strategic model. Reviews of committed developments will have been undertaken by the relevant stakeholders at the same time as preparing and validating the base year model and developing future year models. Given that the models represent a base year position between 2016 and 2018, it is likely that the reviews of forecast

- consideration was also given to relevant non-road plans and projects.

committed developments will have been undertaken between 2016 and 2018 depending on when each model was last updated.

In order to account for traffic growth from 2018 to future years, growth factors were directly obtained from TEMPro version 7.2 which uses the National Trip End Model (NTEM 7.2 ((2017)) 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. It includes all economic and population growth forecasts, and assumes growth in housing and commercial development, therefore providing a prediction of traffic growth by area.

3 Air quality standards

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

Table A1: Air quality standards

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

For the assessment of changes in nitrogen and acid deposition, comparison has been made against the applicable critical loads[37] for the site, as provided by APIS.

[37] 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 of the main ES HRA report[2].

For the assessment of nitrogen deposition, if the change is predicted to be less than 1% of the lower critical load[38], 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 of the main ES HRA 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 of the main ES HRA report.

[38] 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 – 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.

5 Assessment of construction traffic effects – AP1 revised scheme alone

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 (2025 – 2037). Traffic data is presented in Table A2.

The screening process identified one road in the area exceeding the screening thresholds; the M6 junction 16 to 17.

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

Figure A1 presents a detailed map of the modelled area including assessed roads (road network in green) and modelled receptors (yellow dots).

Table A2: Traffic data summary (construction phase – scheme alone)

Road ID	Road names	Annual Average Daily Traffic (AADT)				Heavy Duty Vehicles (HDV)			
		2018 baseline	2027 without the AP1 revised scheme	2027 with the AP1 revised scheme	AP1 revised scheme alone change (2027 with AP1 revised scheme – 2027 without AP1 revised scheme)	2018 baseline	2027 without the AP1 revised scheme	2027 with the AP1 revised scheme	AP1 revised scheme alone change (2027 with AP1 revised scheme – 2027 without AP1 revised scheme)
15041_9308	M6 (SB)	38,892	50,195	51,746	1,551	7,701	8,001	8,709	707
9176_9305	Holmshaw Lane	2,691	3,362	3,054	-308	9	7	5	-2
9191_9192	Nursery Road	431	447	538	91	13	17	19	2
9192_9305	Nursery Road	3,141	3,896	3,600	-296	27	26	24	-2
9293_9211	Nursery Road	2,710	3,449	3,062	-387	15	9	6	-3
9306_9192	Nursery Road	2,710	3,449	3,062	-387	15	9	6	-3
9306_9293	Nursery Road	2,710	3,449	3,062	-387	15	9	6	-3
9308_9351	M6 (SB)	38,892	50,195	51,746	1,551	7,701	8,001	8,709	707
9309_9213	M6 (NB)	34,362	44,206	45,466	1,260	7,027	7,206	7,797	592
9330_9309	M6 (NB)	34,362	44,206	45,466	1,260	7,027	7,206	7,797	592

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

5.2 Receptors assessed and background concentrations

Table 3 presents the details of the receptor assessed, background concentrations, background deposition and relevant critical loads. Table 4 shows the background information for acid deposition. The yellow transect points in Figure A1 represent the closest point to the road for each of the three sensitive habitat types.

Figure A1: Map of construction transect, including modelled links and modelled ecological receptor points

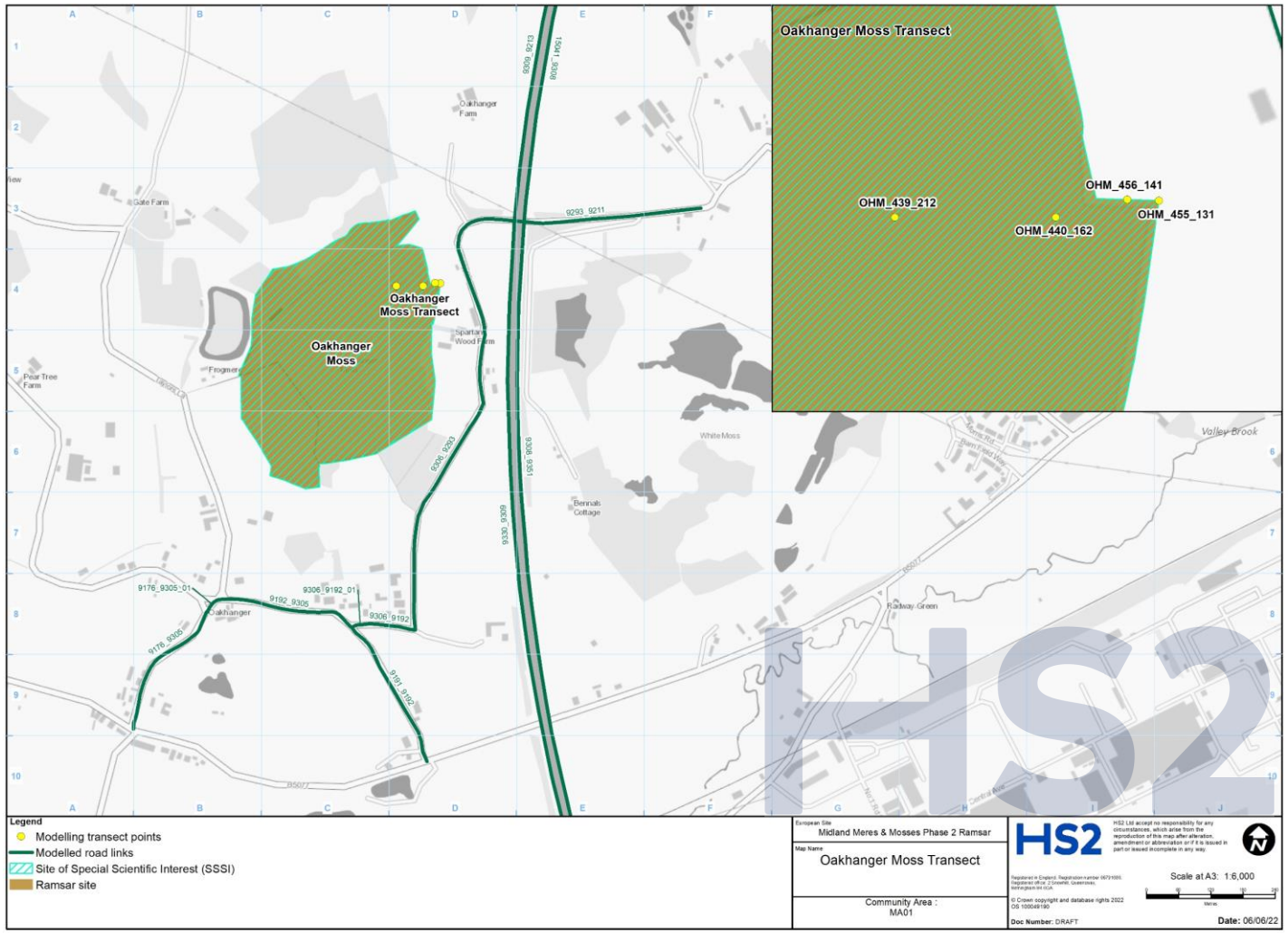


Table A3: Modelled ecological receptor NOx and nitrogen deposition backgrounds, APIS data and critical loads (construction phase)

Receptor	Sensitive habitat	2018 NOx background concentration (µg/m³)	2027 NOx background concentration (µg/m³)	APIS data[24] of average total nitrogen deposition	Critical load (kg N/ha/yr)
Oakhanger Moss	Deciduous Woodland	12.7	8.9	54.0	10

Table A4: Modelled ecological receptor acid deposition backgrounds, APIS data and critical loads (construction phase)

Receptor	Sensitive habitat	APIS data[24] of average total acid deposition (k eq/ha/yr)	Critical load (k eq/ha/yr) (min)	Critical load (k eq/ha/yr) (max)
Oakhanger Moss	Deciduous Woodland (W10)	3.9	0.1	0.3
	Deciduous Woodland (W5)	3.9	0.3	0.6
	Deciduous Woodland (W4)	3.9	0.3	0.6

5.3 Assessment results

Table A5 presents a summary of the modelled NOx concentrations for the ecological site, the change in concentration and a comparison against the air quality standard (30µg/m³).

Table A6 presents a summary of the modelled nitrogen deposition, change in deposition and percentage change in relation to the lower critical load.

Table A7 presents a summary of the modelled acid deposition and percentage change in deposition and percentage change in relation to the critical load.

Table A5: Predicted annual mean of NOx concentrations at ecological sites (construction phase, AP1 revised scheme alone)

Ecological site	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	2027 without the AP1 revised scheme	2027 with the AP1 revised scheme			
Oakhanger Moss	122	28.55	17.39	17.48	0.09	Within standard	0.30%
	165	25.42	15.67	15.75	0.08	Within standard	0.27%
	200	23.52	14.63	14.70	0.07	Within standard	0.23%

Table A6: Assessment of nitrogen deposition at ecological sites (construction phase, AP1 revised scheme alone)

Ecological site	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	2027 without the AP1 revised scheme	2027 with the AP1 revised scheme			
Oakhanger Moss	122	56.45	55.34	55.35	0.01	10	0.12%
	165	55.98	55.07	55.08	0.01	10	0.12%
	200	55.68	54.91	54.92	0.01	10	0.12%

Table A7: Assessment of acid deposition at ecological sites (construction phase – AP1 revised scheme alone)

Ecological Site	Sensitive habitat	Distance to road (m)	Acid deposition (k eq/ha/yr)			Change in acid deposition as percent of CLmax	Total with AP1 revised scheme acid deposition as percent of CLmax
			2018 baseline	2027 without the AP1 revised scheme	2027 with the AP1 revised scheme		
Oakhanger Moss	Deciduous Woodland (W10)	122	3.90	3.90	3.90	0.29%	1,368.7%
	Deciduous Woodland (W5)	165	3.90	3.90	3.90	0.14%	654.5%
	Deciduous Woodland (W4)	200	3.90	3.90	3.90	0.14%	654.5%

5.4 Assessment of significance (construction phase, AP1 revised scheme alone)

NOx concentrations at the Oakhanger Moss 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.

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 AP1 revised scheme. The change in nitrogen deposition due to the AP1 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 AP1 revised scheme. The changes in acid deposition due to the AP1 revised scheme are less than 1% of the maximum critical load and therefore not significant.

6 Assessment of construction traffic effects – AP1 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 M6 junction 16 to 17.

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

Table A8 presents the traffic data used in the assessment.

Table A8: Traffic data summary (construction phase, 2018 baseline AP1 revised scheme in combination)

Road ID	Road names	Annual Average Daily Traffic (AADT)				Heavy Duty Vehicles (HDV)			
		2018 baseline	2018 baseline with smart motorway	2027 with the AP1 revised scheme	In-combination change (2027 with the AP1 revised scheme – 2018 baseline with smart motorway)	2018 baseline	2018 baseline with smart motorway	2027 with the AP1 revised scheme	In-combination change (2027 with the AP1 revised scheme – 2018 baseline with smart motorway)
15041_9308	M6 (SB)	38,892	44,074	51,746	7,672	7,701	8,101	8,709	608
9176_9305	Holmshaw Lane	2,691	1,809	3,054	1,245	9	5	5	0
9191_9192	Nursery Road	431	690	538	-152	13	19	19	0
9192_9305	Nursery Road	3,141	2,300	3,600	1,300	27	23	24	1
9293_9211	Nursery Road	2,710	1,610	3,062	1,452	15	4	6	2
9306_9192	Nursery Road	2,710	1,610	3,062	1,452	15	4	6	2
9306_9293	Nursery Road	2,710	1,610	3,062	1,452	15	4	6	2
9308_9351	M6 (SB)	38,892	44,074	51,746	7,672	7,701	8,101	8,709	608
9309_9213	M6 (NB)	34,362	38,904	45,466	6,562	7,027	7,221	7,797	576
9330_9309	M6 (NB)	34,362	38,904	45,466	6,562	7,027	7,221	7,797	576

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

Figure A1 presents a detailed map of the modelled area including assessed roads (road network in green) and transect points which represent the closest point to the road for each of the three sensitive habitat types.

Table A9 presents the details of the receptor assessed, background concentrations, background deposition and relevant critical loads. Table A10 shows the background information for acid deposition.

Table A9: Modelled ecological receptor NOx and nitrogen deposition backgrounds, APIS data and critical loads (construction phase – AP1 revised scheme in-combination)

Receptor	Sensitive habitat	2018 NOx background concentration (µg/m^3)	2027 NOx background concentration (µg/m^3)	APIS data[24] of average total nitrogen deposition	Critical load (kg N/ha/yr)
Oakhanger Moss	Deciduous Woodland	12.7	8.9	54.0	10

Table A10: Modelled ecological receptor acid deposition backgrounds, APIS data and critical loads (construction phase – AP1 revised scheme in-combination)

Receptor	Sensitive habitat	APIS data[24] of average total acid deposition (k eq/ha/yr)	Critical load (k eq/ha/yr) (min)	Critical load (k eq/ha/yr) (max)
Oakhanger Moss	Deciduous Woodland (W10)	3.9	0.1	0.3
	Deciduous Woodland (W5)	3.9	0.3	0.6
	Deciduous Woodland (W4)	3.9	0.3	0.6

6.4 Assessment results

Table A11 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 A12 presents a summary of the modelled nitrogen deposition, change in deposition and percentage change in relation to the lower critical load.

Table A13 presents a summary of the modelled acid deposition, percentage change in deposition and percentage change in relation to the critical load.

Table A11: Predicted annual mean of NOx concentrations at ecological sites (construction phase, AP1 revised scheme in-combination)

Ecological site	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
		Baseline 2018	2027 do nothing	2027 with the AP1 revised scheme			
Oakhanger Moss	122	28.55	16.03	17.48	1.45	Within standard	4.83%
	165	25.42	14.58	15.75	1.17	Within standard	3.90%
	200	23.52	13.70	14.70	1.00	Within standard	3.33%

Table A12: Assessment of nitrogen deposition at ecological sites (construction phase, AP1 revised scheme in-combination)

Ecological site	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
		Baseline 2018	2027 do nothing	2027 with the AP1 revised scheme			
Oakhanger Moss	122	56.45	55.13	55.35	0.22	10	2.22%
	165	55.98	54.90	55.08	0.18	10	1.78%
	200	55.68	54.76	54.92	0.16	10	1.55%

Table A13: Assessment of acid deposition at ecological sites (construction phase – AP1 revised scheme in-combination)

Ecological Site	Sensitive habitat	Distance to road (m)	Acid deposition (k eq/ha/yr)			Change in acid deposition as percent of CLmax	Total with AP1 revised scheme acid deposition as percent of CLmax
			Baseline 2018	2027 do nothing	2027 with the AP1 revised scheme		
Oakhanger Moss	Deciduous Woodland (W10)	122	3.90	3.90	3.92	5.54%	1,374.0%
	Deciduous Woodland (W5)	165	3.90	3.90	3.91	2.13%	656.5%
	Deciduous Woodland (W4)	200	3.90	3.90	3.91	1.86%	656.2%

6.5 Assessment of significance

NOx concentrations at the Oakhanger Moss are predicted to be within the air quality standard in all scenarios. The changes in NOx concentrations between the 2027 do nothing scenario and with the AP1 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 3.5 of the main ES HRA 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 AP1 revised scheme in-combination. Predicted nitrogen deposition rates in 2027, with the AP1 revised scheme in-combination, are lower than the 2018 baseline rates at all modelled locations. The changes in nitrogen deposition between the 2027 do nothing scenario and with the AP1 revised scheme in-combination scenario are greater than 1% of the lower critical load. Potentially significant effects are therefore predicted, and this is addressed further in Section 3.5 of the main ES HRA report.

Acid deposition rates are predicted to be above the lower critical load at all modelled receptors in all scenarios with or without the AP1 revised scheme in combination. The changes in acid deposition between the 2027 do nothing scenario and with the AP1 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 3.5 of the main ES HRA report.

7 Assessment of operational traffic effects

7.1 Screening of traffic data

The AP1 revised scheme will not change traffic movements on roads within 200m of Oakhanger Moss in the operation phase and therefore no further assessment is required.

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