ATKINS

Member of the SNC-Lavalin Group

Oxford Core Transport Schemes (Traffic Filters)

Habitats Regulations Assessment Stage 2 - Statement to Inform Appropriate Assessment

Oxfordshire County Council

November 2022

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This document does not purport to provide legal advice.

This document has 71 pages including the cover.

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1. Introduction

1.1. Terms of Reference

Atkins, a member of SNC-Lavalin Group, has been appointed by Oxfordshire County Council to provide a Habitats Regulations Assessment (HRA) Statement to Inform Appropriate Assessment (SIAA) in relation to potential air quality and surface water quality impacts on Oxford Meadows Special Area of Conservation (SAC) associated with the 'Oxford Core Transport Schemes' which involves the installation of Strategic Traffic Filters (STFs) (hereafter referred to as the 'Proposed Scheme').

The Proposed Scheme involves the installation of six STFs, located within the ring road encircling Oxford city centre and surrounding suburbs (comprised of the A34, A4142, A423 and A40), as shown on Figure A-1 in Appendix A.

The Proposed Scheme directly affects the city of Oxford road network, therefore this assessment has been undertaken following National Highways guidance in the Design Manual for Roads and Bridges (DMRB) LA 115 Habitats Regulations Assessment (formerly HD 44/09) Revision 1[1].

The Stage 1: HRA screening was undertaken in August 2022[2]. The information in the Stage 1: HRA Screening was collated by Atkins in order to inform the assessment undertaken by the Competent Authority[3] (in this case, Oxfordshire County Council) as to whether there would be any Likely Significant Effects (LSEs) as a result of the Proposed Scheme on any European Sites. This is in accordance with the Conservation of Habitats and Species Regulations 2017 (as amended)[4] (the 'Habitats Regulations'). The Stage 1 screening identified one European Site for consideration; the Oxford Meadows SAC (further details are given in section 1.3 of this report). The need for HRA Stage 2 Appropriate Assessment, in accordance with the Regulation 63(1) of the Habitats Regulations, was identified during the HRA Screening (full details are provided in the Habitats Regulations Assessment Stage 1 Screening document[2]).

This SIAA is required to satisfy Regulation 63(2) of the Habitats Regulations, which requires anyone applying for consent for a project likely to have a significant effect on a European Site to provide the Competent Authority with the information that may reasonably be required to complete an Appropriate Assessment.

The lead author of this SIAA is a Chartered Ecologist and full member of the Chartered Institute of Ecology and Environmental Management (CIEEM), with 15 years' experience of working an as Ecological Consultant, and experience of working on numerous HRAs.

1.2. The Proposed Scheme

The aim of the 'Oxford Core Transport Schemes' is to create a sustainable and reliable transport system in the city. The proposals will expand connectivity, protect the environment, and improve the health and wellbeing of residents. The reallocation of road space will help travelling within the city of Oxford without a car easier and reduce traffic, meaning that those who need to travel by car or van can do so more reliably and safely.

1.2.1. Strategic Traffic Filters (STF)

Six STFs will be installed; the traffic filters are points in the road where general traffic will not be permitted to pass. Some traffic will be exempt, including buses, cyclists, pedestrians, and certain (limited) other road users. These will be enforced by Automatic Number-Plate Recognition (ANPR) technology along with local and advanced signage similar to the existing bus gate in Oxford High Street. A total of 12 cameras and 31 signs (including 45 m advanced signage) will be installed as part of the Proposed Scheme. Cameras and signage will be required on either side of the STF location. Between 12-36 poles will be required, depending on the

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[1] Highways England (2019) *Design Manual for Roads and Bridges LA 115: Habitats Regulations Assessment.* Available at: https://www.standardsforhighways.co.uk/prod/attachments/e2fdab58-d293-4af7-b737-b55e08e045ae?inline=true [Accessed November 2022].

[2] Atkins (August 2022) Oxford Core Transport Schemes (Traffic Filters) Habitats Regulations Assessment Stage 1: Screening.

[3] Competent Authority means a Competent Authority within the meaning of Regulation 7of the Conservation of Habitats and Species Regulations 2017.

[4] Following the changes made to the Conservation of Habitats and Species Regulations 2017 (as amended) by the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019, Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) in the UK no longer form part of the EU's Natura 2000 ecological network and now form part of the UK's national site network of European Sites. In this document they are still referred to as European Sites.

requirements for additional poles as mounting will occur on existing street furniture where possible. Traffic filters will operate from 7am to 7pm, seven days a week.

The STFs are proposed on main roads within the city centre on Hythe Bridge Street, Thames Street and St Cross Road, and to the east of the city on St Clements, Marston Ferry Road and Hollow Way, as shown on Figure A-1 in Appendix A.

1.2.2. Overview of the proposed works

All works for the STFs will be within the highway boundary, consisting primarily of hardstanding and occasionally of small patches of amenity grassland. Regulatory signage will also be within the existing highway boundary. These works may require localised vegetation or tree pruning.

Camera and sign poles will be a minimum of 2.1 m mounting height, or 2.4 m mounting height if on a cycle route, plus the height of the sign which is subject to further design work. Existing poles and cameras will be used as much as possible. Where any new poles are required for the Proposed Scheme, they will require small-scale excavation to a depth of 0.5 m, subject to further design work. Construction dates are yet to be determined. It is assumed that it will only take one day to install the new poles and signage at each location.

Localised widening of roads to allow vehicles to U-turn is not included as part of the Proposed Scheme.

The Proposed Scheme will not result in any changes to street lighting configurations and no additional street lighting will be installed.

During operation of the Proposed Scheme, the traffic filters will affect car accessibility and will lead to displacement of traffic onto other routes. For details of the Affected Road Network (ARN), see section 1.2.3 below.

1.2.3. The Affected Road Network

The ARN has been calculated based on a comparison of the 2024 Do-Something (DS) scenario and 2024 Do-Minimum (DM) scenario transport modelling data. The ARN has been defined using the traffic change scoping criteria provided in the DMRB LA 105 Air Quality[5], and also referenced in the Natural England NEA001 guidance[6]. These criteria include:

- Daily traffic flows will change by 1,000 annual average daily traffic (AADT) or more;
- Heavy duty vehicle (HDV) flows will change by 200 AADT or more.

Figure C-1 in Appendix C shows the road links which have an increase in AADT of 1000 or greater. No road links showed an increase in heavy duty vehicles of 200 AADT or above.

The ARN consists predominantly of the rings roads encircling Oxford city centre, including the A34, A44, A40, A4142 and A423.

1.3. Outcome of the HRA screening

The HRA: Stage 1 Screening[2], was undertaken following National Highways guidance in the Design Manual for Roads and Bridges (DMRB) LA 115 Habitats Regulations Assessment (formerly HD 44/09) Revision 1[1].

One European Site; Oxford Meadows SAC was identified as requiring screening for LSEs. HRA Screening was identified as being necessary under DMRB LA 115 criteria[1] due to three of the STFs being within 2 km of the SAC (as shown in Figure B-1 in Appendix B). Screening was also identified as necessary for Oxford Meadows SAC under LA 105 of the DMRB[7] and Natural England[8] criteria, due to Oxford Meadows SAC being within 200 m of the ARN (as shown in Figure C-1 in Appendix C).

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5 Design Manual for Roads and Bridges (2019) Highways England. Sustainability & Environment Appraisal LA 105 Air quality Available from: https://www.standardsforhighways.co.uk/dmrb/search/10191621-07df-44a3-892e-c1d5c7a28d90 [Accessed November 2022].

6 Natural England (2018) Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations.

7 LA 105 Air quality. Available from: https://www.standardsforhighways.co.uk/dmrb/search/10191621-07df-44a3-892e-c1d5c7a28d90 [Accessed April 2022].

8 NE Internal Guidance – Approach to Advising Competent Authorities on Road Traffic Emissions and HRAs V1.4 Final – June 2018.

No LSEs on the SAC and/ or its qualifying features were identified during construction of the Proposed Scheme, due to the minor nature of the works and the distance from the SAC (construction works would be approximately 1.1 km from the SAC).

The Screening identified the following operational impacts of the Proposed Scheme as having potential LSEs on both qualifying features of the SAC (see section 2.2 below), due to its close proximity to the operational ARN:

- Reduction of habitat area (due to changes in air quality and surface water quality);
- Reduction in species density (due to changes in air quality and surface water quality); and
- Changes in key indicators of conservation value (due to changes in air quality and surface water quality).

No other potential impact mechanisms for the Oxford Meadows SAC were identified during the Screening process.

The HRA Stage 1 Screening[2] assessment concluded than an Appropriate Assessment would be required in order to determine if the identified air quality and surface water quality LSE pathways are likely to result in an adverse effect on the integrity of the Oxford Meadows SAC, as the ARN is located 3 m from the Oxford Meadows SAC boundary along both the northbound and southbound lanes of the A34.

1.4. Background to HRA

1.4.1. The need for an HRA

The requirement for HRA is described within Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (otherwise known as the Habitats Directive), which is transposed into English law through the Conservation of Habitats and Species Regulations 2017 (as amended) (hereafter referred to as the Habitats Regulations).

In accordance with Regulation 63(1) of the Habitats Regulations, a competent authority[9], before deciding to undertake, or give any consent, permission or other authorisation for a plan or project which may have a significant effect on a European Site or a European offshore marine site (either alone or in-combination with other plans or projects), and is not directly connected with or necessary to the management of that site, must make an appropriate assessment of the implications of the plan or project for that site in view of that site's conservation objectives.

In the event of an adverse effect on the integrity of a European Site being identified, then in accordance with Regulation 64(1) of the Habitats Regulations, if the competent authority is satisfied that, there being no alternative solutions, the plan or project must be carried out for imperative reasons of overriding public interest (which, may be of a social or economic nature), it may agree to the plan or project notwithstanding a negative assessment of the implications for the European Site or the European Offshore Marine Site (as the case may be).

A European Site or European Offshore Marine Site is defined within Regulation 8 of the Habitats Regulations as:

- a Special Area of Conservation (SAC);
- a Special Protection Area (SPA)[10]; and,
- a European Site so far as consisting of marine areas.

LA 115, National Planning Policy Framework (NPPF)[11] and ODPM Circular 06/2005[12] state that potential Special Protection Areas (pSPA) and possible Special Areas of Conservation (including candidate SACs, or

[9] In this case, Oxfordshire County Council.

[10] Within the meaning of Council Directive 2009/147/EC on the conservation of wild birds (otherwise known as the Birds Directive).

[11] Ministry of Housing, Communities and Local Government. (2021) *National Planning Policy Framework*. Secretary of State for Housing, Communities and Local Government by Command of Her Majesty [online]. Available from <https://www.gov.uk/government/publications/national-planning-policy-framework--2> [Accessed November 2022].

[12] ODPM. (2005) Government Circular: Biodiversity and Geological Conservation – Statutory Obligations and their impact within the planning system. Office of the Deputy Prime Minister [online]. Available from <https://www.gov.uk/government/publications/biodiversity-and-geological-conservation-circular-06-2005> [Accessed November 2022].

cSAC), listed or proposed Ramsar sites[13], Site of Community Importance (SCI)[14] and sites identified, or required, as compensatory measures for adverse effects on habitats sites, pSPAs, cSACs, and listed or proposed Ramsar sites, on which the Government has initiated public consultation on the scientific case for their designation, should also be considered European Sites. Hereafter, all of the above designated nature conservation sites are referred to as 'European sites'.

1.4.2. HRA stages

Based on the requirements of Articles 63(1) and 64(1) of the Habitats Regulations (previously Articles 6(3) and 6(4) of the Habitats Directive), the European Commission (2001) describes four distinct stages to the HRA process:

- **Stage 1 (Screening):** the process which identifies the likely impacts upon European Sites of a plan or project, either alone or in-combination with other plans or projects, and considers whether these impacts are likely to be significant;
- **Stage 2 (Appropriate Assessment):** the consideration of the impact on the integrity of European Sites of the plan or project, either alone or in-combination with other plans or projects, with respect to the site's structure and function and its conservation objectives. Additionally, where there are adverse impacts, an assessment of the potential mitigation of those impacts;
- **Stage 3 (Assessment of alternative solutions):** Where a plan is assessed as having an adverse impact (or risk of this) on the integrity of a European Site, there should be an examination of alternatives (e.g. alternative locations and designs of development); and,
- **Stage 4 (Assessment of compensatory measures):** an assessment of compensatory measures to offset negative impacts where, in the light of an assessment of imperative reasons of overriding public interest (IROPI), it is deemed that the plan or project should proceed.

This report comprises Stage 2 of the HRA process: Statement to Inform Appropriate Assessment (SIAA). This SIAA assesses the potential impacts that were identified as leading to a likely significant effect on a European Site during the HRA Stage 1: Screening document[2], and determines whether it is possible to ascertain that the project would have no adverse effect on the integrity of a European site.

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[13] Defined by the Convention on Wetlands of International Importance especially as Waterfowl Habitat (otherwise known as the Ramsar Convention).

[14] Sites of Community Importance (SCIs) are sites that have been adopted by the European Commission but not yet formally designated by the government of each country. There is one SCI in the UK, located in Scotland.

2. European Sites potentially affected by the proposals

The Habitats Regulations Assessment Report: Stage 1 Screening[2] identified Oxford Meadows SAC as the only European Site with features that could be subject to LSEs as a result of the Proposed Scheme (refer to section 1.3 above for further details).

2.1. Physical area of the European Site

Oxford Meadows SAC (EU code: UK0012845[15]) comprises four Sites of Special Scientific Interest (SSSIs) distributed alongside the River Thames, located north and south of the A34, covering a total area of 267.4 ha (as shown in Figure D-1 in Appendix D):

- Cassington Meadows SSSI;
- Pixey and Yarnton Meads SSSI;
- Port Meadow with Wolvercote Common and Green SSSI;
- Wolvercote Meadows SSSI.

The closest part of the SAC to the Proposed Scheme is located approximately 1.1 km north-west of the nearest STF. However, the SAC is approximately 3 m north-west and approximately 3 m south-east from the closest point of the ARN, where the A34 bisects the SAC. The two units of the SAC on either side of the ARN consist of Pixey and Yarnton Meads Site SSSI and Wolvercote Meadows SSSI. These are the only parts of the SAC that fall in close proximity to the ARN, and where LSEs could therefore potentially occur.

2.2. Qualifying interests of the European Site

This section gathers information on the SAC, including details on qualifying features and conservation objectives for the SAC.

Oxford Meadows SAC is located on the floodplain of the River Thames to the west and north-west of Oxford. The landscape is characterised by large and small grass fields bounded by tall hedges, with frequent tall willows. The site is made up of a complex of meadows and pastures which support species-rich grassland vegetation which is located on alluvial, river terrace deposits, with silty, free-draining, relatively nutrient-rich soils. In terms of soil chemistry, the soils are typically neutral with localised areas of moderately alkaline conditions. The grasslands include Pixey and Yarnton Meads, and Port Meadows and Wolvercote Common which have a long history of management by traditional hay making, followed by aftermath grazing in the former, and extensive pasture management in the latter. The grasslands are located on predominantly flat ground but small-scale topographical variations create seasonally-wet hollows, marshy areas and drier, raised hummocks, which creates transitions in the vegetation from dry grassland, through damp grassland to tall fen and inundation communities.

The site is designated under article 4(4) of the Directive (92/43/EEC) as it hosts the following habitats listed in Annex I.

- Annex I habitats that are a primary reason for selection of this site:
  - 6510 Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*) – 106.96 ha of total site area.

The SAC supports vegetation communities that reflect the influence of long-term grazing and hay-cutting on lowland hay meadows. The site has benefitted from traditional management which has been undertaken for several centuries, and as a result it exhibits a good conservation of structure and function. The vegetation at Oxford Meadows SAC includes extensive stands of grassland which are strongly associated with floodplain meadows, characterised by the frequent occurrence of greater burnet, meadow foxtail, meadowsweet, pepper saxifrage and knapweed. It is a distinct plant community under the National Vegetation Classification (NVC) as type MG4 *Alopecurus pratensis – Sanguisorba officinalis* grassland, which is a nationally rare grassland type.

[15] English Nature (2005) EC Directive 92/43 on the Conservation of Natural Habitats and of Wild Fauna and Flora Citation for Special Area of Conservation (SAC), Oxford Meadows. Available at: http://publications.naturalengland.org.uk/publication/5815888603250688?category=6528471664689152 [Accessed October 2022].

The grassland is confined to lowland situation and is associated with relatively fertile alluvial soils in floodplains which are subject to seasonal (winter) flooding. This grassland is vulnerable to degradation through excessive nutrient input, changes in the cutting or grazing regimes and changes in hydrology[16].

The site is also designated under article 4(4) of the Directive (92/43/EEC) as it hosts the following species listed in Annex II:

- Annex II species that are a primary reason for selection of this site:
  - 1614 Creeping marshwort *Apium repens*.

Oxford Meadows SAC is selected because Port Meadow is the larger of only two known sites in the UK for creeping marshwort. Creeping marshwort is a very rare plant of seasonally-flooded habitats which are unshaded and have very low levels of competition with surrounding vegetation. It is a perennial, capable of surviving summer flooding. The plant is tolerant of a wide range of environmental conditions (being present in habitats from short-grazed rush pasture, coastal grassland, riverside gravel banks and mown grassland), so long as there is an absence of shading, ground conditions are wet/ damp all year round and there are low levels of competition. It is tolerant of heavy grazing. Within the SAC, creeping marshwort is confined to Port Meadow and is found within a narrow ecological zone associated with seasonally-inundated hollows in the middle and southern parts of the site[16].

2.3. Conservation objectives

Natural England has identified the following conservation objectives for Oxford Meadows SAC[17]:

With regard to the SAC and the natural habitats and/or species for which the site has been designated [lowland hay meadows, creeping marshwort], and subject to natural change, ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;

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

Natural England has produced supplementary advice on conserving and restoring the site features of the Oxford Meadows SAC[16]. This document describes the attributes and targets for each of the qualifying features, which are summarised in Table 2-1 below.

Table 2-1 - Attributes and targets for the qualifying features of Oxford Meadows SAC

Attributes		Targets
H6510. Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*)		
Extent and distribution of the feature	Extent of the feature within the site	Maintain the total extent of the feature to at or above the baseline level of 106.96 hectares.
	Spatial distribution of the feature within the site	Maintain the distribution and configuration of the feature, including where applicable its component vegetation types, across the site.
Structure and function (including its typical species)	Vegetation community composition	Ensure the component vegetation communities of the feature are referable to and characterised by the following National Vegetation Classification type: MG4 *Alopecurus pratensis - Sanguisorba officinalis* grassland.

[16] Natural England (2019) European Site Conservation Objectives: Supplementary advice on conserving and restoring site features. Available at: http://publications.naturalengland.org.uk/publication/5815888603250688?category=6528471664689152 [Accessed October 2022].

[17] Natural England (2019) European Site Conservation Objectives for Oxford Meadows Special Area of Conservation Site Code: UK0012845. Available at: http://publications.naturalengland.org.uk/publication/5815888603250688?category=6528471664689152 [Accessed October 2022].

Attributes		Targets
	Key structural, influential and/or distinctive species	Maintain or restore as necessary the abundance of the typical species listed below to enable each of them to be a viable component of the Annex 1 habitat: • Constant and preferential plant species of the MG4 *Alopecurus pratensis – Sanguisorba officinalis* grassland type at this site.
	Vegetation: undesirable species	Maintain the frequency/cover of the following undesirable species to within acceptable levels and prevent changes in surface condition, soils, nutrient levels or hydrology which may encourage their spread.
	Vegetation community transitions	Maintain the pattern of natural vegetation zonations/ transitions.
	Soils, substrate and nutrient cycling	Maintain the properties of the underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal: bacterial ratio, to within typical values for the habitat. For this feature soil P index should typically be between index 0 and 1 (< 15 mgl^{-1}).
	Water quality	Where the feature is dependent on surface water and/ or groundwater, maintain water quality and quantity to a standard which provides the necessary conditions to support the feature. For Oxford Meadows SAC groundwater supply should be assessed as 'good' in relation to Water Framework Directive targets. River water quality in the River Thames upstream of the SAC should be assessed as at least meeting the 'good ecological status' target.
	Hydrology: Water table	Maintain a hydrological regime which provides a consistently near-surface water table which typically averages depths of 35 cm (winter), 45 cm (spring), 70 cm (summer) and 60cm (autumn) below ground level.
	Hydrology: Flooding regime	Maintain a hydrological regime which provides a cumulative duration of annual surface flooding which is typically less than 10 days between December-February and less than 3 days between September-November, with no inundations during March – August, subject to natural change.
	Supporting off-site habitat	Maintain the extent, quality and spatial configuration of land or habitat surrounding or adjacent to the site which is known to support the feature.
	Functional connectivity with wider landscape	Maintain the overall extent, quality and function of any supporting features within the local landscape which provide a critical functional connection with the site.
	Adaptation and resilience	Maintain the feature's ability, and that of its supporting processes, to adapt or evolve to wider environmental change, either within or external to the site.
Supporting processes (on which the feature relies)	Air quality	Maintain the concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).
	Conservation measures	Maintain the management measures (either within and/or outside the site boundary as appropriate) which are necessary to maintain the structure, functions and supporting processes associated with the feature.
S1614. *Apium repens* Creeping marshwort		
Population (of the feature)	Area of occupancy	Maintain the known actual area occupied by the feature, typically varies between 100 and 600 m^2 depending on conditions (notably seasonal fluctuations in water table).

Attributes		Targets
	Population abundance	Maintain the abundance of the population at a level which is above the baseline population-size, whilst avoiding deterioration from its current level as indicated by the latest count or estimation. Baseline population size = 100 plants.
Supporting habitat: extent and distribution	Distribution of supporting habitat	Maintain the distribution and continuity of the feature and its supporting habitat, including where applicable its component vegetation types and associated transitional vegetation types, across the site.
	Extent of supporting habitat	Maintain the total extent of the habitat(s) which support the feature at a baseline level of 164.97 hectares, meaning that there should be no reduction in the extent of that part of Port Meadow and Wolvercote Common within the SAC.
Supporting habitat: structure/ function	Hydrological regime	Maintain a regime of winter flooding (at least 2 weeks inundation at least one year in three in areas potentially holding the plant) and gradual drying out in late summer/ autumn.
	Soils, substrate and nutrient cycling	Maintain the properties of the underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal: bacterial ratio, within typical values for the supporting habitat.
	Vegetation composition: invasive non-native species	Ensure that invasive non-native plants are not present or that their effects are maintained at a level which does not significantly affect the feature.
	Vegetation structure	Maintain vegetation supporting Apium repens with typically 5- 10% cover of patchy bare ground in late summer and a sward typically 1-10 cm tall with 75% <5 cm.
	Water level fluctuation	Maintain the zones where winter flooding recedes to leave a drying muddy margin with reduced competition.
	Water quality/ quantity	Maintain water quality and quantity to a standard which provides the necessary conditions to support the feature. For Oxford Meadows SAC groundwater supply should be assessed as 'good' in relation to Water Framework Directive targets. River water quality in the River Thames upstream of the SAC should be assessed as at least meeting the 'good ecological status' target.
Supporting processes (on which the feature and/or its supporting habitat relies)	Adaptation and resilience	Maintain the feature's ability, and that of its supporting habitat, to adapt or evolve to wider environmental change, either within or external to the site.
	Air quality	Maintain concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).
	Conservation measures	Maintain the management measures (either within and/or outside the site boundary as appropriate) which are necessary to maintain the structure, functions and supporting processes associated with the feature and/ or its supporting habitats.
	Grazing pressure	Maintain a stable grazing regime to produce suitable habitat conditions for Apium repens, i.e. maintenance of short sward conditions (at least 75% should be less than 5 cm tall) and with frequent bare patches in damp areas of the site, whilst avoiding excessive 'poaching'.
	Water quantity/ quality	Maintain water quality and quantity to a standard which provides the necessary conditions to support the feature.

In addition, Natural England has produced a Site Improvement Plan[18] that outlines the key threats and pressures on the qualifying species of the SAC and proposed measures to address these issues. These are summarised in Table 2-2 below. This table shows the prioritised issues for the site, the proposed measures to address the issues and the delivery bodies whose involvement is required to deliver the measures. The list of delivery bodies includes those who have agreed to the actions as well as those where discussions over their role in delivering the actions is on-going.

Table 2-2 - The key issues for the SAC with regards to the qualifying features, and the proposed measures to address these issues

Key threats and pressures	Feature affected	Proposed remedial measure	Delivery bodies
Hydrological changes	S1614 Creeping Marshwort	Improve the knowledge and understanding of the hydrological conditions required to sustain and restore the *Apium repens* population.	Delivery lead body: Local partnership Delivery partners: Environment Agency, Natural England, Oxford City Council, Oxfordshire Rare Flora Group
	S1614 Creeping Marshwort	Seek to manage favourable hydrological conditions in the low lying 'dip' in Port Meadow which is the key area for Apium repens. Undertake appropriate management of the channels and ditches linked to this area.	Delivery lead body: Local partnership Delivery partners: Environment Agency, Natural England, Network Rail, Oxford City Council, Oxfordshire Rare Flora Group
Invasive species	S1614 Creeping Marshwort	Prevent Crassula spreading to the lower areas of Port Meadow and affecting the rare *Apium repens* population by the implementation of appropriate control mechanisms - these need to be identified at the national level.	Delivery lead body: Local partnership Delivery partners: Natural England, Oxford City Council, Oxfordshire Rare Flora Group, Wolvercote Commons Committee
	S1614 Creeping Marshwort	Increase the resilience of the rare *Apium repens* population to Crassula and other invasive species by considering SSSI notification for the introduced population at North Hinksey.	Delivery lead body: Natural England Delivery partners: Oxfordshire Rare Flora Group

2.4. Details of existing baseline conditions

The area of the SAC within 200 m of the A34 which could potentially be affected by changes in air quality corresponds with:

- Unit 002 of Pixey and Yarnton Meads SSSI, also known as Pixey Mead[19];
- Unit 001 of Wolvercote Meadows SSSI, also known as Eastern Meadow; and
- Unit 002 of Wolvercote Meadows SSSI, also known as Western Meadow[20].

These SSSI units are shown in Figure D-2 in Appendix D.

2.4.1. Pixey and Yarnton Meads SSSI Unit 002

Unit 002 of Pixey and Yarnton Meads SSSI has a total area of 46.05 ha. No specific field assessment work at this Unit has been undertaken to inform this SIAA. The last SSSI condition assessment of this unit was

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[18] Natural England (2014) Site Improvement Plan: Oxford Meadows. Available at: http://publications.naturalengland.org.uk/publication/4942743310696448 [Accessed October 2022].

[19] Natural England Pixey and Yarnton Meads SSSI. Available at: https://designatedsites.naturalengland.org.uk/SiteDetail.aspx?SiteCode=s1000131 [Accessed: 03/11/2022].

[20] Natural England Wolvercote Meadows SSSI. Available at: https://designatedsites.naturalengland.org.uk/SiteDetail.aspx?SiteCode=s1001707 [Accessed: November 2022].

undertaken by Natural England in 2020[21], when it was assessed as being in Favourable Condition and described as follows:

> *"Pixey Mead is very species-rich lowland meadow which forms part of Oxford Meadows SAC. The grassland is in favourable condition, with a high frequency of lowland meadow indicator species characteristic of NVC community type MG4. Common birds-foot trefoil, great burnet, meadow vetchling, meadowsweet and small blue/ green sedges such as glaucous sedge are frequent. Black knapweed, common meadow-rue, lady's bedstraw, oxeye daisy, pepper saxifrage, ragged robin and yellow rattle are also quite frequent (at 40-50% of sampling points). Goats-beard and common spotted-orchid were seen at 20-30% of sample points. Typical meadow invertebrates are frequent including the 5 spot burnet moth. Overall there is an 80% cover of forbs and sedges, 1% cover of weeds, 0% cover of scrub and trees in the field and 1% cover of bare ground. The grassland therefore meets the targets for the habitat to be considered to be in a favourable condition. The smaller section east of the A34 is slightly less species-rich but still has considerable conservation value. The grassland has typical forbs and sedges ranging from 50 – 99% of cover per metre surveyed. The characteristic plants black knapweed, greater burnet, meadow vetchling, meadowsweet, common bird's-foot trefoil, pepper saxifrage and small blue-green sedges remain frequent in the areas surveyed. Cover of bare ground does not exceed 1% and there are no injurious weeds or other indications of disturbance. The grassland is cut for hay to a traditional regime in early July, and the aftermath grazed."*

It is concluded from this that the lowland hay meadows SAC qualifying feature is present within this unit and is therefore present within 3 m north-west and south-east of the ARN. Aerial imagery indicates that there is continuous grassland cover over this compartment, which can be inferred to be the lowland hay meadows habitat..

The creeping marshwort qualifying feature is not considered to be present within this unit as it is confined to Port Meadow with Wolvercote Common and Green SSSI (as set out in Section 2.4.4 below).

2.4.2. Wolvercote Meadows SSSI Unit 001

Unit 001 of Wolvercote Meadows SSSI has a total area of 3.31 ha. No specific field assessment work at this Unit has been undertaken to inform this SIAA. The last SSSI condition assessment of this unit was undertaken by Natural England in 2010[22], when it was assessed as being in Favourable condition and described as follows:

> *"The whole field has been grazed with horses for a number of years and in 2010 it was grazed earlier on in the year with horses. However, over the summer the horses have been removed and it is currently grazed by 3 cows and 4 calves. Due to the grazing, it is difficult to fully assess the unit using the Conservation Objectives. The whole field looks grazed, but throughout the field the flower heads of Black knapweed, Great burnet, Devil's-bit scabious, Oxeye daisy, Crested dog's-tail, Pepper-saxifrage are all frequent. The field is now included within the hay management with aftermath cattle grazing under an HLS agreement so the future management for the unit is good and a further assessment next year (2011) would help to clarify the condition of the sward further. This field is much drier than unit 2 fields."*

It is concluded from this that the lowland hay meadows SAC qualifying feature is present within this unit and is present approximately 84 m south-east of the ARN. Aerial imagery indicates that there is continuous grassland cover over this compartment, which can be inferred to be the lowland hay meadows habitat. The creeping marshwort qualifying feature is not considered to be present within this unit as it is confined to Port Meadow with Wolvercote Common and Green SSSI (as set out in Section 2.4.4 below).

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[21] Natural England. Pixey and Yarnton Meads SSSI – Pixey Mead (002). Available at: https://designatedsites.naturalengland.org.uk/UnitDetail.aspx?UnitId=1002089 [Accessed October 2022].

[22] Natural England. Wolvercote Meadows SSSI – Eastern Meadow (001). Available at: https://designatedsites.naturalengland.org.uk/UnitDetail.aspx?UnitId=1002448 [Accessed October 2022].

2.4.3. Wolvercote Meadows SSSI Unit 002

Unit 002 of Wolvercote Meadows SSSI has a total area of 3.75 ha. No specific field assessment work at this Unit has been undertaken to inform this SIAA. The last SSSI condition assessment of this unit was undertaken by Natural England in 2020[23], when it was assessed as being in Favourable condition and described as follows:

> *"This part of the SSSI has always had a rather 'grassy' character with plants typical of unimproved grassland rather scattered in distribution though the sward. In the 10 sample points surveyed three long-established grassland indicator species were frequent and one occasional. The cover of herbs in relation to grasses is generally around 40%. There are some moderately nutrient-rich and grassy areas with lots of Yorkshire fog and false oat-grass but also with meadowsweet quite frequent, and more extensive areas of moderately herb-rich areas with widely scattered greater burnet together with other unimproved meadow indicators including meadow brome, pepper saxifrage, creeping Jenny, together with more common plants such as sweet vernal grass, red fescue, lesser stitchwort, meadow buttercup, cocksfoot and creeping buttercup. There is high cover of sedge in some areas. There is little accumulation of thatch or other indications of management neglect. However, shading by tall poplars on the eastern boundary restricts plant diversity in this part of the meadow."*

It is concluded from this that the lowland hay meadows SAC qualifying feature is present within this unit and is present approximately 14 m south-east of the ARN. Aerial imagery indicates that there is continuous grassland cover over this compartment, which can be inferred to be the lowland hay meadows habitat. The creeping marshwort qualifying feature is not considered to be present within this unit as it is confined to Port Meadow with Wolvercote Common and Green SSSI (as set out in Section 2.4.4 below).

2.4.4. Distribution of creeping marshwort

Within the Oxford Meadows SAC, creeping marshwort (*Apium repens)* is only found in Port Meadow, which forms Unit 004 of the Port Meadow with Wolvercote Common and Green SSSI (as shown in Figure D-3 in Appendix D). Creeping marshwort is not found in any of the other component SSSIs of the Oxford Meadows SAC[24]. Port Meadow with Wolvercote Common & Green SSSI is over 400 m from the ARN at its closest point, and Port Meadow Unit 004 is located approximately 900 m from the ARN at the closest point.

As set out in the conservation objectives supplementary advice for Oxford Meadows SAC[25]:

> *"At the time of SAC classification Port Meadow, a component part of the Oxford Meadows complex, was the only known locality for this plant in the UK. It was formerly recorded at widely scattered localities from Fife and Kintyre in Scotland, to East Anglia, London and Oxfordshire. However, by the 1960s only two populations were known to survive in the UK. The second site additional to Port Meadow, Langel Common in Witney, appears to have been lost as a result of agricultural intensification. Two apparently 'native' populations have subsequently been re-discovered at Binsey Green which is on the opposite bank of the Thames from Port Meadow and in a ditchside location in Walthamstow, Greater London.*
>
> *Two 'new' colonies have been successfully established through translocation. The Port Meadow population remains the largest and most consistently recorded of the colonies. On Port Meadow Apium repens is confined to a narrow ecological zone, associated with seasonally-inundated hollows in the middle and southern parts of the site. The number of plants present varies considerably from year to year suggesting that individual plants have a short life span but re-establishment from seed is consistently good when conditions for germination are suitable."*

Therefore, creeping marshwort is not found in Pixey and Yarnton Meads SSSI or Wolvercote Meadows SSSI where the potential LSEs as a result of the operational ARN could occur, and adverse effects on creeping marshwort as a result of the Proposed Scheme can be ruled out.

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[23] Natural England. Wolvercote Meadows SSSI – Western Meadow (002). Available at: https://designatedsites.naturalengland.org.uk/UnitDetail.aspx?UnitId=1002449 [Accessed October 2022].

[24] As set out in Natural England (2006) Apium repens creeping marshwort Species Recovery Programme 1995-2005. Available at: http://publications.naturalengland.org.uk/publication/65065 [Accessed November 2002].

[25] Natural England (2019) European Site Conservation Objectives: Supplementary advice on conserving and restoring site features. Available at: http://publications.naturalengland.org.uk/publication/5815888603250688?category=6528471664689152 [Accessed October 2022].

2.5. Likely future baseline changes at the site in the absence of the Proposed Scheme

As set out in Table 2-3, all SSSI units within the Oxford Meadows SAC were in favourable condition, when last assessed by Natural England, and are considered likely to still be in favourable condition. In the absence of the Proposed Scheme it is expected that the SAC and all of its component SSSI units will continue to remain in favourable condition.

Table 2-3 - The condition of the SSSI units of Oxford Meadows SAC

SSSI	Unit	Condition	Date assessed
Cassington Meadows SSSI[26]	001	Favourable	2011
Pixey and Yarnton Meads[27]	001	Favourable	2010
	002	Favourable	2012
	003	Favourable	2012
Port Meadow with Wolvercote Common and Green SSSI[28]	001	Favourable	2010
	002	Favourable	2010
	003	Favourable	2022
	004	Favourable	2010
Wolvercote Meadows SSSI[29]	001	Favourable	2010
	002	Favourable	2010

2.6. Key ecological factors for maintaining site integrity

Table 2-1 above sets out the attributes and targets of the SAC which should be maintained or restored. Only those attributes applicable to the lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*) are of relevance to this SIAA, as creeping marshwort is restricted to Port Meadow Unit 004 of the Port Meadow with Wolvercote Common and Green SSSI, which is located approximately 900 m from the ARN at the closest point.

The targets for lowland hay meadows relevant to the LSEs being considered in this SIAA are:

- Maintaining water quality and quantity to a standard which provides the necessary conditions to support the feature;
- Maintain the concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).

Table 2-2 above sets out the key issues for the SAC with regards to the qualifying features. However, these key issues all relate to creeping marshwort and will not be affected by the Proposed Scheme.

[26] Natural England *Cassington Meadows SSSI*. Available at: https://designatedsites.naturalengland.org.uk/SiteDetail.aspx?SiteCode=s1006658 [Accessed November 2022].
[27] Natural England *Pixey and Yarnton Meads SSSI*. Available at: https://designatedsites.naturalengland.org.uk/SiteDetail.aspx?SiteCode=s1000131 [Accessed November 2022].
[28] Natural England *Port Meadow with Wolvercote Common & Green SSSI*. Available at: https://designatedsites.naturalengland.org.uk/SiteDetail.aspx?SiteCode=s1000153 [Accessed November 2022].
[29] Natural England *Wolvercote Meadows SSSI*. Available at: https://designatedsites.naturalengland.org.uk/SiteDetail.aspx?SiteCode=s1001707 [Accessed November 2022].

3. Assessment methodologies and assumptions

3.1. Background

The purpose of this SIAA is to establish whether there are elements of the Proposed Scheme that could have an adverse effect on the integrity of Oxford Meadows SAC. All available information about the Proposed Scheme was gathered, including air quality modelling data and surface water quality modelling. The assessment of integrity is based on the site features and conservation objectives.

3.2. Surface water quality modelling methodology

3.2.1. Background

The surface water quality assessment detailed within this report has been undertaken in accordance with the DRMB LA 113 (Road Drainage and the Water Environment) and LA 104 (Environmental assessment and monitoring). The assessments considers the impact of routine road runoff on receiving watercourses and the risk of a spillage causing a pollution incident. To fully understand the potential impacts of the Proposed Scheme on surface water quality, assessments have been undertaken for the baseline (existing conditions) and the Proposed Scheme. In terms of the surface water quality assessment the only difference between the baseline and Proposed Scheme assessments is a change in two-way Annual Average Daily Traffic (AADT) flows and the percentage Heavy Goods Vehicles (HGVs).

The Proposed Scheme includes the installation of Strategic Traffic Filters. During operation of the Proposed Scheme, the traffic filters will affect car accessibility and may lead to displacement of traffic onto other routes. One of the routes which may receive the displaced traffic is the A34. The section of the A34 which is located to the north-west of Oxford City Centre intersects Oxford Meadows SAC. AADT flows have an influence on concentrations of pollutants found in highway discharges, with higher AADT equating to increased pollutant concentrations. Therefore if a highway outfall discharges into a watercourse which interacts with Oxford Meadows SAC there is potential for some deterioration in surface water quality which may affect the SAC.

Following a review of modelled traffic flows it was established that the Proposed Scheme was predicted to result in a 7% increase in two-way AADT flows on this section of the A34. Using National Highways Drainage Data Management System (HADDMS) it was identified that a highway outfall (HADDMS reference SP4809_3163f) is located immediately adjacent to the SAC and may discharge into a watercourse (tributary of Wolvercote Mill Stream) which flows through Oxford Meadows SAC. A site visit was undertaken in August 2022 to try and verify the receiving watercourse of the outfall. Following the site visit and analysis of elevation data it was concluded that it is very likely that the tributary of Wolvercote Mill Stream does receive drainage from the outfall, although it was recorded as being dry at the time of the site visit.

It was therefore decided that a surface water quality assessment following the DMRB LA 113 standard should be undertaken to determine what impact (if any) the outfall currently has on the SAC and how this may change as a result of the Proposed Scheme.

As outlined in DMRB LA 113 the significance of potential effects on the water environment starts with the identification of the importance of the water receptors. The importance of water receptors has been established using Table 3.70 from the DMRB LA 113.

A magnitude of impact is then assigned to each receptor using Table 3.71 from DMRB LA 113. The magnitude of impact is determined through the routine runoff and surface water quality assessment (the Highways England Water Risk Assessment Tool (HEWRAT)) and the spillage assessment. If required a Bioavailability assessment is undertaken using UKTAG Rivers and Lakes Metal Bioavailability Assessment Tool (M-BAT). When determining the magnitude of impact mitigation measures are taken into consideration. Further details of the routine runoff and surface water quality assessment (HEWRAT), spillage assessment and bioavailability assessment are presented in sections 3.2.3 and 3.2.4.

Once the importance of each receptor and the magnitude of the potential impact upon it are established, the significance of the potential effects are determined in accordance with Table 3.8.1 in DMRB LA 104.

3.2.2. Drainage Catchment

The impermeable road area draining to the outfall has been calculated using data available on HADDMS and through using elevation data.

The elevation data was used to establish where the high and low points are located along the A34. The low points indicate where outfalls are potentially located, and the high points indicate the potential boundary of a drainage catchment. This information was used to validate the information gathered from HADDMS.

Through analysing the data on HADDMS it was determined that the drainage catchment extends approximately 450 m north-east to where the A34 crosses the Wolvercote Mill Stream and 200 m south-west to where the A34 crosses the River Thames. This was validated by the elevation data which showed the high points to be located on the bridges which cross the River Thames and Wolvercote Mill Stream. It was estimated that the carriageway is 25 m wide using Google Maps Satellite View, giving an impermeable area of 1.625 ha draining to the outfall. The location of the outfall and the drainage catchment extent is presented in Figure 3-1.

HADDMS also showed that filter drains are present throughout the drainage catchment.

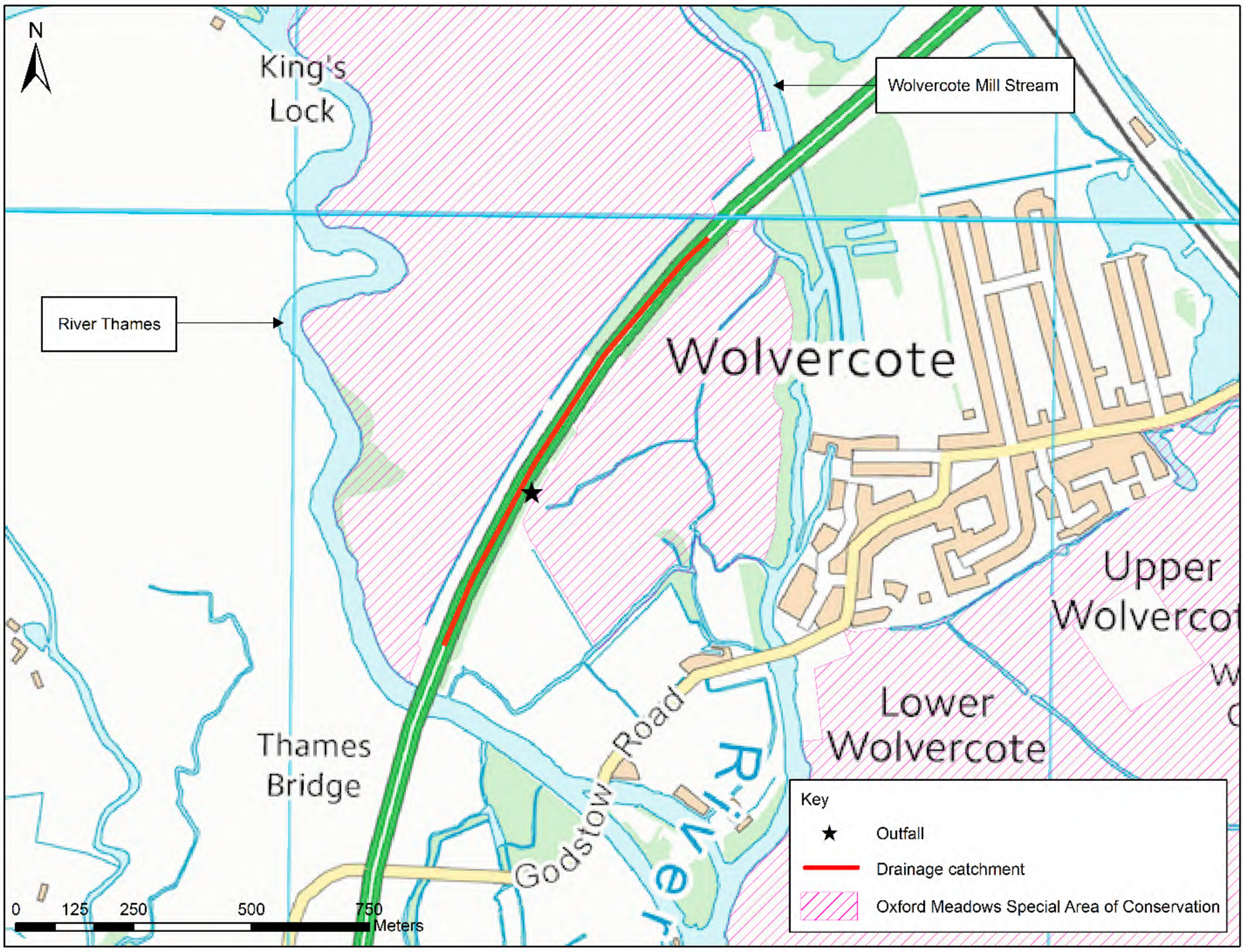

Figure 3-1 - Outfall and drainage catchment locations. *Contains OS data © Crown copyright [and database right] (2022)*

3.2.3. Routine runoff assessment

3.2.3.1. Simple assessment

The HEWRAT has been used to assess whether the impact of routine runoff on surface water quality is acceptable by assessing the acute impacts from soluble pollutants, chronic impacts from sediment related pollutants and compliance with Environmental Quality Standards (EQS) using annual average concentrations of soluble pollutants. The EQSs used for the assessment are pre-defined in the HEWRAT:

- Bioavailable dissolved copper 1 µg/l; and,
- Bioavailable dissolved zinc 10.9 µg/l.

The assessment for chronic impacts from sediment contains two tiers of assessment:

- Tier 1 is a simple assessment requiring only an estimate of the river width; and,
- Tier 2 is a more detailed assessment which requires the physical dimensions of the river.

Tier 1 is initially used for the assessment with Tier 2 only being used if the assessment fails using Tier 1.

The following results are obtained from the HEWRAT:

- A pass or fail result for acute impacts from soluble pollutants;
- A pass or fail result for chronic impacts due to sediment related pollutants; and,
- Compliance with EQSs annual average concentrations of soluble pollutants.

For the assessment of impacts associated with soluble pollutants, outfalls within 1 km (measured along the watercourse) are aggregated for purposes of cumulative assessment.

For the assessment of impacts associated with sediment related pollutants, outfalls within 100 m (measured along the watercourse) are aggregated for purposes of cumulative assessment.

3.2.3.2. Detailed assessment

When the annual average concentrations of soluble pollutants predicted by the HEWRAT exceed the EQS a detailed bioavailability assessment is carried out using the M-BAT.

The M-BAT is used to provide a more detailed assessment for annual average concentrations of soluble pollutants following dilution. The M-BAT is a simplified version of the 'full' biotic ligand models[30] (BLMs) for copper and zinc and the key output is an estimate of the bioavailable concentration of a metal under the conditions found at a site (WFD – UKTAG[31], 2014).

Additional water quality data (dissolved organic carbon (DOC), dissolved calcium (Ca) and pH) are required for this assessment. This water quality data is used to calculate a Predicted No Effect Concentration (PNEC) for dissolved copper and dissolved zinc. The PNEC can be considered a site-specific EQS and is compared to the annual average concentrations of dissolved copper and dissolved zinc predicted in the HEWRAT. The annual average concentrations of dissolved copper and dissolved zinc predicted in the HEWRAT need to be below the dissolved copper and dissolved zinc PNEC values for compliance.

3.2.4. Spillage assessment

The HEWRAT provides an automated facility to perform the spillage assessment. The assessment determines the risk of a pollution incident occurring as the result of a spillage.

The assessment initially estimates the risk that there will be an incident causing the spillage of a potentially polluting substance somewhere on the length of road being assessed. It then calculates the risk, assuming a spillage has occurred, that the pollutant will reach and impact on the receiving watercourse or groundwater. The pollution impacts considered are those that fall into either Category 1 or 2 incidents, as defined by the Environment Agency in their Common Incident Classification System (CICS), hereafter described as 'serious pollution incidents'. The risks are expressed as annual probabilities of such an event occurring, allowing objective decisions to be made as to their acceptability, or whether measures are needed to reduce the risk.

Using the spillage assessment method, for the risk of a serious pollution incident to be acceptable the calculated annual probability of such an incident shall not be greater than 1%. Using the spillage assessment method, for the risk of a serious pollution incident to be acceptable the calculated annual probability shall not be greater than 0.5% where spillage has the potential to affect a:

- SSSI;
- Source Protection Zone (SPZ);
- Protected area;
- Drinking water supply; or

[30] A BLM is a predictive tool that can take account of water quality parameters (such as calcium and pH) to determine the amount of bioavailable metal present (WFD-UKTAG, 2014).
[31] Water Framework Directive – United Kingdom Technical Advisory Group (WFD-UKTAG).

- Commercial activity abstracting from the watercourse.

Where more than one outfall discharges to the same reach of a watercourse, the combined risk from the outfalls is assessed.

3.2.5. Input Data

3.2.5.1. Simple routine runoff assessment

Table 3-1 presents the input data and its sources for the simple routine runoff assessment.

Table 3-1 – Simple routine runoff assessment input data

Parameter	Value used for assessment	Source or assumption
AADT band	>=50,000 and <100,000	Traffic modelling undertaken for the Proposed Scheme
Climatic region	Warm/dry	HEWRAT v2.0 Help Guide[32]
Rainfall site	London	HEWRAT v2.0 Help Guide
Annual Q_{95} River Flow	0.001 m^3/s	Assumption – watercourse was dry when visited in August 2022, therefore the lowest Q_{95} flow the tool accepts was used for the assessment Assumed watercourse is ephemeral
Base Flow Index (BFI)	0.5	Default value
Impermeable road area drained (ha)	1.625 ha	Calculated using HADDMS data, elevation data and Google Maps Satellite View
Permeable area draining to outfall (ha)	0.000 ha	Assumed to be zero
Discharge within 1km of protected site for conservation	Yes	MAGIC website[33]
Downstream structure, lake, pond or canal that reduced velocity within 100m of the point of discharge	No	MAGIC website
Estimated river width (m)	1.5 m	Google Maps Satellite View
Ambient background concentration for dissolved copper (µg/l)	1.4 µg/l	Environment Agency's Water Quality Archive[34]
Water Hardness (for dissolved zinc only)	High =>200mg CaCO3/l	Defra – Map showing the rate of hardness in mg/l as Calcium Carbonate in England and Wales
Mitigation for treatment for soluble	Dissolved copper 0% Dissolved zinc 45%	Indicative treatment efficiency for filter drains taken from CG 501 Table 8.6.4N3 Pollution and flow control measure options.
Mitigation for treatment for sediments	60%	

[32] As available from the National Highways (2022) *HA DDMS Drainage Data Management System*. Available at: http://www.haddms.com/index.cfm?fuseaction=home.home [Accessed November 2022].
[33] Multi-Agency Geographic Information for the Countryside. Available at: https://magic.defra.gov.uk/MagicMap.aspx [Accessed November 2022].
[34] Environment Agency (2022) *Water Quality Data Archive*. Available at: Open WIMS data [Accessed November 2022].

Assessments have been undertaken for the baseline and with Proposed Scheme so a comparison can be made. The variable factor for these two assessments is two-way AADT flows. Table 3-2 shows the existing AADT flows for the base year and the AADT flows for the Proposed Scheme. As the HEWRAT requires AADT to be input in bands (>10,000 and <50,000, >=50,000 and <100,000 and >=100,000) the results of the routine runoff assessment will be the same for both the baseline and for the Proposed Scheme because both AADT values are within the same band, i.e. >=50,000 and <100,000.

Table 3-2 - Annual Average Daily Traffic Flows (AADT)

Traffic modelling scenario	AADT northbound carriageway	AADT southbound carriageway	Two-way AADT
Base Year (2018)	41,805	39,040	80,845
With the Proposed Scheme (2024)	44,253	42,486	86,739

3.2.5.1.1. Calculating indicative treatment efficiencies

Indicative treatment efficiencies for mitigation measures have been taken from Table 8.6 4N3 (Pollution and flow measures options) from DMRB CG 501 (Design of highway drainage systems). Table 8.6.4N3 provides an indicative treatment efficiency (shown as percentage removal) for suspended solids, dissolved copper and dissolved zinc. Table 3-3 below presents the indicative treatment efficiencies for filter drains. Table 8.6.4N3 from DMRB CG 501 states that filter drains remove no dissolved copper. It is likely that filter drains do remove dissolved copper as they remove dissolved zinc and these metals would be removed by similar processes. However, for the assessments the DMRB standards have been followed and therefore 0% removal for dissolved copper has been used.

Table 3-3 - Indicative treatment efficiencies for filter drains

Measure	Suspended solids % removal	Dissolved copper % removal	Dissolved zinc % removal
Filter drains	60	0	45

3.2.5.2. Detailed routine runoff assessment

The input data for the M-BAT have been obtained from the Environment Agency's water quality data archive[35]. There were no sampling points located on the tributary of Wolvercote Mill Stream which receives the highway discharge. There was a sampling point located on Wolvercote Mill Stream but none of the parameters required for the M-BAT are collected at this point. The nearest sampling point which collects the required data is located on the River Thames approximately 250 m upstream of the confluence of Wolvercote Mill Stream and the River Thames. The sampling point is shown in Figure 3-2.

[35] Environment Agency (2022) *Water Quality Data Archive*. Available at: Open WIMS data [Accessed November 2022].

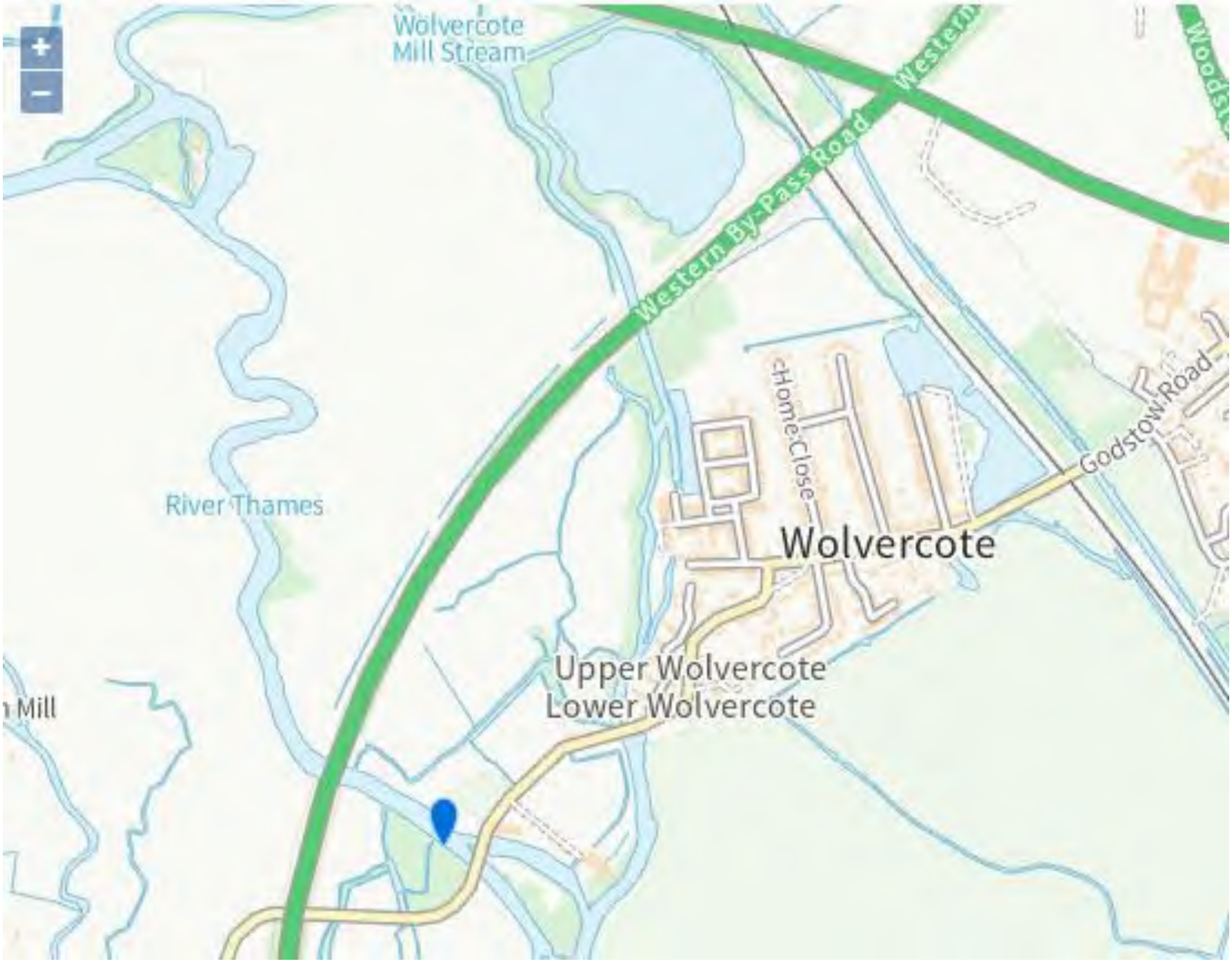

Figure 3-2 - River Thames at Trout Inn, Godstow sampling point (indicated by blue marker on map).
Contains OS data © Crown copyright [and database right] (2022).

It should be noted that the River Thames at Trout Inn, Godstow sampling point stopped collecting the required parameters for the M-BAT in 2013 for dissolved copper and in 2019 for the remaining parameters (dissolved Ca, DOC and pH). The input data presented in Table 3-4 have been calculated by taking an average over 2013 for dissolved copper and an average over 2019 for dissolved Ca, DOC and pH.

Table 3-4 – M-BAT input data

Parameter	Unit	River Thames at Trout Inn Godstow
Dissolved Copper	µg/l	1.4
Dissolved Calcium	mg/l	101
DOC	mg/l	3.8
pH	pH units	8.2

3.2.5.3. Spillage assessment

Table 3-5 presents the input data and its sources for the spillage assessment.

One of the inputs for the assessment is AADT and %HGVs. AADT and %HGVs has been modelled for the baseline and for the Proposed Scheme. The assessment will consider both these modelling scenarios.

Table 3-5 – Spillage assessment input data

Parameter	Value used for assessment
Waterbody type	Surface water
Location (response time for emergency services)	<20 minutes
Road Type (A- road or motorway)	A-road
If A road, is site urban or rural?	Rural
Traffic flow (AADT 2-way) (Baseline)	80,845
Traffic flow (AADT 2-way) (With the Proposed Scheme)	86,739
% HGV (Baseline)	6
% HGV (With the Proposed Scheme)	5
Mitigation factor	0.6
Junction type	No junction
Length of road draining to outfall (m)	650
Spillage factor	0.29

3.2.5.3.1. Calculating spillage risk reduction factors

Optimum spillage risk reduction factors for mitigation measures (presented as a decimal) have been taken from Table 8.6 4N3 (Pollution and flow measures options) from DMRB CG 501 (Design of highway drainage systems). The optimum spillage risk reduction factor for filter drains is 0.6.

3.3. Air quality modelling methodology

The air quality assessment detailed within this report has followed guidance provided by Natural England, the DMRB LA 105, and the Institute of Air Quality Management (IAQM)[36].

As noted previously, the air quality assessment focusses on the lowland hay meadows feature present in Oxford Meadows SAC. The lowland hay meadows feature is noted as being sensitive to the following items listed on the APIS website[37]:

- concentrations of nitrogen oxides (NO_x);
- concentrations of ammonia (NH_3);
- nitrogen deposition (N dep); and
- acid deposition.

The pollutants and critical levels used in the assessment are provided in Table 3-6.

Table 3-6 – Critical Levels and Loads applicable to Lowland hay meadows

Parameter	Critical Level/ Load
NOx	30 µg/m3 (annual mean) (critical level)
NH3	3 µg/m3 (annual mean) (critical level)
Nutrient nitrogen	20 kgN/hr/yr (lower range of critical load)
Acidity (Acid grassland)	MinCLmaxN: 2.058 keq/ha/yr (critical load)*
Acidity (Calcareous grassland)	MinCLmaxN: 4.856 keq/ha/yr (critical load)*

36 IAQM (2020). A guide to the assessment of air quality impacts on designated nature conservation sites. Version 1.1. Available at: http://iaqm.co.uk/text/guidance/air-quality-impacts-on-nature-sites-2020.pdf

37 Select a Feature | Air Pollution Information System (apis.ac.uk)

**For acid deposition, the maximum nitrogen critical load has been considered, given that the assessment is only considering traffic emissions, and the sulphur deposition will be zero*

Ricardo's RapidAIR dispersion modelling system was used to estimate NO_x and NH_3 pollutant concentrations for the road component of the assessment. Vehicle exhaust emissions factors of NO_x and NH_3 were calculated using fleet specific emissions factors taken from COPERT v5.0[38] and the EMEP/ EEA Emission Inventory Guidebook[39]. Link specific emission factors were calculated using Ricardo's in-house emission calculation tool RapidEMS, which links directly to the RapidAIR dispersion modelling system.

The traffic model data provided vehicle flows for cars, HGVs, LGVs and buses and speeds. A further breakdown of the HGVs into rigid and articulated categories was conducted using local ANPR data to create a percentage of each vehicle type for the whole study domain.

The following scenarios were assessed:

- 2019 base year;
- 2024 do nothing (growth from base year only, DN);
- 2024 do minimum (growth from base year and any committed developments, DM); and
- 2024 do something (growth from base year, any committed developments and the Proposed scheme, DS).

3.3.1. Receptors

Changes in air quality were modelled at points within the SAC along six transects perpendicular to the A34; three on the eastern side of the A34, and three on the western side as shown in Figure E-1 in Appendix E. Receptor points were modelled at 10 m intervals along each transect in line with DMRB LA 105.

3.3.2. Verification

Model verification is the process of determining the local area performance of the base year model in comparison with measured data. The verification step involves comparison of modelled pollutant concentrations at suitable monitoring sites with monitored values that are representative of the base model period (in this case 2019).

Where there is a disparity between modelled and measured concentrations and where further improvements to input data are not possible, then if required, an appropriate adjustment factor can be determined to correct for systematic bias. This adjustment is applied to the base year and future year model outputs.

For this assessment an adjustment factor of 2.56 was derived which was applied to the road NO_x concentrations, this gave an acceptable model performance[40].

In absence of measured ammonia concentrations and in line with guidance in LAQM.TG(16), the NO_x adjustment factor of 2.56 was also applied to the modelled NH_3 output.

3.3.3. Background Concentrations

The output from the RapidAIR dispersion modelling system provides the contribution from road traffic emissions to annual mean concentrations of NO_x and NH_3 at discrete receptor points.

3.3.3.1. Oxides of Nitrogen (NO_x)

NO_x concentrations are combined with estimates of background concentrations obtained from DEFRA based on a combination of modelled values and measurements, to account for other sources of air pollution, and derive total annual mean concentrations for comparison with air quality criteria. Background concentrations used in the assessment have been derived from DEFRA's latest background maps (2018 reference year) for the base year and opening year.

The background NO_x concentrations for the 1 km grid squares covering the SAC are provided below in Table 3-7.

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[38] http://www.emisia.com/copert/
[39] EMEP/EEA air pollutant emission inventory guidebook 2019 — European Environment Agency (europa.eu)
[40] Ricardo Energy & Environment (2022). Oxford Traffic Filters Scheme Air Quality Modelling Report.

Table 3-7 - Background NOx Concentrations within Oxford Meadows SAC, µg/m3

Grid Square	2019	2024
448500, 210500	21.4	17.3
448500, 209500	21.3	17.1

3.3.3.2. Ammonia (NH_3)

The road NH_3 concentration at each receptor point was added to the background ammonia concentration of 2.36 µg/m^3 [41] to derive the total ammonia concentration. In line with a precautionary approach, no change was made to the background concentration in the future opening year.

3.3.4. NOx to NO_2

To derive road NO_2 concentrations from the modelled road NO_x concentrations, the method described in the Department for Environment, Food & Rural Affairs (Defra) LAQM Technical Guidance[42] was used. The total annual mean NO_2 is calculated from the modelled road NO_x and background NO_2. The conversion was carried out using the NO_x to NO_2 conversion spreadsheet Version 8.1 available from the tools on the Defra UK-AIR website[43].

Calculating the road NO_2 concentrations allows the calculation of total nitrogen deposition rates to be undertaken, as explained below.

3.3.5. Nitrogen deposition rates

The road nitrogen deposition rates were calculated from the road nitrogen dioxide concentrations using the deposition velocities for grassland habitats taken from AQTAG and shown in Table 3-8.

Table 3-8 – Nitrogen Deposition Velocities (AQTAG)

Pollutant	Habitat	Deposition Velocity (m/s)
NO2	Grassland	0.0015
NH3	Grassland	0.020

The total nitrogen deposition rates were calculated by summing the road contribution from both NO_2 and NH_3 and then adding on the background deposition rate of 19.6 kg N/ha/yr[44]. It was assumed that there was no change in nitrogen deposition rates in future years, a conservative assumption, given that there should be a gradual decline in future NO_x concentrations.

3.3.6. Acid deposition rates

The acid deposition rates have been calculated from the nitrogen deposition rates using the following equation taken from the APIS website[45]:

1 keq N/ha/yr = 14 kg N/ha/yr

3.3.7. Assessment Criteria

The results were compared with the relevant critical levels and loads for each scenario. Where a critical level or load was exceeded, further consideration was given to the magnitude of change in the opening year. Where the change was in excess of 1% of the critical level or load, then this information was used to determine the likely significance of effect.

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[41] Taken from the APIS website as the maximum background concentration for 2019, the 3 year average for 2018-2020, at https://www.apis.ac.uk/app

[42] Department for Environment Food & Rural Affairs, Local Air Quality Management, Technical Guidance (TG22), August 2022. Available at: https://laqm.defra.gov.uk/wp-content/uploads/2022/08/LAQM-TG22-August-22-v1.0.pdf

[43] Available at: https://laqm.defra.gov.uk/air-quality/air-quality-assessment/nox-to-no2-calculator/

[44] Taken from the APIS website as the maximum background concentration for 2019, the 3 year average for 2018-2020, at https://www.apis.ac.uk/app

[45] How to get the most out of APIS - FAQ | Air Pollution Information System

The change was considered for both the Proposed Scheme alone (Do Something minus Do Minimum) and the Proposed Scheme in combination with other plans and projects (Do Something minus Do Nothing).

4. Potential impacts on European Sites

As set out above, the Proposed Scheme will have no construction impacts on any European Sites.

During the HRA Stage 1 screening[2], potential LSEs were identified with regards to surface water and air quality on Oxford Meadows SAC due to the close proximity of the operational ARN. There are no other potential LSEs as a result of the Proposed Scheme.

Due to the close proximity of the Pixey and Yarnton Meads SSSI and Wolvercote Meadows SSSI to the operational ARN of the Proposed Scheme, there is potential for operational impacts on these component SSSIs of Oxford Meadows SAC and their lowland hay meadows feature.

Port Meadow with Wolvercote Common and Green SSSI is over 400 m from the ARN at its closest point, and separated by Godstow Road. Cassington Meadows SSSI is over 1.8 km from the ARN at the closest point. Therefore, these two component SSSIs of Oxford Meadows SAC can be ruled out from any potential impacts.

Within Oxford Meadows SAC, creeping marshwort *Apium repens* is only found in Port Meadow, which forms Unit 004 of the Port Meadow with Wolvercote Common & Green SSSI. Port Meadow Unit 004 is approximately 900 m from the ARN at the closest point. Therefore, any potential surface water and air quality impacts resulting from operational ARN will have no effect on creeping marshwort.

A summary of the potential impacts of the qualifying features of Oxford Meadows SAC is provided in Table 4-1 below.

Table 4-1 – Summary of potential impacts on the qualifying features of Oxford Meadows SAC

LSE	SAC feature	Potential impact
Operational surface water impact	Lowland hay meadows	Potential impact on Pixey and Yarnton Meads SSSI, and Wolvercote Meadows SSSI components of SAC only (due to close proximity to ARN)
	Creeping marshwort	No potential impact (due to only occurring within Port Meadow, which is approximately 900 m from ARN at the closest point)
Operational air quality impact	Lowland hay meadows	Potential impact on Pixey and Yarnton Meads SSSI, and Wolvercote Meadows SSSI components of SAC only (due to close proximity to ARN)
	Creeping marshwort	No potential impact (due to only occurring within Port Meadow, which is approximately 900 m from ARN at the closest point)

4.1. Surface water impacts (alone and in-combination)

4.1.1. Results

4.1.1.1. Routine Runoff Assessment

Table 4-2 presents the results of the simple routine runoff assessment for the baseline and with the Proposed Scheme. As shown in Table 4-2 the outfall fails the acute impacts from soluble copper assessment and passes the acute impacts from soluble zinc assessment for both scenarios (baseline and with the Proposed Scheme).

Table 4-2 - Simple routine runoff assessment results

Acute impacts from soluble copper – pass or fail	Acute impacts from soluble zinc – pass or fail	Compliance with EQS for copper (compliant or non-compliant)	Compliance with EQS for zinc (compliant or non-compliant)	Chronic impacts from sediment-bound pollutants – pass or fail
Baseline				
Fail	Pass	Non-compliant	Compliant	Pass

With the Scheme				
Fail	Pass	Non-compliant	Compliant	Pass

There are two thresholds used in the acute impacts from soluble pollutants assessment: six hours and 24 hours. The 24 hours threshold is designed to protect against worst case conditions whereas the six hours is designed to protect against more typical exposure conditions of aquatic organisms to soluble pollutants in highway runoff. The acute impacts from soluble copper fails the 24 hours threshold but passes the six hours threshold. Both scenarios exceed the freshwater EQS for dissolved copper, but are compliant with the freshwater EQS for dissolved zinc. The outfall also passes the chronic impacts from sediment bound pollutants assessments for both scenarios.

As the annual average concentration of dissolved copper exceeds the freshwater EQS for both scenarios, the M-BAT was used to predict a PNEC (site-specific EQS) for the watercourses which receive highway runoff. The PNEC generated by the M-BAT is presented in Table 4-3. When the PNEC value is compared to the annual average concentration of dissolved copper predicted by the HEWRAT (Table 4-3) for both scenarios the outfall is compliant with the site-specific dissolved copper EQS.

Table 4-3 - Detailed routine runoff assessment results

PNEC (µg/l)	Annual average concentration of dissolved copper (predicted by HEWRAT) (µg/l)	Compliant with site specific dissolved copper EQS
Baseline		
8.22	2.30	Yes
With the Scheme		
8.22	2.30	Yes

4.1.1.2. Spillage assessment

The results of the spillage assessment are presented in Table 4-4. The risk of a serious pollution incident is deemed acceptable if the annual probability is less than 0.005 (0.5%). The risk is acceptable for the baseline and with the Proposed Scheme. The results show that the increase in two-way AADT and %HGVs has no impact on the results of the spillage assessment.

Table 4-4 - Spillage assessment results

Annual probability of a pollution incident occurring as the result of a spillage	Risk acceptable
Baseline	
0.0001	Yes
With the Scheme	
0.0001	Yes

4.1.2. Assessment of effects

4.1.2.1. Routine runoff assessment

Using the criteria in DMRB LA 113 and DMRB LA 104 the magnitude of impact and significance of effect has been determined for the outfall for the baseline assessment and the Proposed Scheme assessment.

Table 4-5 shows that under both scenarios the highway discharge has a minor adverse magnitude of impact due to failing the dissolved copper acute impacts assessment. As the importance of the receiving watercourses is very high (due to it being located adjacent to a SAC) the significance of effect is moderate adverse.

Table 4-5 – Assigning significance

Importance of receptor	Magnitude of impact	Significance of effect
Baseline		
Very high	Minor adverse	Moderate adverse*
With the Proposed Scheme		
Very high	Minor adverse	Moderate adverse*

*When a receptor has a very high importance and minor adverse magnitude of impact the significance matrix in LA 104 states either a moderate or large significance should be assigned. As the routine runoff assessments for both the baseline and the Scheme only failed the acute impacts from soluble copper and the 24 hours threshold a moderate adverse significance has been assigned to the receptor for both the baseline and the Scheme.

4.1.2.2. Spillage assessment

Using the criteria in DMRB LA 113 and DMRB LA 104 the magnitude of impact and significance of effect has been determined for the outfall for the baseline assessment and with the Proposed Scheme assessment.

Table 4-6 shows that under both scenarios the highway discharge has a negligible magnitude of impact. As the importance of the receiving watercourses is very high (due to it being located in a SAC) the significance of effect is slight adverse.

Table 4-6 – Assigning significance

Importance of receptor	Magnitude of impact	Significance of effect
Baseline		
Very high	Negligible	Slight adverse
With the Proposed Scheme		
Very high	Negligible	Slight adverse

4.1.3. Summary of surface water effects

By comparing the results of the baseline assessment with the Proposed Scheme assessment it can be concluded that the increase in two-way AADT flows and %HGVs has no impact on the predicted water quality of the tributary of Wolvercote Mill Stream. However, the increase in two-way AADT flows (effectively the change variable) was not registered in the routine runoff assessment because the HEWRAT inputs the data in bands, and the baseline and the Proposed Scheme AADT values fell into the same band. Even so, the increase in two-way AADT flows is low (7%) which would result in only a very small increase in the concentrations of pollutants in the highway discharge. The spillage assessment also indicated how insignificant the increase in two-way AADT flows and %HGVs are. The annual probability of a pollution incident occurring as the result of a spillage was the same for both the baseline assessment and the Proposed Scheme assessment.

Even though the assessments have shown the increase in two-way AADT flows and %HGVs results in no change in the impact the outfall has on the tributary of Wolvercote Stream, the routine runoff assessment for the baseline and the Proposed Scheme shows the impact of the highway discharge on the tributary of Wolvercote Mill Stream is of moderate adverse significance. However, this is based on the result of the acute impacts assessment which uses highly conservative thresholds. The assessment also assumes that filter drains, which are present throughout the drainage catchment remove no dissolved copper, which is very unlikely. It is therefore anticipated that the actual impact of the highway discharge on the tributary of Wolvercote Mill Stream will be negligible and unmeasurable for both baseline and Proposed Scheme scenarios. Further evidence to validate this conclusion is provided below.

The acute impacts assessment is designed to protect organisms from short-term exposure (over periods of six hours and 24 hours) to significant pollutants in highway runoff. These thresholds are precautionary because both six hours and 24 hours are longer exposure times than the average exposure of four hours that organisms are likely to experience in receiving waters for highway runoff events[46]. The assessment only fails the 24 hours acute impacts assessment which is highly conservative.

The filter drains which are present in the drainage catchment are likely to remove some dissolved copper, reducing the concentration entering the tributary of Wolvercote Mill Stream. The indicative treatment efficiencies for filter drains were taken from CG 501, Table 8.6 4N3[47]. Although no removal for dissolved copper is listed this is due to lack of insufficient data to assign a percentage removal rather than suggesting no removal capacity for these assets. The fact that filter drains remove dissolved zinc strongly indicates that there would also be removal of dissolved copper as removal would be through similar processes.

As well as the acute impacts assessment using highly conservative thresholds[46] and the assessment assuming that filter drains remove no dissolved copper[47] it should also be noted that the effect of water hardness on dissolved copper is likely to be under-estimated in the acute impacts assessment. Metals are problematical because their toxicity is affected by water hardness, so the effects of hardness need to be considered. The tributary of Wolvercote Mill Stream has a high water hardness which effectively buffers and reduces considerably the toxicity of metals in solution. This has been shown in the detailed routine runoff assessment which used the M-BAT to predict a site-specific EQS value for dissolved copper. The high water hardness meant a higher site-specific EQS value was calculated compared to the freshwater EQS limit used in the HEWRAT. This illustrates how hardness impacts on the toxicity of dissolved copper and that it is likely to not be represented in the acute impacts assessment.

Finally, it should also be noted that the tributary of Wolvercote Mill Stream is an ephemeral stream. The routine runoff assessment is limited in its ability to assess the impact on watercourses where the flow is intermittent or seasonal. As Wolvercote Mill Stream is ephemeral the highway discharge will at times soak into the ground close to the location of the outfall and not enter the tributary of Wolvercote Mill Stream which flows through Oxford Meadows SAC.

Overall, based on the facts that the 24 hours threshold used in the acute impacts assessment is highly conservative, the high hardness of the receiving water will act as a buffer to metal toxicity and the filter drains present in the drainage catchment are likely to remove some dissolved copper it can be concluded that the highway discharge coming from the outfall into the tributary of Wolvercote Mill Stream will contribute a negligible impact and thus a slight adverse significance, for both baseline and Proposed Scheme scenarios. Therefore, the small increase in two-way AADT flows and %HGVs is not anticipated to be a measurable effect and will have no adverse impact on the integrity of Oxford Meadows SAC.

These calculations have been carried out on a traffic model that includes other schemes, and thus includes an ‘in-combination’ assessment. As a result, adverse effects on the integrity of Oxford Meadows SAC have been ruled out ‘in-combination’ and therefore by definition, also ‘alone’.

4.2. Air quality impacts (alone and in-combination)

The results of the air quality assessment are provided in Appendix E. A summary of the results is provided below.

4.2.1. NOx

Total annual mean concentrations of NOx are estimated to exceed the 30 µg/m3 critical level at receptors within the SAC with all scenarios in the opening year.

In addition there is expected to be a change in the annual mean NOx concentration of over 1% of the critical level with the Proposed Scheme both alone and in-combination. The receptor points with both an exceedance of the critical level and a change of over 1% are located up to 30 m from the SAC boundary with the Proposed Scheme alone, and up to 50 m from the SAC boundary with the scheme in combination with other plans or projects.

[46] Johnson, I. and Crabtree, R.W., 2007, Effects of Soluble Pollutants on the Ecology of Receiving Waters, WRc Plc, Report No.: UC 7486/1, UK Highways Agency.

[47] National Highways (2022) Design Manual for Roads and Bridges, CG 501 Design of highway drainage systems.

4.2.2. Ammonia

Total annual mean concentrations were below the critical level of 3 µg/m^3 at all receptor points within the SAC. In addition there were no changes exceeding 1% of the critical level either with the Proposed Scheme alone or in combination with other plans or projects.

4.2.3. Nitrogen Deposition

The total nitrogen deposition rates were above the lower range of the critical load of 20 kgN/ha/yr at all receptor points. However there were no receptors with a change of over 1% of the critical load wither with the Proposed Scheme alone or in combination with other plans or projects.

4.2.4. Acid Deposition

Total acid deposition rates were below the critical loads for both acid and calcareous grassland at all receptor points within the SAC. In addition there were no changes exceeding 1% of either critical load either with the Proposed Scheme alone or in combination with other plans or projects.

4.2.5. Consideration of Likely Significant Effects

As noted in section 2.3 the Conservation Objectives of relevance for air quality are to maintain the concentrations and deposition of air pollutants at or below the site-relevant Critical Load or Level values for this feature of the site on APIS.

As noted above, the only screening threshold that was exceeded was for annual mean NOx concentrations, where changes with the Proposed Scheme exceeded 1% of the critical level of 30 µg/m3 both with the Proposed Scheme alone and in combination with other plans and projects, and concentrations were above the critical level. The discussion below therefore focusses on this pollutant only.

In line with a precautionary approach, the qualifying features of Oxford Meadows SAC, the lowland hay meadows, were assumed to be spread throughout the SAC and thus would be affected by the changes in NOx concentrations arising with the Proposed Scheme. The area affected by the increase in concentrations above 1% of the critical level is predominantly at receptor points along the eastern transects, given the predominant south westerly wind, and is expected to affect an area up to 30 m from the edge of the SAC with the scheme alone, and up to 50 m from the edge of the SAC with the scheme in combination.

The largest change at any receptor point is expected to be 0.7 µg/m3 with the Proposed Scheme alone (2.2% of the critical level), and 0.8 µg/m3 with the Proposed Scheme in combination (2.7%). The highest changes are expected at the receptor points closest to the road.

However, to put these expected changes in concentration with the Proposed Scheme into context, a comparison of the changes in total NOx concentrations between the base year and the opening year has been made (See Table E-1 in Appendix E). This shows that the smallest change at any receptor, regardless of scenario, is a decrease of 4.4 µg/m3 between 2019 and 2024. This reduction in concentrations can also be seen in Defra's background NOx concentrations presented in Table 3-7 in section 3.3.3. These changes are as a result of the expected future reduction in emissions with a cleaner vehicle fleet.

Hence, in summary, although there will be an increase in NOx concentrations with the Proposed Scheme that is above 1% of the critical level, and which will affect the area of the SAC within an area of up to 50 m closest to the ARN the change with the Proposed Scheme either alone or in combination is expected to be small in comparison to future changes in concentrations, and falls below the current baseline. As the component SSSIs of Oxford Meadows SAC are considered to still be in favourable condition under the current baseline, the change in NOx concentrations as a result of the Proposed Scheme will not change this, and will not have an adverse effect on the integrity of the SAC.

4.2.6. Summary of air quality effects

As set out in Section 2.5, all SSSI units within Oxford Meadows SAC were assessed as being in favourable condition in their most recent assessment.

The only screening threshold that was exceeded was for annual mean NOx concentrations, where changes with the Proposed Scheme exceeded 1% of the critical level of 30 µg/m3. The air quality assessment has shown that NOx levels of the Proposed Scheme, both 'alone' and 'in-combination', will be lower than the 2019 base year, and therefore Oxford Meadows SAC will be exposed to lower levels of air pollution than it currently does. The component SSSIs of Oxford Meadows SAC are considered to be in favourable condition under the current baseline, and therefore will continue to remain in favourable condition when the Proposed Scheme is operational, due to lower levels of air pollution than the current baseline (alone and in-combination). Therefore, changes in air quality as a result of the Proposed Scheme will not have an adverse effect on the integrity of Oxford Meadows SAC.

5. Mitigation

As all potential adverse effects on the integrity of any European Sites as a result of the construction and operation of the Proposed Scheme have been ruled out, there is no requirement for mitigation with regards to Oxford Meadows SAC. Therefore, no specific mitigation is set out within this SIAA.

6. Consultations

A meeting was held with Natural England on the 3rd November 2022. The air quality findings were discussed, and the proposed assessment with regards to an absence of an adverse effect on integrity was agreed in principle.

Natural England will review this SIAA and will advise on whether they support the findings.

7. Conclusions

The Stage 1: HRA screening identified LSEs for the Oxford Meadows SAC with regards to potential surface water and air quality impacts as a result of the operational ARN.

As set out in section 4 above, adverse effects on the integrity of the Oxford Meadows SAC resulting from operational surface water and air quality impacts, both alone and in-combination, have been ruled out:

- The highway discharge coming from the outfall into the tributary of Wolvercote Mill Stream will contribute a negligible impact and thus a slight adverse significance, for both baseline and Proposed Scheme scenarios. Therefore, the small increase in two-way AADT flows and %HGVs is not anticipated to be a measurable effect and will have no adverse effect on the integrity of Oxford Meadows SAC, either alone or in-combination;
- The only screening threshold that was exceeded was for annual mean NOx concentrations, where changes with the Proposed Scheme exceeded 1% of the critical level of 30 µg/m3. The air quality assessment has shown that NOx levels of the Proposed Scheme, both 'alone' and 'in-combination', will be lower than the 2019 base year, and therefore the Oxford Meadows SAC will be exposed to lower levels of air pollution than it currently does, and will continue to remain in favourable condition. Therefore, changes in air quality will not lead to adverse effects on the integrity of Oxford Meadows SAC.

Therefore, it can be concluded with certainty that the construction and operation of the Proposed Scheme will have no adverse effect on the integrity of any European Sites.

Appendices

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