West Oxfordshire District Council

Salt Cross Garden Village Area Action Plan: Pre-Submission Habitats Regulations Assessment Report

Final report
Prepared by LUC, August 2020

West Oxfordshire District Council

Salt Cross Garden Village Area Action Plan: Pre-Submission Draft

Habitats Regulations Assessment Report

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Chapter 1
Introduction

1.1 LUC has been commissioned by West Oxfordshire District Council (WODC) to carry out a Habitats Regulations Assessment (HRA) in relation to the Area Action Plan (AAP) for Salt Cross Garden Village. Expert input relating to air quality has been provided by Air Quality Assessments Ltd.

1.2 This report presents the findings of the Screening and Appropriate Assessment stages of the HRA, which have been undertaken in relation to the Pre-Submission Draft version of the AAP (July 2020). This report builds on the HRA Screening Report that was previously prepared for the Preferred Options version of the AAP (December 2019).

Background to the AAP

1.3 The West Oxfordshire Local Plan 2031 was adopted in September 2018 by WODC. Policy EW1 in the Local Plan allocates the Oxfordshire Cotswolds Garden Village Strategic Location for Growth (the garden village has since become known as 'Salt Cross'). The garden village site is located on land north of the A40 near Eynsham, situated between Oxford in the east and Witney in the west.

1.4 Policy EW1 requires an AAP to be prepared to lead the comprehensive development of the garden village. Once adopted, the AAP will form part of the statutory development plan alongside the West Oxfordshire Local Plan and will be used as the basis for determining any future planning applications for the garden village site.

1.5 The AAP must comply with the National Planning Policy Framework (NPPF). Examples of other national and local plans and strategies of relevance to the AAP include the Government's 25 Year Environmental Plan and the Clean Growth Strategy, as well as the Oxfordshire Housing and Growth Deal, the Local Transport Plan, the Oxfordshire Local Industrial Strategy, and the Oxfordshire Energy Strategy.

1.6 The garden village will provide about 2,200 homes, a 40ha science and technology park and various supporting facilities and services including a park and ride system and new schools. It will also involve the creation of green spaces and ecological corridors.

The requirement to undertake Habitat Regulations Assessment of Development Plans

1.7 The requirement to undertake HRA of development plans was confirmed by the amendments to the Habitats Regulations published for England and Wales in 2007[1]. The currently applicable version is the Conservation of Habitats and Species Regulations 2017[2] (as amended). When preparing the AAP for the garden village, WODC is therefore required by law to carry out an HRA. WODC can commission consultants to undertake HRA work on its behalf and this (the work documented in this report) is then reported to and considered by WODC as the 'competent authority'. WODC will consider this work and may only progress the AAP if it considers that the Plan will not adversely affect the integrity of any European site or have a significant effect on qualifying habitats or species for which the European sites e designated for. The requirement for authorities to comply with the Habitats Regulations when preparing a Plan is also noted in the Government's online Planning Practice Guidance (PPG)[3].

1.8 HRA refers to the assessment of the potential effects of a development plan on one or more European sites, including Special Protection Areas (SPA) and Special Areas of Conservation (SACs):

- SACs are designated under the European Habitats Directive and target particular habitat types (Annex 1) and species (Annex II). The listed habitat types and species (excluding birds) are those considered to be most in need of conservation at a European level.
- SPAs are classified in accordance with Article 4(1) of the European Union Birds Directive[4] for rare and vulnerable birds (as listed in Annex I of the Directive), and under Article 4(2) for regularly occurring migratory species not listed in Annex I.

1.9 Potential SPAs (pSPAs)[5], candidate SACs (cSACs)[6], Sites of Community Importance (SCIs)[7] and Ramsar sites should also be included in the assessment.

- Ramsar sites support internationally important wetland habitats and are listed under the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention, 1971).

1.10 For ease of reference during HRA, these designations have been collectively referred to as European sites[8] despite Ramsar designations being at the international level.

1.11 The overall purpose of the HRA is to conclude whether or not a proposal or policy, or the whole development plan, would adversely affect the integrity of the European site in question, either alone or in combination with other plans and projects. This is judged in terms of the implications of the plan for the 'qualifying features' for which the European site was designated, i.e.:

- SACs – Annex I habitat types and Annex II species[9];
- SPAs – Annex I birds and regularly occurring migratory species not listed in Annex I[10];
- Ramsar sites – the reasons for listing the site under the Convention[11].

1.12 Significantly, HRA is based on the precautionary principle meaning that where uncertainty or doubt remains, an adverse impact should be assumed.

Stages of HRA

1.13 The HRA of development plans is undertaken in stages (as described below) and should conclude whether or not a proposal would adversely affect the integrity of the European site in question.

1.14 The HRA should be undertaken by the 'competent authority', in this case WODC. LUC has been commissioned by WODC to carry out HRA work on the Council's behalf, although this is to be reported to and considered by WODC as the competent authority, before adopting the AAP. The HRA also requires close working with Natural England as the statutory nature conservation body[12] in order to obtain the necessary information, agree the process, outcomes and mitigation proposals. The Environment Agency, while not a statutory consultee for the HRA, is also in a strong position to provide advice and information throughout the process as it is required to undertake HRA for its existing licences and future licensing of activities.

[1] *The Conservation (Natural Habitats, &c.) (Amendment) Regulations 2007* (2007) SI No. 2007/1843. TSO (The Stationery Office), London.
[2] *The Conservation of Habitats and Species Regulations 2017* (2017) SI No. 2017/1012, TSO (The Stationery Office), London.
[3] https://www.gov.uk/guidance/appropriate-assessment
[4] *Council Directive 2009/147/EC of 30 November 2009 on the conservation of wild birds* (the codified version of Council Directive 79/409/EEC, as amended).
[5] Potential SPAs are sites that have been approved by the Minister for formal consultation but not yet proposed to the European Commission, as listed on the GOV.UK website.
[6] Candidate SACs are sites that have been submitted to the European Commission, but not yet formally adopted, as listed on the JNCC's SAC list.
[7] SCIs are sites that have been adopted by the European Commission but not yet formally designated as SACs by the UK Government.
[8] The term 'Natura 2000 sites' can also be used interchangeably with 'European sites' in the context of HRA, although the latter term is used throughout this report.
[9] As listed in the site's citation on the JNCC website (all features of European importance, both primary and non-primary, need to be considered).
[10] As identified in sections 3.1, 3.2 and 4.2 of the SPA's standard data form on the JNCC website; at sites where there remain differences between species listed in the 2001 SPA Review and the extant site citation in the standard data form, the relevant country agency (Natural England or Natural Resources Wales) should be contacted for further guidance.
[11] As set out in section 14 of the relevant 'Information Sheet on Ramsar Wetlands' available on the JNCC website.
[12] Regulation 5 of the Habitats Regulations 2017.

Requirements of the Habitats Regulations

1.15 In assessing the effects of a Plan in accordance with Regulation 105 of the Conservation of Habitats and Species Regulations 2017 (as amended), there are potentially two tests to be applied by the competent authority: a 'Significance Test', followed if necessary by an Appropriate Assessment which would inform the 'Integrity Test'. The relevant sequence of questions is as follows:

- Step 1: Under Reg. 105(1)(b), consider whether the plan is directly connected with or necessary to the management of the sites. If not, then the considerations proceed to Step 2.
- Step 2: Under Reg. 105(1)(a) consider whether the plan is likely to have a significant effect on a European site, either alone or in combination with other plans or projects (the 'Significance Test'). If yes, proceed to Step 3.

  *[Steps 1 and 2 are undertaken as part of Stage 1: HRA Screening in **Table 1.1**.]*
- Step 3: Under Reg. 105(1), make an Appropriate Assessment of the implications for the European site in view of its current conservation objectives (the 'Integrity Test'). In so doing, it is mandatory under Reg. 105(2) to consult Natural England, and optional under Reg. 105(3) to take the opinion of the general public.

  *[This step is undertaken during Stage 2: Appropriate Assessment shown in **Table 1.1**.]*
- Step 4: In accordance with Reg. 105(4), but subject to Reg. 107, give effect to the land use plan only after having ascertained that the plan would not adversely affect the integrity of a European site.
- Step 5: Under Reg. 107, if Step 4 is unable to rule out adverse effects on the integrity of a European site and no alternative solutions exist then the competent authority may nevertheless agree to the plan or project if it must be carried out for 'imperative reasons of overriding public interest' (IROPI).

Typical stages

1.16 **Table 1.1** summarises the stages and associated tasks and outcomes typically involved in carrying out a full HRA, based on various guidance documents[13] [14] [15].

Table 1.1: Stages of HRA

Stage	Task	Outcome
Stage 1: HRA Screening	Description of the development plan and confirmation that it is not directly connected with or necessary to the management of European sites. Identification of potentially affected European sites and their conservation objectives[16]. Review of other plans and projects. Assessment of Likely Significant Effects of the development plan alone or in combination with other plans and projects, prior to consideration of avoidance or reduction ('mitigation') measures[17].	Where effects are unlikely, prepare a 'finding of no significant effect report'. Where effects judged likely, or lack of information to prove otherwise, proceed to Stage 2.
Stage 2: Appropriate Assessment (where Stage 1 does not rule out likely significant effects)	Information gathering (development plan and European sites[18]). Impact prediction. Evaluation of development plan impacts in view of conservation objectives of European sites. Where impacts are considered to directly or indirectly affect qualifying features of European sites, identify how these effects will be	Appropriate Assessment report describing the plan, European site baseline conditions, the adverse effects of the plan on the European site, how these effects will be avoided or reduced, including the mechanisms and timescale for these mitigation measures. If effects remain after all alternatives and mitigation measures have been considered proceed to Stage 3.

[13] European Commission (2001) Assessment of plans and projects significantly affecting European Sites. Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC.
[14] UK Government Planning Practice Guidance, available from https://www.gov.uk/guidance/appropriate-assessment
[15] The HRA Handbook. David Tyldesley & Associates, a subscription based online guidance document: https://www.dtapublications.co.uk/handbook/European
[16] Conservation objectives are published by Natural England for SACs and SPAs.
[17] In line with the CJEU judgment in Case C-323/17 People Over Wind v Coillte Teoranta, mitigation must only be taken into consideration at this stage and not during Stage 1: HRA Screening.
[18] In addition to European site citations and conservation objectives, key information sources for understanding factors contributing to the integrity of European sites include (where available) conservation objectives supplementary advice and Site Improvement Plans prepared by Natural England.

Stage	Task	Outcome
	avoided or reduced ('mitigation').	
Stage 3: Assessment where no alternatives exist and adverse impacts remain taking into account mitigation	Identify 'imperative reasons of overriding public interest' (IROPI). Demonstrate no alternatives exist. Identify potential compensatory measures.	This stage should be avoided if at all possible. The test of IROPI and the requirements for compensation are extremely onerous.

1.17 It is normally anticipated that an emphasis on Stages 1 and 2 of this process will, through a series of iterations, help ensure that potential adverse effects are identified and eliminated through the inclusion of mitigation measures designed to avoid, reduce or abate effects. The need to consider alternatives could imply more onerous changes to a plan document. It is generally understood that so called 'imperative reasons of overriding public interest' (IROPI) are likely to be justified only very occasionally and would involve engagement with both the Government and European Commission (until 31st December 2020).

Recent case law changes

1.18 This HRA has been prepared in accordance with relevant case law findings from the past two years, including most notably the 'People over Wind' and 'Holohan' rulings from the Court of Justice for the European Union (CJEU).

1.19 The *People over Wind, Peter Sweetman v Coillte Teoranta* (April 2018) judgment ruled that Article 6(3) of the Habitats Directive should be interpreted as meaning that mitigation measures should be assessed as part of an Appropriate Assessment and should not be taken into account at the screening stage. The precise wording of the ruling is as follows:

"Article 6(3) …….must be interpreted as meaning that, in order to determine whether it is necessary to carry out, subsequently, an appropriate assessment of the implications, for a site concerned, of a plan or project, it is not appropriate, at the screening stage, to take account of measures intended to avoid or reduce the harmful effects of the plan or project on that site."

1.20 In light of the above, the HRA Screening stage does not rely upon avoidance or mitigation measures to draw conclusions as to whether the AAP could result in 'likely significant effects' on European sites, with any such measures being considered at the Appropriate Assessment stage as relevant.

1.21 The HRA has also considered the *Holohan v An Bord Pleanala* (November 2018) judgement which stated that:

"Article 6(3) of Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora must be interpreted as meaning that an 'appropriate assessment' must, on the one hand, catalogue the entirety of habitat types and species for which a site is protected, and, on the other, identify and examine both the implications of the proposed project for the species present on that site, and for which that site has not been listed, and the implications for habitat types and species to be found outside the boundaries of that site, provided that those implications are liable to affect the conservation objectives of the site.

Article 6(3) of Directive 92/43 must be interpreted as meaning that the competent authority is permitted to grant to a plan or project consent which leaves the developer free to determine subsequently certain parameters relating to the construction phase, such as the location of the construction compound and haul routes, only if that authority is certain that the development consent granted establishes conditions that are strict enough to guarantee that those parameters will not adversely affect the integrity of the site.

Article 6(3) of Directive 92/43 must be interpreted as meaning that, where the competent authority rejects the findings in a scientific expert opinion recommending that additional information be obtained, the 'appropriate assessment' must include an explicit and detailed statement of reasons capable of dispelling all reasonable scientific doubt concerning the effects of the work envisaged on the site concerned."

1.22 LUC has fully considered the potential for effects on species and habitats, including those not listed as qualifying features, to result in secondary effects upon the qualifying features of European sites, including the potential for complex interactions and dependencies. In addition, the potential for offsite impacts, such as through impacts to functionally linked land, and or species and habitats located beyond the boundaries of European site, but which may be important in supporting the ecological processes of the qualifying features, has also been considered in this HRA.

HRA work carried out previously

1.23 At an early stage of the development of the AAP, advice was sought by WODC from Natural England who recommended that the following required consideration:

- The AAP should be screened under Regulation 105 of the Conservation of Habitats and Species Regulations 2017.
- Air Pollution – in particular, traffic impacts on local roads within the vicinity of the garden village site. Designated

sites at risk from local impacts are those within 200m of a road with increased traffic.

- Protecting and Enhancing Environment Assets – the AAP needs to make provisions for appropriate quantity and quality of greenspace to meet identified local needs as outlined in paragraph 96 of the NPPF. Guidance can be sought from Natural England's work on Accessible Natural Greenspace Standard (ANGSt) in assessing current level of accessible natural greenspace and planning improved provision.

1.24 An HRA Screening Report was prepared in December 2019 in relation to the Preferred Options version of the AAP. The conclusion of the Screening Report was that there could be likely significant effects on Oxford Meadows SAC in relation to increased air pollution and Appropriate Assessment was therefore required; all other types of effects on European sites were able to be screened out. That HRA screening exercise has now been updated to reflect the contents of the Pre-Submission Draft version of the AAP (see **Chapter 4**) and the report has been expanded to include the Appropriate Assessment stage of the HRA (see **Chapter 5**).

1.25 The HRA Screening Report for the Preferred Options AAP was sent to Natural England for consultation in December 2019, and the response received can be found in **Appendix A**. Natural England was supportive of the conclusions of the report.

1.26 The West Oxfordshire Local Plan was also subject to HRA throughout its preparation, with the submitted HRA report (March 2015)[19] being updated in October 2016[20] to take into account the Main Modifications to the Plan. The HRA considered all Local Plan policies, including policy EW1 which allocates the garden village. Policy EW1 was screened in as having potential for likely significant effects on Oxford Meadows SAC and Cothill Fen SAC, but following Appropriate Assessment the HRA concluded that there will be no adverse effects on the integrity of any European site from the implementation of the Local Plan as modified, either alone or in combination with other plans and projects. Despite this conclusion, the AAP is still being subject to HRA throughout its preparation, reflecting Natural England's advice, the precautionary principle which underpins the HRA process and in order to allow for the most up-to-date case law to be taken into account.

Structure of this report

1.27 This chapter (**Chapter 1**) has described the background to the preparation of the AAP and the requirement to undertake HRA. The remainder of the report is structured into the following sections:

- **Chapter 2** describes the content of the Pre-Submission Draft version of the AAP. It also describes the European sites in and around West Oxfordshire that could be affected by the AAP and summarises the key issues that need to be considered during the HRA.
- **Chapter 3** describes the approach that has been taken to the HRA of the AAP.
- **Chapter 4** sets out the findings of the Screening stage of the HRA for the Pre-Submission Draft version of the AAP.
- **Chapter 5** sets out the findings of the Appropriate Assessment stage of the HRA for the Pre-Submission Draft version of the AAP.
- **Chapter 6** describes the consultation that will be undertaken in relation to the HRA, and the next steps.

1.28 The information in the main body of the report is supported by the following appendices:

- **Appendix A** presents the consultation response that was received from Natural England in relation to the HRA Screening Report for the Preferred Options AAP (December 2019).
- **Appendix B** presents a map showing the European sites within West Oxfordshire District (+15km).
- **Appendix C** sets out detailed information about the European sites that are the focus of this HRA.
- **Appendix D** includes the screening matrices for the policies in the Pre-Submission Draft AAP.
- **Appendix E** includes the location of Oxford Meadows in relation to the A40 and A34.
- **Appendix F** includes the location of the air quality monitoring transects used within the Oxford Meadows SAC.
- **Appendix G** includes the air quality modelling methodology.
- **Appendix H** sets out the total annual mean NOx on each transect along the A40.

[19] URS (March 2015) West Oxfordshire Pre-Submission Local Plan: Habitats Regulations Assessment.
[20] Aecom (October 2016) West Oxfordshire Local Plan: Habitats Regulations Assessment Incorporating Appropriate Assessment.

Chapter 2
The Salt Cross Garden Village AAP

2.1 The Pre-Submission Draft version of the AAP (July 2020) sets out a vision and objectives for Salt Cross Garden Village as well as a series of policies. The vision for the garden village states that:

> By 2031, Salt Cross will be established as a thriving and inclusive community, epitomising all that is good about West Oxfordshire but with its own strong and distinctive character, form and identity, embracing and celebrating the site's rural setting and important local heritage.
>
> Salt Cross will be known for its emphasis on the environment, quality and innovation and will tackle the challenges presented by climate change 'head-on,' adopting a zero-carbon and natural capital based approach providing a model example of how to plan a new community for the 21st century in a logical, organic and sustainable way. The perfect setting for wildlife and people to flourish together.
>
> Those who live there will enjoy a healthy, high quality of life, with affordable, attractive and energy efficient homes set within leafy, walkable village neighbourhoods closely integrated with extensive green space including a new countryside park and supported by a range of facilities including schools, community space, leisure and recreation and local shopping opportunities.
>
> Those who work there will be drawn by a broad range of exciting employment and training opportunities with high quality business space in an attractive rural setting, reliable and integrated public transport choices and 'future proofed' infrastructure including digital connectivity to enable and encourage high rates of home and remote working.
>
> Those who visit will experience a strong sense of place, will be able to easily and safely find their way around, enjoy a broad range of different activities and opportunities and leave wanting to return time and time again.

2.2 In order to take the vision forward, seven core themes have been identified which form the basis of the AAP:

- Climate action
- Healthy place shaping
- Protecting and enhancing environmental assets
- Movement and connectivity

- Enterprise, innovation and productivity
- Meeting current and future housing needs
- Building a strong, vibrant and sustainable community

2.3 Climate action is purposefully identified as the first theme and forms a 'golden thread' that runs through the AAP, linking to a broad range of issues including transport, design, green space, biodiversity, water management and others.

2.4 The AAP is set out in chapters according to the above themes, with each chapter presenting objectives and policies relating to the theme, which will be used to guide the development of the garden village. There are 31 policies in total.

Potential impacts of the Local Plan on European sites

2.5 **Table 2.1** below sets out the range of potential impacts that development in general and related activities may have on European sites. This has been used as a starting point to help identify the types of effects that the AAP could have on European sites. The AAP will not result in all of the different types of impacts and activities. More information about the types of impacts that the AAP could have, and which therefore need to be considered in this HRA, is provided in **Chapter 3**.

Table 2.1: Potential impacts and activities adversely affecting European sites

Broad categories and examples of potential impacts on European sites	Examples of activities responsible for impacts
Physical loss Removal (including offsite effects, e.g. foraging habitat) Mine collapse Smothering Habitat degradation	Development (e.g. housing, employment, infrastructure, tourism) Infilling (e.g. of mines, water bodies) Alterations or works to disused quarries Structural alterations to buildings (bat roosts) Afforestation Tipping Cessation of or inappropriate management for nature conservation
Physical damage Sedimentation / silting Prevention of natural processes Habitat degradation Erosion Trampling Fragmentation Severance / barrier effect Edge effects Fire	Flood defences Dredging Mineral extraction Recreation (e.g. motor cycling, cycling, walking, horse riding, water sports, caving) Development (e.g. infrastructure, tourism, adjacent housing etc.) Vandalism Arson Cessation of or inappropriate management for nature conservation
Non-physical disturbance Noise Vibration Visual presence Human presence Light pollution	Development (e.g. housing, industrial) Recreation (e.g. dog walking, water sports) Industrial activity Mineral extraction Navigation Vehicular traffic Artificial lighting (e.g. street lighting)
Water table/availability Drying Flooding / stormwater Water level and stability Water flow (e.g. reduction in velocity of surface water Barrier effect (on migratory species)	Water abstraction Drainage interception (e.g. reservoir, dam, infrastructure and other development) Increased discharge (e.g. drainage, runoff)
Toxic contamination Water pollution Soil contamination Air pollution	Agrochemical application and runoff Navigation Oil / chemical spills Tipping Landfill Vehicular traffic Industrial waste / emissions
Non-toxic contamination Nutrient enrichment (e.g. of soils and water) Algal blooms Changes in salinity Changes in thermal regime Changes in turbidity Air pollution (dust)	Agricultural runoff Sewage discharge Water abstraction Industrial activity Flood defences Navigation Construction
Biological disturbance	Development (e.g. housing areas with domestic and public gardens)

Broad categories and examples of potential impacts on European sites	Examples of activities responsible for impacts
Direct mortality Out-competition by non-native species Selective extraction of species Introduction of disease Rapid population fluctuations Natural succession	Predation by domestic pets Introduction of non-native species (e.g. from gardens) Fishing Hunting Agriculture Changes in management practices (e.g. grazing regimes, access controls, cutting/clearing)

Chapter 3
Approach to HRA

3.1 This chapter describes the approach that has been taken to the HRA of the AAP throughout its development.

Identification of European sites which may be affected by the AAP

3.2 In order to initiate the search of European sites that could potentially be affected by the AAP, it is established practice to consider European sites within the local planning authority area covered by a plan, and also within a buffer distance around the boundary of the plan area.

3.3 A distance of 15km from the West Oxfordshire District boundary was used as a starting point to identify European sites that could be affected by new development at the Salt Cross Garden Village north of Eynsham in West Oxfordshire. Consideration was also given to European sites potentially connected to the plan area beyond this distance; for example through hydrological pathways or recreational visits by residents of West Oxfordshire.

3.4 The European sites identified for inclusion in the HRA are listed below and are mapped in **Figure 1** in **Appendix B**.

3.5 European sites within West Oxfordshire District:

- Oxford Meadows SAC

3.6 European sites outside of West Oxfordshire District:

- Cothill Fen SAC
- Hackpen Hill SAC
- Little Wittenham SAC
- North Meadow and Clattinger Farm SAC
- River Lambourn SAC

3.7 There are no SPAs or Ramsar sites within West Oxfordshire District (+15km).

3.8 Hackpen Hill, Little Wittenham, North Meadow and Clattinger Farm and River Lambourn SACs are all situated outside the District boundary (either within, or very close to, the 15km buffer around the District) but were initially considered within this HRA as they had been included within the HRA for the West Oxfordshire Local Plan and to determine if there were any pathways between the garden village and these European sites which may affect their integrity, or the qualifying species/habitats for which they are designated for.

3.9 However, given the location of the garden village boundary within the District, these four SACs are therefore even further than 15km from the garden village boundary. The HRA for the West Oxfordshire Local Plan screened out these SACs, concluding that the Local Plan (including the garden village allocation) would not have likely significant effects on them as there are no impact pathways between the sites and the plan area. Therefore, these SACs are screened out of this HRA and the only European sites that needed to be considered further were Oxford Meadows SAC and Cothill Fen SAC.

Ecological attributes of the European sites

3.10 The designated features and conservation objectives of the two screened in European sites, together with current pressures on and potential threats, have been presented in **Appendix C** using the Standard Data Forms for SACs published on the JNCC website[21] as well as Natural England's Site Improvement Plans[22] and the most recent conservation objectives published on the Natural England website (most were published in 2014)[23].

3.11 An understanding of the designated features of each European site and the factors contributing to its integrity informs the assessment of the potential likely significant effects of the AAP. This approach is useful for understanding the inter-dependencies of non-qualifying species and habitats upon which the qualifying species depend, as recently highlighted as a requirement by the 'Holohan' ruling.

3.12 In general, the six SACs initially included in this screening exercise are designated for their lowland hay meadows, grassland, fen and riverine habitats with no mobile species, except for Little Wittenham SAC which is designated for great crested newts.

Screening Methodology

Assessment of 'Likely Significant Effect'

3.13 As required under Regulation 105 of The Conservation of Habitats and Species Regulations 2017 (the 'Habitats Regulations'), an assessment has been undertaken of the 'likely significant effects' of the policies in the Pre-Submission Draft version of the AAP. The assessment has been undertaken in order to identify which policies would be likely to have a significant effect on European sites in West Oxfordshire (+15km). **Appendix D** presents the screening matrices for the AAP policies, and **Chapter 4** summarises the screening findings and conclusions.

3.14 The screening assessment has been conducted without taking pre-embedded mitigation into account, in accordance with the 'People over Wind' judgment. Where a policy could potentially provide some mitigation for the effects of other proposals within the AAP, this is noted in **Appendix D** but such mitigation has not influenced the screening conclusions. It has, however, been considered during the Appropriate Assessment stage of the HRA where relevant (see **Chapter 5**).

3.15 With reference to the broad impact types shown in **Table 2.1**, consideration has been given to the potential for the development proposed in the AAP to result in significant effects associated with:

- physical loss of/damage to habitat;
- non-physical disturbance (noise, vibration and light);
- non-toxic contamination;
- air pollution;
- recreation pressure; and,
- changes to hydrological regimes.

3.16 Toxic contamination of air and water is addressed within air pollution and changes to hydrological regimes. For the SACs considered within this HRA, biological disturbance is only likely to occur as a result of recreation-related activities; therefore this issue is addressed within recreation pressure.

3.17 A risk-based approach involving the application of the precautionary principle has been adopted in the assessment, such that a conclusion of 'no significant effect' has only been reached where it is considered very unlikely, based on current knowledge and the information available, that a proposal in the Pre-Submission Draft AAP would have a significant effect on the integrity of a European site.

Interpretation of 'likely significant effect'

3.18 Relevant case law helps to interpret when effects should be considered as being likely to result in a significant effect, when carrying out HRA of a plan.

3.19 In the Waddenzee case[24], the European Court of Justice ruled on the interpretation of Article 6(3) of the Habitats Directive (translated into Reg. 102 in the Habitats Regulations), including that:

- An effect should be considered 'likely', "if it cannot be excluded, on the basis of objective information, that it will have a significant effect on the site" (para 44).

[21] www.jncc.defra.gov.uk
[22] http://publications.naturalengland.org.uk/category/5458594975711232
[23] http://publications.naturalengland.org.uk/category/6490068894089216

[24] European Court of Justice in Case C-127/02 Landelijke Vereniging tot Behoud van de Waddenzee

- An effect should be considered 'significant', "if it undermines the conservation objectives" (para 48).
- Where a plan or project has an effect on a site "but is not likely to undermine its conservation objectives, it cannot be considered likely to have a significant effect on the site concerned" (para 47).

3.20 An opinion delivered to the Court of Justice of the European Union[25] commented that:

"The requirement that an effect in question be 'significant' exists in order to lay down a de minimis threshold. Plans or projects that have no appreciable effect on the site are thereby excluded. If all plans or projects capable of having any effect whatsoever on the site were to be caught by Article 6(3), activities on or near the site would risk being impossible by reason of legislative overkill."

3.21 This opinion (the 'Sweetman' case) therefore allows for the authorisation of plans and projects whose possible effects, alone or in combination, can be considered 'trivial' or de minimis; referring to such cases as those "which have no appreciable effect on the site". In practice such effects could be screened out as having no likely significant effect; they would be 'insignificant'.

In-combination effects

3.22 Regulation 102 of the Habitats Regulations requires an Appropriate Assessment where "*a land use plan is likely to have a significant effect on a European site (either alone or in combination with other plans or projects) and is not directly connected with or necessary to the management of the site*". Therefore, it is necessary to consider whether any impacts identified from the AAP may combine with other plans or projects to give rise to significant effects in combination. At the Screening stage, in-combination effects could be ruled out if there was no impact pathway identified between the garden village and the European site. However, where a potential effect has been identified, even if not significant from the AAP alone, the potential for in-combination effects is considered further in **Chapter 5**.

[25] Advocate General's Opinion to CJEU in Case C-258/11 Sweetman and others v An Bord Pleanala 22nd Nov 2012.

Chapter 4
Screening Findings

HRA Screening of Policies

4.1 A review of the policies in the Pre-Submission Draft version of the AAP has been undertaken in order to identify which will result in development that could have likely significant effects on the European sites that are the focus of this HRA. **Appendix D** presents the screening matrices for the AAP policies.

Policies with no likely significant effects

4.2 The majority of the AAP policies, as well as the AAP vision, are not expected to have significant effects on European sites because they will not result directly in new development. This applies to the following policies:

- Policy 1: Climate Resilience and Adaptation
- Policy 2: Net Zero Carbon Development
- Policy 3: Towards 'Zero Waste' through the Circular Economy
- Policy 4: Adopting Healthy Place Shaping Principles
- Policy 5: Social Integration, Interaction and Inclusion
- Policy 6: Providing Opportunities for Healthy Active Play, Leisure and Lifestyles
- Policy 7: Green Infrastructure
- Policy 8: Enabling Healthy Local Food Choices
- Policy 9: Biodiversity Net Gain
- Policy 12: Conserving and Enhancing the Historic Environment of Salt Cross
- Policy 13: Movement and Connectivity Key Design Principles
- Policy 15: Public Transport
- Policy 21: Employment Skills and Training
- Policy 23: Housing Mix
- Policy 24: Build to Rent
- Policy 25: Custom and Self-Build Housing
- Policy 26: Specialist Housing Needs
- Policy 27: Key development principles

- Policy 28: Land uses and layout – the spatial framework
- Policy 29: Design requirements
- Policy 31: Long-term maintenance and stewardship

4.3 A number of the other policies in the AAP would not result in development and also include avoidance measures which could help mitigate the potential effects of the garden village development. This is the case for the following policies:

- Policy 10: Water Environment
- Policy 11: Environmental Assets
- Policy 14: Active and Healthy Travel
- Policy 16: Reducing the Overall Need to Travel Including by Car
- Policy 20: Homeworking

4.4 In line with the People over Wind judgement, the potential mitigation provided by these policies has not been taken into account during the screening stage of the HRA and has instead been considered as part of the Appropriate Assessment (see **Chapter 5**).

Possible Likely Significant Effects

4.5 The following policies are identified as resulting in development and likely significant effects on European sites cannot therefore be ruled out:

- Policy 17: Road Connectivity and Access
- Policy 18: Salt Cross Science and Technology Park
- Policy 19: Small-scale Commercial Opportunities and Flexible Business Space
- Policy 22: Housing Delivery
- Policy 30: Provision of supporting infrastructure

HRA Screening by Impact

4.6 The likelihood of the European sites included in this screening exercise being significantly affected by development proposed within the garden village site according to the AAP policies is set out below by the broad categories of impact considered. **Table 4.1** at the end of this section summarises the screening conclusions for each European site in relation to these broad types of impact.

Physical damage and loss

4.7 Any development resulting from the AAP would take place within the garden village site boundary; therefore only European sites within the garden village boundary could be affected through direct physical damage or loss of habitat from within the site boundaries. No European sites lie within the garden village site boundary and **therefore direct impacts from physical damage and loss can be screened out from the assessment.**

4.8 Habitat loss from development in areas outside of European site boundaries may also result in likely significant effects where that habitat contributes towards maintaining the interest feature for which the European site is designated (generally referred to as 'functionally linked habitats'). This includes land or waterbodies which may provide offsite movement corridors or feeding and sheltering habitat for mobile species such as bats, birds and fish.

4.9 Both Oxford Meadows SAC and Cothill Fen SAC have been screened out from further assessment on the basis of distance from the garden village site and because their qualifying features do not include transient species and are therefore not susceptible to off-site habitat loss.

No likely significant effects are therefore predicted as a result of physical damage and loss of habitat at any European sites, either alone or in-combination.

Non-physical disturbance

4.10 Noise and vibration effects, e.g. during the construction of new housing or employment development, are most likely to disturb bird species and are thus a key consideration with respect to European sites where birds are the qualifying features, although such effects may also impact upon some mammals and fish species. Artificial lighting at night (e.g. from street lamps, flood lighting and security lights) has the potential to affect nocturnal qualifying features (such as bats) where it occurs in close proximity to key habitat areas. Impacts associated with human presence have been covered within the 'recreation' assessment below.

4.11 It has been assumed that the effects of noise, vibration and light are most likely to be significant within a distance of 500 metres of either the European site boundary or known areas of functionally linked habitats. There is also evidence of 300 metres being used as a distance up to which certain bird species can be disturbed by the effects of noise[26]; however, it has been assumed (on a precautionary basis) that the effects of noise, vibration and light pollution are capable of causing an adverse effect if development takes place within 500 metres of a European site with qualifying features sensitive to these disturbances.

4.12 All European sites were screened out of the assessment as they do not support qualifying species that are susceptible to impacts from non-physical disturbance.

[26] British Wildlife Magazine. October 2007

No likely significant effects are predicted as a result of non-physical disturbance at any European sites, either alone or in-combination.

Non-toxic contamination

4.13 Habitats can be subject to non-toxic contamination, such as nutrient enrichment, changes in salinity and smothering from dust, due to industrial activities, agriculture, construction and water abstraction and discharge. European sites with the potential to be affected by non-toxic contamination are likely to be sites that lie within close proximity of, or those that are hydrologically connected to, areas of development provided for by the plan. Potential changes to water quantity and quality are separately considered below.

4.14 No European sites lie within or adjacent to the area covered by the AAP and therefore all European sites can be screened out of the assessment.

No likely significant effects are predicted as a result of non-toxic contamination at any European sites, either alone or in-combination.

Air pollution

4.15 Air pollution is most likely to affect European sites where plant, soil and water habitats are the qualifying features, but some qualifying animal species may also be affected, either directly or indirectly, by deterioration in habitat as a result of air pollution. Deposition of pollutants to the ground and vegetation can alter the characteristics of the soil, affecting the pH and nitrogen levels, which can then affect plant health, productivity and species composition.

4.16 In terms of vehicle traffic, nitrogen oxides (NOx, i.e. NO and NO_2) are considered to be the key pollutants. Deposition of nitrogen compounds may lead to both soil and freshwater acidification, and NOx can cause eutrophication of soils and water.

4.17 Based on the Highways Agency Design Manual for Road and Bridges (DMRB) Manual Volume 11, Section 3, Part 114 (which was produced to provide advice regarding the design, assessment and operation of trunk roads including motorways), it is assumed that air pollution from roads is unlikely to be significant beyond 200m from the road itself. Where increases in traffic volumes are forecast, this 200m buffer needs to be applied to the relevant roads in order to make a judgement about the likely geographical extent of air pollution impacts.

4.18 The DMRB Guidance for the assessment of local air quality in relation to highways developments provides criteria that should be applied at the screening stage of an assessment of a plan or project, to ascertain whether there are likely to be significant impacts associated with routes or corridors. Based on the DMRB guidance, affected roads which should be assessed are those where:

- Daily traffic flows will change by 1,000 AADT (Annual Average Daily Traffic) or more; or
- Heavy duty vehicle (HDV) flows will change by 200 AADT or more; or
- Daily average speed will change by 10 km/hr or more; or
- Peak hour speed will change by 20 km/hr or more; or
- Road alignment will change by 5 m or more.

4.19 Where significant increases in traffic are possible on roads within 200m of European sites, traffic forecast data may be needed to determine if increases in vehicle traffic are likely to be significant. In line with the Wealden judgment[27], the traffic growth considered by the HRA should be based on the effects of development provided for by the AAP in combination with other drivers of growth such as development proposed in neighbouring districts and demographic change.

4.20 It has been assumed that only those roads forming part of the primary road network (motorways and 'A' roads) are likely to experience any significant increases in vehicle traffic as a result of development (i.e. greater than 1,000 AADT). As such, where a European site is within 200m of only minor roads, no significant effect from traffic-related air pollution is considered to be the likely outcome.

4.21 The key commuting corridor for new housing and employment development will include the A40, A44, A34, A4144, A420, and A4142. Oxford Meadows SAC is within 200m of the A40 and A34, with the A40 being the key route for consideration due to its proximity to the garden village site and direct route to north Oxford. The A34 is not directly connected with the garden village site but may see an increase in vehicle movements as a result of the development, depending on how many of the vehicles originating from the garden village travel onto the A34 at north Oxford and move southwards past the SAC. Oxfordshire County Council has commissioned traffic modelling work in relation to the AAP, although this did not produce AADT predictions. However, the County Council advised that if the data had been available in that format, the expectation was that the increase in traffic would be above the significance threshold of 1,000 AADT along the A40. In line with the precautionary principle, it has therefore been assumed that this is the case and likely significant effects on

[27] Wealden v SSCLG [2017] EWHC 351 (Admin)

the Oxford Meadows SAC as a result of increased traffic along the A40 and potentially the A34 cannot be ruled out.

4.22 Cothill Fen SAC is situated more than 200m from a strategic road and is therefore screened out of the assessment.

Likely significant effects relating to increased air pollution from the AAP are not able to be screened out in relation to the A40 and A34 and the Oxford Meadows SAC and require further consideration at the Appropriate Assessment stage to determine whether increased air pollution as a result of the AAP will result in adverse effects on site integrity, either alone or in-combination.

Likely significant effects on other European sites as a result of increased air pollution from vehicle traffic can be screened out of the assessment.

Recreation

4.23 Recreational activities and human presence can result in significant effects on European sites as a result of erosion, trampling and introduction of non-native species, as well as associated impacts such as fire and vandalism or disturbance to sensitive features, such as birds through both terrestrial and water-based forms of recreation. Recreation can physically damage habitat as a result of trampling and the use of vehicles and also through erosion associated with water-based activities such as boat wash and terrestrial activities, such as use of vehicles.

4.24 The AAP will result in housing growth and associated population increase within West Oxfordshire and specifically within the garden village location north of Eynsham. Where increases in population are likely to result in significant increases in recreation at a European site which is vulnerable to disturbance, or habitat damage by human presence, either alone or in-combination, the potential for likely significant effects will require assessment.

4.25 Cothill Fen SAC is screened out of the assessment as the qualifying features are not considered to be vulnerable to increases in recreation.

4.26 While Oxford Meadows SAC could be susceptible to increased recreational use (either through contamination from dog fouling or introduction of non-native species from walkers' boots), the HRA that was undertaken for the Oxford City Local Plan[28] identified a distance of 1.9km around the SAC within which new development could have impacts associated with increased dog walking. The area covered by the AAP is more than 1.9km from the SAC and the A40 lies between the garden village site and the SAC, meaning that the SAC is not considered to be a likely destination for dog walkers from the garden village. Recreational impacts on the Oxford Meadows SAC are therefore screened out of this HRA.

Likely significant effects on all European sites as a result of recreation pressure can be screened out of the assessment.

Water quantity and quality

4.27 An increase in demand for water abstraction and treatment resulting from the growth proposed in the AAP could result in changes in hydrology at European sites. Depending on the qualifying features and particular vulnerabilities of the European sites, this could result in likely significant effects; for example due to changes in environmental or biotic conditions, water chemistry and the extent and distribution of preferred habitat conditions. To fully understand the potential impacts of proposed development on European sites a review of relevant Water Cycle Studies (WCS) was undertaken to inform the West Oxfordshire Local Plan HRA[29].

4.28 Oxford Meadows SAC is directly linked to waterbodies within the garden village site via the River Thames and smaller tributaries which adjoin it. Therefore, changes in water quantity and quality through increased demand for water supply and increased wastewater discharges is potentially a key issue for this site.

4.29 A water cycle study[30] was carried out in 2016 to inform the preparation of the West Oxfordshire Local Plan HRA (undertaken by AECOM[20]), in order to ensure that the proposed growth within the district did not have an impact on water quality or quantity.

4.30 The water cycle study concluded that there was sufficient capacity for planned development within the water catchment area in which the Oxford Meadows SAC is situated, sufficient capacity to cope with increased wastewater as a result of the garden village, and that there would be no adverse effects on the qualifying features or overall integrity of the site. Therefore, the Oxford Meadows SAC can be screened out from this assessment.

4.31 Cothill Fen SAC is also screened out as there is no hydrological connectivity with the garden village site.

[28] Levett-Therivel (September 2018) Oxford Local Plan 2036 Habitats Regulations Assessment: Appropriate Assessment.

[29] AECOM (October 2016) West Oxfordshire Local Plan: Habitats Regulations Assessment incorporating Appropriate Assessment

[30] AECOM (2016) West Oxfordshire Water Cycle Study – Phase 1 Scoping Study

No likely significant effects on any European sites are predicted as a result of water quality and quantity changes as a result of the AAP either alone or in-combination.

Summary of Screening Conclusions

4.32 HRA screening of the Salt Cross Garden Village AAP (Pre-Submission Draft) has been undertaken in accordance with available guidance and based on a precautionary approach.

4.33 As shown in **Table 4.1** below, the findings of the HRA screening exercise have determined that likely significant effects cannot be ruled out, and therefore Appropriate Assessment needs to be undertaken, in relation to air pollution at Oxford Meadows SAC. This likely significant effect could occur as a result of the following AAP policies: Road Connectivity and Access (17), Salt Cross Science and Technology Park (18), Small-scale Commercial Opportunities and Flexible Business Space (19), Housing Delivery (22) and Provision of supporting infrastructure (30).

In-combination effects

4.34 Likely significant effects in relation to physical damage and loss of habitat, non-physical disturbance, non-toxic contamination and increased recreation pressure in-combination with other plans and projects can be ruled out because, as described earlier in this chapter, the AAP will not affect European sites in these ways.

4.35 In relation to water quality and quantity, as described earlier in this chapter, the AAP is not expected to have likely significant effects on any European sites. The Water Cycle Study that helped to inform this conclusion examines the impacts of other growth, not just the Salt Cross Garden Village, and an assessment of in-combination effects on water quality and quantity has therefore been effectively carried out through that study.

4.36 In relation to air pollution, as described earlier in this chapter, the AAP could result in a likely significant effect on Oxford Meadows SAC as a result of increased vehicle traffic along the A40. It is therefore necessary to carry out Appropriate Assessment, regardless of the potential for effects to also occur as a result of the proposal in combination with other development. Natural England's guidance on assessment of road traffic emissions under the Habitats Regulations[31] notes that '*if a proposal alone is above the likely significant effect thresholds, there is no need to also look for the risk of in-combination effects before proceeding to the Appropriate Assessment stage*'.

[31] Natural England (June 2018) Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations

Table 4.1: Summary of Screening Findings by Type of Impact

	Physical damage/loss of habitat	Non-physical disturbance	Non-toxic contamination	Air pollution	Recreation pressure	Water quantity and quality
Oxford Meadows SAC	No LSE	No LSE	No LSE	LSE	No LSE	No LSE
Cothill Fen SAC	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE
North Meadow and Clattinger Farm SAC	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE
Hackpen Hill SAC	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE
Little Wittenham SAC	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE
River Lambourn SAC	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE

Chapter 5
Appropriate Assessment

Introduction to the Appropriate Assessment stage of HRA

5.1 Following the screening stage, the plan-making authority is required under Regulation 102 of the Habitats Regulations 2017 (as amended) to make an 'Appropriate Assessment' of the implications of the plan for European sites, in view of their conservation objectives.

5.2 The Appropriate Assessment should consider the impacts of the plan (either alone or in-combination with other projects or plans) on the integrity of European sites with respect to their conservation objectives and to their structure and function[32].

5.3 A European site's integrity depends on it being able to sustain its 'qualifying features' (i.e. those Annex 1 habitats, Annex II species, and Annex 1 bird populations for which it has been designated) and to ensure their continued viability. A high degree of integrity is considered to exist where the potential to meet a European site's conservation objectives is realised and where the European site is capable of self-repair and renewal with a minimum of external management support.

5.4 The Appropriate Assessment stage seeks to determine whether implementation of the plan or project in question (in this case the AAP) will result in an adverse effect on the integrity of the whole European site in question (many European sites are made up of a number of fragments of habitat). This stage therefore needs to focus on those impacts judged likely to have a significant effect on the qualifying features of European sites, or where insufficient certainty regarding this remained at the screening stage. It also considers the potential for in-combination effects from development proposed elsewhere in West Oxfordshire and in neighbouring authorities' Local Plans. Consideration should be given to mitigation measures that already are or may be included in the AAP to reduce the likelihood and significance of effects on European sites.

[32] *Assessment of plans and projects significantly affecting European sites. Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC.* European Commission Environment DG, November 2001.

Outcomes of the HRA of the West Oxfordshire Local Plan Main Modifications

5.5 In relation to the Oxford Meadows SAC, the HRA of the West Oxfordshire Local Plan Main Modifications, concluded that:

- There was the prospect of a likely significant effect from the West Oxfordshire Local Plan on the Oxford Meadows SAC via changes in air quality.
- Increased housing provision, including Salt Cross Garden Village, would likely result in an *"increase in nitrogen deposition and NOx concentration within a small part of the Oxford Meadows SAC as it lies adjacent to the A34 and A40"*.
- As a precaution, until the Oxfordshire authorities undertake more detailed studies to investigate air quality within the SAC adjacent to the A34 and A40, it was assumed that an air quality effect may exist.
- Appropriate plan-level measures to address the issue (as accepted for other local authorities) were identified and are reflected in the Local Plan proposed Main Modifications which enabled a conclusion of no adverse effect to be reached and enabled the West Oxfordshire Local Plan to be adopted.
- The Oxfordshire authorities are undertaking more detailed studies to investigate air quality within the SAC adjacent to the A34 and A40, which will in turn inform specific mitigation interventions.

5.6 As a result of the HRA, Policy EH2 – Biodiversity includes the requirement for a Habitats Regulation Assessment to be undertaken of any development proposal that is likely to have a significant adverse effect, either alone or in combination, on the Oxford Meadows SAC, particularly in relation to air quality and nitrogen oxide emissions and deposition.

Scope of the Appropriate Assessment

5.7 As described in the previous chapter, likely significant effects arising from the Salt Cross Garden Village AAP were only identified for Oxford Meadows SAC and only in relation to air quality. The approach taken to the Appropriate Assessment has therefore been informed by Natural England's guidance for competent authorities on assessing road traffic emissions under the Habitats Regulations[33].

5.8 A conclusion has been reached as to whether or not policies in the Pre-Submission Draft version of the Salt Cross Garden Village AAP would adversely affect the integrity of the Oxford Meadows SAC as a result of increased air pollution by considering whether the predicted impacts of the proposals (either alone or in-combination) have the potential to:

- Delay the achievement of conservation objectives for the site.
- Interrupt progress towards the achievement of conservation objectives for the site.
- Disrupt factors that help to maintain the favourable conditions of the site.
- Interfere with the balance, distribution and density of key habitats and species that are the indicators of the favourable condition of the site.

Exposure of the qualifying features of the Oxford Meadows SAC to emissions

5.9 Natural England's advice on assessing road traffic emissions recommends that consideration is initially given to the extent to which the qualifying features of the European site in question will be exposed to emissions resulting from the AAP. This is determined in part by the extent to which the feature is present within 200m of the road in question.

5.10 **Appendix E** sets out the location of the A40 and A34 in relation the Oxford Meadows SAC, and the parts of the SAC that are within 200m of each road. Oxford Meadows SAC is comprised of four Sites of Special Scientific Interest (SSSI). **Table 5.1** below sets out the area and percentage of each component SSSI of the SAC, and the area and percentage of the total area of the SAC, that is within 200m of the A40 and A34.

[33] Natural England (June 2018) Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations

Table 5.1: Area/percentage of each SSSI and the SAC as a whole within 200m of the A40 and A34

Component SSSI	A34			A40		
	Area (ha)	Intersect Area (ha)	Intersect %	Area (ha)	Intersect Area (ha)	Intersect %
Cassington Meadows SSSI	6.89	0	0	6.89	0.02	0.26
Pixey and Yarnton Meads SSSI	86.38	17.98	20.81	86.38	17.62	20.40
Port Meadow with Wolvercote Common & Green SSSI	167.14	0	0	167.14	0	0
Wolvercote Meadows SSSI	7.06	5.05	71.48	7.06	0	0
Oxford Meadows SAC	**267.48**	**23.02**	**8.61**	**267.48**	**17.64**	**6.60**

5.11 Although just over 15% of the total SAC is within 200m of both the A40 and A34, it is noted that the position of Oxford Meadows SAC in relation to the A40 and A34 means that the prevailing southwesterly wind will carry emissions generated from the A40 away from Oxford Meadows SAC[34] and, to a lesser extent the same applies to the A34[35]. Therefore, those parts of the SAC that are to the northeast of each road are more likely to receive nitrogen deposition within 200m of the road on a regular basis, and this would apply mostly to the small area of Pixey and Yarnton Meads SSSI and Wolvercote Meadows SSSI that are to the east of the A34.

Review of landscape features

5.12 A review of landscape features present in the SAC within 200m of the A40 and A34 using aerial photography, confirms that:

- Cassington Meadows SSSI: only field boundaries, which are considered 'site-fabric'[36], are present within the very small portion of the site (0.02 ha) that is within 200m of the A40.
- The majority of the other areas within 200m of the A40 and A34 contain the designated features for the Oxford Meadows SAC.
- Physical barriers in the form of 3-10m high hedgerows and woodland screen the A34 along approximately 70% of its length in relation to the SAC.
- Physical barriers in the form of 3-10m high hedgerows and woodland screen the A40 along its entire length in relation to the SAC.

5.13 In relation to the physical barriers, the HRA for the West Oxfordshire Local Plan noted:

"During the HRA of the Local Plan undertaken in 2015, it was noted that the SAC boundary also lies alongside the A34, but does not lie immediately adjacent, being separated from the road by the highway boundary/verge which is 20m wide on the north side of the A34 and 12m wide on the south side. The distance between the verge of the A40 and Oxford Meadows SAC to the south is approximately 6 - 10m. Therefore, the greatest NOx concentrations will fall within the highway boundary rather than the SAC. As such, it is entirely possible that even with a change in flows exceeding 1000 AADT as a result of the West Oxfordshire Local Plan the impact due to the principal pathway may not be significant."

5.14 In addition, the Air Quality Expert Group to DEFRA[37], states that:

"*When the wind blows from the road to the dense vegetation barrier there are reductions in concentrations on the downwind side of the barrier. These reductions decrease with distance away from the barrier and depend on the height and density of the barrier as well as other factors such as atmospheric*

[34] Oxford Meadows SAC is located on the windward side of the A40.
[35] Oxford Meadows SAC is partially located on the windward side of the A34.
[36] 'Site-fabric' is a general term used by Natural England to describe land and/or permanent structures present within a designated site boundary which are not, and never have been, part of the special interest of a site, nor do they contribute towards supporting a special interest feature of a site in any way, but which have been unavoidably included within a boundary for convenience or practical reasons. Areas of site-fabric will be deliberately excluded from condition assessment and will not be expected to make a contribution to the achievement of conservation objectives.

[37] Air Quality Expert Group: DEFRA (2018). *Impacts of Vegetation on Urban Air Pollution*. Air Quality Expert Group: Department for Environment Food & Rural Affairs, London.

stability and building morphology in the neighbourhood of the barrier. The measurements show a broad range in the maximum reduction in concentrations up to a factor of five, but reductions within a factor of two are more typical. It is noted that for the studies conducted in the field, some of the concentration reduction may be attributable to deposition rather than dispersion effects."

5.15 However, the paper goes on to state*: "In very light winds reductions in concentration are less apparent and in some cases increases are observed".*

Conclusion on exposure of the SAC's qualifying features to emissions

5.16 Taking all of the above into account, it can be assumed that a considerable percentage of the nitrogen pollutants arising from traffic emissions along the A40 and A34 do not actually reach the SAC. This is due to:

- The small area of the SAC within 200m of the A40 and A34 and the location of those parts of the SAC in relation to the two roads and the prevailing southwesterly wind which would carry emissions away from the SAC.
- The verges along the A40 and A34 (6m – 10m and 12m – 20m respectively), the vegetation the verges support and the known behaviour of particulates from vehicle emissions (in general and in a tree lined road scenario).

Current condition of the Oxford Meadows SAC

SSSI analysis

5.17 Analysis of the condition of the four component SSSIs making up the Oxford Meadows SAC is presented in **Table 5.2** below.

Table 5.2: Review of Oxford Meadows SAC component SSSI condition

Component SSSI	Size	Most recent Condition Assessment (2010 - 2011)
Cassington Meadows SSSI	6.89ha	Favourable
Pixey and Yarnton Meads SSSI	86.38ha	Favourable
Port Meadow with Wolvercote Common & Green SSSI	167.16ha	165ha Favourable 2.16ha Unfavourable Recovering
Wolvercote Meadows SSSI	7.06ha	Favourable
Oxford Meadows SAC	**267.49ha**	**Over 99% in favourable condition**

5.18 It can be seen that the component SSSIs forming the Oxford Meadows SAC are currently reported as being in a 99% favourable condition and no adverse factors associated with nutrient enrichment have been reported. None of the Port Meadow with Wolvercote Common & Green SSSI is within 200m of either the A40 or A34, therefore, the condition of the small area of that SSSI that is unfavourable recovering will not be impacted by air pollution along those roads. Natural England recognises that common standards monitoring (such as that undertaken to monitor SSSI condition status) is not designed to identify the effects of nutrient enrichment associated with nitrogen deposition, but at present the air quality at Oxford Meadows SAC is not resulting in measurable impacts on the grassland, including the proportion of Oxford Meadows SAC which is located within 200m of the A40 and A34. This is despite the existing traffic volumes present along the A40 and A34.

Trends

5.19 Using data from the Air Pollution Information System (APIS)[38] there has generally been a decrease in nitrogen pollutants reaching the grassland habitats present[39] in the Oxford Meadows SAC area:

- Total Nitrogen Deposition has steadily decreased from 17 to 15 Kg N/ha/yr from 2005 to 2017. Including:
  - NHx (reduced nitrogen) has steadily decreased at a slow rate from 7 to 6 kg N/ha/yr from 2005 to 2016 with a recent increase to 7.2 kg N/ha/yr in 2017.
  - NOx has steadily decreased from 7.5 to 4.2 kg N/ha/yr from 2005 to 2016 with a recent increase to 5 kg N/ha/yr in 2017.

[38] Air Pollution Information System. [Online]. APIS. Accessed 28.07.2020. Available at: http://www.apis.ac.uk/srcl/select-a-feature?site=UK0012845&SiteType=SAC&submit=Next
[39] Trend data has been discussed in relation to 'deposition to short vegetation', which is the best fit for the SAC designated grassland habitat.

- Acid Deposition has steadily decreased from 1.55 to 1.25 keq/ha/yr from 2005 to 2017.
- The concentration of Nitrogen Oxides in the air has steadily decreased from 37.5 to 20 ug/m^3 from 2005 to 2017.

Conservation objectives for the Oxford Meadows SAC

5.20 The conservation objectives of the Oxford Meadow SAC are to ensure that the integrity of the site is maintained or restored as appropriate, and to ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring:

- The extent and distribution of the habitats of the qualifying features;
- The structure and function of the habitats of the qualifying features;
- The supporting processes on which the habitats of the qualifying features rely;
- The population of each of the qualifying features; and,
- The distribution of the qualifying features within the site.

5.21 The Oxford Meadows SAC Site Improvement Plan[40] does not include nitrogen deposition or air quality as a priority or issue and therefore there are no issues and actions in relation to nitrogen deposition or air quality.

5.22 However, Natural England's Supplementary advice on conserving and restoring site features for the Oxford Meadows SAC[41] outlines that concentrations and deposition of air pollutants must be maintained at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System.

5.23 Natural England's 2015 Atmospheric Nitrogen Theme Plan[42] identifies Oxford Meadows SAC as being less sensitive to nitrogen and not exceeding critical loads for nitrogen. However, the likelihood of an impact from nitrogen is outlined as 'uncertain'. Further, the Atmospheric Nitrogen Theme Plan identifies local agriculture sources of Nitrogen as being of 'Low' relevance at Oxford Meadows SAC.

Scope of Potential Impact

Likely traffic routes used and traffic arising from the garden village

5.24 Oxford Meadows SAC is within 200m of the A40 and A34. The A40 is the main road linking Oxford to Cheltenham and Cirencester. The A34 provides connections to Newbury and, via the A420, Swindon. The A40 and A34 are main routes between these settlements and therefore these roads will see an increase in vehicle traffic as a result of any future commercial or residential development in these areas.

5.25 Given the location of the garden village, it is expected that a proportion of new residents will undertake daily travel along the A40 with some continuing southwards along the A34. Survey work undertaken in February 2020 indicated that for traffic that was heading eastbound on the A40 (at a point to the west of Wolvercote roundabout), only 6% of traffic observed over a 12 hour period (7am to 7pm) headed south on the A34[43].

5.26 The annual average daily traffic (AADT) flows for the A40 adjacent to the Oxford Meadows SAC have been provided by Oxfordshire County Council, having been extracted from the VISSIM model of Eynsham (see **Table A2** in **Appendix G**). The predicted increase in AADT along the A40 arising from the garden village and the West Eynsham SDA is 2,805 AADT, which is above the 1,000 AADT screening threshold described in Chapter 4.

5.27 Given the survey work undertaken in February 2020 which observed the percentage of traffic taking the A34 from the A40 at Wolvercote roundabout north of Oxford, it is assumed that only 6% of traffic arising from the garden village (and the West Eynsham SDA) would travel south along the A34 and therefore the increase in AADT along the A34 from both of these new developments is estimated to be 6% of 2,805 (the increase along the A40), which equals 168 AADT and is well below the 1,000 AADT screening threshold. In addition, given the information provided above about the low likely exposure of the Oxford Meadow SAC to air pollution from the A34, impacts from the A34 have been scoped out of the following Air Quality Assessment as they are unlikely to give rise to significant effects.

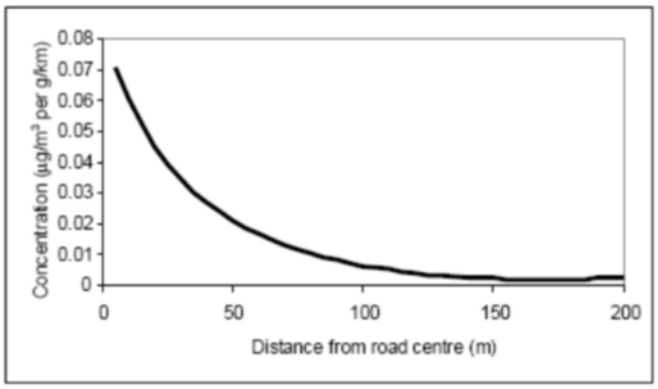
Review of nitrogen deposition behaviour from roads

5.28 According to the Department of Transport's Transport Analysis Guidance, "*beyond 200m, the contribution of vehicle emissions from the roadside to local pollution levels is not significant*". **Figure 5.1** sets out the traffic contribution to pollutant concentration at different distances from the road

[40] Natural England (2014). *Site Improvement Plan: Oxford Meadows: Improvement Programme for England's Natura 2000 Sites (IPENS): Planning for the Future.* Natural England, York.
[41] Natural England (2019). *European Site Conservation Objectives: Supplementary advice on conserving and restoring site features: Oxford Meadows Special Area of Conservation (SAC): Site Code: UK0012845*. Natural England, York.
[42] Natural England (2015). *Atmospheric Nitrogen Theme Plan: Developing a strategic approach for England's Natura 2000 sites*. Natural England, York.
[43] Personal Communication: Email dated 23rd July 2020 from Lynn Morgan, Oxfordshire County Council.

centre, and shows that the pollutant concentration drops significantly in the first 50m from the road centre.

Figure 5.1: Traffic Contribution to Pollutant Concentration at Different Distances from the Road Centre[44]



Air Quality Assessment

Methods

5.29 Information on existing air quality within the study area has been collated from the following sources:

- The results of monitoring and the Air Quality Annual Status Reports undertaken by West Oxfordshire District Council (West Oxfordshire District Council, 2020).
- Background pollutant concentration maps published by Defra (Defra, 2020a). These cover the whole country on a 1 x 1 km grid.
- Background nitrogen deposition fluxes published by the Air Pollution Information System (APIS, 2020).

Road Traffic Impacts

Sensitive Locations

5.30 Concentrations have been modelled at ground level (0m) along four transects that run from the edge of the Oxford Meadows SAC closest to the A40 50m into the SAC. The transect locations are shown in **Appendix F**. Concentrations have been predicted every 1 m along the transect. The grid references for the transect receptor points are shown in **Appendix G**.

Assessment Scenarios

5.31 Annual mean concentrations of NOx have been predicted for the following scenarios:

- Model verification year (2019);
- 2031 without the Salt Cross Garden Village, without the West Eynsham SDA;
- 2031 without the Salt Cross Garden Village, with the West Eynsham SDA; and
- 2031 with the Salt Cross Garden Village, with the West Eynsham SDA.

5.32 The data available did not include a scenario 'with the Salt Cross Garden Village but without the West Eynsham SDA'; however the contribution of the garden village alone can be calculated by deducting the figures associated with the third scenario (without the Salt Cross Garden Village, with the West Eynsham SDA) from the figures associated with the fourth scenario (with both developments). This results in data which is attributable to only the garden village proposal.

In-combination Assessment

5.33 The modelled scenarios have been used to assess the impact of the Salt Cross Garden Village alone and in-combination with the West Eynsham SDA. Note that the 2031 scenarios all include other planned development within the Oxfordshire districts as provided to Oxfordshire County Council by the District Councils in Summer 2016. Therefore, the wider in-combination effects of development planned in West Oxfordshire and the other Oxfordshire districts have also been taken into account within this Appropriate Assessment.

Modelling Methodology

5.34 Concentrations have been predicted using the ADMS Roads (v5.0.0.1) dispersion model (CERC, 2020)[45]. The model requires the input of a range of data, details of which are provided in **Appendix G**, along with details of the model verification calculations.

Uncertainty

5.35 There are many factors that contribute to uncertainty when predicting pollutant concentrations. The emission factors utilised in the air quality model are dependent on traffic data, which have inherent uncertainties associated with them. There are also uncertainties associated with the model itself, which simplifies real world conditions into a series of algorithms. The model verification process, as described in **Appendix G**, minimises the uncertainties; however, future year predictions use projected traffic data, emissions data, and background concentrations. The most recent emission factors and background data published by Defra have been used in this assessment.

[44] Figure C1 from Design Manual for Roads and Bridges (May 2007) Volume 11 Environmental Assessment, Section 3 Environmental Assessment Techniques. Part 1 HA207/7 Air Quality

[45] Cambridge Environmental Research Consultants (2020). ADMS Roads (v5.0.0.1) Dispersion Model. CERC, Cambridge.

5.36 Past analysis has shown a disparity between historical monitoring data and the projected background concentrations published by Defra (Carslaw, et al., 2011)[46]. This disparity is believed to have arisen due to the actual on-road performance of diesel vehicles when compared with emissions calculations based on the Euro standards and published in the Emissions Factor Toolkit (EFT) used for modelling. Air Quality Consultants Ltd (AQC) historically produced the Calculator Using Realistic Emissions for Diesels (CURED) tool that applied adjustments to diesel emission factors from the EFT to account for the possible underprediction of future emissions (AQC, 2018)[47].

5.37 Recent research has identified a significant reduction in roadside NOx concentrations in recent years (AQC, 2020a)[48]. Analysis of annual mean NOx concentrations at roadside monitoring sites, adjusted to remove inter-year differences due to meteorology, show an overall decrease of 6.4µg/m3/yr between 2013 and 2019, with an even greater rate of reduction between 2016 and 2019.

5.38 AQC have compared the scale of reductions in NOx emissions predicted by the latest version of the EFT (v9.0) with the reductions observed at roadside monitoring sites (AQC, 2020b)[49]. At an average site in the UK, the EFT is likely to under-predict the rate at which NOx emissions fall in the near future. Therefore, provided a dispersion model is verified against measurements made in 2016, or later, the use of EFT emissions will result in the most likely, or even conservative, future predicted NOx concentrations.

5.39 AQC consider that there is little value in continuing to use, or update, the CURED tool. Based on the evidence in the reports published by AQC, it is not considered necessary to undertake a sensitivity analysis with regard to future emissions.

Assessment Criteria and Significance

Assessment Criteria

5.40 Critical loads for nitrogen deposition onto sensitive ecosystems have been specified by the United Nations Economic Commission for Europe (UNECE). They are defined as a quantitative estimate of exposure to one or more pollutants, below which significant harmful effects on specified sensitive elements of the environment do not occur, according to present knowledge. The critical load relates to the quantity of pollutant deposited from air to ground, whereas the critical level is the gaseous concentration of a pollutant in the air. It must be emphasised that an exceedance of the critical load does not provide a quantitative estimate of damage to an ecosystem, but only the potential for damage to occur. The critical loads for the ecosystems under consideration in this assessment, as defined in the Air Pollution Information System (APIS, 2020), are provided in **Table 5.3**.

Table 5.3: Critical loads

Site	Feature of Interest	Critical Load			
		Nutrient N (kg/ha/yr)		Acid N (keq/ha/yr)	
		Min	Max	Min	Max
Oxford Meadows SAC	Lowland hay meadows	20	30	2.058	4.558
	Apium repens - Creeping marshwort	20	30	4.856	5.071

5.41 The critical loads from the habitats most sensitive to nutrient or acid nitrogen deposition have been used, along with the NOx objective for the protection of vegetation and ecosystems, to determine the assessment criteria used in this HRA for the Oxford Meadows SAC, as shown in **Table 5.4**. Environment Agency online guidance also sets out a critical level for 24-hour NOx, which is a non-statutory level derived from the World Health Organisation (WHO) Air Quality Guidelines for Europe[50,51]. The WHO Guidelines state that:

"A strong case can be made for the provision of critical levels for short-term exposures. There are insufficient data to provide these levels with confidence at present, but current evidence suggests values of about 75 µg/m3 for NOx … as 24-hour means."

Table 5.4: Assessment Criteria

Site	Annual Mean NOx (µg/m3)	Nutrient N (kg/ha/yr)	Acid N (keq/ha/yr)
Oxford Meadows SAC	30	20	2.058

5.42 Given the uncertainty associated with the short-term critical level for NOx and its non-statutory status, greater

[46] Carslaw, D., Tate J., Murrells T., Stedman J., Li Y., Grice S., Kent A. and Tsagatakis I. (2011). *Trends in NOx and NO2 Emissions and Ambient Measurements in the UK*. Defra. London.
[47] AQC (2018). *Development of the CURED V3A Emissions Model. January*. AQC, Burnham-on-Sea.
[48] AQC (2020). *Nitrogen Oxides Trends in the UK 2013 to 2019*. AQC, Burnham-on-Sea.
[49] AQC (2020). *Performance of Defra's Emission Factor Toolkit 2013-2019*. AQC, Burnham-on-Sea.
[50] WHO (2000). *Air Quality Guidelines for Europe Second Edition*. World Health Organization. Geneva.
[51] Defra and EA [Online]. *Air Emissions Risk Assessment for your Environmental Permit*. Accessed: 28.07.2020. Available at: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit

emphasis should be placed on the achievement of the annual mean NOx objective and an assessment of the impact on 24-hour NOx has not been included in this assessment.

Significance

5.43 There is no official guidance in the UK on how to describe air quality impacts, nor how to assess their significance. Online guidance published by Defra and the Environment Agency has been used in the first instance to screen out impacts that will have an insignificant effect[51]. The guidance explains that regardless of the baseline environmental conditions, a process can be considered as insignificant if:

'The long-term (annual mean) process contribution is less than 1% of the long-term environmental standard.'

5.44 It should be recognised that this criterion determines when an impact can be screened out as not significant. It does not imply that there will be damage to a habitat above this threshold, or that impacts will necessarily be significant above these criteria, merely that there is a potential for significant impacts to occur that should be considered using a detailed assessment methodology, such as a detailed dispersion modelling study (as has been carried out for this assessment in any event), in association with a qualified ecologist to consider the likelihood of an adverse effect on the integrity of the habitat. The Institute of Air Quality Management (IAQM) suggests that the 1% criterion should not be used rigidly and not to a numerical precision greater than the expression of the criteria themselves, i.e. only impacts clearly above 1% should be treated as potentially significant, rather than impacts that are about 1%, or slightly higher (IAQM, 2020).

5.45 For the purposes of this assessment, where concentrations and/or deposition rates are predicted to increase by 1% or less of the assessment criterion, the potential for significant impacts can be discounted, and no further assessment is necessary. If the initial screening shows the potential for significant impacts, i.e. concentrations and/or deposition rates are predicted to increase by more than 1% of the assessment criterion, the total concentrations and deposition rates (road contribution + background) will be compared with the critical level/loads. The overall effect of the air quality impacts should be judged as either likely to have an adverse effect on integrity or not following evaluation by a qualified ecologist with full consideration of the qualifying habitat's extent, distribution, structure and function.

Baseline Conditions

Background Concentrations and Fluxes

National Background Pollution Maps

5.46 Estimated background concentrations of NOx and NO_2 at the four transects in the Oxford Meadows SAC along the A40, derived from the national maps published by Defra, are shown in **Table 5.5**. The background concentrations are well below the critical level.

Table 5.5: Estimated Annual Mean Background Concentrations in 2019 and 2031 (µg/m3)[a]

Year	NOx	NO_2
2019	15.6 - 25.4	11.4 - 17.5
2031	11.5 - 17.7	8.6 - 12.7
Critical Level	**30**	**-**

a - Predicted background concentrations from the background maps are only available up to 2030; therefore, 2031 concentrations have been assumed to be the same as in 2030.

Diffusion Tube Monitoring

5.47 West Oxfordshire District Council has undertaken NO_2 diffusion tube monitoring along the A40 in 2019 (locations shown in **Figure 1 Appendix G**). The monitoring sites are located approximately 7km to the west of the SAC; however, the sites are likely to be representative of current air quality conditions close to the A40 and have also been used for model verification. Annual mean NOx concentrations have been estimated at the diffusion tube monitoring sites using the NO_2 to NOx calculator v7.1 published by Defra (Defra, 2020b)[52].

5.48 **Table 5.6** summarises the 2019 monitoring data, which shows that the annual mean critical level for NOx is likely to have been exceeded at the diffusion tube monitoring sites close to the A40 in 2019. The diffusion tube monitoring site NAS8 is located to the north of the A40 adjacent to the road, while NAS9, where there was a marginal exceedance of the NOx critical level, is located to the south of the A40, on the same side of the road as the Oxford Meadows SAC. The difference in measured concentrations is likely to be due to the transport of road traffic emissions towards the north side of the A40 on the prevailing southwesterly wind (a windrose is shown in **Figure 2 Appendix G**).

[52] Defra [Online]. *Local Air Quality Management (LAQM) Support*. Accessed 28.07.2020. Available at: http://laqm.defra.gov.uk/

Table 5.6: Measured Annual Mean NO_2 Concentrations and Estimated Annual Mean NOx Concentrations (µg/m3)

Site ID	Location	Type	NO_2	NOx
NAS8	A40 Whitehill House Cottage	Roadside	31.4	56.4
NAS9	A40 junction with Southleigh Turn	Roadside	18.7	30.1
Critical Level				**30**

Nutrient Nitrogen and Acid Nitrogen Deposition

5.49 Background nitrogen deposition fluxes across the Oxford Meadows SAC have been obtained from the APIS website and are shown in **Table 5.7**. The data are average fluxes from the years 2016 to 2018. Background deposition fluxes of acid nitrogen are below the critical load; however, background deposition fluxes of nutrient nitrogen may exceed the critical load in some areas of the SAC.

Table 5.7: Estimated Annual Mean Background Nitrogen Deposition 2016-2018 (µg/m3)

Year		Nutrient Nitrogen (kg/ha/yr)	Acid Nitrogen (keq/ha/yr)
2016-2018	Minimum	14.9	1.1
	Maximum	23.6	1.7
	Average	17.4	1.2
Critical Load		**20**	**2.058**

Predicted Baseline Concentrations

5.50 Baseline concentrations and deposition fluxes at the closest point of the four transects in the Oxford Meadows SAC to the A40, i.e. at 0m distance from the road, are set out in **Table 5.8**. These are the predicted baseline concentrations at 2019 and 2031 without the Salt Cross Garden Village or the West Eynsham SDA. The baseline road contributions of nutrient and acid nitrogen have been added to the average background nitrogen depositions in order to estimate total nitrogen deposition.

Table 5.8: Predicted Baseline Concentrations and Deposition Fluxes in 2019 and 2031[a]

Receptor	NOx (µg/m^3)		Nutrient Nitrogen (kg/ha/yr)		Acid Nitrogen (keq/ha/yr)	
	2019	2031	2019	2031	2019	2031
Transect 1	27.4	17.3	18.4	17.9	1.272	1.235
Transect 2	**42.4**	25.4	19.3	18.3	1.338	1.268
Transect 3	**46.5**	28.1	19.1	18.2	1.321	1.260
Transect 4	**44.7**	27.2	19.0	18.2	1.312	1.255
Assessment Criteria	30		20		2.058	

a - Exceedances of the assessment criteria are shown in bold.

5.51 In 2019, baseline annual mean NOx concentrations are predicted to be below the assessment criterion of 30 µg/m3 on Transect 1 closest to the A40; however, the assessment criterion is exceeded on Transects 2, 3 and 4 closest to the A40. By 2031 the baseline annual mean NOx concentrations are below the assessment criterion on all transects. The complete set of results for annual mean NOx concentrations at 1m intervals along each transect are provided in **Appendix H**.

5.52 At Transect 2, baseline annual mean NOx concentrations are predicted to exceed the assessment criterion up to 21m into the Oxford Meadows SAC in 2019. At Transects 3 and 4, annual mean NOx concentrations are predicted to exceed the assessment criterion along the full length of the modelled transects, 50m into the Oxford Meadows SAC in 2019.

5.53 Baseline nutrient and acid nitrogen deposition is predicted to be below the assessment criteria along the length of all the transect receptors in 2019 and 2031.

Impact Assessment

Screening

NOx

5.54 The effects of the predicted increase in traffic associated with the garden village alone, as well as in-combination with the West Eynsham development, on annual mean NOx concentrations at the closest point of the four transects in the Oxford Meadows SAC to the A40, i.e. at 0m distance from the

road, are set out in **Table 5.9**. The screening criterion is exceeded at all four transects; therefore, further assessment has been undertaken to inform the conclusion regarding adverse effects on integrity, see below.

Table 5.9: Predicted Road Contribution to NOx in 2031

Receptor	Predicted Road Contribution of Annual Mean NOx (µg/m3)		% of Screening Criterion	
	Alone	In-combination	Alone	In-combination
Transect 1	0.7	0.8	**2**	**3**
Transect 2	1.4	1.5	**5**	**5**
Transect 3	1.2	1.4	**4**	**5**
Transect 4	1.1	1.3	**4**	**4**
Screening Criterion	-		**1**	

A - Exceedances of 1% of the assessment criterion are shown in bold.

Nitrogen Deposition

5.55 The predicted road contributions of the garden village both alone and in-combination with the West Eynsham SDA to nutrient and acid nitrogen deposition fluxes at the transect receptors located closest to the A40 are set out in **Table 5.10** and **Table 5.11** respectively. The predicted contributions are below the screening criteria for both nutrient and acid nitrogen deposition; therefore, the impacts would not be significant, and no further assessment has been undertaken. The effect due to road traffic emissions decreases with distance from source (A40) and there would not be significant impacts further along the transects.

Table 5.10: Predicted Road Contribution to Nutrient Nitrogen Deposition in 2031

Receptor	Predicted Road Contribution of Nutrient N (kg/ha/yr)		% of Nutrient N Screening Criterion	
	Alone	In-combination	Alone	In-combination
Transect 1	0.05	0.06	0	0
Transect 2	0.10	0.11	0	1
Transect 3	0.09	0.10	0	0
Transect 4	0.08	0.09	0	0
Screening Criterion	-		**1**	

Table 5.11: Predicted Road Contribution to Acid Nitrogen Deposition in 2031

Receptor	Predicted Road Contribution of Acid N (keq/ha/yr)		% of Acid N Screening Criterion a	
	Alone	In-combination	Alone	In-combination
Transect 1	0.004	0.004	0	0
Transect 2	0.007	0.008	0	0
Transect 3	0.006	0.007	0	0
Transect 4	0.006	0.006	0	0
Screening Criterion	-		**1**	

Further Assessment

NOx

Impacts of Salt Cross Garden Village Alone

5.56 Predicted total annual mean NOx concentrations at the closest point of the four transects in the Oxford Meadows SAC to the A40, i.e. at 0m distance from the road, are set out in **Table 5.12**. Predicted total NOx concentrations are below the 30µg/m^3 assessment criterion both with the Salt Cross Garden Village and without the garden village but with the West Eynsham SDA. The complete set of results for annual mean NOx concentrations along each transect are provided in **Appendix H**, and show that the NOx concentrations decrease further below the assessment criterion with distance from the road.

Table 5.12: Predicted 2031 Nitrogen Oxides Impacts Salt Cross Garden Village Alone

Receptor	Predicted Total NOx (µg/m^3)		Impact		
	Without Garden Village, with West Eynsham SDA	With Garden Village and West Eynsham SDA	Increase in total NOx from Garden Village Alone (µg/m^3)	Increase as Percentage of Assessment Criterion (%)	With Garden Village Total NOx as Percentage of Assessment Criterion (%)
Transect 1	17.4	18.1	0.7	2	60
Transect 2	25.5	26.9	1.4	5	90
Transect 3	28.2	29.4	1.2	4	98
Transect 4	27.3	28.4	1.1	4	95
Assessment Criterion	**30**		-		

Impacts of Salt Cross Garden Village In-combination with West Eynsham SDA

5.57 Predicted total annual mean NOx concentrations at the closest point of the four transects in the Oxford Meadows SAC to the A40, i.e. at 0m distance from the road, are set out in **Table 5.13**. Predicted total NOx concentrations are below the 30µg/m^3 critical level assessment criterion both without and with the Salt Cross Garden Village and West Eynsham SDA. Total NOx concentrations with the Salt Cross Garden Village and West Eynsham SDA are predicted to be 98% of the critical level at the worst-case receptor (Transect 3). The complete set of results for annual mean NOx concentrations along each transect are provided in **Appendix H**.

Table 5.13: Predicted 2031 Nitrogen Oxides Impacts Salt Cross Garden Village In-combination with West Eynsham SDA

Receptor	Predicted Total NOx (µg/m3)		Impact		
	Without Garden Village, without West Eynsham SDA	With Garden Village and West Eynsham SDA	Increase in total NOx from Garden Village and West Eynsham SDA (µg/m3)	Increase as Percentage of Assessment Criterion (%)	With Garden Village and West Eynsham SDA Total NOx as Percentage of Assessment Criterion (%)
Transect 1	17.3	18.1	0.8	3	60
Transect 2	25.4	26.9	1.5	5	90
Transect 3	28.1	29.4	1.4	5	98
Transect 4	27.2	28.4	1.3	4	95
Assessment Criterion	30		-		

Mitigation

5.58 Mitigation measures to reduce pollutant emissions from road traffic are principally being delivered in the longer term by the introduction of more stringent emissions standards, largely via European legislation. The transport modelling report[53] published as part of the evidence base for the AAP states the following:

[53] Oxfordshire County Council (July 2020). *Garden Village AAP and West Eynsham SPD Evidence Base. 2031 Forecast Year Modelling. VISSIM Microsimulation. Modelling Report.* Available at:

"In recent years, there have been significant technological advances and changes in the social, economic and environmental conditions which influence travel behaviour.

Current modelling does not take into account these future changing trends nor the mode shift that will take place as a result of the bold Connecting Oxford proposals and other policy interventions; the increasing momentum towards modal shift due to the climate emergency; and increased home/remote working. The HIF infrastructure improvements were also excluded from the modelling due to their uncertainty at the time that modelling for the OCGV and West Eynsham SDA began.

All of these initiatives will discourage driving along the A40 and will influence background traffic growth in the area as well as OCGV and West Eynsham SDA development-related trips.

Further work to model the impact of policy interventions and changing travel behaviours will be undertaken as part of the ongoing HIF modelling work and to further support the AAP process."

5.59 The Salt Cross Garden Village AAP already includes a number of policies that will help to reduce car journeys along the A40, as follows:

- Policy 13: Movement and Connectivity Key Design Principles
- Policy 14: Active and Healthy Travel
- Policy 15: Public Transport
- Policy 16: Reducing the Overall Need to Travel Including by Car
- Policy 20: Homeworking

5.60 In addition, Policy 11: Environmental Assets already requires the following report to accompany the outline planning application for the garden village proposal:

"An air quality assessment, assessing the impact of the operational characteristics of the development, the traffic generated by it and the cumulative effects on local air quality and wider air quality, including … the Oxford Meadows SAC, in accordance with up to date best practice."

5.61 Therefore, it is not considered necessary to make any further recommendations for policies in the AAP.

https://westoxon.gov.uk/media/k4qjr1g4/2031-forecast-year-modelling-final-report.pdf

Assessment of effects on integrity of Oxford Meadows SAC

5.62 The air quality assessment has shown that the Salt Cross Garden Village will not increase above 1% of the critical loads for the Oxford Meadows SAC in relation to nutrient and acid nitrogen deposition within 50m of the A40.

5.63 In addition, despite the annual mean NOx concentration associated with the Garden Village increasing by more than 1% of the critical level, the NOx concentration within the Oxford Meadows adjacent to the A40 at 2031, associated with increased traffic from the Salt Cross Garden Village alone and in-combination with the West Eynsham SDA (and other planned housing growth within the Oxfordshire districts) will not exceed the critical level (30µg/m^3) for the qualifying habitats of the Oxford Meadows SAC. However, at some locations along the A40 (i.e. near Transects 2, 3 and 4), the predicted NOx concentrations at 2031 will be 90-98% of the critical level.

5.64 Although this is very close to the critical level, adverse effects on the integrity of the SAC are considered unlikely as a result of air pollution for the following reasons:

- The three component SSSI units in areas susceptible to nitrogen deposition (i.e. within 200m of the A40) are currently in 'favourable' condition despite the existing levels of nitrogen in the air, and the historic, long-term presence of main roads in the vicinity of this SAC. Therefore, the SAC may show some resilience to the effects of nitrogen deposition.
- Only 6.6% of the SAC is within 200m of the A40.
- Physical barriers in the form of high hedgerows and woodland are present between the road and the SAC for most of the length of the A40 that is adjacent to the SAC.
- The prevailing wind will generally move particulates north-east and away from the SAC which is located on the south and west of the A40.
- Policies in the AAP will help to reduce car journeys along the A40 and ensure that air quality impacts on the Oxford Meadows SAC are considered in further detail as part of the outline planning application for the Garden Village.

5.65 The potential increases in NOx concentrations associated with the Salt Cross Garden Village (alone and in-combination) are therefore considered unlikely to:

- Delay the achievement of conservation objectives for the site.
- Interrupt progress towards the achievement of conservation objectives for the site.

- Disrupt factors that help to maintain the favourable conditions of the site.
- Interfere with the balance, distribution and density of key habitats and species that are the indicators of the favourable condition of the site.

5.66 Therefore, it can be concluded that the Salt Cross Garden Village AAP will not result in adverse effects on the integrity of the Oxford Meadows SAC as a result of air pollution, either alone or in-combination with other plans and projects.

Chapter 6
Consultation and Next Steps

6.1 This HRA report concluded at the Screening stage that likely significant effects on the integrity of European sites around West Oxfordshire and neighbouring districts from preferred policy approaches in the Pre-Submission Draft version of the AAP will not occur in relation to:

- physical loss or damage to on- or off-site habitat;
- non-physical disturbance;
- non-toxic contamination;
- water quality/quantity; and
- recreation pressure.

6.2 However, there could be likely significant effects on Oxford Meadows SAC in relation to increased air pollution.

6.3 Therefore, this potential likely significant effect has been considered further through an Appropriate Assessment to determine whether the AAP will affect the integrity of the SAC. The Appropriate Assessment found that the Salt Cross Garden Village will not increase above 1% of the critical loads for the Oxford Meadows SAC in relation to nutrient and acid nitrogen deposition within 50m of the A40.

6.4 In addition, the annual mean NOx concentration at 2031 within the Oxford Meadows SAC adjacent to the A40, associated with increased traffic from the Salt Cross Garden Village alone and in-combination with the West Eynsham SDA (and other planned housing growth within the Oxfordshire districts) will not exceed the critical level (30µg/m3) for the qualifying habitats of the Oxford Meadows SAC.

6.5 The conclusions of the Appropriate Assessment are that the Salt Cross Garden Village AAP will not result in adverse effects on the integrity of the Oxford Meadows SAC as a result of air pollution, either alone or in-combination with other plans and projects.

6.6 This HRA report will be published alongside the Regulation 19 version of the AAP. Specific consultation will be undertaken with Natural England throughout as the statutory consultation body for HRA, and any further work undertaken if necessary prior to Submission of the AAP or during its Examination.

LUC
August 2020

Appendix A

Consultation response from Natural England

Table A.1: Consultation response from Natural England in relation to the Preferred Options HRA Report (December 2019)

Comment	Response
Thank you for providing us with a copy of the HRA Screening Report for the OCGV; I have reviewed the report and can confirm that I am satisfied with the conclusions. I note that Oxford Meadows has been screened-in for Appropriate Assessment due to Likely Significant Effects arising from air pollution from traffic; with regard to this we have published information on our approach to advising competent authorities on the assessment of road traffic emissions under the Habs Regs and would recommend that reference is made to this when traffic modelling data is available to inform the Appropriate Assessment.	Noted. The Natural England guidance referred to has been used to inform the Appropriate Assessment.

Appendix B

Map of European Sites within 15km of West Oxfordshire Local Authorities

Oxfordshire Cotswold Garden Village AAP HRA

Figure B.1: European sites within 15km of West Oxfordshire District

- West Oxfordshire District Boundary
- 15km Boundary Buffer
- District Boundaries
- Garden Village Boundary
- Special Areas of Conservation

Map Scale @A3: 1:260,000

CB:CB EB:Bean_C LUC FIGX_T190628_EuropeanSites_A3L_2 16/09/2019

Source: NE, OS, WODC

Appendix C

Attributes of screened in European Sites

European site	Area (ha)	Location in relation to the OCGV site	Qualifying features	Non-qualifying habitats and species upon which the qualifying habitats and/or species depend	Key vulnerabilities and environmental conditions to support site integrity
Within West Oxfordshire					
Oxford Meadows SAC	265.89	2.5km east with the majority of the site within the Cherwell and Oxford districts	Annex 1 Habitats Lowland hay meadows Creeping marshwort *Apium repens*	Lowland hay meadows The habitat is maintained through annually cutting for hay, with light aftermath grazing, seasonal flooding maintains an input of nutrients. Therefore, conservation measures for this feature will typically include grazing, cutting, scrub management, weed control, recreation/visitor management. Along with the maintenance of surface drainage features such as grips, gutters and foot drains, and retention of suitable land use infrastructure/patterns to enable site management e.g. pastoral livestock farming. Creeping marshwort *Apium repens* This species relies on damp and sparsely vegetated grasslands which are nutrient-rich and susceptible to winter flooding. This species requires periodic disturbance which can be achieved through cattle grazing or the seasonal flooding. This is to reduce competition for light as this species is a low-growing clonal perennial.	*The conservation objective is to 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.* *Subject to natural change, maintain or restore:* ■ the extent and distribution of 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." Key priorities and threats include: ■ Hydrological changes; ■ Invasive species such as *Crassula* ■ Water quality *The associated SSSI is predominantly in a favourable condition, with a small portion in an unfavourable condition but is recovering*.
Outside of West Oxfordshire:					
Cothill Fen SAC	43.55	9.3km south within the Valley of the White Horse	Annex 1 Habitats Alkaline Fens Alluvial forests with Alnus	Alkaline Fens This habitat relies on calcium-rich, waterlogged soils which generally support a varied assemblage of mosses and floral	*The conservation objective is to ensure that the integrity of the site is maintained or restored as appropriate and ensure that the site contributes to achieving the Favourable Conservation*

European site	Area (ha)	Location in relation to the OCGV site	Qualifying features	Non-qualifying habitats and species upon which the qualifying habitats and/or species depend	Key vulnerabilities and environmental conditions to support site integrity
		district	glutinosa and Fraxinus excelsior; Alder woodland on floodplains	species. These conditions have been achieved due to hydrological changes within the site's unique geology. The SAC contains one of the largest surviving examples of alkaline fen in the UK, and has been managed through moderate mowing or grazing with arisings removed to prevent nutrient enrichment, peat digging and creation of ponds. The SAC supports black bog-rush – blunt flowered rush *Schoenus nigricans – Juncus subnodulosus,* bottle sedge *Carex rostrata*, grass-of-Parnassus *Parnassia palustris,* common butterwort *Pinguicula vulgaris* and marsh helleborine *Epipactis palustris.* Alluvial forests The alkaline fens have transitioned into wet alder *Alnus glutinosa* woodland which are characteristicly found within floodplains. They often then transition further into dry woodlands. Alluvial forests typically support a varied community assemblage given the transitional conditions, comprising tall herb, reed and sedge species to marshy and lo-growing species. This habitat has become fragmented within the UK due to riverine woodland clearances.	*Status of its Qualifying Features.* *Subject to natural change, maintain or restore:* ■ the extent and distribution of habitats of qualifying species; ■ the structure and function (including typical species) of qualifying natural habitats; and, ■ the supporting processes on which qualifying natural habitats and the habitats of qualifying species rely. The key priorities and issues facing this site include: ■ Water quality and quantity ■ Air pollution *The associated SSSI is predominantly in a favourable condition, with the remainder in an unfavourable condition but recovering.*

Appendix D

HRA Screening Matrices for the Salt Cross Garden Village AAP

Table D.1 Policies with no pathway to European Sites

AAP Policy	Likely activities (operations) to result as a consequence of the proposal	Likely effects if proposal implemented	European site(s) potentially affected	Likely significant effect (LSE)?
Policy 1: Climate Resilience and Adaptation	None – the policy itself will not lead to development.	None	None	No LSE
Policy 2: Net Zero Carbon Development	None – the policy itself will not lead to development.	None	None	No LSE
Policy 3: Towards 'Zero Waste' through the Circular Economy	None – the policy itself will not lead to development.	None	None	No LSE
Policy 4: Adopting Healthy Place Shaping Principles	None – the policy itself will not lead to development but sets out principles of healthy place shaping which will apply to all development.	None	None	No LSE
Policy 5: Social Integration, Interaction and Inclusion	None – the policy itself will not lead to development.	None	None	No LSE
Policy 6: Providing Opportunities for Healthy Active Play, Leisure and Lifestyles	None – the policy itself will not lead to development.	None	None	No LSE
Policy 7: Green Infrastructure	None – the policy itself will not lead to development. This policy will promote a high quality network of blue and green infrastructure throughout the garden village, which could potentially provide mitigation and enhancement measures for the proposed development (mitigation will be considered during the Appropriate Assessment as relevant).	None	None	No LSE
Policy 8: Enabling Healthy Local Food Choices	None – this policy will not result in development.	None	None	No LSE
Policy 9: Biodiversity Net Gain	None – this policy will not result in development.	None	None	No LSE
Policy 10: Water Environment	None – the policy itself will not lead to development	None	None	No LSE
Policy 11: Environmental Assets	None – the policy itself will not lead to development.	None	None	No LSE

AAP Policy	Likely activities (operations) to result as a consequence of the proposal	Likely effects if proposal implemented	European site(s) potentially affected	Likely significant effect (LSE)?
Policy 12: Conserving and Enhancing the Historic Environment of Salt Cross	None – the policy itself will not lead to development.	None	None	No LSE
Policy 13: Movement and Connectivity Key Design Principles	None – the policy itself will not lead to development.	None	None	No LSE
Policy 14: Active and Healthy Travel	None – this policy will not result in built development; rather it focuses on the provision of walking and cycle links which may help to reduce the level of vehicular traffic and reduce nitrogen deposition within the site (mitigation will be considered during the Appropriate Assessment as relevant).	None	None	No LSE
Policy 15: Public Transport	None that will result in an increase in vehicle movements along the A40 (the only type of effect screened into this HRA).	N/A	None	No LSE
Policy 16: Reducing the Overall Need to Travel Including by Car	None – this policy itself will not result in development	None	None	No LSE
Policy 20: Homeworking	None – this policy itself will not result in development	None	None	No LSE
Policy 21: Employment Skills and Training	None – this policy itself will not result in development	None	None	No LSE
Policy 23: Housing Mix	None – the policy itself will not lead to development as it relates to the mix of housing. The quantum of housing to be provided is within the overall housing figure assessed separately.	None	None	No LSE
Policy 24: Build to Rent	None – the policy itself will not lead to development as it relates to the type of housing to be provided. The quantum of housing to be provided is within the overall housing figure assessed separately.	None	None	No LSE
Policy 25: Custom and	None – although this policy proposes that at	None	None	No LSE

AAP Policy	Likely activities (operations) to result as a consequence of the proposal	Likely effects if proposal implemented	European site(s) potentially affected	Likely significant effect (LSE)?
Self-Build Housing	least 5% of the total number of proposed residential units are comprised of serviced plots for self and custom build housings; it relates to the type of housing whereas the quantum of housing to be provided is within the overall housing figure assessed separately.			
Policy 26: Specialist Housing Needs	None – although this policy proposes the provision of specialised residential units; it relates to the type of housing whereas the quantum of housing to be provided is within the overall housing figure assessed separately.	None	None	No LSE
Policy 27: Key development principles	None – the policy itself will not lead to development, but sets out key development principles which all proposed development will be expected to comply with.	None	None	No LSE
Policy 28: Land uses and layout – the spatial framework	None – the policy itself will not lead to development, but will determine the distribution and layout of development within the garden village site.	None	None	No LSE
Policy 29: Design requirements	None – the policy itself will not lead to development, but sets out design requirements that all development will need to comply with.	None	None	No LSE
Policy 31: Long-term maintenance and stewardship	None – the policy itself will not lead to development.	None	None	No LSE

Table D.2 Plan policies with potential pathway to European Sites

AAP Policy	Likely activities (operations) to result as a consequence of the proposal	Likely effects if proposal implemented (taking into account only those effects screened in within Chapter 4)	European site(s) potentially affected	Significant effect
Policy 17: Road Connectivity and Access	New/improved highways infrastructure.	Increased vehicle traffic.	Oxford Meadows SAC	LSE
Policy 18: Salt Cross Science and Technology Park	Development of a campus of business floorspace, approximately 40 hectares in size.	Increased vehicle traffic (including commuters from elsewhere to access the site)	Oxford Meadows SAC	LSE
Policy 19: Small-scale Commercial Opportunities and Flexible Business Space	Development of small-scale commercial and flexible business space.	Increased vehicle traffic.	Oxford Meadows SAC	LSE
Policy 22: Housing Delivery	Development of 2,200 homes.	Increased vehicle traffic	Oxford Meadows SAC	LSE
Policy 30: Provision of supporting infrastructure	Development of transport infrastructure, schools, green and blue infrastructure, flood management and sewerage infrastructure to support delivery of the 2,200 homes.	Increased vehicle traffic	Oxford Meadows SAC	LSE

Appendix E

Location of Oxford Meadows in relation to the A40 and A34

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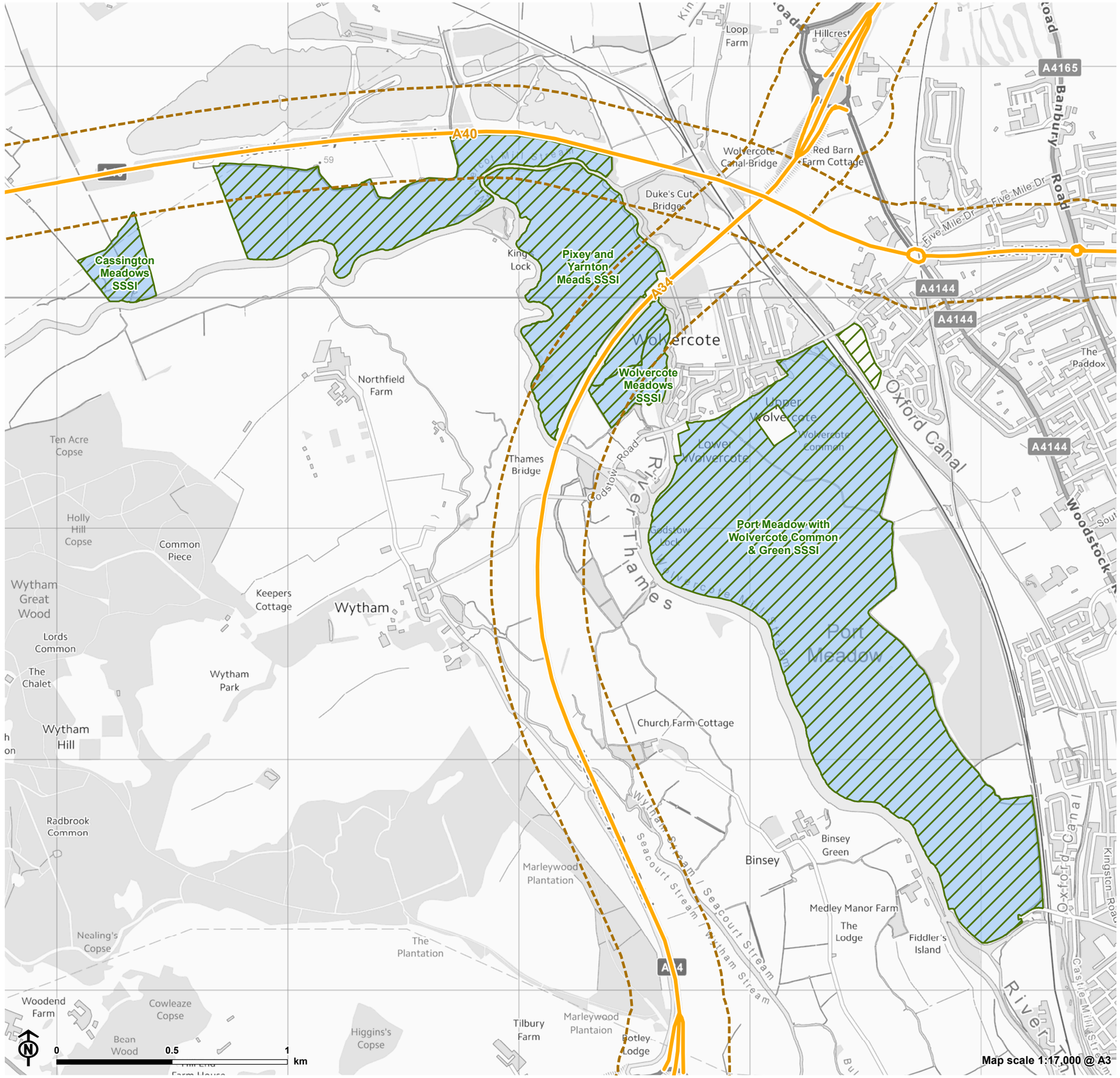
Figure E.1: Location of Oxford Meadows SAC in relation to the A40 and A34

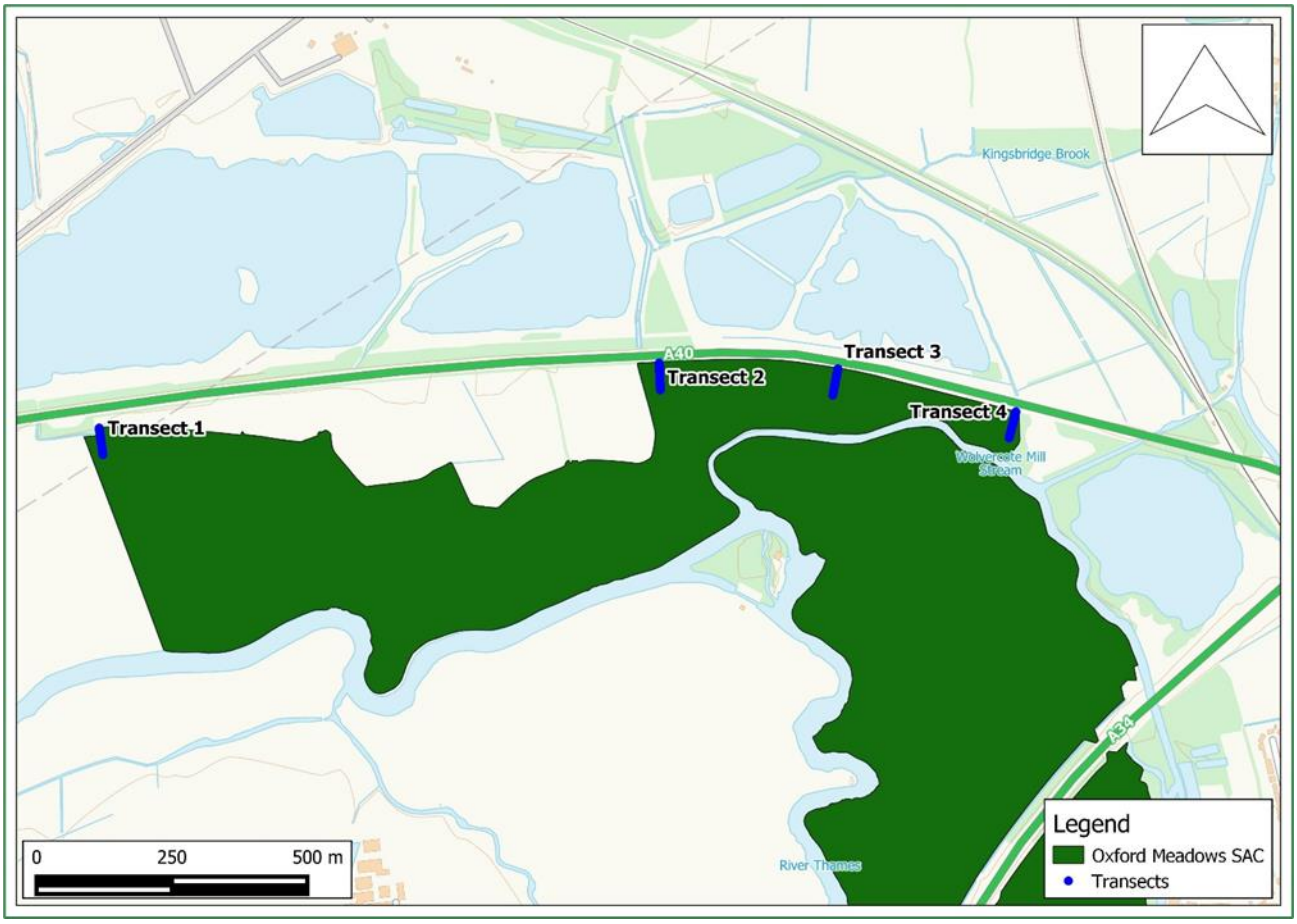


CB:MN EB:Nicholson_M LUC FIGAE-1_10887_r0_Designations_A3L 04/08/2020
Source: Natural England, OS

Appendix F

Oxford Meadows SAC and Location of the Monitoring Transects

Figure F.1: Oxford Meadows SAC and Location of the Monitoring Transects



Appendix G
Modelling Methodology

Model Inputs

Receptors

Table G.1: Location of Transect Receptors

Receptor	Transect 1		Transect 2		Transect 3		Transect 4	
	x	y	x	y	x	y	x	y
0m	446706.9	210580.2	447741.8	210700.6	448071.8	210689.7	448400.7	210610.3
1m	446707.0	210579.2	447741.8	210699.6	448071.6	210688.7	448400.4	210609.3
2m	446707.2	210578.2	447741.8	210698.6	448071.4	210687.7	448400.2	210608.3
3m	446707.3	210577.2	447741.8	210697.6	448071.2	210686.7	448399.9	210607.4
4m	446707.4	210576.3	447741.9	210696.6	448071.0	210685.7	448399.7	210606.4
5m	446707.6	210575.3	447741.9	210695.6	448070.8	210684.8	448399.4	210605.4
6m	446707.7	210574.3	447742.0	210694.6	448070.7	210683.8	448399.2	210604.5
7m	446707.8	210573.3	447742.0	210693.6	448070.5	210682.8	448398.9	210603.5
8m	446708.0	210572.3	447742.1	210692.6	448070.3	210681.8	448398.7	210602.5
9m	446708.1	210571.3	447742.1	210691.6	448070.1	210680.8	448398.4	210601.6
10m	446708.3	210570.3	447742.1	210690.6	448069.9	210679.8	448398.2	210600.6
11m	446708.4	210569.3	447742.2	210689.6	448069.7	210678.9	448397.9	210599.6
12m	446708.5	210568.3	447742.2	210688.6	448069.5	210677.9	448397.7	210598.7
13m	446708.7	210567.3	447742.3	210687.6	448069.3	210676.9	448397.4	210597.7
14m	446708.8	210566.3	447742.3	210686.6	448069.1	210675.9	448397.2	210596.7
15m	446708.9	210565.4	447742.3	210685.6	448068.9	210674.9	448396.9	210595.8
16m	446709.1	210564.4	447742.4	210684.6	448068.7	210674.0	448396.7	210594.8
17m	446709.2	210563.4	447742.4	210683.6	448068.5	210673.0	448396.4	210593.8
18m	446709.4	210562.4	447742.4	210682.6	448068.3	210672.0	448396.2	210592.8
19m	446709.5	210561.4	447742.5	210681.6	448068.2	210671.0	448395.9	210591.9
20m	446709.6	210560.4	447742.5	210680.6	448068.0	210670.0	448395.7	210590.9
21m	446709.8	210559.4	447742.6	210679.6	448067.8	210669.1	448395.4	210589.9
22m	446709.9	210558.4	447742.6	210678.6	448067.6	210668.1	448395.2	210589.0
23m	446710.1	210557.4	447742.7	210677.6	448067.4	210667.1	448394.9	210588.0
24m	446710.2	210556.4	447742.7	210676.6	448067.2	210666.1	448394.7	210587.1
25m	446710.3	210555.5	447742.7	210675.6	448067.0	210665.1	448394.4	210586.1
26m	446710.5	210554.5	447742.8	210674.6	448066.8	210664.1	448394.2	210585.1
27m	446710.6	210553.5	447742.8	210673.6	448066.6	210663.2	448393.9	210584.1
28m	446710.8	210552.5	447742.8	210672.6	448066.4	210662.2	448393.7	210583.2
29m	446710.9	210551.5	447742.9	210671.6	448066.2	210661.2	448393.4	210582.2
30m	446711.0	210550.5	447742.9	210670.6	448066.0	210660.2	448393.2	210581.2
31m	446711.2	210549.5	447743.0	210669.6	448065.8	210659.2	448392.9	210580.3
32m	446711.3	210548.5	447743.0	210668.6	448065.7	210658.3	448392.7	210579.3
33m	446711.4	210547.5	447743.0	210667.6	448065.5	210657.3	448392.4	210578.3
34m	446711.6	210546.5	447743.1	210666.6	448065.3	210656.3	448392.2	210577.4
35m	446711.7	210545.6	447743.1	210665.6	448065.1	210655.3	448391.9	210576.4
36m	446711.8	210544.6	447743.2	210664.6	448064.9	210654.3	448391.7	210575.4
37m	446712.0	210543.6	447743.2	210663.6	448064.7	210653.3	448391.4	210574.5
38m	446712.1	210542.6	447743.3	210662.6	448064.5	210652.4	448391.2	210573.5
39m	446712.3	210541.6	447743.3	210661.6	448064.3	210651.4	448390.9	210572.5
40m	446712.4	210540.6	447743.3	210660.6	448064.1	210650.4	448390.7	210571.6
41m	446712.5	210539.6	447743.3	210659.6	448063.9	210649.4	448390.4	210570.6
42m	446712.7	210538.6	447743.4	210658.6	448063.7	210648.4	448390.2	210569.6
43m	446712.8	210537.6	447743.4	210657.6	448063.5	210647.5	448389.9	210568.6
44m	446713.0	210536.6	447743.5	210656.6	448063.3	210646.5	448389.7	210567.7
45m	446713.1	210535.6	447743.5	210655.6	448063.2	210645.5	448389.5	210566.7
46m	446713.3	210534.7	447743.6	210654.6	448063.0	210644.5	448389.2	210565.7
47m	446713.4	210533.7	447743.6	210653.6	448062.8	210643.5	448389.0	210564.8
48m	446713.5	210532.7	447743.6	210652.6	448062.6	210642.6	448388.7	210563.8
49m	446713.7	210531.7	447743.7	210651.6	448062.4	210641.6	448388.5	210562.8
50m	446713.8	210530.7	447743.7	210650.6	448062.2	210640.6	448388.2	210561.9

Traffic Data

1.1 The AADT flows for the A40 adjacent to the Oxford Meadows SAC have been provided by Oxfordshire County Council, having been extracted from the VISSIM model of Eynsham. The vehicle fleet composition data have been determined using 2019 data from a Department for Transport (DfT) count point located on the same stretch of the A40 (DfT, 2019a). The vehicle fleet composition is assumed to remain the same for the 2031 scenarios as it is in 2019. Traffic speeds have been estimated based on the speed limit (60 mph). The traffic data are shown in **Table G.2**. The modelled road network is shown in **Figure G.2**.

1.2 The VISSIM baseline traffic data are from 2018. In order to verify the model against the most recent published monitoring data, the 2018 traffic data has been factored to 2019 using the TEMPRO System v7.2b (DfT, 2019b).

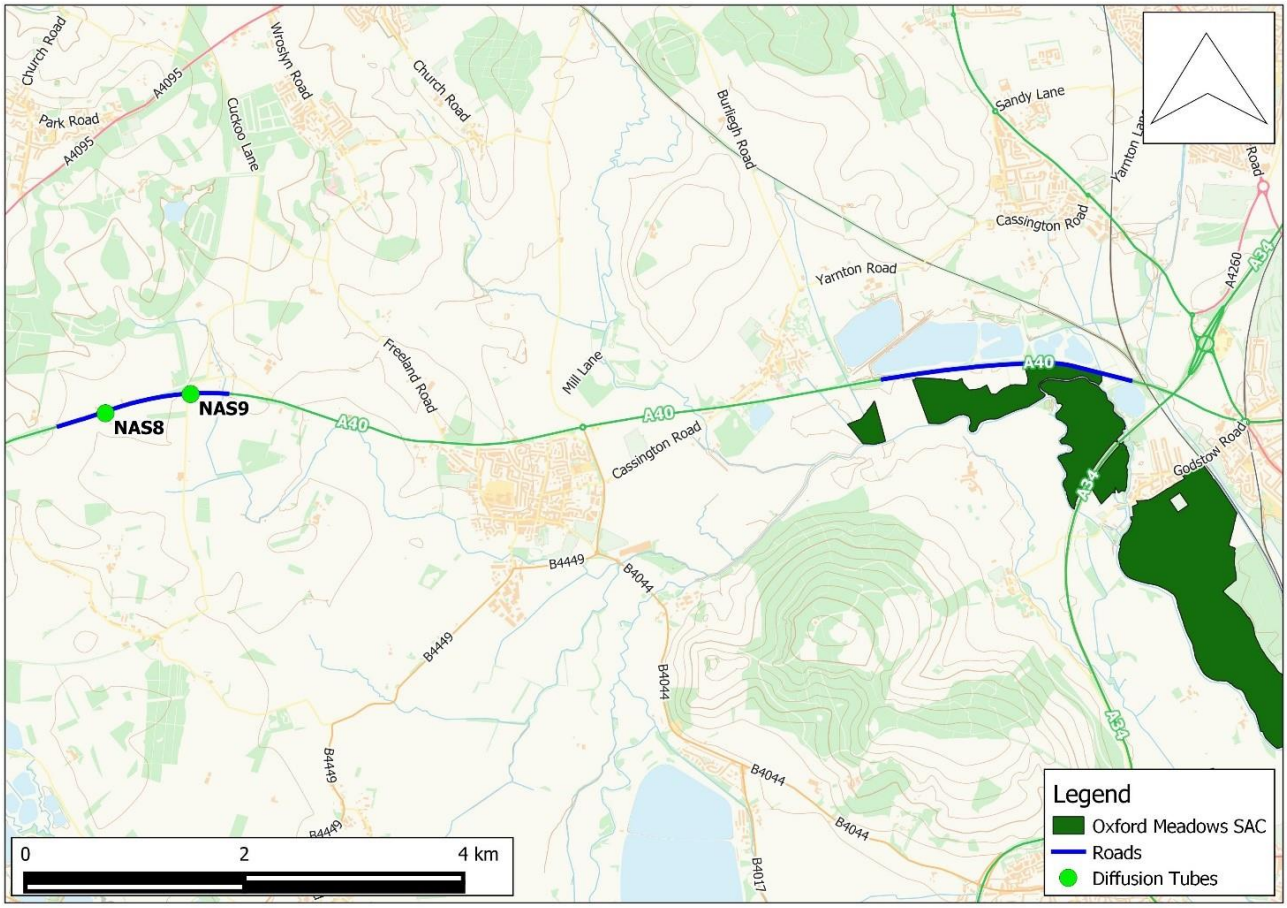
1.3 Diurnal flow profiles for the traffic have been derived from the national diurnal profiles published by the DfT (DfT, 2019c).

Table G.2: Summary of Traffic Data used in the Assessment[1]

Road Link	AADT				Fleet Composition (%)					
	2019	2031			Car	LGV	Rigid HGV	Artic HGV	Bus Coach	MC
		Baseline	With West Eynsham SDA	With West Eynsham SDA and Garden Village						
A40	18,617	23,441	23,722	26,246	75.2	15.0	4.3	3.7	0.5	1.4

[1] LGV = light goods vehicle (<3.5 tonnes), HGV = heavy goods vehicle (>3.5 tonnes), MC = motorcycle

Figure G.2: Modelled Roads and Diffusion Tube Monitoring Sites



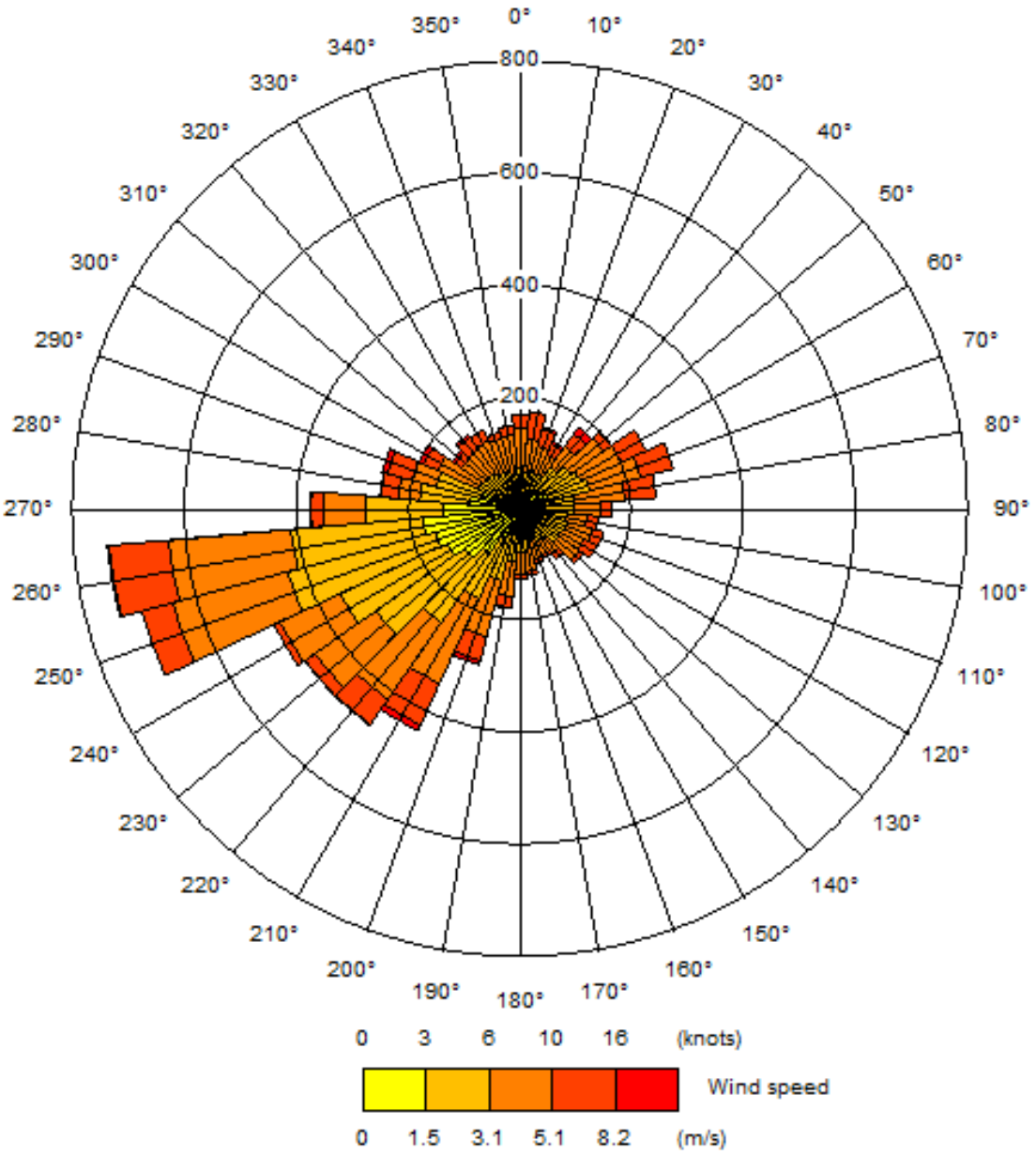
Emissions

1.4 Emissions have been calculated using the most recent version of the Emissions Factor Toolkit (EFT) v8.0.1 (Defra, 2020b). The traffic data were entered into the EFT in order to calculate a combined emission rate for each of the road links in the modelled network. Emissions data are only available up to 2030; therefore, it has been assumed that emissions in 2031 will be the same as those in 2030.

Meteorological Data

1.5 The model has been run using the full year of meteorological data that corresponds with the most recent set of published monitoring data used for model verification (2019). The meteorological data has been taken from the monitoring station located at RAF Brize Norton, approximately 18 km to the west-southwest of the SAC, which is considered suitable for the area. A wind rose of the data is shown in **Figure G.3**.

Figure G.3: Wind Rose RAF Brize Norton 2019



Background Concentrations

1.6 Background NOx and NO2 concentrations have been derived from those published by Defra (Defra, 2020a). These cover the whole country on a 1 km by 1 km grid and are published for each year from 2017 to 2030. The current maps have been verified against measurements undertaken during 2017. As the background maps are only available up to 2030, it has been assumed that background concentrations in 2031 will be the same as those in 2030.

1.7 Background nitrogen and acid deposition data have been taken from the APIS database (APIS, 2020).

Verification

1.8 The verification process seeks to minimise uncertainties associated with the air quality model by comparing the model output with locally measured concentrations. The model has been verified against data from two diffusion tube monitoring sites located close to the A40, approximately 7km to the west of the SAC. The verification methodology is described below.

Background Concentrations

1.9 Background concentrations at each of the monitoring sites in the verification year (2019) have been derived from those published by Defra (Defra, 2020a) and are shown in **Table G.3**.

Table G.3: Annual Mean NOx and NO2 Background Concentrations at the Monitoring Sites (µg/m3)

Monitoring Site ID	Monitoring Site Location	Grid Square	2019	
			NOx	NO2
NAS8	A40 Whitehill House Cottage	439500,210500	12.2	9.1
NAS9	A40 junction with Southleigh Turn	440500,210500	12.3	9.2

Traffic Data

1.10 for model verification have been determined using DfT data, factored to match the data from the VISSIM model by comparing the VISSIM data with the DfT data adjacent to the Oxford Meadows SAC. DfT traffic data for 2019 have yet to be published; therefore, the 2018 traffic data has been factored to 2019 using the TEMPRO System v7.2b (DfT, 2019b). Traffic speeds have been estimated based on a speed limit of 60mph. The traffic data used for verification are shown in **Table G.4**. The modelled road is shown in **Figure G.2**.

1.11 Diurnal flow profiles for the traffic have been derived from the national diurnal profiles published by the DfT (DfT, 2019c).

Table G.4: Summary of Traffic Data used for Verification (2019)[2]

Road Link	AADT	Fleet Composition (%)					
		Car	LGV	Rigid HGV	Artic HGV	Bus Coach	MC
A40	23,083	77.8	13.6	4.2	2.9	0.5	1.1

NO2

1.12 Most NO2 is produced in the atmosphere by reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions of nitrogen oxides (NOx = NO + NO2). The model has been run to predict the 2019 annual mean NOx concentrations at two diffusion tube monitoring sites located close to the A40, as shown in **Figure G.2**.

1.13 The model output of road-NOx has been compared with the 'measured' road-NOx, calculated from the measured annual mean NO2 concentrations and the background concentrations using the NOx from NO2 calculator v7.1 published by Defra (Defra, 2020b).

1.14 The slope of the best-fit line between the 'measured' road-NOx contribution and the model derived road-NOx contribution, forced through zero, has been used to determine the adjustment factor (Figure 4). The adjustment factor of 1.73 has been applied to the modelled road-NOx concentration for each receptor to provide adjusted modelled road-NOx concentrations. The NOx to NO2 calculator has then been used to determine total NO2 concentrations from the adjusted modelled road-NOx concentrations and the background NO2 concentrations. A comparison of the final adjusted modelled total NO2 at each monitoring site to the measured total NO2 shows close agreement (**Figure G.5**).

1.15 The results imply that the model has under-predicted the road-NOx contribution. This is a common experience with this and most other models. An evaluation of the model performance using statistical methods is shown in **Table G.5**.

[2] LGV = light goods vehicle (<3.5 tonnes), HGV = heavy goods vehicle (>3.5 tonnes), MC = motorcycle

Figure G.4: Comparison of Measured Road NOx to Unadjusted Modelled Road NOx Concentrations

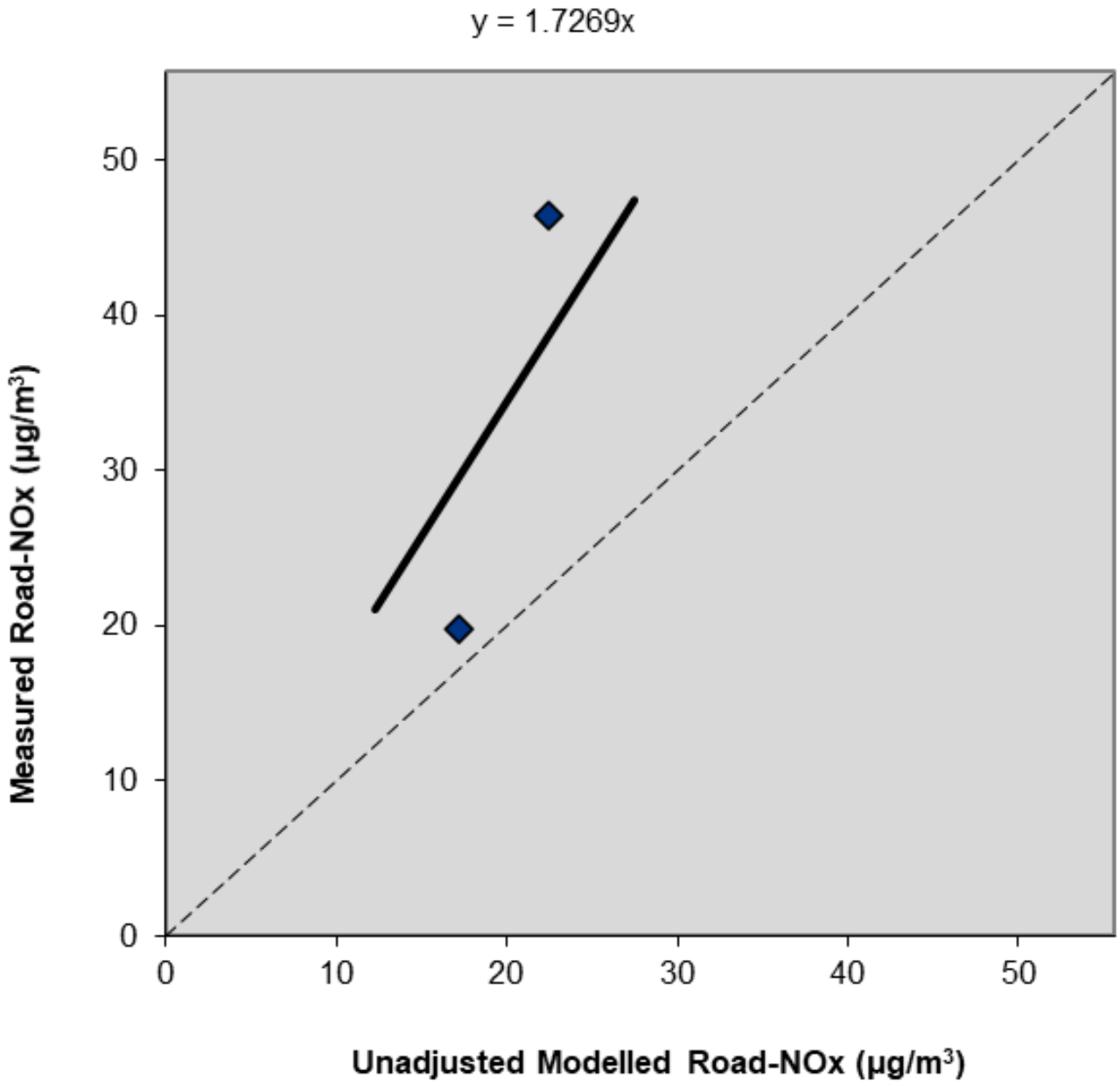


Figure G.5: Comparison of Measured Total NO2 to Primary Adjusted Modelled Total NO2 Concentrations

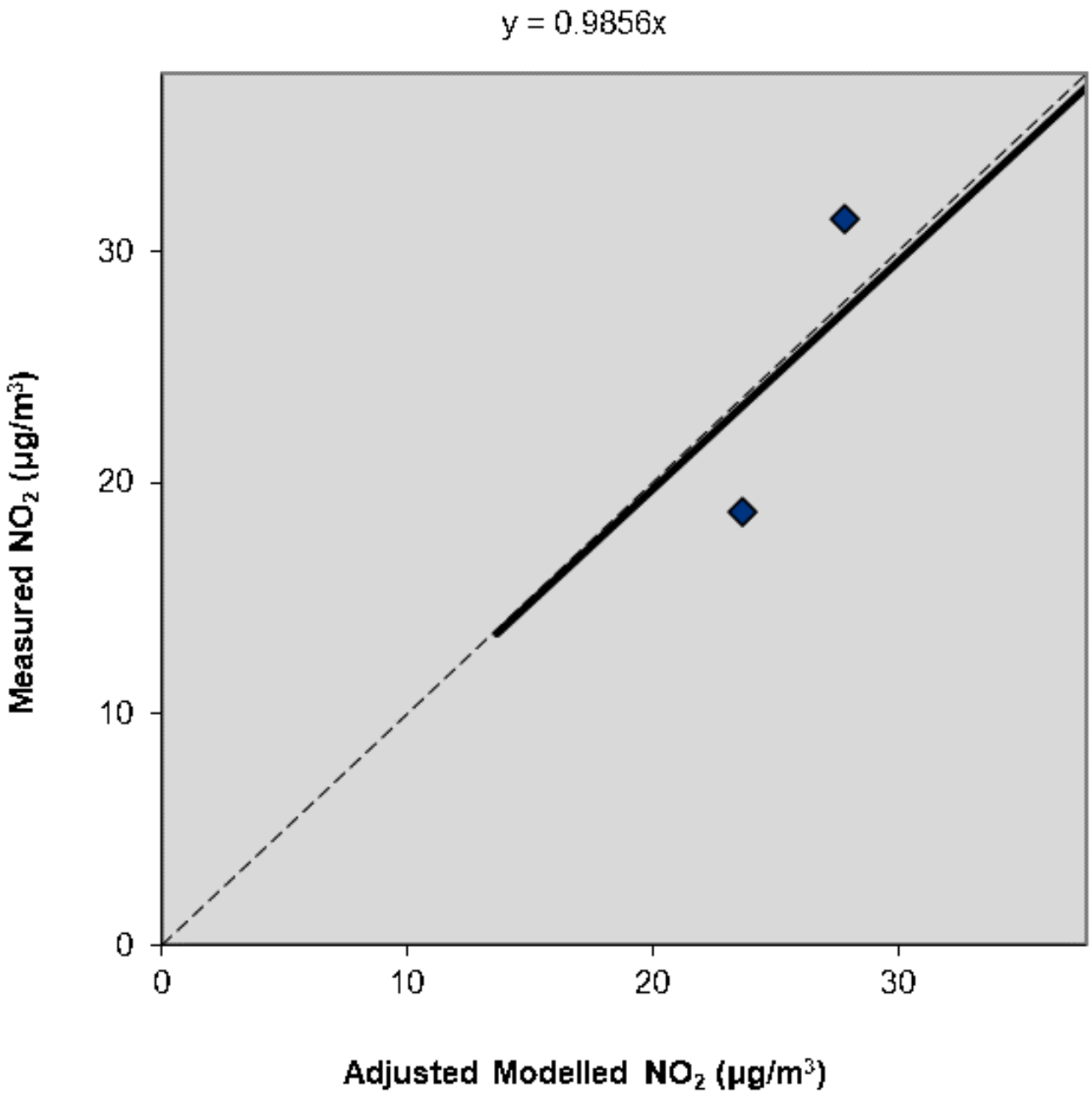


Table G.5: Evaluation of Model Performance

Statistical Parameter	Description	Values		
		Before verification (Figure 4)	After verification (Figure 5)	Ideal
Correlation coefficient	Linear relationship between predicted and observed data. Less useful for small datasets as single high/low values can have a large effect.	1.00	1.00	1
Fractional bias	Identifies systematic tendency to over/under predict (negative = over-predict, positive = under-predict).	0.50	-0.03	0.0
Root mean square error (RMSE)	Average error of the model (µg/m^3). Ideally within 10% of the annual mean NO_2 objective, i.e. 4 µg/m^3; however, within 25% acceptable, i.e. 10 µg/m^3.	17.03	4.31	0.0

Model Post-processing

NOx

1.16 The modelled, verified road-NOx output for each receptor has been added to the background NOx concentrations to determine the total NOx concentration at each receptor.

NO2

1.17 The NOx to NO2 calculator v7.1 published by Defra (Defra, 2020b) has been used to convert the modelled, verified road-NOx output for each receptor to road-NO2. Road-NO2 has then been added to background NO2 to determine the total NO2 concentration at each receptor.

Deposition Fluxes

1.18 Deposition has been calculated from the predicted total NO2 concentration using the deposition velocity for grassland of 0.0015 m/s published by the Environment Agency (Environment Agency, 2011).

1.19 The deposition velocity multiplied by the predicted concentration (µg/m3) gives the deposition flux (µg/m2/s). A factor of 96 was then used to calculate the nutrient nitrogen deposition due to NO2 in units of kg/ha/yr (Environment Agency, 2011).

1.20 The acid nitrogen deposition has been calculated from the nutrient nitrogen deposition using a factor of 0.071428 (Environment Agency, 2011).

1.21 Wet deposition has not been assessed as it is not considered to be significant within the distances covered by the study area (Environment Agency, 2011).

Appendix H

Total Annual Mean NOx On Each Transect

Table H.1: Predicted Total Annual Mean NOx Concentrations[1][2]

Receptor	Transect 1				Transect 2				Transect 3				Transect 4			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
0m	27.4	17.3	17.4	18.1	**42.4**	25.4	25.5	26.9	**46.5**	28.1	28.2	29.4	**44.7**	27.2	27.3	28.4
1m	27.1	17.1	17.2	17.9	**41.4**	24.9	25.0	26.3	**45.6**	27.6	27.8	28.9	**43.8**	26.8	26.9	28.0
2m	26.8	17.0	17.1	17.7	**40.4**	24.4	24.5	25.8	**44.8**	27.2	27.4	28.5	**43.1**	26.4	26.5	27.6
3m	26.5	16.8	16.9	17.6	**39.5**	23.9	24.1	25.3	**44.1**	26.9	27.0	28.1	**42.4**	26.1	26.2	27.2
4m	26.2	16.7	16.8	17.4	**38.6**	23.5	23.7	24.8	**43.4**	26.5	26.7	27.7	**41.7**	25.7	25.9	26.8
5m	26.0	16.6	16.6	17.3	**37.9**	23.2	23.3	24.4	**42.7**	26.2	26.3	27.4	**41.1**	25.4	25.5	26.5
6m	25.7	16.4	16.5	17.1	**37.2**	22.8	22.9	24.0	**42.1**	25.9	26.0	27.0	**40.5**	25.2	25.3	26.2
7m	25.5	16.3	16.4	17.0	**36.5**	22.5	22.6	23.7	**41.5**	25.6	25.8	26.7	**40.0**	24.9	25.0	25.9
8m	25.2	16.2	16.3	16.9	**35.9**	22.2	22.3	23.3	**41.0**	25.4	25.5	26.4	**39.5**	24.7	24.7	25.6
9m	25.0	16.1	16.2	16.7	**35.3**	21.9	22.0	23.0	**40.5**	25.1	25.2	26.1	**39.0**	24.4	24.5	25.3
10m	24.8	16.0	16.1	16.6	**34.7**	21.6	21.7	22.7	**40.0**	24.9	25.0	25.9	**38.5**	24.2	24.3	25.1
11m	24.6	15.9	16.0	16.5	**34.2**	21.4	21.5	22.4	**39.6**	24.7	24.8	25.6	**38.1**	24.0	24.1	24.9
12m	24.4	15.8	15.9	16.4	**33.7**	21.1	21.2	22.1	**39.2**	24.5	24.6	25.4	**37.7**	23.8	23.9	24.6
13m	24.2	15.7	15.8	16.3	**33.2**	20.9	21.0	21.9	**38.8**	24.3	24.4	25.2	**37.3**	23.6	23.7	24.4
14m	24.0	15.6	15.7	16.2	**32.8**	20.7	20.8	21.6	**38.4**	24.1	24.2	25.0	**37.0**	23.4	23.5	24.2
15m	23.8	15.5	15.6	16.1	**32.4**	20.5	20.6	21.4	**38.0**	23.9	24.0	24.8	**36.6**	23.3	23.3	24.0
16m	23.6	15.4	15.5	16.0	**32.0**	20.3	20.4	21.2	**37.7**	23.7	23.8	24.6	**36.3**	23.1	23.2	23.9
17m	23.5	15.3	15.4	15.9	**31.6**	20.1	20.2	21.0	**37.3**	23.6	23.7	24.4	**36.0**	23.0	23.0	23.7
18m	23.3	15.3	15.3	15.8	**31.2**	19.9	20.0	20.8	**37.0**	23.4	23.5	24.2	**35.7**	22.8	22.9	23.5
19m	23.1	15.2	15.2	15.7	**30.9**	19.7	19.8	20.6	**36.7**	23.3	23.4	24.1	**35.4**	22.7	22.7	23.4
20m	23.0	15.1	15.2	15.6	**30.6**	19.6	19.7	20.4	**36.4**	23.1	23.2	23.9	**35.1**	22.5	22.6	23.2
21m	22.8	15.0	15.1	15.5	**30.2**	19.4	19.5	20.2	**36.1**	23.0	23.1	23.8	**34.9**	22.4	22.5	23.1
22m	22.7	15.0	15.0	15.5	29.9	19.3	19.4	20.1	**35.9**	22.9	23.0	23.6	**34.6**	22.3	22.4	22.9
23m	22.5	14.9	14.9	15.4	29.7	19.1	19.2	19.9	**35.6**	22.8	22.8	23.5	**34.4**	22.2	22.2	22.8
24m	22.4	14.8	14.9	15.3	29.4	19.0	19.1	19.8	**35.4**	22.7	22.7	23.4	**34.2**	22.1	22.1	22.7
25m	22.3	14.8	14.8	15.2	29.1	18.9	18.9	19.6	**35.2**	22.5	22.6	23.2	**34.0**	22.0	22.0	22.6
26m	22.1	14.7	14.8	15.2	28.9	18.7	18.8	19.5	**34.9**	22.4	22.5	23.1	**33.8**	21.9	21.9	22.5
27m	22.0	14.6	14.7	15.1	28.6	18.6	18.7	19.3	**34.7**	22.3	22.4	23.0	**33.6**	21.8	21.8	22.4
28m	21.9	14.6	14.6	15.0	28.4	18.5	18.6	19.2	**34.5**	22.2	22.3	22.9	**33.4**	21.7	21.7	22.2
29m	21.8	14.5	14.6	15.0	28.2	18.4	18.5	19.1	**34.3**	22.1	22.2	22.8	**33.2**	21.6	21.6	22.1
30m	21.7	14.5	14.5	14.9	28.0	18.3	18.4	19.0	**34.1**	22.0	22.1	22.7	**33.0**	21.5	21.5	22.0
31m	21.6	14.4	14.5	14.8	27.7	18.2	18.3	18.9	**34.0**	21.9	22.0	22.6	**32.8**	21.4	21.5	21.9
32m	21.4	14.4	14.4	14.8	27.5	18.1	18.2	18.7	**33.8**	21.9	21.9	22.5	**32.6**	21.3	21.4	21.9
33m	21.3	14.3	14.4	14.7	27.3	18.0	18.1	18.6	**33.6**	21.8	21.8	22.4	**32.5**	21.2	21.3	21.8
34m	21.2	14.3	14.3	14.7	27.2	17.9	18.0	18.5	**33.4**	21.7	21.7	22.3	**32.3**	21.2	21.2	21.7
35m	21.1	14.2	14.3	14.6	27.0	17.8	17.9	18.4	**33.3**	21.6	21.7	22.2	**32.2**	21.1	21.1	21.6
36m	21.0	14.2	14.2	14.6	26.8	17.7	17.8	18.3	**33.1**	21.5	21.6	22.1	**32.0**	21.0	21.1	21.5
37m	20.9	14.1	14.2	14.5	26.6	17.7	17.7	18.2	**33.0**	21.5	21.5	22.0	**31.9**	20.9	21.0	21.4
38m	20.9	14.1	14.1	14.5	26.5	17.6	17.6	18.2	**32.8**	21.4	21.4	21.9	**31.7**	20.9	20.9	21.4
39m	20.8	14.0	14.1	14.4	26.3	17.5	17.6	18.1	**32.7**	21.3	21.4	21.9	**31.6**	20.8	20.9	21.3
40m	20.7	14.0	14.0	14.4	26.2	17.4	17.5	18.0	**32.5**	21.2	21.3	21.8	**31.5**	20.7	20.8	21.2
41m	20.6	13.9	14.0	14.3	26.0	17.4	17.4	17.9	**32.4**	21.2	21.2	21.7	**31.4**	20.7	20.7	21.1
42m	20.5	13.9	13.9	14.3	25.9	17.3	17.3	17.8	**32.3**	21.1	21.2	21.6	**31.2**	20.6	20.7	21.1
43m	20.4	13.9	13.9	14.2	25.7	17.2	17.3	17.8	**32.1**	21.1	21.1	21.6	**31.1**	20.6	20.6	21.0
44m	20.3	13.8	13.9	14.2	25.6	17.1	17.2	17.7	**32.0**	21.0	21.1	21.5	**31.0**	20.5	20.6	21.0
45m	20.3	13.8	13.8	14.1	25.5	17.1	17.1	17.6	**31.9**	20.9	21.0	21.4	**30.9**	20.5	20.5	20.9
46m	20.2	13.8	13.8	14.1	25.3	17.0	17.1	17.5	**31.8**	20.9	20.9	21.4	**30.8**	20.4	20.5	20.8
47m	20.1	13.7	13.8	14.1	25.2	17.0	17.0	17.5	**31.7**	20.8	20.9	21.3	**30.7**	20.4	20.4	20.8
48m	20.0	13.7	13.7	14.0	25.1	16.9	17.0	17.4	**31.6**	20.8	20.8	21.3	**30.6**	20.3	20.4	20.7
49m	20.0	13.6	13.7	14.0	25.0	16.8	16.9	17.3	**31.5**	20.7	20.8	21.2	**30.5**	20.3	20.3	20.7
50m	19.9	13.6	13.6	13.9	24.8	16.8	16.8	17.3	**31.4**	20.7	20.7	21.1	**30.4**	20.2	20.3	20.6
Criterion	**30**															

[1] A = 2019
B = 2031 without Oxfordshire Cotswolds Garden Village, without West Eynsham SDA
C = 2031 without Oxfordshire Cotswolds Garden Village, with West Eynsham SDA
D = 2031 with Oxfordshire Cotswolds Garden Village, with West Eynsham SDA

[2] Exceedances of the assessment criterion are shown in bold.