Habitats Regulations Assessment of the Ilminster Neighbourhood Plan

Ilminster Parish Council

Project number: 60571087

31 July 2020

Quality information

Prepared by	Checked by	Verified by	Approved by
Dr Damiano Weitowitz Consultant Ecologist	Dr James Riley Technical Director	Dr Max Wade Technical Director	Dr James Riley Technical Director

Revision History

Revision	Revision date	Details	Authorized	Name	Position
0	31/07/2020	Draft following group review (Martha Covell)	JR	James Riley	Technical Director

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

Ilminster Parish Council

Prepared by:

Dr Damiano Weitowitz
Consultant Ecologist

AECOM Limited
Midpoint, Alencon Link
Basingstoke
Hampshire RG21 7PP
United Kingdom

T: +44(0)1256 310200
aecom.com

Table of Contents

Figures

Tables

1. Introduction

Scope of project

1.1 AECOM was appointed by Ilminster Parish Council (IPC) to undertake a Habitats Regulations Assessment (HRA) of the Ilminster Regulation 14 Neighbourhood Plan 2016-2036. This is to inform the planning group and South Somerset District Council of the potential effects of Neighbourhood Plan (NP) development on European Sites and how they are being, or should be, addressed in the draft NP. While the Ilminster NP covers the same period as the overarching South Somerset Local Plan (SSLP), IPC have decided to bring their NP ahead of the SSLP.

1.2 The emerging SSLP was subject to HRA in 2019, which identified water quality, water level, loss of functionally linked habitat, atmospheric pollution and recreational pressure as the impact pathways requiring assessment. For example, it discussed the sensitivity of the Somerset Levels & Moors SPA / Ramsar to negative changes in water quality and level, and to recreational disturbance. It also recommended policy wording to be included in the next iteration of the SSLP to ensure that adverse effects on the site integrity of the SPA / Ramsar are avoided. While this HRA assessed different growth (i.e. that for the entire South Somerset District), it is nonetheless a useful starting point for identifying European sites linked to the Ilminster NP.

1.3 The emerging SSLP for the years between 2016 and 2036 already specified that 839 new homes are to be allocated in Ilminster, identified as a Primary Market Town in the overarching planning document. The SSLP included several strategic allocations (e.g. Policy ILM1 – Housing Growth South West of Canal Way, Ilminster, specifying 400 dwellings), some of which are now included in the NP. Other site allocations now incorporated in the NP are not identified in the overarching SSLP.

1.4 Because the Ilminster NP is now being delivered ahead of the SSLP, a stand-alone HRA is required under the terms of the Conservation of Habitats & Species Regulations 2017 (as amended). Furthermore, this HRA will assess if any NP site allocation and / or other NP policies have the potential to cause an adverse effect on the integrity of Natura 2000 or European Designated Sites (Special Areas of Conservation, SACs, Special Protection Areas, SPAs, and Ramsar sites designated under the Ramsar convention), either in isolation or in combination with other plans and projects, and to determine whether site-specific or policy mitigation measures are required.

Legislation

1.5 The UK left the EU on 31 January 2020 under the terms set out in the European Union (Withdrawal Agreement) Act 2020 (“the Withdrawal Act”). This established a transition period, which is currently set to end on 31 December 2020. The Withdrawal Act retains the body of existing EU-derived law within our domestic law. During the transition period EU law applies to and in the UK.

1.6 The need for HRA is set out within the Conservation of Habitats & Species Regulations 2017 (as amended) and concerns the protection of European sites (Figure 1). European sites (also called Natura 2000 sites) can be defined as actual or proposed/candidate Special Areas of Conservation (SAC) or Special Protection Areas (SPA). It is also Government policy for sites designated under the Convention on Wetlands of International Importance (Ramsar sites) to be treated as having equivalent status to Natura 2000 sites.

1.7 The HRA process applies the precautionary principle to protected areas. Plans and projects can only be permitted having ascertained that there will be no adverse effect on the integrity of the site(s) in question. Plans and projects may still be permitted if there are no alternatives to them and there are Imperative Reasons of Overriding Public Interest (IROPI) as to why they should go ahead. In such cases, compensation would be necessary to ensure the overall integrity of the site network.

Conservation of Habitats and Species Regulations 2017 (as amended)

With specific reference to Neighbourhood Plans, Regulation 106(1) states that:

"*A qualifying body which submits a proposal for a neighbourhood development plan must provide such information as the competent authority* [the Local Planning Authority] *may reasonably require for the purpose of the assessment under regulation 105…* [which sets out the formal process for determination of 'likely significant effects' and the appropriate assessment']*."*

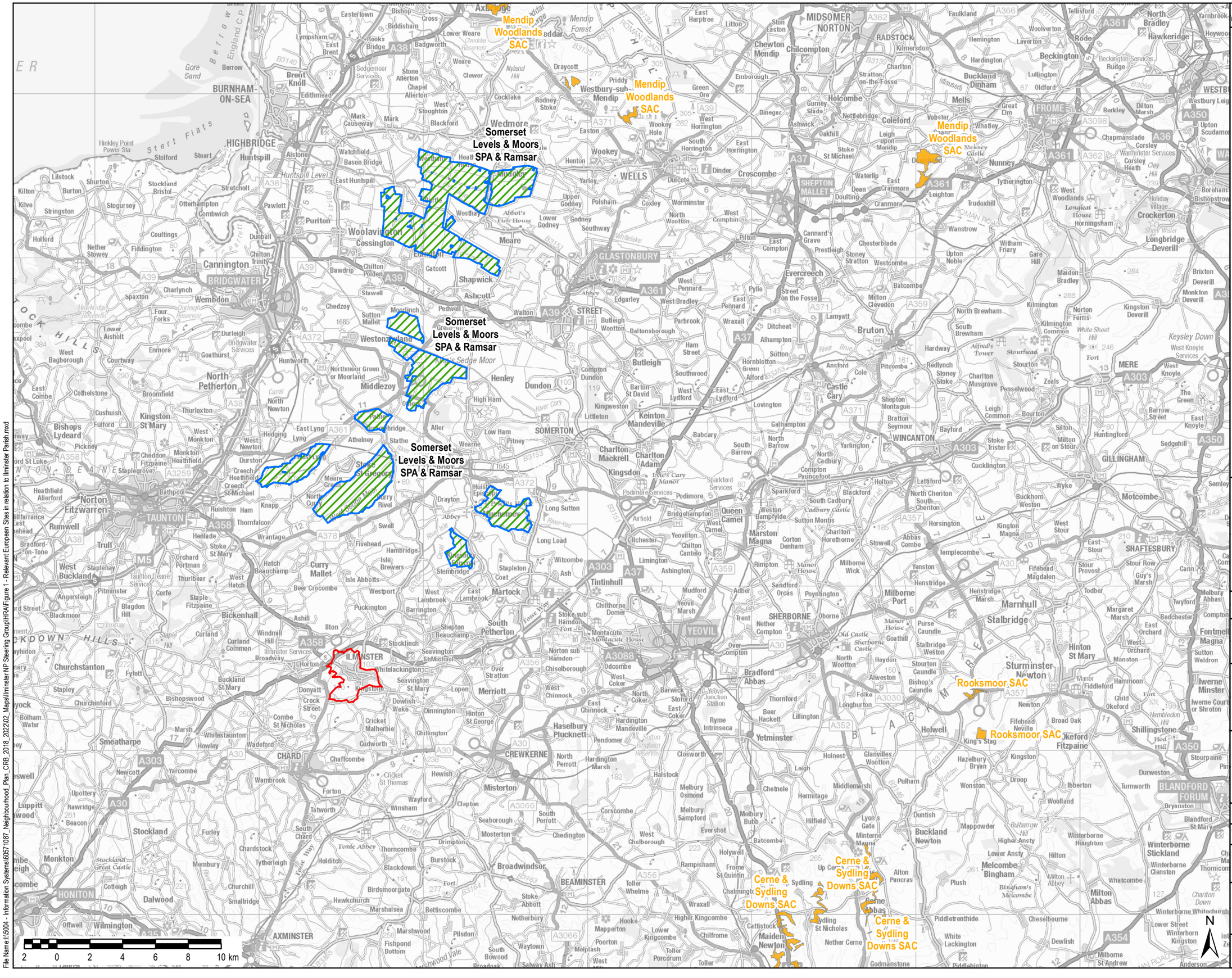
Figure 1: The legislative basis for HRA

1.8 It is therefore important to note that this report has two purposes:

- To assist the Qualifying Body (Ilminster Parish Council) in preparing their plan by recommending (where necessary) any adjustments required to protect European sites, thus making it more likely their plan will be deemed compliant with the Conservation of Habitats and Species Regulations 2017 (as amended); and
- On behalf of the Qualifying Body, to assist the Local Planning Authority (South Somerset District Council) to discharge their duty under Regulation 105 (in their role as 'plan-making authority' within the meaning of that regulation) and Regulation 106 (in their role as 'competent authority').

1.9 As 'competent authority', the legal responsibility for ensuring that a decision of 'likely significant effects' is made, for ensuring an 'appropriate assessment' (where required) is undertaken, and for ensuring Natural England are consulted, falls on the local planning authority. However, they are entitled to request from the Qualifying Body the necessary information on which to base their judgment and that is a key purpose of this report.

1.10 Over the years, 'Habitats Regulations Assessment' (HRA) has come into wide currency to describe the overall process set out in the Habitats Regulations, from screening through to identification of IROPI. This has arisen in order to distinguish the overall process from the individual stage of "Appropriate Assessment". Throughout this Report the term HRA is used for the overall process and restricts the use of Appropriate Assessment to the specific stage of that name.



THIS DRAWING IS TO BE USED ONLY FOR THE PURPOSE OF ISSUE THAT IT WAS ISSUED FOR AND IS SUBJECT TO AMENDMENT

LEGEND

- Ilminster Neighbourhood Plan Area
- Ramsar
- Special Area of Conservation (SAC)
- Special Protection Area (SPA)

Purpose of Issue
DRAFT

Client
ILMINSTER PARISH COUNCIL

Project Title
HRA OF THE ILMINSTER NEIGHBOURHOOD PLAN

Drawing Title
RELEVANT EUROPEAN SITES IN RELATION TO ILMINSTER PARISH

Drawn	Checked	Approved	Date
TD	BM	DW	24/07/2020

AECOM Internal Project No.: 60571087
Scale @ A3: 1:210,000

AECOM
Midpoint
Alencon Link, Basingstoke
Hampshire, RG21 7PP
Telephone (01256) 310200
Fax (01256) 310201
www.aecom.com

Drawing Number: FIGURE 1
Rev: 01

File Name:I:\5004 - Information Systems\60571087_Neighbourhood_Plan_CRB_2018_2022\02_Maps\Ilminster NP Steering Group\HRA\Figure 1 - Relevant European Sites in relation to Ilminster Parish.mxd

2. Methodology

Introduction

2.1 Figure 2 below outlines the stages of HRA according to current Ministry of Housing, Communities and Local Government guidance. The stages are essentially iterative, being revisited as necessary in response to more detailed information, recommendations and any relevant changes to the Plan until no significant adverse effects remain.

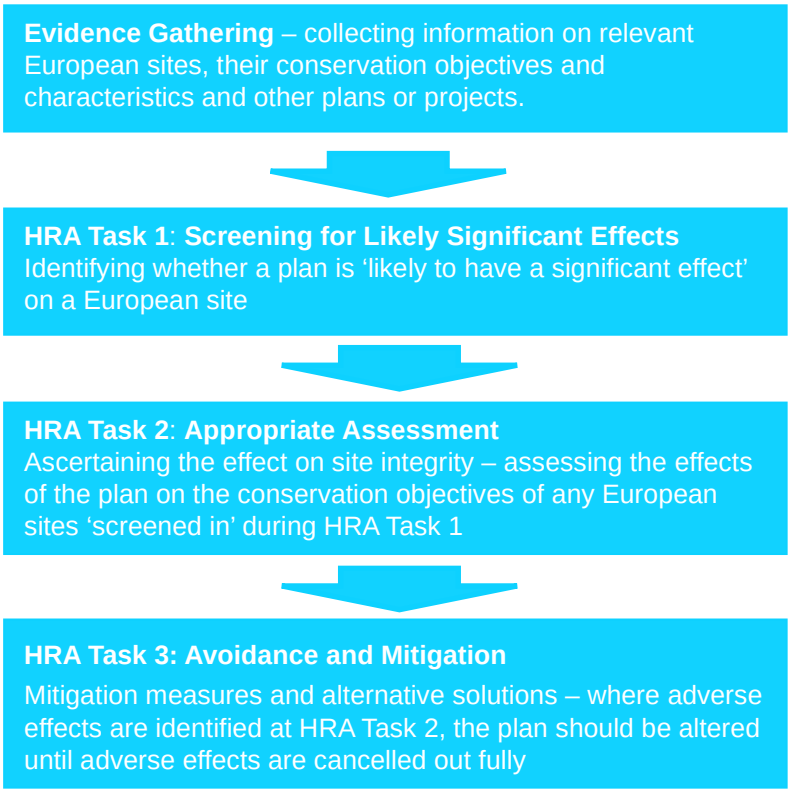


Figure 2: Four Stage Approach to Habitats Regulations Assessment. Source GOV.UK, 2019.

HRA Task 1 – Likely Significant Effects (LSE)

2.2 Following evidence gathering, the first stage of any Habitats Regulations Assessment is a Likely Significant Effect (LSE) test - essentially a risk assessment to decide whether the full subsequent stage known as Appropriate Assessment is required. The essential question is:

"*Is the project, either alone or in combination with other relevant projects and plans, likely to result in a significant effect upon European sites?*"

2.3 The objective is to 'screen out' those plans and projects that can, without any detailed appraisal, be said to be unlikely to result in significant adverse effects upon European sites, usually because there is no mechanism for an adverse interaction with European sites. This stage is undertaken in Chapter 5 of this report.

HRA Task 2 – Appropriate Assessment (AA)

2.4 Where it is determined that a conclusion of 'no likely significant effect' cannot be drawn, the analysis has proceeded to the next stage of HRA known as Appropriate Assessment. Case law has clarified that 'appropriate assessment' is not a technical term. In other words, there are no

particular technical analyses, or level of technical analysis, that are classified by law as belonging to appropriate assessment rather than determination of likely significant effects.

2.5 During July 2019 the Ministry of Housing, Communities and Local Government published guidance for Appropriate assessment[1]. Paragraph: 001 Reference ID: 65-001-20190722m explains: '*Where the potential for likely significant effects cannot be excluded, a competent authority must make an appropriate assessment of the implications of the plan or project for that site, in view of the site's conservation objectives. The competent authority may agree to the plan or project only after having ruled out adverse effects on the integrity of the habitats site. Where an adverse effect on the site's integrity cannot be ruled out, and where there are no alternative solutions, the plan or project can only proceed if there are imperative reasons of over-riding public interest and if the necessary compensatory measures can be secured*'.

2.6 As this analysis follows on from the screening process, there is a clear implication that the analysis will be more detailed than undertaken at the Screening stage and one of the key considerations during appropriate assessment is whether there is available mitigation that would entirely address the potential effect. In practice, the appropriate assessment takes any policies or allocations that could not be dismissed following the high-level screening analysis and analyses the potential for an effect in more detail, with a view to concluding whether there would be an adverse effect on integrity (in other words, disruption of the coherent structure and function of the European site(s)).

2.7 A decision by the European Court of Justice[2] concluded that measures intended to avoid or reduce the harmful effects of a proposed project on a European site may no longer be taken into account by competent authorities at the Likely Significant Effects or 'screening' stage of HRA. The UK is no longer part of the European Union. However, as a precaution, it is assumed for the purposes of this HRA that EU case law regarding Habitat Regulations Assessment will still be considered informative jurisprudence by the UK courts. That ruling has therefore been considered in producing this HRA.

2.8 Also, in 2018 the Holohan ruling[3] was handed down by the European Court of Justice. Among other provisions paragraph 39 of the ruling states that '*As regards other habitat types or species, which are present on the site, but for which that site has not been listed, and with respect to habitat types and species located outside that site, … typical habitats or species must be included in the appropriate assessment, if they are necessary to the conservation of the habitat types and species listed for the protected area*' [emphasis added]. This has been taken into account in the HRA, specifically regarding habitat that is functionally linked to the Somerset Levels & Moors SPA / Ramsar.

HRA Task 3 – Avoidance and Mitigation

2.9 Where necessary, measures are recommended for incorporation into the Plan in order to avoid or mitigate adverse effects on European sites. There is considerable precedent concerning the level of detail that a Neighbourhood Plan document needs to contain regarding mitigation for recreational impacts on European sites. The implication of this precedent is that it is not necessary for all measures that will be deployed to be fully developed prior to adoption of the Plan, but the Plan must provide an adequate policy framework within which these measures can be delivered.

2.10 In evaluating significance, AECOM has relied on professional judgement and the LP HRA regarding development impacts on the European sites considered within this assessment.

2.11 When discussing 'mitigation' for a Neighbourhood Plan document, one is concerned primarily with the policy framework to enable the delivery of such mitigation rather than the details of the mitigation measures themselves since the Local Development Plan document is a high-level policy document. A Neighbourhood Plan is a lower level constituent of a Local Development Plan.

[1] https://www.gov.uk/guidance/appropriate-assessment#what-are-the-implications-of-the-people-over-wind-judgment-for-habitats-regulations-assessments [Accessed: 07/01/2020].
[2] People Over Wind and Sweetman v Coillte Teoranta (C-323/17)
[3] Case C-461/17

Confirming Other Plans and Projects That May Act 'In Combination'

2.12 It is a requirement of the Regulations that the impacts of any development plans are not only considered in isolation but in-combination with other plans and projects that may also be affecting the European site(s) in question.

2.13 For example, when considering the potential for combined regional housing development across multiple local authorities to impact on European sites, a key emphasis must be on the cumulative impact of visitor numbers (i.e. recreational pressure). While one Parish might only contribute a minor portion of recreational pressure (with no negative impact on a European site), other adjacent Parishes may also each contribute minor 'amounts' of such pressure. Cumulatively, this could result in detectable effects on designated species.

2.14 When undertaking this part of the assessment it is essential to bear in mind the principal intention behind the legislation i.e. to ensure that those projects or plans (which in themselves may have minor impacts) are not simply dismissed on that basis, but are evaluated for any cumulative contribution they may make to an overall significant effect. In practice, in-combination assessment is therefore of greatest relevance when the plan or policy would otherwise be screened out because its individual contribution is negligible.

3. European Sites

Somerset Levels & Moors SPA / Ramsar

Introduction

3.1 This SPA in south-west England represents one of the largest and richest areas of traditionally managed wet grassland and fen in lowland UK. The Somerset Levels and Moors SPA covers an area of 35,000ha in the floodplains of the Rivers Axe, Brue, Parrett and Tone. A main part of the site lies approximately at sea level and drains through a network of ditches, rhynes and drains.

3.2 This can result in large parts of the area being flooded in winter, depending on rainfall and tidal conditions. A portion of the site in the Brue Valley includes former raised peatbog potentially modified by agriculture and peat extraction. This has created areas of open water, fen and reedbed, in turn attracting significant number of waterfowl in winter (e.g. swans, ducks and waders).

SPA Qualifying Features[4]

3.3 This site qualifies under **Article 4.1** of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive:

Over winter

- Bewick's Swan *Cygnus columbianus bewickii* - 191 individuals representing at least 2.7% of the wintering population in Great Britain (5 year peak mean 1991/2 - 1995/6)
- Golden plover *Pluvialis apricaria* – 3,029 individuals representing at least 1.2% of the wintering population in Great Britain (5 year peak mean 1991/2 - 1995/6)

3.4 This site also qualifies under **Article 4.2** of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species:

Over winter

- Shoveler *Anas clypeata* - 501 individuals representing at least 1.3% of the wintering Northwestern / Central Europe population (5 year peak mean 1991/2 - 1995/6)
- Teal *Ana crecca* – 13,307 individuals representing at least 3.3% of the wintering Northwestern / Central Europe population (5 year peak mean 1991/2 – 1995/6)
- Wigeon *Anas penelope* – 13,661 individuals representing at least 1.1% of the wintering Western Siberia / Northwestern / Northeastern Europe population (5 year peak mean 1991/2 – 1995/6)

Assemblage qualification: A wetland of international importance.

3.5 The area qualifies under **Article 4.2** of the Directive (79/409/EEC) by regularly supporting at least 20,000 waterfowl

3.6 Over winter, the area regularly supports 72,874 individual waterfowl (5 year peak mean 1991/2 - 1995/6) including: Snipe *Gallinago* gallinago, Lapwing *Vanellus vanellus,* Pintail *Anas acuta*, Gadwall *Anas strepera*, Shoveler *Anas clypeata*, Teal *Anas crecca*, Wigeon *Anas Penelope*, Golden Plover *Pluvialis apricaria*, Bewick's Swan *Cygnus columbianus bewickii*, Whimbrel *Numenius phaeopus*.

[4] http://jncc.defra.gov.uk/default.aspx?page=2026 [Accessed on the 06/06/2020]

Ramsar Qualifying Features[5]

3.7 The Somerset Levels and Moors Ramsar is designated for the following criteria:

Ramsar Criterion 2

Supports 17 species of British Red Data Book invertebrates.

Ramsar Criterion 5

Assemblages of international importance:

Species with peak counts in winter: 97,155 waterfowl (5 year peak mean 1998/99-2002/2003)

Ramsar Criterion 6

Species/populations occurring at levels of international importance.

Qualifying Species/populations (as identified at designation):

Species with peak counts in winter:

Tundra swan, *Cygnus columbianus bewickii*, NW Europe: 112 individuals, representing an average of 1.3% of the GB population (5 year peak mean 1998/9-2002/3)

Eurasian teal, *Anas crecca*, NW Europe: 21,231 individuals, representing an average of 5.3% of the population (5 year peak mean 1998/9-2002/3)

Northern lapwing, *Vanellus vanellus*, Europe - breeding: 36,580 individuals, representing an average of 1% of the population (5 year peak mean for 1998/9-2002/03)

Species/populations identified subsequent to designation for possible future consideration under criterion 6.

Species with peak counts in winter:

Mute swan, *Cygnus olor*, Britain: 842 individuals, representing an average of 2.2% of the population (5 year peak mean 1998/9-2002/3)

Eurasian wigeon, *Anas penelope*, NW Europe: 25,759 individuals, representing an average of 1.7% of the population (5 year peak mean 1998/9-2002/3)

Northern pintail, *Anas acuta*, NW Europe: 927 individuals, representing an average of 1.5% of the population (5 year peak mean 1998/9-2002/3)

Northern shoveler, *Anas clypeata*, NW & C Europe: 1,094 individuals, representing an average of 2.7% of the population (5 year peak mean 1998/9-2002/3)

SPA Conservation Objectives[6]

3.8 With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified (the 'Qualifying Features' listed below), and subject to natural change;

3.9 Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, 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,

[5] http://jncc.defra.gov.uk/pdf/RIS/UK11064.pdf [Accessed on the 09/06/2020]
[6] http://publications.naturalengland.org.uk/publication/4598158654963712 [Accessed on the 09/06/2020]

- The distribution of the qualifying features within the site.

Potential Threats to Site Integrity[7]

3.10 The following threats and pressures to the integrity of the Somerset Levels and Moors SPA have been identified in Natural England's Site Improvement Plan:

- Drainage
- Inappropriate water levels
- Maintain and upgrade water management structure
- Change in land management
- Agricultural management practices
- Peat extraction
- Public access / disturbance
- Offsite habitat availability / management

Cerne & Sydling Downs SAC

Introduction

3.11 This SAC is a 371.75ha site comprising dry grassland (89%), heath / scrub (10.5%) and a small amount of mixed woodland (0.5%). The semi-natural dry grassland lies on dry valley slopes of chalk, supporting extensive communities of *Festuca ovina – Avenula pratensis*. There is also a community of *Succisa pratensis – Leucanthum vulgare*, which are entirely restricted to Wiltshire and Dorset. The nationally scarce dwarf sedge *Carex humilis* can be abundant in the latter community.

3.12 Furthermore, the site supports a significant marsh fritillary butterfly *Euphydryas aurinia* metapopulation that consists of several colonies and sub-populations regularly changing in population size. These colonies complement the Dorset populations that are primarily associated with wet grassland.

Qualifying Features[8]

3.13 Annex I habitats that are a primary reason for selection of this site:

- Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (*important orchid sites)

3.14 Annex II species that are a primary reason for selection of this site

- Marsh fritillary butterfly *Euphydryas aurinia*

Conservation Objectives[9]

3.15 With regard to the SAC and the natural habitats and/or species for which the site has been designated (the 'Qualifying Features' listed below), and subject to natural change;

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

[7] http://publications.naturalengland.org.uk/publication/6561001356918784 [Accessed on the 09/06/2020]
[8] https://sac.jncc.gov.uk/site/UK0030115 [Accessed on the 09/06/2020]
[9] http://publications.naturalengland.org.uk/publication/4867410389630976 [Accessed on the 09/06/2020]

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

Threats / Pressures to Site Integrity[10]

3.17 The following threats / pressures to the site integrity of the Cerne & Sydling Downs SAC have been identified in Natural England's Site Improvement Plan:

- Habitat fragmentation
- Overgrazing
- Undergrazing
- Inappropriate weed control
- Fertiliser use
- Inappropriate scrub control
- Air pollution: Impact of atmospheric nitrogen deposition

Mendip Woodlands SAC

Introduction

3.18 This SAC is 251.39ha in size and comprises broad-leaved deciduous woodland (98.5%) and some dry grassland / steppes (1.5%). The Mendip Woodlands are in the south-west of England and are an extensive example of *Tilio-Acerion* forests on limestones. It is a composite site containing clusters of three ash-dominated woods. A range of other trees are present in the site, including elm *Ulmus* spp. and small-leaved lime *Tilia cordata*,

3.19 Other notable plants are the characteristic ferns of this woodland type, such as hart's-tongue *Phyllitis scolopendrium* and shield-ferns *Polystichum* spp. The SAC is also an important stronghold for the common dormouse *Muscardinus avellanarius*.

Qualifying Features[11]

3.20 Annex I habitats that are a primary reason for selection of this site:

- *Tilio-Acerion* forests of slopes, screes and ravines

Conservation Objectives[12]

3.21 With regard to the SAC and the natural habitats and/or species for which the site has been designated (the 'Qualifying Features' listed below), and subject to natural change;

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

[10] http://publications.naturalengland.org.uk/publication/5102855774011392?category=35016 [Accessed on the 09/06/2020]
[11] https://sac.jncc.gov.uk/site/UK0030048 [Accessed on the 09/06/2020]
[12] http://publications.naturalengland.org.uk/publication/6243663101296640 [Accessed on the 09/06/2020]

- The extent and distribution of qualifying natural habitats
- The structure and function (including typical species) of qualifying natural habitats, and
- The supporting processes on which qualifying natural habitats rely

Threats / Pressures to Site Integrity[13]

3.23 The following threats / pressures to the site integrity of the Mendip Woodlands SAC have been identified in Natural England's Site Improvement Plan:

- Vehicles: Illicit
- Deer
- Disease
- Air pollution: Impact of atmospheric nitrogen deposition

Rooksmoor SAC

Introduction

3.24 Rooksmoor is a site that supports the marsh fritillary butterfly in the southern part of its range in England. This site harbours an exceptionally large population within the cluster of sites in the Dorset stronghold. An outlying population as Lydfinch has been included because it is part of this metapopulation.

3.25 The Rooksmoor SAC comprises a variety of habitats, including bogs, marshes, heath, scrub, humid grassland and broad-leaved deciduous woodland.

Qualifying Features[14]

3.26 The Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site are:

- *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)

3.27 The Annex II species that are a primary reason for selection of this site are:

- Marsh fritillary butterfly *Euphydryas aurinia*

Conservation Objectives[15]

3.28 With regard to the SAC and the natural habitats and/or species for which the site has been designated (the 'Qualifying Features' listed below), and subject to natural change;

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

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

[13] http://publications.naturalengland.org.uk/publication/6568821745778688 [Accessed on the 09/06/2020]
[14] http://jncc.defra.gov.uk/ProtectedSites/SACselection/sac.asp?EUCode=UK0012681 [Accessed on the 09/06/2020]
[15] http://publications.naturalengland.org.uk/publication/5711141984534528 [Accessed on the 09/06/2020]

- The populations of qualifying species, and,
- The distribution of qualifying species within the site.

Potential Threats to Site Integrity[16]

3.30 The following threats and pressures to the integrity of the Rooksmoor SAC have been identified in Natural England's Site Improvement Plan:

- Inappropriate scrub control
- Undergrazing
- Inappropriate cutting / mowing
- Air pollution: Impact of atmospheric nitrogen deposition

[16] http://publications.naturalengland.org.uk/publication/4768030953308160 [Accessed on the 09/06/2020]

4. Impact Pathways

Loss of Functionally Linked Habitat

4.1 While most European sites have been geographically defined to encompass the key features that are necessary for coherence of their structure and function, and the support of their qualifying features, this is not always the case. A diverse array of qualifying species including birds, bats and amphibians are not always confined to the boundary of designated sites.

4.2 For example, the highly mobile nature of wildfowl implies that areas of habitat of crucial importance to the maintenance of their populations are outside the physical limits of European sites. Despite not being designated, this area is still integral to the maintenance of the structure and function of the interest feature on the designated site and, therefore, land use plans that may affect such areas should be subject to further assessment.

4.3 The Somerset Levels and Moors SPA is designated for its assemblages of overwintering bird species, including Bewick swan, golden plover, shoveler, teal and wigeon and these are also part of the reason for the designation of the area as a Ramsar site. Many of these bird species depend on land beyond the designated site boundaries for their survival. For example, the site conservation objectives for the Somerset Levels and Moors SPA / Ramsar highlight that Bewick's swans depend on the supply of cereal grains, rape, potatoes and sugar beet on land located outside the SPA. A study has shown that Bewick swans travel 5-10km from roosts to feeding sites[17]. Similarly, a BTO Research Report determined the high mobility of golden plover, which travel up to 10km between feeding sites[18]. Given these data, residential and employment development within 10km of the Somerset Levels and Moors SPA / Ramsar has the potential to result in the loss of functionally linked habitat for these qualifying species.

4.4 There is now an abundance of authoritative examples of HRA cases on plans affecting bird populations, where Natural England recognised the potential importance of functionally linked land[19]. For example, bird surveys have established that approximately 25% of the golden plover population in the Somerset Levels and Moors SPA were affected while on functionally linked land, and this required the inclusion of mitigation measures in the relevant plan policy wording. Another important case study originates from the Mersey Estuary SPA / Ramsar, where adjacently located functionally linked land had a peak survey count of 108% of the 5 year mean peak population of golden plover. Similar to the above example, this led to considerable amendments in the planning proposal to ensure that the site integrity was not adversely affected.

4.5 The importance of non-designated land parcels may not be apparent and requires the analysis of existing data sources to be firmly established. In some instances, data may not be available at all, requiring further survey work. The Somerset Levels & Moors SPA / Ramsar harbours very mobile bird species, and the SPA's / Ramsar's bird populations may be negatively affected by the implementation of the Ilminster NP.

4.6 The following European site within 10km of Ilminster Parish is susceptible to the loss of functionally linked habitat as a result of NP development (the site in bold is taken forward into the following chapters):

- **Somerset Levels & Moors SPA / Ramsar (located 7.7km to the north-east of Ilminster Parish)**

[17] Nolet B.A., Bevan R.M., Klaassen M., Langevoord O., Van Der Heijden Y.G.J.T. (2002). Habitat switching by Bewick's swans: Maximization of average long-term energy gain? Journal of Animal Ecology 71: 979-993.
[18] Gillings S. & Fuller R.J. (1999). Winter Ecology of Golden Plovers and Lapwings: A Review and Consideration of Extensive Survery Methods. BTO Research Report No. 224. 54pp.
[19] Chapman C & Tyldesley D. 2016. Functional linkage: How areas that are functionally linked to European sites have been considered when they may be affected by plans and projects – A review of authoritative decisions. Natural England Commissioned Reports 207: 73pp.

Atmospheric Pollution (through Nitrogen Deposition)

4.7 The main pollutants of concern for European sites are oxides of nitrogen (NOx), ammonia (NH_3) and sulphur dioxide (SO_2) and are summarised in Table 2. Ammonia can have a directly toxic effect upon vegetation, particularly at close distances to the source such as near road verges[20]. NOx can also be toxic at very high concentrations (far above the annual average critical level). However, in particular, high levels of NOx and NH_3 are likely to increase the total N deposition to soils, potentially leading to deleterious knock-on effects in resident ecosystems. Increases in nitrogen deposition from the atmosphere is widely known to enhance soil fertility and to lead to eutrophication. This often has adverse effects on the community composition and quality of semi-natural, nitrogen-limited terrestrial and aquatic habitats[21] [22].

Table 1: Main sources and effects of air pollutants on habitats and species[23]

Pollutant	Source	Effects on habitats and species
Sulphur Dioxide (SO_2)	The main sources of SO_2 are electricity generation, and industrial and domestic fuel combustion. However, total SO_2 emissions in the UK have decreased substantially since the 1980's. Another origin of sulphur dioxide is the shipping industry and high atmospheric concentrations of SO_2 have been documented in busy ports. In future years shipping is likely to become one of the most important contributors to SO_2 emissions in the UK.	Wet and dry deposition of SO_2 acidifies soils and freshwater and may alter the composition of plant and animal communities. The magnitude of effects depends on levels of deposition, the buffering capacity of soils and the sensitivity of impacted species. However, SO_2 background levels have fallen considerably since the 1970's and are now not regarded a threat to plant communities. For example, decreases in Sulphur dioxide concentrations have been linked to returning lichen species and improved tree health in London.
Acid deposition	Leads to acidification of soils and freshwater via atmospheric deposition of SO_2, NOx, ammonia and hydrochloric acid. Acid deposition from rain has declined by 85% in the last 20 years, which most of this contributed by lower sulphate levels. Although future trends in S emissions and subsequent deposition to terrestrial and aquatic ecosystems will continue to decline, increased N emissions may cancel out any gains produced by reduced S levels.	Gaseous precursors (e.g. SO_2) can cause direct damage to sensitive vegetation, such as lichen, upon deposition. Can affect habitats and species through both wet (acid rain) and dry deposition. The effects of acidification include lowering of soil pH, leaf chlorosis, reduced decomposition rates, and compromised reproduction in birds / plants. Not all sites are equally susceptible to acidification. This varies depending on soil type, bed rock geology, weathering rate and buffering capacity. For example, sites with an underlying geology of granite, gneiss and quartz rich rocks tend to be more susceptible.
Ammonia (NH_3)	Ammonia is a reactive, soluble alkaline gas that is released following decomposition and volatilisation of animal wastes. It is a naturally occurring trace gas, but ammonia concentrations are directly related to the distribution of livestock. Ammonia reacts with acid pollutants such as the products of SO_2 and NO_X emissions to produce fine ammonium (NH_4+) - containing aerosol. Due to its significantly longer lifetime, NH_4+ may be transferred	The negative effect of NH_4+ may occur via direct toxicity, when uptake exceeds detoxification capacity and via N accumulation. Its main adverse effect is eutrophication, leading to species assemblages that are dominated by fast-growing and tall species. For example, a shift in dominance from heath species (lichens, mosses) to grasses is often seen.

[20] http://www.apis.ac.uk/overview/pollutants/overview_NOx.htm, accessed 01/04/2020.
[21] Wolseley, P. A.; James, P. W.; Theobald, M. R.; Sutton, M. A. **2006.** Detecting changes in epiphytic lichen communities at sites affected by atmospheric ammonia from agricultural sources. Lichenologist 38: 161-176
[22] Dijk, N. **2011.** Dry deposition of ammonia gas drives species change faster than wet deposition of ammonium ions: evidence from a long-term field manipulation Global Change Biology 17: 3589-3607
[23] Information summarised from the Air Pollution Information System (http://www.apis.ac.uk/)

Pollutant	Source	Effects on habitats and species
	much longer distances (and can therefore be a significant trans-boundary issue). While ammonia deposition may be estimated from its atmospheric concentration, the deposition rates are strongly influenced by meteorology and ecosystem type.	As emissions mostly occur at ground level in the rural environment and NH_3 is rapidly deposited, some of the most acute problems of NH_3 deposition are for small relict nature reserves located in intensive agricultural landscapes.
Nitrogen oxides (NO_x)	Nitrogen oxides are mostly produced in combustion processes. Half of NO_X emissions in the UK derive from motor vehicles, one quarter from power stations and the rest from other industrial and domestic combustion processes. In contrast to the steep decline in Sulphur dioxide emissions, nitrogen oxides are falling slowly due to control strategies being offset by increasing numbers of vehicles.	Direct toxicity effects of gaseous nitrates are likely to be important in areas close to the source (e.g. roadside verges). A critical level of NOx for all vegetation types has been set to 30 ug/m3. Deposition of nitrogen compounds (nitrates (NO_3), nitrogen dioxide (NO_2) and nitric acid (HNO_3)) contributes to the total nitrogen deposition and may lead to both soil and freshwater acidification. In addition, NO_x contributes to the eutrophication of soils and water, altering the species composition of plant communities at the expense of sensitive species.
Nitrogen deposition	The pollutants that contribute to the total nitrogen deposition derive mainly from oxidized (e.g. NO_X) or reduced (e.g. NH_3) nitrogen emissions (described separately above). While oxidized nitrogen mainly originates from major conurbations or highways, reduced nitrogen mostly derives from farming practices. The N pollutants together are a large contributor to acidification (see above).	All plants require nitrogen compounds to grow, but too much overall N is regarded as the major driver of biodiversity change globally. Species-rich plant communities with high proportions of slow-growing perennial species and bryophytes are most at risk from N eutrophication. This is because many semi-natural plants cannot assimilate the surplus N as well as many graminoid (grass) species. N deposition can also increase the risk of damage from abiotic factors, e.g. drought and frost.
Ozone (O_3)	A secondary pollutant generated by photochemical reactions involving NOx, volatile organic compounds (VOCs) and sunlight. These precursors are mainly released by the combustion of fossil fuels (as discussed above). Increasing anthropogenic emissions of ozone precursors in the UK have led to an increased number of days when ozone levels rise above 40ppb ('episodes' or 'smog'). Reducing ozone pollution is believed to require action at international level to reduce levels of the precursors that form ozone.	Concentrations of O_3 above 40 ppb can be toxic to both humans and wildlife, and can affect buildings. High O_3 concentrations are widely documented to cause damage to vegetation, including visible leaf damage, reduction in floral biomass, reduction in crop yield (e.g. cereal grains, tomato, potato), reduction in the number of flowers, decrease in forest production and altered species composition in semi-natural plant communities.

4.8 Sulphur dioxide emissions overwhelmingly derive from power stations and industrial processes that require the combustion of coal and oil, as well as (particularly on a local scale) shipping[24]. Ammonia emissions originate from agricultural practices[25], with some chemical processes also making notable contributions. As such, it is unlikely that material increases in SO_2 or NH_3 emissions will be associated with the Ilminster NP.

4.9 NOx emissions, however, are dominated by the output of vehicle exhausts (more than half of all emissions). A 'typical' housing development will contribute by far the largest portion to its overall NOx footprint (92%) through the associated road traffic. Other sources, although relevant, are of

[24] http://www.apis.ac.uk/overview/pollutants/overview_SO2.htm.
[25] Pain, B.F.; Weerden, T.J.; Chambers, B.J.; Phillips, V.R.; Jarvis, S.C. 1998. A new inventory for ammonia emissions from U.K. agriculture. Atmospheric Environment 32: 309-313

minor importance (8%) in comparison[26]. Emissions of NOx could therefore be reasonably expected to increase because of a higher number of vehicles due to implementation of the Local Plan Documents.

4.10 According to the World Health Organisation, the critical NOx concentration (critical threshold) for the protection of vegetation is 30 μgm^{-3}; the threshold for sulphur dioxide is 20 μgm^{-3}. In addition, ecological studies have determined 'critical loads'[27] of atmospheric nitrogen deposition (that is, NOx combined with ammonia NH_3).

4.11 The Department of Transport's Transport Analysis Guidance stipulates that, beyond 200m, the contribution of vehicle emissions from the roadside to local pollution levels is not significant[28] (Figure 3). This is therefore the distance that has been used throughout this HRA in order to determine whether European sites are likely to be significantly affected by development outlined in the Local Plan.

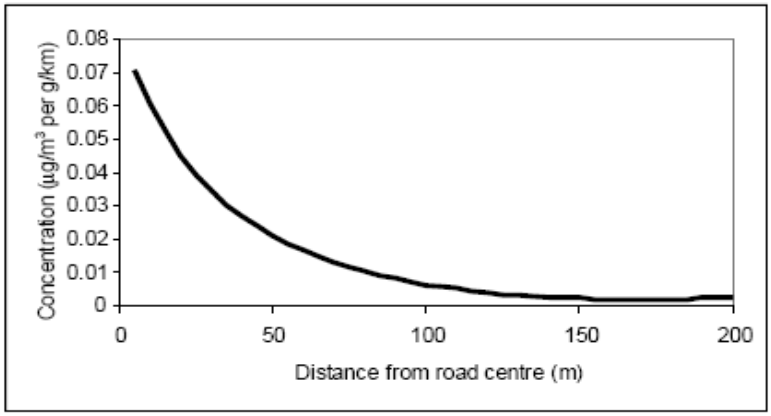


Figure 3: Traffic contribution to concentrations of pollutants at different distances from a road (Source: DfT[29])

4.12 Exhaust emissions from vehicles are capable of adversely affecting most plants and their community composition. Considering this, an increase in net population and employment growth within the Ilminster NP could result in increased traffic alongside several SACs shown to be affected by commuter journeys from / to Ilminster.

4.13 Air quality and European sites is an 'in combination' issue and therefore traffic growth across the whole of South Somerset must be considered for context. Overall, the following European sites within and around South Somerset are sensitive to atmospheric pollution, lie within 200m of significant journey to work routes, and have been linked to development in the Parish (sites in bold are taken forward into the following chapters):

- **Cerne & Sydling Downs SAC (the closest component part lies approx. 29.6km to the south-east of Ilminster Parish)**
- **Mendip Woodlands SAC (the closest component part lies approx. 44.1km to the north-east of Ilminster Parish)**
- **Rooksmoor SAC (the closest component part lies approx. 35.4km to the east of Ilminster Parish)**

4.14 Cerne & Sydling Downs SAC is sensitive to nitrogen deposition due to its qualifying feature semi-natural dry grasslands and scrubland facies (empirical critical load of 15-25 kg N/ha/yr)[30]. Likely consequences of exceedance impacts include an increase in tall grasses, a decline in plant

[26] Proportions calculated based upon data presented in Dore CJ et al. 2005. UK Emissions of Air Pollutants 1970 – 2003. UK National Atmospheric Emissions Inventory. http://www.airquality.co.uk/archive/index.php
[27] The critical load is the rate of deposition beyond which research indicates that adverse effects can reasonably be expected to occur.
[28] http://www.dft.gov.uk/webtag/documents/expert/unit3.3.3.php#013 [Accessed on the 01/04/2020]
[29] http://www.dft.gov.uk/ha/standards/dmrb/vol11/section3/ha20707.pdf [Accessed on the 01/04/2020]
[30] http://www.apis.ac.uk/srcl/select-a-feature?site=UK0030138&SiteType=SAC&submit=Next [Accessed on the 05/03/2020]

diversity, N leaching and surface acidification. Furthermore, the Marsh fritillary butterfly may also be sensitive to nitrogen impacts on its broad habitat type within the SAC.

4.15 The Mendip Woodlands SAC is sensitive to atmospheric pollution due to its *Tilio-Acerion* forests with a critical nitrogen load of 15-20 kg N/ha/yr. Exceedance of this critical load is likely to lead to generalised changes in ground vegetation.

4.16 Rooksmoor SAC is sensitive to atmospheric nitrogen deposition due to its *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (critical nitrogen load of 15-25 kg N/ha/yr). Exceedance of this nitrogen load would lead to an increase in tall graminoids, reduced plant species diversity and a decrease of bryophytes. Furthermore, the marsh fritillary butterfly may also be sensitive due to atmospheric nitrogen deposition on its broad habitat in this SAC.

Water Quality

4.17 The quality of the water that feeds European sites is an important determinant of the nature of their habitats and the species they support. Poor water quality can have a range of environmental impacts:

- At high levels, toxic chemicals and metals can result in immediate death of aquatic life, and can have detrimental effects even at lower levels, including increased vulnerability to disease and changes in wildlife behaviour.
- Eutrophication, the enrichment of plant nutrients in water, increases plant growth and consequently results in oxygen depletion. Algal blooms, which commonly result from eutrophication, increase turbidity and decrease light penetration. The decomposition of organic wastes that often accompanies eutrophication deoxygenates water further, augmenting the oxygen depleting effects of eutrophication. In the marine environment, nitrogen is the limiting plant nutrient and so eutrophication is associated with discharges containing bioavailable nitrogen.
- Some pesticides, industrial chemicals, and components of sewage effluent are suspected to interfere with the functioning of the endocrine system, possibly having negative effects on the reproduction and development of aquatic life.

4.18 The most significant issue in relation to the Ilminster NP is the discharge of treated sewage effluent, which is likely to increase the nutrient concentration (particularly phosphate concentrations) in local watercourses such as the River Isle. Phosphate is the main limiting nutrient in freshwater ecosystems and is likely to cause eutrophication if it increases significantly. The Somerset Levels and Moors SPA is designated for bird species (rather than habitats) as is not primarily sensitive to an increase in nutrient levels. However, the Somerset Levels and Moors Ramsar is partly designated for its invertebrate populations, including 17 Red Data Book species of national importance. Changes to the quality of surface water runoff from hardstanding within the catchment of the Somerset Levels and Moors SPA / Ramsar also needs consideration.

4.19 The NP assessed in this HRA provides for development in the geographic area covered by Wessex Water, responsible for the public water supply and wastewater treatment within South Somerset and Ilminster Parish. The potential implications of this development are outlined in Table 2.

Table 2: Wastewater Treatment Works serving development in Ilminster Parish that are in hydrological continuity with the Somerset Levels and Moors Ramsar.

WwTW Catchment	Residential and employment development quantum allocated in the Ilminster Neighbourhood Plan	HRA implications
Ilminster Water Recycling Centre (operated by Wessex Water)	839 new residential dwellings and an unspecified amount of employment space	Discharge of treated sewage effluent into local watercourses, such as the River Isle (ultimately a tributary of the River Parrett), which is in hydrological continuity with the Somerset Levels and Moors Ramsar

4.20 Natural England have confirmed to South Somerset Council and surrounding authorities that development that discharges to water courses connected to the Somerset Levels and Moors Ramsar site could adversely affect that site. Based on the maps Natural England has provided Ilminster is within the catchment. The following European site within 10km of Ilminster Parish is sensitive to changes in water quality as a result of NP development (the site in bold is taken forward into the following chapters):

- **Somerset Levels & Moors Ramsar (located 7.7km to the north-east of Ilminster Parish)**

Water Level

4.21 The unique nature of wetlands combines shallow water, high levels of nutrients and high primary productivity. These conditions are ideal for the growth of organisms at the basal level of food webs, which feed many species of birds, mammals, fish and amphibians. Overwintering and migrating wetland bird species are particularly reliant on these food sources, as they need to build up enough nutritional reserves to sustain their long migration routes.

4.22 Winter flooding is integral to the function of most wetlands and essential in maintaining a variety of foraging habitats for SPA birds. Maintaining a steady water supply during key stages of their life cycle will be critical for survival. However, different species vary in their requirements of water levels. Splash and / or shallow flooding is required to provide suitable feeding areas and roosting sites for ducks and waders. In contrast, deeper flooding is essential to provide these habitats for Bewick's swans and other ducks.

4.23 Wetland habitats rely on hydrological connections with other surface waters, such as rivers, streams and lakes. A constant supply of water is fundamental to maintaining the ecological integrity of sites. However, while the natural fluctuation of water levels within narrow limits is desirable, excess or too little water supply might cause the water level to be outside of the required range of SPA birds and / or their prey. This might lead to the loss of the structure and functioning of wetland habitats. There are two mechanisms through which urban development might negatively affect the water level in aquatic SPAs:

4.24 The supply of new housing with potable water will require an increase in the abstraction of water from surface water and groundwater bodies. Depending on the level of water stress in the geographic region, this is likely to reduce the water level in SPAs / Ramsars that share the same catchment.

4.25 The expansion of impermeable surfaces in urban areas increases the volume and speed of surface water runoff. As traditional drainage systems often cannot cope with the volume of stormwater, sewer overflows are designed to discharge excess water directly into watercourses. Often this pluvial flooding results in downstream inundation of watercourses and the potential flooding of wetland habitats.

4.26 Specifically, the Site Improvement Plan for the Somerset Levels and Moors SPA / Ramsar identifies inappropriate water levels as a primary concern for the SPA / Ramsar. Increases to the quantity and rate of water delivery can result in summer flooding and prolonged / deeper winter flooding. This in turn results in the reduction of feeding and roosting sites for birds. For example, in areas where water is too deep, most waders will be unable to reach their food sources close to the ground.

4.27 Generally, wetlands within and downstream of urban areas are likely to have limited capacity to absorb some of the surface- water runoff from pavement and buildings, thereby providing flood control and preventing water logging of crops. However, if this capacity is exceeded, there might be adverse effects on the integrity of such sites. In the case of the Ilminster NP, direct water surface runoff is unlikely to be an issue, given that the nearest sensitive European site (the Somerset Levels and Moors SPA / Ramsar) is 7.7km from the Parish.

4.28 The implementation of the Ilminster NP may result in changes to the water quantity, level and flow in the catchment of the Somerset Levels and Moors SPA / Ramsar due to increased water abstraction rates. This might alter the water level in the designated site with potential cascading effects on overwintering wildfowl.

4.29 The following European site within 10km of Ilminster Parish is sensitive to changes in the water level, quantity and flow as a result of NP development (the site in bold is taken forward into the following chapters):

- **Somerset Levels & Moors SPA / Ramsar (located 7.7km to the north-east of Ilminster Parish)**

Recreational Pressure

4.30 There is concern over the cumulative impacts of recreation on key nature conservation sites in the UK, as most sites must fulfill conservation objectives while also providing recreational opportunity. Various research reports have provided compelling links between changes in housing and access levels and impacts on European protected sites[31] [32]. This applies to any habitat, but the additional recreational pressure from housing growth on destinations designated for bird interests can be especially strong and some waterfowl qualifying for SPA designation are known to be susceptible to disturbance. Different European sites are subject to different types of recreational pressures and have different vulnerabilities. Studies across a range of species have shown that the effects from recreation can be complex. HRAs of planning documents tend to focus on recreational sources of disturbance as a result of new residents[33].

4.31 Human activity can affect birds either directly (e.g. through causing them to flee) or indirectly (e.g. through damaging their habitat or reducing their fitness in less obvious ways e.g. stress). The most obvious direct effect is that of immediate mortality such as death by shooting, but human activity can also lead to much subtler behavioural (e.g. alterations in feeding behaviour, avoidance of certain areas and use of sub optimal areas etc.) and physiological changes (e.g. an increase in heart rate). While these are less noticeable, they might result in major population-level changes by altering the balance between immigration/birth and emigration/death[34].

4.32 Concern regarding the effects of disturbance on birds stems from the fact that they are expending energy unnecessarily and the time they spend responding to disturbance is time that is not spent feeding[35]. Disturbance therefore risks increasing energetic expenditure of birds while reducing their energetic intake, which can adversely affect the 'condition' and ultimately survival of the birds. Additionally, displacement of birds from one feeding site to others can increase the pressure on the resources available within the remaining sites, as they then must sustain a greater number of birds[36]. Moreover, the more time a breeding bird spends disturbed from its nest, the more its eggs are likely to cool and the more vulnerable they, or any nestlings, are to predators. Recreational effects on ground-nesting birds are particularly severe, with many studies concluding that urban sites support lower densities of key species, such as stone curlew and nightjar[37] [38]. Recreation disturbance in winter can be more adverse because birds are more vulnerable at this time of year due to food shortages.

4.33 Evidence in the literature suggests that the magnitude of disturbance clearly differs between different types of recreational activities. For example, dog walking leads to a significantly higher reduction in bird diversity and abundance than hiking[39]. Scientific evidence also suggests that key disturbance parameters, such as areas of influence and flush distance, are significantly

[31] Liley D, Clarke R.T., Mallord J.W., Bullock J.M. 2006a. The effect of urban development and human disturbance on the distribution and abundance of nightjars on the Thames Basin and Dorset Heaths. Natural England / Footprint Ecology.
[32] Liley D., Clarke R.T., Underhill-Day J., Tyldesley D.T. 2006b. Evidence to support the appropriate Assessment of development plans and projects in south-east Dorset. Footprint Ecology / Dorset County Council.
[33] The RTPI report 'Planning for an Ageing Population'(2004) which states that 'From being a marginalised group in society, the elderly are now a force to be reckoned with and increasingly seen as a market to be wooed by the leisure and tourist industries. There are more of them and generally they have more time and more money.' It also states that 'Participation in most physical activities shows a significant decline after the age of 50. The exceptions to this are walking, golf, bowls and sailing, where participation rates hold up well into the 70s'.
[34] Riley, J. 2003. Review of Recreational Disturbance Research on Selected Wildlife in Scotland. Scottish Natural Heritage.
[35] Riddington, R. *et al*. 1996. The impact of disturbance on the behaviour and energy budgets of Brent geese. *Bird Study* 43:269-279
[36] Gill, J.A., Sutherland, W.J. & Norris, K. 1998. The consequences of human disturbance for estuarine birds. *RSPB Conservation Review* 12: 67-72
[37] Clarke R.T., Liley D., Sharp J.M., Green R.E. 2013. Building development and roads: Implications for the distribution of stone curlews across the Brecks. PLOS ONE. doi:10.1371/journal.pone.0072984.
[38] Liley D., Clarke R.T. 2003. The impact of urban development and human disturbance on the numbers of nightjar *Caprimulgus europaeus* on heathlands in Dorset, England. Biological Conservation 114: 219-230.
[39] Banks P.B., Bryant J.Y. 2007. Four-legged friend or foe? Dog walking displaces native birds from natural areas. Biology Letters 3: 14pp.

greater for dog walkers than hikers[40]. A UK meta-analysis suggests that important spatial (e.g. the area of a site potentially influenced) and temporal (e.g. how often or long an activity is carried out) parameters differ between recreational activities, suggesting that activity type is a factor that should be taken into account by HRAs[41].

4.34 Disturbance can also result from a wider urbanisation effect that might pose a much more direct threat to survival, such as in the case of predation by dogs and cats. Dogs are often exercised off-lead and roam out of sight of their owners and have been documented to kill ground-nesting birds. Cats tend to roam freely at night, potentially seeking out prey many kilometres away from their home.

Non-breeding birds (August to July)

4.35 Because the Somerset Levels and Moors SPA / Ramsar is designated for overwintering waterfowl, this section summarises academic research available on this functional group of birds.

4.36 The potential for disturbance may be different in winter than in summer, in that there are often a smaller number of recreational users. Furthermore, the impacts of disturbance at a population level may be reduced because birds are not breeding. However, recreational disturbance in winter may still have negative impacts, because birds face seasonal food shortages and are likely to be susceptible to any nutritional loss. Therefore, the abandonment of suitable feeding areas due to disturbance can have serious consequences for their ability to find suitable alternative feeding sites.

4.37 Evans & Warrington[42] found that on Sundays total water bird numbers (including shoveler and gadwall) were 19% higher on Stocker's Lake LNR in Hertfordshire, and attributed this to observed greater recreational activity on surrounding water bodies at weekends relative to week days displacing birds into the LNR. However, in this study, recreational activity was not quantified in detail, nor were individual recreational activities evaluated separately.

4.38 Tuite et al[43] used a large (379 sites), long-term (10-year) dataset (September – March species counts) to correlate seasonal changes in wildfowl abundance with the presence of various recreational activities. They determined that shoveler was one of the most sensitive species to recreational activities, such as sailing/windsurfing and rowing. Studies on recreation in the Solent have established that human leisure activities cause direct disturbance to wintering waterfowl populations[44] [45].

4.39 The degree of impact that varying levels of noise will have on different species of bird is poorly understood except that a number of studies have found that an increase in traffic levels on roads does lead to a reduction in the bird abundance within adjacent hedgerows - Reijnen et al (1995) examined the distribution of 43 passerine species (i.e. 'songbirds'), of which 60% had a lower density closer to the roadside than further away. By controlling vehicle usage they also found that the density generally was lower along busier roads than quieter roads[46]. A study on Holt Heath noted reduced levels of fitness due to occupation of sub optimal habitats alongside roads amongst heathland species.

4.40 A recent study on recreational disturbance on the Humber[47] assesses different types of noise disturbance on waterfowl referring to studies relating to aircraft (see Drewitt 1999[48]), traffic

[40] Miller S.G., Knight R.L., Miller C.K. 2001. Wildlife responses to pedestrians and dogs. 29: 124-132.
[41] Weitowitz D., Panter C., Hoskin R., Liley D. The spatio-temporal footprint of key recreation activities in European protected sites. Manuscript in preparation.
[42] Evans, D.M. & Warrington, S. 1997. The effects of recreational disturbance on wintering waterbirds on a mature gravel pitlake near London. International Journal of Environmental Studies 53: 167-182
[43] Tuite, C.H., Hanson, P.R. & Owen, M. 1984. Some ecological factors affecting winter wildfowl distribution on inland waters in England and Wales and the influence of water-based recreation. *Journal of Applied Ecology* 21: 41-62
[44] Footprint Ecology. 2010. Recreational Disturbance to Birds on the Humber Estuary
[45] Footprint Ecology, Jonathan Cox Associates & Bournemouth University. 2010. Solent disturbance and mitigation project – various reports.
[46] Reijnen, R. et al. 1995. The effects of car traffic on breeding bird populations in woodland. III. Reduction of density in relation to the proximity of main roads. Journal of Applied Ecology 32: 187-202
[47] Helen Fearnley Durwyn Liley and Katie Cruickshanks (2012) Results of Recreational Visitor Survey across the Humber Estuary produced by Footprint Ecology
[48] Drewitt, A. (1999) Disturbance effects of aircraft on birds. English Nature, Peterborough.

(Reijnen, Foppen, & Veenbaas 1997)[49], dogs (Lord, Waas, & Innes 1997[50]; Banks & Bryant 2007[51]) and machinery (Delaney et al. 1999; Tempel & Gutierrez 2003). These studies identified that there is still relatively little work on the effects of different types of water-based craft and the impacts from jet skis, kite surfers, windsurfers etc. (see Kirby et al. 2004[52] for a review). Some types of disturbance are clearly likely to invoke different responses. In very general terms, both distance from the source of disturbance and the scale of the disturbance (noise level, group size) will both influence the response (Delaney et al. 1999[53]; Beale & Monaghan 2005[54]). On UK estuaries and coastal sites, a review of WeBS data showed that, among the volunteer WeBS surveyors, driving of motor vehicles and shooting were the two activities most perceived to cause disturbance (Robinson & Pollitt 2002)[55].

4.41 Disturbing activities present themselves on a continuum. Generally, activities that involve irregular, infrequent and loud noise events, movement or vibration are likely to be the most disturbing. For example, the presence of dogs around water bodies generate substantial disturbance due the areas accessed and their impact on bird behaviour. Birds are least likely to be disturbed by activities that involve regular, frequent, predictable and quiet patterns of sound, movement or vibration. The further any activity is from the birds, the less likely it is to result in disturbance. Therefore, the factors that determine species responses to disturbance include species sensitivity, timing/duration of the recreational activity and the distance between source and receptor of disturbance.

4.42 The specific distance at which a species takes flight when disturbed is known as the 'tolerance distance' (also called the 'escape flight distance') and greatly differs between species. Tolerance distances from various literature sources are summarised in Table 3. It is reasonable to assume from this evidence that disturbance is unlikely to be relevant at distances of beyond 200m. Generally, tolerance distances are known for only few species and should not be extrapolated to other species.

Table 3: Tolerance distances in metres of 21 species of waterfowl to various forms of recreational disturbance, as described in the literature. Where the mean is not available, distances are provided as a range.[56]

Species	Type of disturbance. [1] Tydeman (1978), [2] Keller (1989), [3] Van der Meer (1985), [4] Wolff et al (1982), [5] Blankestijn et al (1986)		
	Rowing boats/kayak	Sailing boats	Walking
Little grebe		60 – 100 [1]	
Great crested grebe	50 – 100 [2]	20 – 400 [1]	
Mute swan		3 – 30 [1]	
Teal		0 – 400 [1]	

[49] Reijnen, R., Foppen, R. & Veenbaas, G. (1997) Disturbance by traffic of breeding birds: evaluation of the effect and considerations in planning and managing road corridors. Biodiversity and Conservation, 6, 567-581.
[50] Lord, A., Waas, J.R. & Innes, J. (1997) Effects of human activity on the behaviour of northern New Zealand dotterel Charadrius obscurus aquilonius chicks. Biological Conservation, 82,15-20.
[51] Banks, P.B. & Bryant, J.V. (2007) Four-legged friend of foe? Dog-walking displaces native birds from natural areas. Biology Letters, 3, 611-613.
[52] Kirby, J.S., Clee, C. & Seager, V. (1993) Impact and extent of recreational disturbance to wader roosts on the Dee estuary: some preliminary results. Wader Study Group Bulletin, 68, 53-58.
[53] Delaney, D.K., Grubb, T.G., Beier, P., Pater, L.L.M. & Reiser, H. (1999) Effects of Helicopter Noise on Mexican Spotted Owls. The Journal of Wildlife Management, 63, 60-76.
[54] Beale, C.M. & Monaghan, P. (2005) Modeling the Effects of Limiting the Number of Visitors on Failure Rates of Seabird Nests. Conservation Biology, 19, 2015-2019.
[55] Robinson, J.A. & Pollitt, M.S. (2002) Sources and extent of human disturbance to waterbirds in the UK: an analysis of Wetland Bird Survey data, 1995/96 to 1998/99: Less than 32% of counters record disturbance at their site, with differences in causes between coastal and inland sites. Bird Study, 49, 205.
[56] Tydeman, C.F. 1978. Gravel Pits as conservation areas for breeding bird communities. PhD thesis. Bedford College
Keller, V. 1989. Variations in the response of Great Crested Grebes *Podiceps cristatus* to human disturbance - a sign of adaptation? *Biological Conservation* 49:31-45
Van der Meer, J. 1985. *De verstoring van vogels op de slikken van de Oosterschelde*. Report 85.09 Deltadienst Milieu en Inrichting, Middelburg. 37 pp.
Wolf, W.J., Reijenders, P.J.H. & Smit, C.J. 1982. The effects of recreation on the Wadden Sea ecosystem: many questions but few answers. In: G. Luck & H. Michaelis (Eds.), *Schriftenreihe M.E.L.F., Reihe A: Agnew. Wissensch* 275: 85-107
Blankestijn, S. et al. 1986. Seizoensverbreding in de recreatie en verstoring van Wulp en Scholkester op hoogwatervluchplaatsen op Terschelling. Report Projectgroep Wadden, L.H. Wageningen. 261pp.

Mallard	10 – 100 [1]
Shoveler	200 – 400 [1]
Pochard	60 – 400 [1]
Tufted duck	60 – 400 [1]
Goldeneye	100 – 400 [1]
Smew	0 – 400 [1]
Moorhen	100 – 400 [1]
Coot	5 – 50 [1]
Curlew	211 [3]; 339 [4]; 213 [5]
Shelduck	148 [3]; 250 [4]
Grey plover	124 [3]
Ringed plover	121 [3]
Bar-tailed godwit	107 [3]; 219 [4]
Brent goose	105 [3]
Oystercatcher	85 [3]; 136 [4]; 82 [5]
Dunlin	71 [3]; 163 [2]

4.43 The available baseline information suggests that the Somerset Levels and Moors SPA / Ramsar is vulnerable to recreational pressure because of the risk of disturbance to overwintering wildfowl species (e.g. Bewick's swan, golden plover), which are qualifying features of the SPA. The SPA / Ramsar is approximately 7.7km from the boundary of Ilminster Parish. An increase in recreational pressure due to the implementation of the Ilminster NP is therefore a potential concern for the populations of bird species which the SPA / Ramsar is designated for.

4.44 Mitigation measures to avoid recreational pressure effects usually involve a combination of access management, habitat management and provision of alternative recreational space. Access management (restricting access to some or all of a European site) is not typically within the remit of a Parish Council and restriction of access may contravene a range of Government policies on access to open space and objectives for increasing exercise, improving health etc. However, active management of access may be possible, such as that practised on nature reserves. Habitat management also does not lie within the direct remit of Parish Councils. However, the Council can help to set a framework for improved habitat management by promoting collaboration with neighbouring parishes and Local Planning Authorities. Provision of alternative recreational space can help to attract recreational users away from sensitive European sites and reduce pressure on the sites. However, the location and type of alternative space must be attractive to users for this to be effective.

4.45 It is to be noted that the Ilminster Parish lies relatively far from the Somerset Levels and Moors SPA / Ramsar (approx. 7.7km), which is beyond the core recreational catchment of most inland sites. In contrast, coastal and estuarine protected sites may have core recreational catchments extending to 10km and beyond. Notwithstanding this, this HRA considers recreational pressure as a precautionary measure in Chapter 5.

4.46 Overall, the following European site within 10km of Ilminster Parish is sensitive to recreational pressure as a result of NP development (the site in bold is taken forward into the following chapters):

- **Somerset Levels & Moors SPA / Ramsar (located 7.7km to the north-east of Ilminster Parish)**

5. Test of Likely Significant Effects

Introduction

5.1 The initial scoping of impact pathways and relevant European sites identified that the following require consideration:

Loss of Functionally Linked Habitat

- Somerset Levels & Moors SPA / Ramsar

Atmospheric Pollution

- Cerne & Sydling Downs SAC
- Mendip Woodlands SAC
- Rooksmoor SAC

Water Quality

- Somerset Levels & Moors Ramsar

Water Level

- Somerset Levels & Moors SPA / Ramsar

Recreational Pressure

- Somerset Levels & Moors SPA / Ramsar

5.2 The policies contained within the Ilminster NP are screened for their Likely Significant Effects (LSEs) on European sites in Appendix A. Figure 4 below shows Ilminster Parish in relation to the European sites listed above.

Figure 4: Ilminster Parish in relation to European Sites

Loss of Functionally Linked Habitat

Somerset Levels & Moors SPA / Ramsar

5.3 The following policy has the potential to result LSEs regarding the impact pathway atmospheric pollution:

- **Policy ILM12 – Amount and Location of Our New Homes** (provides for 839 new dwellings in Ilminster Parish)

5.4 The Somerset Levels & Moors SPA / Ramsar is partly designated for its overwintering population of Bewick's swan, European golden plover and northern lapwing as well as a waterbird assemblage of European importance. All three species rely heavily on wet grassland and arable land outside the designated site boundary, often forming large mobile flocks. Of the three species, Bewick's swans are most dependent on functionally linked habitat, because they primarily forage on waste root crops, grain stubbles and winter cereals. Generally, the swans roost on shallow freshwater lakes or marshes, near grasslands that are prone to flooding or arable land. The number of Bewick's swans have declined in recent decades and the loss of supporting habitat may be one reason for this decline. Natural England's Conservation Objectives Supplementary Advice Note[57] specifies that the amount of supporting arable land and grassland should be maintained to help this species recover.

5.5 It is documented that Bewick's swans will fly up to 10km from their roost sites to feed[58]. Given such foraging distances, it is possible that Bewick's swans from the Somerset Levels & Moors SPA / Ramsar will forage in Ilminster Parish (approx. 7.7km from the SPA / Ramsar). Several sites allocated in the Ilminster NP comprise arable land and grassland, meaning that their development may result in the loss of functionally linked habitat of the swans. Golden plovers may also cover long distances to reach foraging grounds (maximum distances of up to 10km), although their median ranges are likely to be much shorter.

5.6 Therefore, LSEs of the Ilminster NP on the Somerset Levels & Moors SPA / Ramsar regarding the loss of functionally linked habitat cannot be excluded. The site is screened in for Appropriate Assessment.

Atmospheric Pollution

5.7 The following policy has the potential to result LSEs regarding the impact pathway atmospheric pollution:

- **Policy ILM12 – Amount and Location of Our New Homes** (provides for 839 new dwellings in Ilminster Parish)

5.8 The Ilminster NP is a development plan that is subordinate to the emerging South Somerset Local Plan (SSLP). For the SSLP bespoke traffic and air quality modelling will be undertaken, assessing the effect of in-combination growth in South Somerset and the surrounding authorities on nitrogen deposition along key SACs. However, the Parish of Ilminster is now progressing their NP prior to the delivery of the SSLP and a detailed assessment of potential air quality impacts is therefore required.

5.9 While air quality is an impact pathway where 'in combination' assessment is required, it is also necessary to consider whether an individual plan or project will meaningfully contribute to that effect. For example, paragraph 48 of Advocate-General Sharpston's Opinion in European Court of Justice Case C-258/11 states that [emphasis added]: *'the requirement for an effect to be 'significant' exists in order to lay down a de minimis threshold. Plans and projects that have no* ***appreciable*** *effect on the site can therefore be excluded. If all plans and projects capable of*

[57] Natural England. 2019. European Site Conservation Objectives: Supplementary advice on conserving and restoring site features. 21pp. Available at: http://publications.naturalengland.org.uk/publication/4598158654963712 [Accessed on the 15/06/2020]

[58] Stroud, D.A., Bainbridge, I.P., Maddock, A., Anthony, S., Baker, H., Buxton, N., Chambers, D., Enlander, I., Hearn, R.D., Jennings, K.R, Mavor, R., Whitehead, S. & Wilson, J.D. (2016). The status of UK SPAs in the 2000s: The Third Network Review. JNCC, Peterborough. 1,108pp.

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.

5.10 As an initial exercise, AECOM therefore modelled the likely change in flows of the 839 proposed dwellings in Ilminster on two-way vehicle trips in 24 hours (i.e. the Annual Average Daily Traffic) along key routes for trips originating in Ilminster, including the A361, the A357, the A352 and the A37. This was based on using Routeplanner to identify the destinations (district and MSOA level) for journeys arising from Ilminster.

5.11 The traffic modelling indicates that the A357 between Bishop's Caundle and Lydlinch within 200m of the Rooksmoor SAC, the A361 at Leighton within 200m of the Mendip Woodlands SAC, and the A352 at Cerne Abbas and the A37 at Sydling St. Nicholas (both within 200m of the Cerne & Sydling Downs SAC) are all routes linking to the Ilminster NP. Therefore, despite lying far beyond 10km from Ilminster Parish, all three SACs have been included in this HRA as a precautionary measure.

Cerne & Sydling Downs SAC

5.12 As identified in the previous chapter on impact pathways, the Cerne & Sydling Downs SAC is sensitive to atmospheric pollution due to its semi-natural dry grassland and scrubland facies with a critical nitrogen load of 15-25 kg N/ha/yr. The A37 is a major commuter road and in 2018 an Annual Average Daily Traffic flow of 7,316 cars, 1,832 light goods vehicles and 684 heavy goods vehicles was counted at traffic count point 46392[59]. The A37 runs directly adjacent to the Cerne & Sydling Downs SAC, specifically the sub-component Court Farm, Sydling SSSI, where lowland dry grassland occurs over much of the SSSI. The A352 is a less busy A road with 831 cars, 255 light goods vehicles and 48 heavy goods vehicles counted at traffic point 6961. It runs within 200m of the Cerne & Sydling Downs SAC, specifically the Black Hill Down SSSI, at Cerne Abbas.

5.13 Traffic modelling for this Neighbourhood Plan HRA indicates that the 839 dwellings allocated in Ilminster would result in an additional 104 AADT on the A37 at Sydling St. Nicholas, a section of road close to the SAC. This represents a 1% increase on the 2018 two-way trip baseline of 9,944 AADT. On the A352 at Cerne Abbas, the Ilminster NP would lead to an additional 12 AADT, also representing an increase of 1% compared to the 2018 baseline for that link.

5.14 It is considered that any resulting air quality changes from the changes in AADT for these two links would be inconsequential even in-combination with other projects and plans (or in Advocate-General Sharpston's words would have no appreciable effect on the SAC) for the following reasons:

- Daily traffic flows are not fixed numerals but fluctuate from day to day. The AADT for a given road is an annual average (specifically, the total volume of traffic for a year, divided by 365 days). It is this average number that is used in air quality modelling, but the 'true' flows on a given day will vary around this average figure. Small changes in average flow will lie well within the normal variation (known as the standard deviation or variance) and would not result in a statistically significant difference in the total AADT; and

- When converted into NOx concentrations, ammonia concentrations or nitrogen deposition rates, the experience of AECOM's air quality modelling team is that very small changes in AADT (tens of AADT) would only affect the third decimal place. The third decimal place is not normally reported in air quality modelling to avoid false precision. For this reason, pollution is generally not reported to more than 2 decimal places (0.01). Anything smaller is simply reported as less than 0.01 (< 0.01) i.e. probably more than zero but too small to model with precision.

5.15 Overall, given that the increase in traffic on the identified A37 road link is negligible, it is concluded that the Ilminster NP will not lead to Likely Significant Effects on the Cerne & Sydling Downs SAC regarding atmospheric pollution. The site is screened out from Appropriate Assessment.

[59] Department for Transport road traffic counts. Available at: https://roadtraffic.dft.gov.uk/manualcountpoints/46392 [Accessed on the 09/06/2020]

Rooksmoor SAC

5.16 The Rooksmoor SAC is sensitive to atmospheric pollution due to its Molinia meadows on calcareous, peaty or clayey-silt-laden soils with a critical nitrogen load of 15-25 kg N/ha/yr. Furthermore, the Marsh fritillary butterflies might be sensitive to habitat changes triggered by excess nutrient deposition. Traffic modelling undertaken by AECOM for this Neighbourhood Plan HRA indicates that the A357, which lies directly adjacent to the SAC, will only receive 59 additional two-way vehicle trips due to the Ilminster NP. This is a 1% increase on the current baseline.

5.17 For the reasons given above relating to Cerne & Sydling Downs SAC it is considered that any resulting air quality changes from the changes in AADT for this link would be inconsequential even in-combination with other projects and plans (or in Advocate-General Sharpston's words would have no appreciable effect on the SAC).

5.18 Overall, it is concluded that the Ilminster NP will not result in Likely Significant Effects on the Rooksmoor SAC regarding atmospheric pollution. The site is screened out from Appropriate Assessment.

Mendip Woodlands SAC

5.19 The feature sensitive to atmospheric pollution in this SAC is the meso- and eutrophic *Quercus* woodland, which has a critical nitrogen load of 15-20 kg N/ha/yr. The Mendip Woodlands lie in Mendip District within 200m of the A361 to the south of Frome at Leighton. This is identified as a potential commuter route for Ilminster residents that travel to the east of the District, for example to Frome. Census 2011 data indicate that Mendip is the second most important origin and the third most important destination for commuters from and to South Somerset.

5.20 However, the traffic modelling undertaken by AECOM for the Ilminster NP shows that only 41 additional two-way vehicle trips are expected as a result of the Ilminster allocations, equating to a 0.33% increase on the current AADT baseline of 12,356. For the reasons outlined for Cerne & Sydling Downs SAC, it is considered that any resulting air quality changes from the changes in AADT for these two links would be inconsequential even in-combination with other projects and plans (or in Advocate-General Sharpston's words would have no appreciable effect on the SAC).

5.21 Overall, it is concluded that the Ilminster NP will not result in Likely Significant Effects on the Mendip Woodlands SAC regarding atmospheric pollution. The site is screened out from Appropriate Assessment.

Water Quality

Somerset Levels & Moors Ramsar

5.22 The following policy has the potential to result in LSEs regarding the impact pathway water quality:

- **Policy ILM12 – Amount and Location of Our New Homes** (provides for 839 new dwellings in Ilminster Parish)

5.23 As discussed earlier in this HRA, the Somerset Levels & Moors Ramsar is sensitive to changes in water quality, and specifically excess phosphorus input. The Ramsar site is partly designated for its internationally important wetland feature, such as its floristic and invertebrate diversity. Importantly, many of the waterbodies (including the River Parrett operational catchment to which Wastewater Treatment Works relevant to Ilminster would discharge) feeding into the Ramsar component parts fail to reach 'good' ecological status and are deemed in unfavourable condition. Whereas nitrogen in watercourses derives primarily from agriculture, the majority of phosphorus

entering watercourses comes from treated sewage effluent[60] and phosphorus is the principal growth limiting nutrient (controlling eutrophication) in lowland freshwaters.

5.24 Policy ILM12 provides for 839 dwellings in Ilminster Parish. These new residential homes will be discharging wastewater via the nearby Wastewater Treatment Works (WWTWs) at Chard and Crewkerne. Despite the fact that the overarching South Somerset Local Plan requires WWTWs to have sufficient consented headroom for new residential development to go ahead, wastewater effluent from new housing development in Ilminster may still lead to an increase in phosphorus in some of the waterbodies in the Somerset Levels & Moors Ramsar. Overall, Likely Significant Effects regarding water quality on the Ramsar cannot be excluded and the site is therefore screened in for Appropriate Assessment.

Water Level

Somerset Levels & Moors SPA / Ramsar

5.25 The following policy has the potential to result LSEs regarding the impact pathway water level:

- **Policy ILM12 – Amount and Location of Our New Homes** (provides for 839 new dwellings in Ilminster Parish)

5.26 Excessive changes in the water level of European Sites are most likely to be caused by increased water abstraction rates and surface water run-off in or near urbanised areas. Due to the relatively long distance between Ilminster Parish and the Somerset Levels & Moors SPA / Ramsar (approx. 7.7km), it is unlikely that enhanced surface runoff from developed brownfield sites will directly change the water level in the site. However, abstraction of surface water for household or industrial supply might result in a drop of the water level in the SPA / Ramsar, which critically depends on specific water level ranges at different times of the year.

5.27 The Somerset Levels & Moors SPA / Ramsar depend on surface water input over a large catchment area, including the Rivers Axe, Brue, Parrett and Tone, to maintain its water level. The importance of a steady water level regime in sustaining the qualifying species (and / or their habitats) is highlighted in Natural England's Supplementary Advice Note on Conserving and Restoring Features in the SPA / Ramsar. This document states that '*The presence of overwintering SPA birds on the floodplain depends on a complex integrated approach to water level and flood risk management*'. The recent decline in overwintering Bewick's swan numbers has been partly attributed to a reduction in winter flooding.

5.28 Furthermore, the Somerset Levels & Moors Ramsar is designated for 17 species of Red Data Book invertebrates and three vascular plant species considered vulnerable (i.e. *Wolffia arrhizal*, *Hydrocharis morsus-ranae* and *Peucedanum palustre*). These protected features are also sensitive to changes in the Ramsar's water level.

5.29 Given the above, the Somerset Levels & Moors SPA / Ramsar is considered sensitive to potential changes in the hydrological regime resulting from the Ilminster NP. The site is screened in for Appropriate Assessment.

Recreational Pressure

Somerset Levels & Moors SPA / Ramsar

5.30 The following policy has the potential to result LSEs regarding the impact pathway recreational pressure:

- **Policy ILM12 – Amount and Location of Our New Homes** (provides for 839 new dwellings in Ilminster Parish)

[60] https://www.ceh.ac.uk/news-and-media/news/sewage-blame-phosphorus-river-pollution#:~:text=Phosphorus%20sources%20include%20runoff%20from,treatment%20works%20and%20septic%20tanks.&text=The%20researchers%20found%20a%20link,the%20likely%20source%20of%20pollution.

5.31 The residential development outlined in the Ilminster NP allocates 839 new homes, which is likely to result in a net increase of recreational visits to nearby greenspaces. The distances that local residents will travel to undertake recreational activities are likely to vary greatly and depend on the type of recreational activity. For example, dog walkers often tend to undertake frequent and short walks near their home, whereas birdwatchers or people on family outings, are likely to travel further and spend more time undertaking their activities.

5.32 The Somerset Levels & Moors SPA / Ramsar is a European site designated for several migratory and overwintering bird species. Policies that directly influence the number of people using this SPA / Ramsar have the potential for LSEs by causing disturbance to these birds. A prolonged increase in recreational pressure might affect the long-term survival of these qualifying species, ultimately causing adverse effects on site integrity.

5.33 A core catchment of 5km (based on the 75th percentile of visitors) has been identified for many SPAs. This has been used as an indicator of relative housing density around the SPA to reflect the number of residential dwellings close to the SPA / Ramsar and from which a significant portion of the recreational pressure is likely to arise. However, other European sites (such as coastlines) often have much larger core recreational catchments of up to 10km. Considering this and the attractiveness of the Somerset Levels & Moors SPA / Ramsar, the site is screened in for Appropriate Assessment as a precautionary measure. This is also in line with the HRA of the overarching South Somerset Local Plan, which assessed recreational pressure in more detail.

6. Appropriate Assessment

Introduction

6.1 The law does not prescribe how an Appropriate Assessment (AA) should be undertaken or presented but the AA must consider all impact pathways that have been screened in, whether they are due to policies alone or to impact pathways that arise in-combination with other projects and plans. That analysis is the purpose of this section. The law does not require the 'alone' and 'in combination' effects to be examined separately provided all effects are discussed.

6.2 The Ilminster NP allocates 839 dwellings and this extent of growth is large enough to have the potential for Likely Significant Effects (LSEs) alone, such as may be the case regarding the impact pathway loss of functionally linked habitat (discussed below). Furthermore, LSEs must also be discussed in-combination, taking account of the growth in parishes surrounding Ilminster Parish. The South Somerset Local Plan (SSLP) provides for 15,638 new dwellings between 2016 and 2036, of which 839 dwellings are allocated for Ilminster Parish. Therefore, the SSLP provides an appropriate starting point to assess in-combination effects on European sites. Overall, the growth in Ilminster Parish accounts for approximately 5% of the development expected in South Somerset District.

6.3 The HRA screening exercise undertaken in Chapter 5, Appendix A, Table 5 indicated one policy for which Likely Significant Effects on European Sites cannot be excluded, including the impact pathways loss of functionally linked habitat, water quality, water level and recreational pressure. These are discussed in turn below.

Loss of Functionally Linked Habitat

Somerset Levels and Moors SPA / Ramsar

6.4 The Test of LSEs section screened in the loss of functionally habitat in relation to the Somerset Levels & Moors SPA / Ramsar. Ilminster Parish lies well within 10km (approx. 7.7km) of the SPA / Ramsar, the foraging distance within which Bewick's swans may routinely forage. Golden plover, on rare occasions, may travel similar distances to foraging habitats. Given that some of the sites allocated in the Ilminster NP may comprise suitable feeding grounds for the swans and golden plovers, development of these sites could result in adverse effects on the site integrity of the SPA / Ramsar.

6.5 Therefore, the suitability of the sites allocated for development for supporting Bewick's swans is assessed in the first instance. The key parameters that guide this assessment include distance to the Somerset Levels & Moors SPA / Ramsar (the likelihood of site use decreases with distance from the SPA / Ramsar; as evidenced by Natural England's Impact Risk Zones (IRZs) set for the Arun Valley SPA; IRZs are not available for the Somerset Levels & Moors SPA / Ramsar), habitat type (Bewick's swans predominantly forage in agricultural stubble, but may also be found in wet grassland) and site size (it is generally assumed that sites should be at least 2ha in size to support a significant population of wintering waterfowl). Table 4 provides a summary of the 15 residential sites allocated in the Ilminster NP, summarising these key parameters.

Table 4: Residential site allocations proposed in the Ilminster NP, listing the distance (km) to the Somerset Levels & Moors SPA / Ramsar, the habitat type on site and the site size (ha).

Site Ref	Site Name	Distance to Somerset Levels & Moors SPA / Ramsar	Habitat type	Site size (ha)
25	Station Road	9km	Arable land	4.9
21B	West of Winterhay Lane adjacent to Daido Factory	8.6km	Grazing land, semi-improved grassland	3.5
21A		8.8km	Grassland, scrub, trees	0.3
19	Land east of Winterhay Lane	8.6km	Arable land	1.8
12	Land to the rear of New Wood House, The Beacon	8.6km	Grazing land, semi-improved grassland	2.2
22A	Land East of Winterhay Lane	8.7km	Grazing land, semi-improved grassland, scattered trees	0.9
30	Sussex Business Park	8.9km	Dense tree cover, partially brownfield site (old parking lot)	1.6
11	Falls under small sites completed / committed	8.9km	Tree cluster, grassland, in middle of residential area	0.1
24	Gooch and Housego, Market, East St	8.6km	Grassland, some scrub	< 0.1
23	The Swan	8.6km	Trees, existing garden	< 0.1
15A	Land south of Shudrick Lane	8.5km	Arable land	1.5
26	Land east of Playing Field, Shudrick Lane	8.6km	Arable land	2.5
10	Canal Way	9.2km	Mainly arable land, semi-improved grassland, scattered trees	20.9
17	Greenway Farm, west of Listers Hill	9.4km	Grazing land, semi-improved grassland	2.4
31	Land to east of Greenway, Listers Hill	9.4km	Arable land	1.7

6.6 Table 1 shows that all residential site allocations lie within the maximum foraging distance of 10km, documented for Bewick's swans. Therefore, all sites were assessed in more detail regarding their habitat and size. This assessment highlighted that 5 of the allocations (site references 25, 19, 26, 10, 31) comprise arable land and are sufficiently large to potentially support 1% of the SPA's / Ramsar's Bewick's swan population. A further 3 allocations comprise sufficiently large grassland (and potentially wet grassland) to be potential foraging alternatives, as it is well known that the swans frequently switch feeding habitats in winter. Sites 21A, 22A, 30, 11, 24, 23 and 15A are either too small (size <0.1ha up to 1.6ha) or comprise habitats (e.g. scrubland, trees, brownfield development) that are unsuitable for the swans.

6.7 It is important to note that Ilminster's allocations lie beyond the distances suggested by the IRZs that Natural England identifies for another European site designated for Bewick swan, the Arun Valley SPA / Ramsar. Those IRZs are based on Bewick's swan records that delineate the area outside the SPA / Ramsar, which supports the highest number of swans. However, such IRZs are not available for the Somerset Levels & Moors SPA / Ramsar and AECOM have thus opted for the precautionary approach of considering that the allocations above might constitute functionally linked habitat.

6.8 The loss of habitat that is functionally linked to the Somerset Levels & Moors SPA / Ramsar was also considered in the HRA of the emerging South Somerset Local Plan (SSLP), the overarching planning document guiding the NPs in its constituent parishes. It was identified that some of the residential allocations in Langport and Martock are large enough and comprise suitable habitat (wet grassland, agricultural land) to be potentially linked to the SPA / Ramsar. While these settlements lie closer to the European site than Ilminster Parish, the HRA provides useful context in which to assess development in Ilminster.

6.9 In the first instance, AECOM have contacted the Somerset Environmental Records Centre (SERC) to obtain bird records for the centroids of the site allocations. This will help determine whether there are historical records and, if so, the abundances of qualifying bird species in or near the proposed sites. Furthermore, this will inform whether overwintering bird surveys in the allocations identified above might be required for planning applications.

6.10 SERC provided all available bird records for the geographic boundaries of 1km surrounding the proposed site allocations. These data were collected between 1989 and 2014 and ranged in resolution from 6 figure (low resolution) to 10 figure (high resolution) grid references. Notably, there are no records of Bewick's swan within 1km of any of the proposed development sites. This species is known to undertake the longest off-site foraging trips and is of greatest concern in relation to the Somerset Levels and Moors SPA / Ramsar. While the absence of records does not mean Bewick swan to not use the fields, the available evidence gives no basis to assume these fields are important functionally-linked habitat.

6.11 Although there are no historical Bewick's swan records within the search area, some of the proposed allocations are clearly potential foraging grounds for this species. The most recent records are from 2016 and this needs to be set into the context of dwindling wildlife areas, increasing habitat fragmentation and changing species home ranges. Overall, it cannot be excluded that the wider area around Ilminster village (including the site allocations) are used by Bewick's swan from the Somerset Levels and Moors SPA / Ramsar without further work at the application level and the Neighbourhood Plan must therefore set an appropriate policy framework for this further analysis.

6.12 In contrast, there are several records of golden plover within 1km of the allocations from 1991 to 2015, ranging in abundance from 30 to 2,500 counted individuals. These data clearly show that the agricultural fields around the village of Ilminster are suitable for, and used by, golden plover. That said, the proposed allocations nearest to the SPA / Ramsar (allocations 19 and 21B) lie at a distance of 8.6km from the European site. Past research has shown that golden plovers are unlikely to routinely forage beyond 4km from their breeding sites[61] and the Natural England document 'Impact Risk Zones Guidance Summary Sites of Special Scientific Interest Notified for Birds Version 1.1' (dated March 2019) suggests that 5km may be an appropriate Impact Risk Zone for residential development around an SSSI designated for the species.

[61] Time budgets and foraging of breeding golden plover *Pluvialis apricaria*. *Journal of Applied Ecology* **37**: 632-646.

6.13 Notwithstanding this, the foraging behaviour of this species is also shaped by numerous other local conditions such as prey availability and it cannot be dismissed that golden plover at times move further from their breeding sites. Overall, it is likely that most golden plover records from around the village of Ilminster do not represent individuals from the SPA / Ramsar population and the available evidence gives no basis to assume these fields are important functionally-linked habitat. However, it cannot be excluded that the wider area around Ilminster village (including the site allocations) are used by golden plover from the Somerset Levels and Moors SPA / Ramsar without further work at the application level and the Neighbourhood Plan must therefore set an appropriate policy framework for this further analysis.

6.14 AECOM recommended insertion of the following wording into Policy EQ5 (Biodiversity) or another appropriate policy of the overarching SSLP to address this issue: **'To meet the requirements of the Habitats Directive regarding allocated sites LH1, LH2, MB1, MB2 and MB3, the applicant should be required to provide evidence that the development will not result in adverse effects on integrity. To prove this, a survey will be required to determine the habitats and current site use to verify if the land parcel is indeed suitable for supporting a significant population[62] of designated bird species. Where habitats are suitable, non-breeding bird surveys will be required to determine if the site and neighbouring land constitute a significant area of supporting habitat. Bird surveys will need to be undertaken during autumn, winter and spring. If habitat within the site or adjacent land are identified to support significant populations of designated bird species, avoidance measures and mitigation will be required, and the planning application will likely need to be assessed through a project specific Habitats Regulations Assessment to ensure that the development does not result in adverse effects on integrity.'**

6.15 Given that the SSLP guides planning in Ilminster Parish, it is concluded that an appropriate protective policy framework for this impact pathway already exists. It is recommended that the NP make reference to this section of the SSLP in an appropriate policy, such as Policy **ILM2 (Conserve and Enhance Ilminster's Ecology, Species and Habitats)** to ensure that any functionally linked habitats in the Parish are protected.

6.16 Overall, provided that appropriate reference to policy wording in the overarching SSLP is made in the Ilminster NP, adverse effects on the site integrity of the Somerset Levels & Moors SPA / Ramsar regarding the loss of functionally linked habitat can be excluded, alone or in-combination.

Water Quality

Somerset Levels & Moors Ramsar

6.17 The Ilminster NP was screened in for Appropriate Assessment in relation to its likely phosphorus input into the Somerset Levels & Moors Ramsar, predominantly through the discharge of sewage from WwTWs into the hydrological catchment of the Ramsar. The Ramsar site is designated for 17 Red Data book invertebrates, which depend on good water quality in the network of drainage ditches. One example is the lesser silver water beetle *Hydrochara caraboides* which is classified as an endangered species that is now restricted to 45 breeding pools.

6.18 A review of the various waterbodies encompassing the Ramsar indicates that a large proportion of the site is in Unfavourable Declining condition. This is further supported by data on the Environment Agency's Catchment Data Explorer. The Ilminster Water Recycling Centre, the WwTW responsible for treating Ilminster's wastewater, discharges to the River Isle to the north of Ilminster village. This part of the River Isle belongs to the Upper Isle – confluence with Cad Brook section of the river. The 2016 overall waterbody status was 'Moderate', with many hydrochemical parameters classified as being of 'High' quality. However, regarding the waterbody was qualified as 'Poor' for its high phosphate concentration. This part of the river is in hydrological continuity with the West Moor SSSI, a subcomponent of the Ramsar that is in an unfavourable state. The Unfavourable Declining status also applies to the other main components of the Ramsar, including the West Sedgemoor SSSI and the Curry & Hay Moors SSSI.

[62] A significant population is classified as a site that regularly used by 1% or more of the population of qualifying bird species

6.19 Recently, Competent Authorities elsewhere have followed a 'nutrient neutrality' approach to new development, which is likely to be the most robust approach to avoiding an adverse effect on site integrity, alone or in-combination. Examples of multi authority catchment solutions include the nutrient neutral approach in the Solent, the approach being undertaken to phosphorus in the Stour catchment in Kent, the phosphate neutrality set out in the River Avon Local Authorities Phosphorus Interim Delivery Plan, the River Axe Nutrient Management Plan and the Poole Harbour Nitrogen Supplementary Planning Document. In a recent communication, Natural England advised that a similar approach should also be adopted for the District of South Somerset (the Local Planning Authority under which Ilminster Parish falls). It was advised that this approach was necessary to allow residential development that would otherwise result in additional phosphorus input to the Ramsar to come forward.

6.20 While phosphorus input to the Ramsar is clearly a concern, attenuation processes should also be considered. The Ilminster Water Recycling Centre discharges into a section of the River Isle that lies at a flow path distance of approx. 15.8km from the West Moor SSSI. Attenuation processes are likely to remove a significant portion of the phosphate over the first 10km downstream from the point of discharge, thus preventing the majority of the phosphate from affecting the Ramsar. Furthermore, due to the complexity of the drainage ditches, the hydrological connections surrounding the Ramsar are very complex and it is very difficult to attribute the origins of pollutants accurately. The precise fluvial catchment of the Ramsar is therefore subject to ongoing revision by Natural England.

6.21 Notwithstanding this, a residual risk of eutrophication from phosphate input remains, and development plans need to ensure that risks of adverse effects on the water quality of European sites are avoided. As such, this HRA provides a precautionary nutrient neutral approach regarding phosphate. In the absence of a specific methodology for the Somerset Levels & Moors Ramsar (we understand Natural England are currently working on such a methodology), AECOM consulted Natural England's advice on nutrient neutrality for new development surrounding the Stodmarsh SPA / SAC. This is deemed to be appropriate, because the process for calculating the additional phosphorus loading is likely to be essentially identical irrespective of the European site involved. For the detail of the calculations summarised in Table 5 please refer to the relevant guidance note published by Natural England (see Appendix B).

Table 5: Nutrient neutrality (Total Phosphorus; TP) calculation for the allocations proposed in the Ilminster NP, including Stage 1 (TP load from future wastewater), Stage 2 (TP loss resulting from the conversion of current land uses), Stage 3 (TP leachate from future land uses) and Stage 4 (overall phosphate balance as a result of the individual allocation).

Other Parameters				Calculation Steps for Total Phosphorus			
Site Ref	Site Name	Habitat type	Site size (ha)	Stage 1 – TP from future Wastewater (kg TP yr)	Stage 2 – Phosphate loss from current land use (kg TP / ha / yr)	Stage 3 – Phosphate leachate from future land use (kg TP / ha /yr)	**Stage 4 – Overall phosphate balance (kg TP / yr)**
25	Station Road	Arable land	4.9	4.3	1.8	2.1	**5.6**
21B	West of Winterhay Lane adjacent to Daido	Grazing land, semi-improved grassland	3.5	3.9	0.98	1.5	**5.3**
21A	Factory	Grassland, scrub, trees	0.3	0.6	0	0.13	**0.88**
19	Land east of Winterhay Lane	Arable land	1.8	3	0.5	0.77	**4**

12	Land to the rear of New Wood House, The Beacon	Grazing land, semi-improved grassland	2.2	1.3	0.5	0.95	**2.1**
22A	Land East of Winterhay Lane	Grazing land, semi-improved grassland, scattered trees	0.9	1.3	0.3	0.39	**1.7**
24	Gooch and Housego, Market, East St	Grassland, some scrub	< 0.1	1.2	0.43	0.43	**1.5**
23	The Swan	Trees, existing garden	< 0.1	0.17	0.04	0.04	**0.2**
15A	Land south of Shudrick Lane	Arable land	1.5	1.7	0.42	0.64	**2.5**
26	Land east of Playing Field, Shudrick Lane	Arable land	2.5	2.5	0.7	1.08	**3.5**
10	Canal Way	Mainly arable land, semi-improved grassland, scattered trees	20.9	34.7	5.9	9	**45.4**
17	Greenway Farm, west of Listers Hill	Grazing land, semi-improved grassland	2.4	3.8	0.67	1.03	**5.01**
31	Land to east of Greenway, Listers Hill	Arable land	1.7	3.8	0.48	0.73	**4.9**

6.22 The total phosphate balances of the sites included in the Ilminster NP show that all allocations will lead to a phosphorus surplus in the River Isle and, potentially, to impacts on the ecological communities in the Somerset Levels and Moors Ramsar. Most site allocations are greenfield sites that are currently in agricultural use. The main driver of these elevated future phosphate loads is that the conversion of farmland to urban brownfield sites will result in increased phosphate leachate into surface water and groundwater bodies. In addition to phosphate released in treated wastewater effluent, this is due to the higher average phosphate loss from the urban fabric compared to agricultural land (0.83 kg TP/ha/yr vs 0.28 kg TP/ha/yr).

6.23 All phosphorus balances (listed in under Stage 4 in Table 5) are positive and this implies that mitigation will be required to achieve nutrient neutrality in relation to the Somerset Levels and Moors Ramsar. It is to be noted that detailed Masterplans are not yet available for any of the allocations, which is particularly relevant for the larger residential sites such as Canal Way (site

ref 10) and Station Road (site ref 25). Masterplans provide detail on the specific layout of developments, including the extent of greenspaces. The delivery of large on-site greenspaces (phosphorus leachate of a minimum of 0.14 kg TP/ha/yr) has the potential to reduce the phosphorus surplus currently predicted for the Ilminster NP. Therefore, the nutrient balances will have to be updated as further layout details on the allocations becomes available.

6.24 Nutrient mitigation can be achieved through a combination of the following measures:

- Secure an agreement with the wastewater treatment company (in this case Wessex Water) to ensure that phosphate removal at the relevant WwTW is increased
- Develop solutions that would remove phosphorus directly at the development site or downstream from the WwTW (e.g. wetlands or reedbeds)
- Acquire parcels of agricultural land elsewhere and change land use in perpetuity to natural habitat types (e.g. woodland, saltmarsh, grassland)
- Increase the proportion of greenspaces within the larger allocated sites (see discussion above) to help reduce phosphorus leachate

6.25 Natural England recognises that nutrient neutral solutions are difficult to achieve for smaller developments, both for financial and logistical reasons. Therefore, a stronger burden of responsibility is placed on local planning authorities to develop strategic mitigation solutions. South Somerset District Council is currently progressing their Local Plan Review 2016-2036, which is at the Preferred Options Reg.18 stage. A review of the document shows that it currently only provides for a general protection of biodiversity in Policy EQ5 (Biodiversity): '*All proposals for development, including those which would affect sites of regional and local biodiversity, nationally and internationally protected sites… will: a) protect the biodiversity value of land… e) Ensure that Habitat Features, Priority Habitats and Geological Features that are used by bats and other wildlife are protected…'*. Given that the overarching Local Plan does not currently address the issue of nutrient neutrality (as this issue has only recently been raised by Natural England), it is recommended that the Ilminster NP acknowledge this emerging concept and explicitly require mitigation measures for residential developments clarifying that before they can be consented (and subject to any subsequent advice on the issue from Natural England and the local planning authority) they will need to demonstrate phosphate neutrality.

6.26 To this end it is recommended that the following text is inserted into the next iteration of the Ilminster NP: '**Given the sensitivity of the Somerset Levels and Moor SPA / Ramsar to an increase in phosphate concentrations, it is a requirement that all developments contributing to the total wastewater burden in the Parish must achieve phosphate neutrality. Developments resulting in a phosphorus surplus, will be required to provide appropriate mitigation measures (e.g. wetlands, reedbeds) in agreement with the local planning authority. The requirement for mitigation will be commensurate with the scale of development and might be achieved strategically, particularly in the case of smaller developments.**' Provided that this text (or an appropriate equivalent) is inserted into the next iteration of the Ilminster NP, it is concluded that the NP will not result in adverse effects on the site integrity of the Somerset Levels and Moors SPA / Ramsar, alone or 'in-combination'.

Water Level

Somerset Levels & Moors SPA / Ramsar

6.27 The water level in any European site can be negatively impacted in two ways. A proliferation of impermeable surfaces near a European site or its tributaries might result in faster runoff rates and / or flash floods, leading to excessively high water levels. In contrast, water abstraction for public consumption or industrial use may lead to a drop in the baseline water levels in a European site or its tributaries. Both mechanisms may threaten the integrity of ecological assemblages and both are relevant to the Somerset Levels & Moors SPA / Ramsar.

6.28 The development outlined in the Ilminster NP is likely to increase the total area of ground covered by impermeable surfaces. Such impermeable surfaces may increase the risk of flooding, especially more localised flash floods, if mitigation steps were not taken. Due to the relatively

long distance of 7.7km between Ilminster Parish and the Somerset Levels & Moors SPA / Ramsar, direct flooding from Ilminster is unlikely. However, development in the Parish might contribute to increased surface runoff into tributaries ultimately feeding the SPA / Ramsar. As identified in the screening for Likely Significant Effects section, such changes in water levels might affect the roosting and / or feeding behaviour of some of the qualifying species of wildfowl.

6.29 For example, splash conditions (i.e. habitat ranging from field to 10cm deep water) are required over at least 30% of the SPA to provide good feeding conditions for wigeon and teal, while leaving some damp ground for golden plover, snipe and lapwing. Shallow conditions (i.e. habitat of 10 to 30cm deep water) should occur over up to 25% of the SPA, to provide undisturbed feeding areas and roosting sites for ducks and waders. In contrast, deeper water conditions (up to 75cm deep), are required only over about 5 to 10% of the SPA. At the time of writing of Natural England's Supplementary advice on conserving and restoring site features (February 2019), the area of deeper habitat already exceeded the 5-10% target level. An increase in runoff rates from Ilminster Parish may exacerbate this existing water level problem.

6.30 Some relevant protective mechanisms are already set out in the SSLP, the overarching planning document that guides development set out in the NP. The SSLP stipulates that 'Development will be directed away from medium and high flood risk areas by using South Somerset's Strategic Flood Risk Assessment as the basis for applying the Sequential Test.' It therefore already provides some protection to the water levels in the Somerset Levels and Moors SPA / Ramsar. Restricting development to areas of low flood risk means that the effects of any additional water surface run-off are unlikely to be exacerbated by flooding conditions in the wider area.

6.31 Furthermore, the Environment Agency now requires new development to incorporate Sustainable Drainage Systems (SuDS). SuDS are designed to manage stormwater as close to its source as possible, thereby mimicking natural drainage and encouraging infiltration and attenuation. These same systems can be used to manage the pollution risk from urban runoff. The Flood and Water Management Act (2010) makes it a legal requirement to install SuDS for the management of all surface water. Policy EQ1 of the SSLP makes reference to SuDS as a means to reducing flood risk and to mitigate the impacts of climate change. However, no specific reference in the document is made regarding the need for managing flood risk in relation to the Somerset Levels and Moors SPA / Ramsar.

6.32 AECOM recommended to further explain the need for SuDS using appropriate policy wording. It was advised to insert the following wording into policy EQ5 – Biodiversity of the SSLP: '*Sustainable Drainage Systems (SuDS) should be utilised in all development unless demonstrated to be inappropriate. Their implementation should ensure that there is no net increase of peak run-off rates from all urban surfaces beyond that of greenfield runoff rates. Therefore, the run-off rates should not exceed the existing rate / volume of discharge as a minimum requirement.*' It was also recommended to add a paragraph ensuring the multi-functionality of SuDS sustems: '*SuDS should be designed and implemented to be multi-functional and deliver other objectives, such as: promoting good water quality and use efficiency, supporting high biodiversity; reinforcing local landscape character and enhancing the design of development.*' These recommendations would also apply to the Ilminster NP.

6.33 Given the supporting evidence for its applicability and the importance SuDS are assigned in the SSLP, it follows that the provision of SuDS in development delivered under the Ilminster NP would be an appropriate mitigation measure. **Policy ILM15 – Design and Layout of Strategic Sites** stipulates that '*New development on the two strategic sites, namely on (1) Land South West of Canal Way and (2) Station Road, should deliver high quality sustainable communities in accordance with national and Local Plan policy.*' They should also *(d) Incorporate Sustainable Urban Drainage Systems (SUDS) including swales and ditches and provision for their ongoing maintenance'*. Therefore, the Ilminster NP already makes appropriate references to the overarching Local Plan and the requirement for SuDS. However, as a precautionary measure, it is recommended that SuDS are made mandatory for all residential allocations that come forward under the Ilminster NP.

6.34 The existing policy framework in the SSLP and the Ilminster NP ensures that the rates of run-off from development in the whole of South Somerset District (and therefore also in Ilminster) are maintained to background greenfield rates in both flow and volume, which will prevent an adverse cumulative effect of hydrological input downstream in the SPA / Ramsar. Therefore, it is

concluded that the Ilminster NP will not result in adverse effects on the integrity of the Somerset Levels & Moors SPA / Ramsar regarding excessive flooding in the site.

6.35 As highlighted in the screening for Likely Significant Effects, the water supply to new residential or industrial development might reduce the water level in surface waterbodies in hydrological continuity with the Somerset Levels & Moors SPA / Ramsar. A drop in the water level of the SPA / Ramsar, or in habitat that is functionally linked to the SPA / Ramsar, may render this habitat unsuitable for qualifying species, such as the Bewick's swan.

6.36 Wessex Water is the company that is responsible for the public water supply in South Somerset District and Ilminster Parish. A review of Wessex's Water Resources Management Plan (WRMP) indicates that the water supply – demand ratio remains in surplus until 2044/45, meaning that the consented abstraction headroom will not be exceeded. This is important because the total water available for use (Ml/d) is determined in consultation with the Environment Agency, who ensure that the Conservation Objectives of European sites are taken into account.

6.37 Notwithstanding this, Natural England (NE) expressed concerns over water abstraction in Somerset rivers that are hydrologically linked to the Somerset Levels & Moors SPA / Ramsar. NE stipulated that the projected level of water abstraction could threaten the management of water levels in the Somerset Levels & Moors Ramsar. This is mainly because the Environment Agency's 2010 Review of Consents process only considered the SPA features and not the invertebrate and plant communities of the Ramsar designation. Of particular concern is the abstraction of water from the River Tone, which runs eastwards feeding the Curry and Hay Moors SSSI, a component part of the Somerset Levels & Moors SPA / Ramsar. Wessex Water committed to working with the Environment Agency and the Canal and River Trust to assess the environmental impacts of water abstraction in this part of its supply network, as well as a 6-year period of ecological baseline monitoring and improving flow gauge data.

6.38 Overall, the HRA of Wessex Water's WRMP concluded no adverse effects on the site integrity of the Somerset Levels & Moors SPA / Ramsar. Given that this WRMP encompasses the water supply for a much larger region than Ilminster Parish (effectively the in-combination growth surrounding the Parish), it is concluded that the Ilminster NP will not result in adverse effects on the site integrity of the Somerset Levels & Moors SPA / Ramsar regarding a reduction in the site's water level.

Recreational Pressure

Somerset Levels & Moors SPA / Ramsar

6.39 The Ilminster NP allocates 839 new dwellings, which will inevitably lead to an increase in the number of recreational users in South Somerset. In turn this may result in more visits being undertaken to nearby nature conservation sites, such as the Somerset Levels & Moors SPA / Ramsar. It is noted that the boundary of Ilminster Parish lies approx. 7.6km – and therefore beyond 5km, the typical core recreational catchment for many sites – from the SPA / Ramsar. However, because some very attractive sites have larger core catchments, the Somerset Levels & Moors is assessed in more detail below.

6.40 The distance to a potential destination is a key parameter, as it predicts the likelihood of visiting. Distance to home interacts with other parameters, such as the mode of transport (e.g. walking or driving by car). For example, for one of the most thorough studies, repeat visitor surveys were conducted at the Thames Basin Heaths Special Protection Area. The study found that the average distance between the visitor's home postcode and Thames Basin Heaths SPA when arriving by foot was 0.8 km, with 75% of foot-based visitors living within a 0.9 km straight line distance from the visitor survey point. Other surveys show a similar broad pattern, likely because there is a natural limit as to how far most people are prepared to walk to visit a particular countryside site, even when it is large and appealing. Therefore, it is concluded that the Somerset Levels & Moors SPA / Ramsar is too far from Ilminster Parish to be a realistic destination for walkers.

6.41 Regarding visitors arriving by car, it is likely that the limited amount of parking available near components of the SPA / Ramsar in South Somerset, will inherently limit any increase in car-

based visitor numbers due to the Ilminster NP. In addition to this, a study carried out in 2002 found that in Moorlinch SSSI, a component of the SPA in Mendip District, visitors had a low-level impact on overwintering bird species (Chown, 2002). It was determined that there was little suitable habitat close to footpaths, and that most birds were therefore aggregating in wetter, inaccessible parts of the site.

6.42 Overall, it is concluded that the Ilminster NP will not result in adverse effects on the site integrity of the SPA / Ramsar alone.

In-combination Assessment

6.43 It has become customary to assess recreational pressure in-combination with residential growth in nearby authorities, as visitors frequently move between districts for recreational activities. The most recent piece of evidence for such an in-combination assessment is a visitor survey that stems from the HRA of the Mendip Local Development Framework Draft Core Strategy (2011).

6.44 It summarises results from a survey undertaken on several components of the Somerset Levels and Moors SPA / Ramsar. As part of the survey and most relevant to this HRA, one SPA parcel within the South Somerset District boundary was surveyed: Ablake Clyce, Pibsbury, Langport. However, survey results for parcels that lie outside South Somerset are still useful, as they provide an indication of how popular the site is for recreation. The broad aim of the survey was to establish how popular sites were among residents, how far people travelled to visit and the reasons why people were visiting.

6.45 The data highlight that recreational pressure is highest in summer (when SPA bird numbers are lowest) and much lower in the winter months (the key period for most SPA birds). The number of people visiting over two days in October was low at most survey points. For example, at Ablake Clyce, the SPA parcel closest to Ilminster Parish, only 27 visitors were recorded over two days. At Ashcott Corner further north in Mendip District, the visitor number over two days was 203, and therefore much higher.

6.46 The Somerset Levels and Moors SPA / Ramsar appears to have a relatively unusual catchment size, which is probably related to the type of recreation it attracts. The most popular activities were birdwatching (37.7% of interviewees) and walking (35% of interviewees). Uniquely, bird-watching appears to be less associated with the amount of local housing, with bird watchers travelling very large distances to visit sites. On average, 40% of visitors travelled more than 20km, whilst 22% of visitors travelled between 5km and 10km to the site. A total of 62% of visitors are therefore sourced from beyond 5km. As such, most visitors to this SPA appear to be people from across the region rather than being locals. Furthermore, travel distances were different between activities, with walkers and dog walkers living nearby, while bird watchers living significantly further away.

6.47 The key results regarding the recreational impact pathway are therefore:

- **The SPA / Ramsar experiences relatively low levels of use**
- **The site has a relatively large catchment area**
- **It has an unusually high proportion of bird watchers**

6.48 The Mendip Core Strategy HRA also reported that, according to Natural England, the level of disturbance across the SPA is considered to be low. The main reasons for this are that: the SPA is relatively remote, there are limiting parking opportunities for visitors and significant parts of sites are not served by paths. The HRA states that '*the vast majority of users stick to defined paths and walking routes*', thereby avoiding many of the more sensitive areas of the SPA.

6.49 It is noted that some key components of the SPA / Ramsar relevant to the Ilminster NP were not surveyed in 2010. This includes the RSPB site at West Sedgemoor and a parcel to the north-west of Kingsbury Episcopi, which could be recreational destinations for residents from Ilminster. However, the conclusions of this assessment regarding the relatively far distance between the allocated housing and the SPA / Ramsar, and the role that parking availability will have in inherently restricting visitor numbers, will still apply.

6.50 Recreational pressure in the Somerset Levels & Moors SPA / Ramsar was also assessed in the HRA of the emerging South Somerset Local Plan, in-combination with residential growth in the surrounding local authorities of West Somerset & Taunton, Sedgemoor, Mendip, Wiltshire, North Dorset, West Dorset and East Devon. This HRA concluded that there would not be in-combination adverse effects on the site integrity of the SPA / Ramsar. This assessed a much higher level in-combination growth and supports the assessment provided here.

6.51 Overall, it is concluded that the Ilminster NP will not result in adverse effects on the integrity of the Somerset Levels & Moors SPA / Ramsar regarding recreational pressure, in-combination with other development plans.

7. Conclusions

7.1 The HRA of the Ilminster NP concluded that LSEs could not be excluded regarding the following impact pathways and undertook an Appropriate Assessment of these:

- Loss of functionally linked habitat
- Water quality
- Water level
- Recreational pressure

7.2 Regarding the loss of functionally linked habitat the AA concluded that further reference to the overarching SSLP was advisable. Although all proposed site allocations lie over 8km from the Somerset Levels and Moors SPA / Ramsar, and therefore near the maximum distances that Bewick's swans and golden plovers are likely to travel, many of the site allocations are sufficiently large and provide suitable habitat for SPA / Ramsar birds.

7.3 Therefore, it is recommended that the following is added to the supporting text for Policy ILM2, with reference in the policy itself: **'To meet the requirements of the Habitats Directive regarding allocated sites 25, 19, 26, 10, 31, the applicants should provide evidence that the development will not result in adverse effects on the integrity of Somerset Levels and Moors SPA/Ramsar through loss of functionally linked land. To prove this, a survey will be required to determine the habitats and current site use to verify if the land parcel is indeed suitable for supporting a significant population of designated bird species. Where habitats are suitable, non-breeding bird surveys will be required to determine if the site and neighbouring land constitute a significant area of supporting habitat. Bird surveys will need to be undertaken during autumn, winter and spring. If habitat within the site or adjacent land are identified to support significant populations of designated bird species, avoidance measures and mitigation will be required, and the planning application will likely need to be assessed through a project specific Habitats Regulations Assessment to ensure that the development does not result in adverse effects on integrity.'** Provided that this text (or an appropriate equivalent) is inserted into the next iteration of the Ilminster NP, it is concluded that the NP will not result in adverse effects on the site integrity of the Somerset Levels and Moors Ramsar regarding the loss of functionally linked habitat, alone or 'in-combination'.

7.4 Regarding the water quality in the Somerset Levels and Moors Ramsar (the SPA designation is not sensitive to changes in water quality), particularly the phosphate concentrations, the AA took the issue of phosphate neutrality into account. Importantly, the phosphate budgets for all allocations (calculated using the most relevant NE guidance) were in surplus, meaning that all residential sites are likely to result in a net increase in phosphate concentrations in the Ramsar. To this end it is recommended that the following text is inserted into the next iteration of the Ilminster NP: '**Given the sensitivity of the Somerset Levels and Moor Ramsar site to an increase in phosphate concentrations, it is a requirement that all developments contributing to the total wastewater burden in the Parish must achieve phosphate neutrality. Developments resulting in a phosphorus surplus, will be required to provide appropriate mitigation measures (e.g. wetlands, reedbeds) in agreement with the local planning authority. The requirement for mitigation will be commensurate with the scale of development and might be achieved strategically, particularly in the case of smaller developments.**' Provided that this text (or an appropriate equivalent) is inserted into the next iteration of the Ilminster NP, it is concluded that the NP will not result in adverse effects on the site integrity of the Somerset Levels and Moors SPA / Ramsar regarding water quality, alone or 'in-combination'.

7.5 Regarding the water level impact pathway potentially affected by flash flooding, it was concluded that Ilminster lies too far from the nearest component part of the SPA / Ramsar for surface runoff to be an issue. Notwithstanding this, it was concluded that the Ilminster NP contains an appropriate policy framework (e.g. by requiring SuDS) to address potential flash flooding. Regarding a drop in the water level due to increased water abstraction, the WRMP published by Wessex Water shows that there is surplus abstraction headroom covering the entire period of the

Ilminster NP. Furthermore, Wessex Water committed to working with the Environment Agency and the Canal and River Trust to assess the environmental impacts of water abstraction from the River Tone, which may be of concern for the Somerset Levels and Moors Ramsar. Overall, given this evidence it is concluded that the Ilminster NP will not result in adverse effects on the site integrity of the Somerset Levels and Moors SPA / Ramsar regarding water level, alone or 'in-combination'.

7.6 Regarding recreational pressure, the AA documented that the Somerset Levels and Moors SPA / Ramsar experiences relatively low levels of use and is visited by an unusually high number of bird watchers. A 2010 visitor survey in the SPA / Ramsar also revealed that visitors tend to stick to the paths, likely reducing the potential for disturbance. The HRA of the emerging SSLP, which assessed a much larger residential growth, also concluded that there would be no 'in-combination' recreational pressure effects on the SPA / Ramsar. Overall, it is therefore concluded that the Ilminster NP will not result in adverse effects on the site integrity of the Somerset Levels and Moors SPA / Ramsar regarding recreational pressure, alone or 'in-combination'.

Appendix A

Table 6. Screening table showing the Test of Likely Significant Effects (LSEs) results of policies contained within the Ilminster Neighbourhood Plan. Where a screening result is shaded in green there will be no LSEs on European sites. Orange shading means that there is a potential for LSEs on European sites from the impact pathways identified in the box.

Policy	Description	Test of Likely Significant Effects (LSEs)
Chapter 6 – Environment and Leisure		
Policy ILM1 – Conserve and Enhance Ilminster's Historic Landscape Setting	All development proposals, excluding householder developments*, must demonstrate how they: (a) Preserve all views of Beacon Hill, Herne Hill, Pretwood Hill, River Isle and The Minster especially from main roads into Ilminster and those from the twenty 'Identified views of Ilminster' (b) Enhance views and vistas, particularly those containing heritage assets, through public realm improvements and carefully managing development (c) Create new views and vistas, particularly on allocated housing sites on the edge of the built up area (d) Conserve or enhance local landscape character, features (such as trees and hedgerows) (e) Ensure all new development includes a strategic landscape plan and associated management for the whole site to include hard and soft landscaping which enhances the local landscape. * Householder developments are defined as works or extensions within the curtilage of a dwellinghouse which requires an application for planning	There are no Likely Significant Effects of this policy on European sites. This is a development management policy that preserves Ilminster's historic landscape setting, including its views, vistas, trees and hedgerows. The policy does not provide for a location and / or quantum of residential or employment development. The policy is therefore screened out from Appropriate Assessment.
Policy ILM2 – Conserve and Enhance Ilminster's	All development proposals should demonstrate that they conserves or enhances biodiversity having regard to designated local green space, flood zone, water, local wildlife sites, areas of high recreational amenity and to the green chain identified on the Proposals Map (figure 5) by:	There are no Likely Significant Effects of this policy on European sites.

Ecology, Species and Habitats	(a) Planting one new tree per new bedroom built (b) Replacing every tree removed by development with two trees (c) Facilitating the green chain as shown on the proposals map either within or adjacent to the site where relevant. (d) Providing a buffer zones of 10 metres adjacent to existing and new habitats.	This is a policy that protects the environment, including local green spaces, flood zones, local wildlife sites and areas of high recreational amenity. The protection of wildlife in Ilminster Parish would also benefit any European sites that are linked to the Ilminster NP via impact pathways. The policy does not provide for a location and / or quantum of residential or employment development. It is therefore screened out from Appropriate Assessment.
Policy ILM3 – Enhance and Connect Our Local Green Spaces With a Green Chain	Site allocations should preserve and enhance existing GREEN OPEN SPACES and the green chain network by: (a) Providing a well signposted, 'Green chain' of designated Local Green Spaces* and well signposted, routes identified on the proposals map, where it does not compromise ecology, including safer road crossings and cycle facilities (b) Providing more facilities and equipment to encourage greater use of green open spaces by all age groups (c) Increasing biodiversity by attracting more wildlife, flora and fauna especially on the identified 'Green Chain' (d) Ensuring that the site allocations preserve and enhance existing open spaces and enhance the 'Green Chain' network. * This policy applies to the following 'Local Green Spaces on the Ilminster NP Proposals Map: (A) Herne Hill Local Nature Reserve (LNR) (B) Britten's Field recreation ground (C) Wharf Lane Recreation Ground (D) Winterhay Recreation Area (E) Burma Star Garden (F) Shudrick Stream & Environs (G) Cemetery North of the Town Centre and Beacon (H)Shudrick Valley Nature Trail (I) Allotments off Hillview Terrace (J) Ilminster Bowling and Tennis Club (K) Swanmead Community School Playing Field (L) Greenfylde First School Playground (M) Market House and Surrounds (N) St. Mary's Churchyard (O) Blackdown Hill Play Area (P) River Isle	There are no Likely Significant Effects of this policy on European sites. This is a policy that is positive for the environment because it provides for a 'green chain' of greenspaces, an increase in the biodiversity in Ilminster and the protection of existing open spaces. The policy does not provide for a location and / or quantum of residential or employment development. It is therefore screened out from Appropriate Assessment.

Policy ILM4 – Promote Recreation Facilities For Our Growing Community	To improve health and well-being, provide facilities for the rising population and reduce the need to travel. Planning applicants of the allocated sites covered in Policy ILM12 must contribute towards building a new indoor sport/recreation facility adjacent to Canal Way as designated on the proposals map.	There are no Likely Significant Effects of this policy on European sites. This is a development management policy supporting the provision of recreation facilities in Ilminster's community, especially in order to reduce the need for travel. A reduction in car-based travel might have a positive impact on the atmospheric pollution associated with sites allocated in Policy ILM12. The policy does not provide for a location and / or quantum of residential or employment development. It is therefore screened out from Appropriate Assessment.
Chapter 7 – Economy, Tourism and Heritage		
Policy ILM5 – The Ilminster Environmental Enterprise Zone	Within The Ilminster Environmental Enterprise Zone (illustrated on the proposals map) the following development is supported: (a) Improved facilities for cyclists and walkers, including cycle hubs, visitor parking and new connections to public rights of way and the National Cycle Network (b) High quality business hubs for self employment, micro and small businesses* (c) Development that conserves or enhances the local landscape character, local distinctiveness, biodiversity and heritage assets (d) Sustainable public access to the open countryside, its footpaths, cycle ways, nature reserves, open spaces and gardens (e) A large regional scale sport or leisure facility. Other acceptable land uses in this area include visitor accommodation and eco tourism facilities, such as camp sites. *EU definition of micro business is less than 10 employees and	There are no Likely Significant Effects of this policy on European sites. This is a development management policy that specifies the types of development supported in the Ilminster Environmental Enterprise Zone, including cycling / walking facilities, small businesses and development that conserves / enhances the local biodiversity. The policy does not provide for a location and / or quantum of residential or employment development. It is therefore screened out from Appropriate Assessment.

	turnover of under £2 Million and small business is less than 50 employees and turnover of under £10 Million.	
Policy ILM6 – Enhance Ilminster's Economy, Tourism and Heritage	The INP will encourage more shoppers and visitors to Ilminster by preserving and enhancing its heritage assets and improving facilities to enhance the day and night time economy. Applications will be supported which improve Ilminster's profile and performance as: (a) A unique historic market town (b) A beautiful place in which to live work and learn (c) A more dynamic place for business, enterprise, creativity and Innovation (d) An attractive centre for shopping, leisure and recreation (f) A visitor destination (g) A place that connects people to the historic and natural environment.	There are no Likely Significant Effects of this policy on European sites. This is a policy that promotes Ilminster's economy and tourism by shaping it as an attractive centre for shopping, leisure and recreation, and a visitor destination. Although it is noted that this might lead to an increase in car-based travel to Ilminster, such journeys are considered to be relatively infrequent compared to commuter traffic. The policy does not provide for a location and / or quantum of residential or employment development. Overall, the policy is therefore screened out from Appropriate Assessment.
Policy ILM7 – Promote High Quality Design	Ilminster's historic environment will be sustained and enhanced and all development in the wider INP area should reflect its unique character. Development must contribute, reinforce and demonstrate that it is in keeping with the identified characteristics of Ilminster, as set out below and in the Ilminster Design Guide: (a) Exemplary urban design in the conservation area, where the relationship between streets and public spaces presents a high quality environment (b) A fine, permeable, urban grain made up of streets, blocks, plots with many active street frontages which contribute to lively streets and public areas (c) An extensive area of high quality architecture combining to form a harmonious townscape ensemble	There are no Likely Significant Effects of this policy on European sites. This is a design management policy that aims at protecting Ilminster's historic environment, such as through exemplary urban design, high-quality architecture and a strong visual relationship between the built environment and its landscape setting. The policy does not provide for a location and / or quantum of residential or employment development. It is therefore screened out from Appropriate Assessment.

	(d) A limited palette of materials and the quality detailing skill of craftsmanship and authenticity of construction to present a coherent and high-quality finish (e) Conversion of old buildings and the creation of new buildings, which are capable being easily adapted to a range of uses over time (f) A strong visual relationship between the built environment and its landscape setting providing glimpses and views, out of, within and into the Conservation Area and the green landscape setting of the town (g) Utilise the proximity of the conservation area and open countryside by connecting parks, facilities and open countryside on foot and bike.	
Chapter 8 – Access and Movement		
Policy ILM8 – Encourage Shoppers and Visitors Into Ilminster Centre	Development proposals and infrastructure should create or contribute to a safe, attractive and high quality inclusive public realm. Development must demonstrate regard to the following priorities: (a) Welcoming pedestrians - Public realm enhancements and provision of dropped curbs at key gateways, as shown on the proposals map, in particular adjacent to Market House (b) Welcoming cyclists - Provision of cycle friendly streets, sensitively designed racks and signage and removal of barriers on cycle paths (c) Managing cars - Reduce cars in the centre by improving the quality and accessibility of existing car parks, reducing charges, improving paths and pavements, signage, lighting, layout and accessibility (d) Welcoming bus travel - Improve the bus stops with sensitively designed street furniture and ensure they are located in convenient locations.	There are no Likely Significant Effects of this policy on European sites. This is a development management policy that encourages visitors into Ilminster Centre, including provisions such as cycling friendly streets and public realm enhancements. Since this policy mostly promotes sustainable transport modes, it is concluded that it may have positive effects on air quality. The policy does not provide for a location and / or quantum of residential or employment development. It is therefore screened out from Appropriate Assessment.
Policy ILM9 – Safe, Interesting Walking and Cycling Routes	Development sites as set out under policy ILM12, should improve walking and cycling routes, within development sites and on the proposed ‘Ilminster Green Chain’ as shown on the proposals map (and in accordance with Policy ILM10) by including:	There are no Likely Significant Effects of this policy on European sites.

	(a) Improvements to the National Cycle Network routes 30 and 33, including better signage, surfaces, road markings and priority at key junctions (b) Provision of safe walking routes, defined as 'pavements and paths wide enough to meet demand, with dropped curbs at key junctions, sufficient lighting and safe road crossings' The town council will prioritise the use of Neighbourhood portion on CIL on the Green chain.	This is a development management policy, which specifies that development sites should improve walking and cycling routes, including the National Cycle Network routes 30 and 33. Such a policy may contribute to an improvement in air quality by increasing sustainable travel. Specifically, it is considered positive that the policy provides specific examples of projects to be supported. The policy does not provide for a location and / or quantum of residential or employment development. The policy is therefore screened out from Appropriate Assessment.
Policy ILM10 – Welcome People To Ilminster	Improvements to the following gateways and junctions into Ilminster town centre are encouraged: (a) East Street and Butts (b) Bay Hill and Townsend (c) North Street and HighStreet/Butts (d) New Road, Station Road and West Street (e) Station Road and Riec-Sur-Belon Way. (f) Ditton Street and East Street to Shudrick Lane	There are no Likely Significant Effects of this policy on European sites. This is a development management policy that aims at improving the access points and junctions into Ilminster. However, as mentioned in relation to Policy ILM6, attracting more visitors into the Centre of Ilminster will not increase the number of regular car-based journeys along any of the European sites. The policy does not provide for a location and / or quantum of residential or employment development. The policy is therefore screened out from Appropriate Assessment.
Policy ILM11 – The Layout And Appearance of The Historic Market Town Centre	Proposals in the Ilminster Town Centre (as shown on Figure 8- Sustainable Access and Movement) will be supported where they provide: (a) A high quality, vibrant market destination and local amenity space befitting its important heritage status	There are no Likely Significant Effects of this policy on European sites. This is a development management policy that protects the layout and appearance of the historic market town centre by specifying the criteria that proposals should fulfil in order to be

<table>
<tr><td></td><td>(b) Public realm enhancements which encourage people to linger and provide safe, level road crossings

(c) A shared surface approach where pedestrians have priority over vehicular traffic most of the time

(d) Suitable access and servicing arrangements for the market, businesses, residents and shortstay parking.</td><td>supported. However, the policy has no impact pathways connecting to European sites.

The policy does not provide for a location and / or quantum of residential or employment development.

It is therefore screened out from Appropriate Assessment.</td></tr>
<tr><td colspan="3">Chapter 9 – Homes and Places for Living</td></tr>
<tr><td>Policy ILM12 – Amount and Location of Our New Homes</td><td>To meet the SSDC Local Plan target and housing needs of the Ilminster community, the INP supports the sustainable and phased development of up to 839 additional homes between 2016 and 2036 in the following locations:

<table><tr><th>Name</th><th>Site Ref</th><th>Suggested Number</th></tr><tr><td>Canal Way</td><td>10</td><td>400</td></tr><tr><td>Land to the rear of New Wood House, The Beacon</td><td>12</td><td>15</td></tr><tr><td>Land south of Shudrick Lane</td><td>15A</td><td>20</td></tr><tr><td>Greenway Farm, west of Listers Hill</td><td>17</td><td>44</td></tr><tr><td>Land east of Winterhay Lane</td><td>19</td><td>35</td></tr><tr><td rowspan="2">West of Winterhay Lane Adjacent to Daido Factory</td><td>21A</td><td>7</td></tr><tr><td>21B</td><td>45</td></tr><tr><td>Land East of Winterhay Lane</td><td>22A</td><td>15</td></tr><tr><td>The Swan</td><td>23</td><td>2</td></tr><tr><td>Gooch and Housego, Market, East St</td><td>24</td><td>14</td></tr></table></td><td>Likely Significant Effects of Policy ILM12 on European sites cannot be excluded.

This policy delivers a total of 839 dwellings in Ilminster in the NP period (2016 – 2036) to meet the Parish’s target in the South Somerset Local Plan. While the dwellings in Ilminster are identified in the overarching LP, Ilminster’s NP is to be delivered ahead of the LP and therefore requires bespoke assessment.

Policy ILM12 is screened in for Appropriate Assessment regarding the following impact pathways:

• Atmospheric pollution
• Recreational pressure
• Loss of functionally linked habitat</td></tr>
</table>

	Station Road	25	50 in connection with Site 16
	Land east of Playing Field, Shudrick Lane	26	29
	Land to east of Greenway, Listers Hill	31	44
	Small sites completed / committed	Various	119
	TOTAL		**839**
Policy ILM13 – Types of New Homes	All new housing developments* will provide an adequate mix of dwellings in terms of size, type and tenure in accordance with the findings of the Ilminster Housing Needs Assessment (2019) or any subsequent update. Development will be expected to provide: (1) At least 20% of new homes to be built to accessible and adaptable standards to meet the requirements of Building Regulations M4(2) meeting lifetime home standards. (2) On sites of 20 or more dwellings a target of 5% of homes to be provided as serviced plots for self-build and/or custom build homes. If this cannot be delivered after marketing the site for a continuous period of 12 months, the plot may revert to open market dwellings. Evidence of marketing the plots for self build or custom build must be submitted to and approved by the Local Planning Authority. This should set out the details of marketing that has been undertaken and demonstrate that there is no market demand. (3) A suitable mix of sizes, as follows: (a) Up to 6%, one bedroom flats subject to the design being wholly in keeping with the character of the Town (b) 14%, two bedroom flats or houses (c) 25%, two or three bedroom bungalows (d) 40%, three bedroom houses		There are no Likely Significant Effects of this policy on European sites. This is a housing management policy that specifies the types of new homes to be delivered in Ilminster, such as the percentage of accessible housing and the number of bedrooms to be delivered. However, the type of home has no significant bearing on European sites. The policy does not provide for a location and / or quantum of residential or employment development. It is therefore screened out from Appropriate Assessment.

	(e) 15%, four-bedroom plus houses OR live-work units. (f) Affordable Housing in accordance with adopted South Somerset Local Plan. * On sites with less than five dwellings, this policy will be applied more flexibly depending on the character of the site and development.	
Policy ILM14 – Allocated or Small Brownfield Sites	Within the INP Development Area, there is a presumption in favour of all development on allocated sites as set out in Policy ILM12. Any infilling within the settlement boundary will be in strict accordance with the INP Design Guide and Policies and have regard to the character of immediately adjoining properties and sites, considering: a. Layout b. Density, c. Front, rear and side gardens d. Size of dwellings e. Character f. Appearance g. Gaps between buildings.	There are no Likely Significant Effects of this policy on European sites. This is a development management policy which stipulates that all infill development in small brownfield sites must fulfil the criteria set out in the INP Design Guide and Policies. These criteria are not associated with impact pathways connecting to European sites. The policy does not provide for a location and / or quantum of residential or employment development. The policy is therefore screened out from Appropriate Assessment.
Policy ILM15 – Design and Layout of Strategic Sites	New development on the two strategic sites, namely on (1) Land South West of Canal Way and (2) Station Road, should deliver high quality sustainable communities in accordance with national and Local Plan policy. In addition, they should seek to: a. Contribute positively to the area's character, scale, layout, height and form and conform with design and heritage policies as well as other policies in the INP b. Reduce reliance on fossil fuels and reduce fuel poverty, the provision of on-site renewable energy sources to meet a minimum of 10% of predicted energy use of the residential development c. Incorporate sustainable landscaping with associated maintenance and management plans, in consultation with Somerset Wildlife Trust, which	There are no Likely Significant Effects of this policy on European sites. This is a development management policy that sets specific criteria for the two strategic sites in the NP: Land South West of Canal Way and Station Road. These contain several positive elements, including sustainable landscaping, Sustainable Urban Drainage Systems (SuDS) and access to local greenspaces. Providing access to greenspaces adjacent to residential development is one of the most effective measures to mitigate recreational pressure in European sites, such as the Somerset Levels SPA / Ramsar. Overall, Policy ILM15 is considered to be positive for the natural environment. Furthermore, the policy does not provide for a specific location and / or quantum of residential or employment development.

	includes minimal hard (non-permeable) landscaping and maximum net gain of native species (flora and fauna) for optimal biodiversity d. Incorporate Sustainable Urban Drainage Systems (SUDS) including swales and ditches and provision for their ongoing maintenance e. Provide areas of meaningful landscaping for amenity space, nature conservation, walking, playing and cycling routes on areas adjacent to: (i) the site boundary (ii) areas of ecological importance (iii) waterways (iv) nature reserves f. Provide high quality cycle and pedestrian routes within the site and into Ilminster's town centre to prevent a car dominated environment g. Provide an adequate amount of car parking spaces within the site, to limit on-street parking on the adjacent streets, in accordance with the Somerset County Council Parking Strategy or any subsequent adopted policy documents	The policy is therefore screened out from Appropriate Assessment.

Appendix B Nutrient Neutrality Methodology for Stodmarsh

Advice on Nutrient Neutrality for New Development in the Stour Valley Catchment in Relation to Stodmarsh Designated Sites - For Local Planning Authorities

December 2019

© Natural England/Mike Hammett

Nesting Bittern

Advice on Nutrient Neutrality for New Development in the Stour Valley Catchment in Relation to Stodmarsh[1] - For Local Planning Authorities

SECTION 1 INTRODUCTION

1.1 The water environment within the Stour catchment is one of the most important for water dependant wildlife in the United Kingdom. The Stodmarsh water environment is internationally important for its wildlife and is protected under the Water Environment Regulations[2] and the Conservation of Habitats and Species Regulations[3] as well as national protection for many parts of the floodplain catchment[4].There are high levels of nitrogen and phosphorous input to this water environment with sound evidence that these nutrients are causing eutrophication at part of these designated sites. These nutrient inputs are currently thought to be caused mostly by wastewater from existing housing and agricultural sources, though recycling of nutrients within the lake habitats cannot be ruled out. The nutrient enrichment is impacting on the Stodmarsh protected habitats and species. The area covered by this advice is described in Appendix 1.

1.2 There is uncertainty as to whether new growth will further deteriorate designated sites. The wastewater treatment works discharging into the River Stour and surrounds are subject to an investigation of their impacts and connection with Stodmarsh designated sites under the Environment Agency Water Industry National Environment Programme (WINEP) that will report in 2022. Until this work is complete, the uncertainty remains and the potential for future housing developments across the Stodmarsh catchment to exacerbate these impacts creates a risk to their potential future conservation status.

1.3 One way to address this uncertainty is for new development to achieve nutrient neutrality. Assessing and mitigating nutrients is a means of ensuring that development does not add to existing nutrient burdens and this provides greater certainty that the whole of the scheme is deliverable in line with the requirements of the Conservation of Habitats and Species Regulations 2017 (as amended) and in light of caselaw[5].

1.4 This report sets out the planning and environmental context for this nutrient assessment approach as well as a practical methodology for calculating net nutrient input from development and provides suggestions for mitigation that will allow neutral development. This methodology is based on best available scientific knowledge,

[1] See Appendix 1 for details of area covered by this plan.
[2] The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017
[3] Conservation of Habitats and Species Regulations (England and Wales) Regulations 2017 (as amended)
[4] Including Wildlife and countryside Act 1981 as amended, Countryside and Rights of Way Act 2000, Natural Environment and Rural Communities Act 2006
[5] For example Cooperatie Mobilisation for the Environment UA and College van gedeputeerde staten van Noord-Brabant (Case C-293/17 and C294/17) People Over Wind and Peter Sweetman v Coillte Teoranta.(Case C-323/17).

Natural England's current understanding of the caselaw and therefore, will be subject to revision as further evidence is obtained.

1.5 It is Natural England's advice to local planning authorities and applicants to have regards to the precautionary principle when addressing uncertainty and calculating nutrient budgets. Using a precautionary approach to the calculations and solutions gives the local planning authority and applicants a higher level of certainty for their assessments.

1.6 Though this advice is aimed at assessment and mitigation of plans and projects, in applying this advice competent authorities need to have regards to the requirement under both domestic and international legislation to restore sites, such as Stodmarsh, that are not at favourable conservation status or favourable condition[6]. The WINEP investigation will provide information on what is needed with regards to water company assets to reach favourable conservation status and favourable condition with regards to water quality impacts on Stodmarsh. Natural England will update this advice in light of the findings of the WINEP investigation should the application of this advice have implications for achievement of restoration objectives.

SECTION 2 PLANNING CONTEXT

Natural England's position

2.1 Natural England has started to advise that housing, mixed use and tourist development including all EIA development is likely to contribute to a likely significant effect in combination and could therefore use this approach as part of the appropriate assessment. We recommend a nutrient budget is calculated for such development and achieve nutrient neutrality as part of an appropriate assessment. Early consideration of the issues ensures that any potential risks are addressed at the outset and provides the applicant with confidence that the development is deliverable subject to other material considerations being addressed.

2.2 During the 2017/18 a review of the condition of Stodmarsh lake units against the newly agreed lake water quality targets was undertaken (see next section). The best available up-to-date evidence has identified that some of the designated site units are in unfavourable condition due to existing levels of nutrients (both phosphorous and nitrogen) and are at unfavourable conservation status for the supporting attribute, with some at risk of deteriorating. These sites are therefore at risk from additional nutrient inputs. There is no or limited water quality data for some of the units that are currently at favourable condition and this lack of monitoring will be addressed in the WINEP investigation.

2.3 It is Natural England's view that there is a likely significant effect on the internationally designated sites (Special Protection Area, Special Area of Conservation and Ramsar site) due to the increase in wastewater from the new developments coming forward.

[6]For example Regulations 9 and 10 of the conservation of Habitats and Species Regulations 2017 (as amended) and Section 28G of Wildlife and Countryside Act 1981 as amended.

2.4 The uncertainty about the impact of new development on designated sites needs to be recognised for all development proposals that are subject to new planning permissions and have inevitable wastewater implications. These implications, and all other matters capable of having a significant effect on designated sites in the Stodmarsh catchment, must be addressed in the ways required by Regulation 63 of the Conservation of Habitats and Species Regulations 2017 (as amended).

2.5 Where there is a likelihood of significant effects (excluding any measures intended to avoid or reduce harmful effects on the European site), or there are uncertainties, a competent authority should fully assess (by way of an "appropriate assessment") the implications of the proposal in view of the conservation objectives for the European site(s) in question. Appropriate assessments cannot have lacunae and must contain complete, precise and definitive findings and conclusions capable of removing all reasonable scientific doubt as to the effects of the works proposed on the protected site concerned. Complete information is required to ensure that the proposal will not affect the integrity of the international sites[7].

2.6 Natural England advises that the wastewater issue is examined within appropriate assessments and that the existing nutrient and conservation status of the receiving waters be taken into account.

2.7 LPAs and applicants will be aware of relatively recent CJEU decisions regarding the assessment of elements of a proposal aimed toward mitigating adverse effects on designated sites and the need for certainty that mitigating measures will achieve their aims. The achievement of nutrient neutrality, if scientifically and practically effective and achievable, is a means of ensuring that development does not add to existing nutrient burdens.

2.8 LPAs have duties to conserve and enhance Sites of Special Scientific Interest (SSSIs) consistent with the proper exercise of their functions and to exercise those functions in a way that prevents deterioration of habitats and birds and has regard to the achievement of favourable conservation status for international sites. The LPAs should give consideration if application of neutrality would hinder the ability to restore the sites conservation objectives.

Joint working

2.9 Natural England is working with water companies, local planning authorities, stakeholders and the Environment Agency to try to ensure the Habitats Regulations are met.

2.10 The Habitats Regulations require uncertainty to be appropriately recognised and addressed. It is the Local Planning Authority, as competent authority under the provisions of the Habitats Regulations, which requires the evidence and certainty to

[7]Regulations 9 and 10 of the conservation of Habitats and Species Regulations 2017 (as amended) and Section 28G of Wildlife and Countryside Act 1981 as amended

undertake the appropriate assessment in order to fully assess the implications of the proposal in view of the conservation objectives for the international site in question.

2.10 Natural England will be working closely with local planning authorities to progress options that achieve nutrient neutrality. It is appreciated that this may be difficult for smaller developments, developments on brownfield land or developments that are well-progressed in the planning system.

2.11 Natural England will be advising affected local planning authorities to set up authority-wide or strategic approaches that developments can contribute to thereby ensuring that this uncertainty is addressed in so far as is reasonably practicable by all applications and will be working closely with affected local planning authorities to help address this issue.

2.12 All queries in relation to the application of this methodology to specific applications or development of strategic solutions will be treated as pre-application advice and therefore subject to chargeable services.

SECTION 3 ENVIRONMENTAL CONTEXT

Designated sites interest features

3.1 Stodmarsh is a Special Protection Area (SPA), a Special Area of Conservation (SAC), Ramsar site and a Site of Special Scientific Interest (SSSI) additionally some parts are also designated as a National Nature Reserve (NNR). The site is of national and international importance for a range of water-dependant habitats such as lakes as well as the wildlife that relies on these habitats. The designations and features are described in Appendix 1 table A.2 along with links to key documents of interest.

Designated sites water quality target review

3.2 The water quality targets for the Stodmarsh SPA/ SAC SSSI lakes were agreed with the Environment Agency 2017 (and 2019 for Hersden lake). These targets are based on national water quality standards for freshwater habitats and are in the published supplementary advice to the conservation objectives for the designated sites underpinning habitat. This targets include standards for nitrogen and phosphorous as an excess of both nutrients can impact lake habitats which underpin the designated sites national and international interest features. Once the standards were agreed, Natural England assessed the available data for water quality in the Stodmarsh lakes using the Environment Agency catchment data explorer and any available data against the newly agreed standards and if no data was available to Natural England the existing condition remained based on previous site data. Where the site condition was correctly identified in terms of water quality (e.g. unit 10) the existing condition remained. Subsequently as part of the WINEP programme the Environment Agency assessed their data against the lake standards and incorporated this into the measures specification form (scope) for the WINEP investigation.

3.3 Detailed assessments of other features are available on Defra's Magic Map and condition assessments are not solely based on water quality standards. Table 1 sets out the agreed lake nitrogen and phosphorous standards and whether these standards are met or failed or if this is unknown due to lack of data (based on an amalgam of the Environment Agency and Natural England data for the WINEP investigation). Appendix 1 includes a map of SSSI unit condition. A brief summary of the condition classes follows. The information from the WINEP investigation will be used to inform a review of these lakes condition assessments with regards to the water quality attributes, including but not limited to nitrogen and phosphorous standards.

Favourable – high risk

3.4 Some Stodmarsh lakes are in favourable condition as they are meeting the nutrient targets or, where data is not available to complete the assessment, the officer judgement has viewed them as having no significant signs of water quality impacts at last visit (though this may be significantly out-of-date). These units are all considered to be at risk of elevated nutrients due to lack of information on their nutrient status. Lakes in this category include Fordwich East and main Fordwich lake (unit 2) and Hersden lake (unit 5). The tidal lake (Hersden lake) is only notified for bird features that are feeding on the benthic muds and therefore has less stringent water quality targets than the other lakes. Risks are described as "threats" on the Natural England designated sites database (CSMI).

Unfavourable recovering

3.5 The Westbere lake (unit 1) passed the total phosphorous standard (based on Environment Agency Assessment of WFD status) but it is considered unfavourable for other reasons and is considered recovering on the basis of management measures to address the other impacts. It has a threat recorded due to the absence of adequate water quality data for lake assessments.

Unfavourable no change

3.6 The main NNR lake and Collards lake are failing both the total phosphorous and total nitrogen standards based on Environment Agency assessment of WFD status. Since the sources of elevated nutrients have not been removed the lakes are not considered to be recovering. The condition assessment of the NNR lake (unit 10) already identified the water quality issues and was therefore not changed in 2018. Unit 10 condition assessment states "Study of Aufwuchs (prompted by algae bloom and fish kill events) indicates high nutrient levels in main NNR lake. (Total Phosphorus (TP) at 1 mg/l = 1000 ug/l …the target for SSSI lakes is [49]ug/l. More research is required to understand hydrological regime and water quality of input sources (Great Stour and Lampen Stream)".

Catchment work

3.7 The high levels of nitrogen and phosphorus input to the water environment in the Stour catchment generally is currently caused by wastewater from existing housing and agricultural sources, though some local and within site process can occur in lake habitats and there are suspected mine waste contamination in some areas of the Stour. There are a number of mechanisms already in place to reduce the amount of nutrient inputs within our river and lake catchments and coastal waterbodies. Within the river Stour catchment; both Defra and partnership funded Catchment Sensitive Farming (CSF) programmes work with agriculture to reduce diffuse agricultural sources of pollution such as fertiliser and slurry run-off. One of the aims of this work is to deliver environmental benefits from reducing diffuse water pollution. To achieve these goals the CSF partnership delivers practical solutions and targeted support which should enable farmers and land managers to take voluntary action to reduce diffuse water pollution from agriculture to protect water bodies and the environment. The Stour has been a priority catchment under CSF since phase 1 (2006).

3.8 Although catchment wide advice has been provided, often through newsletters and events, 1:1 advice and grant support; engagement has always been geographically focused based upon where the risks and issues are most apparent or where multiple issues overlap, and in order to make the most of available resources. Geographic targeting has been primarily focused around surface waterbodies although CSF have always tried to make provision for some sector specific targeting, for example dairies or large horticultural enterprises where direct point pollution or significant surface water flow may occur. The catchment contains numerous spring fed streams which flow over permeable chalk, sandstones and clays. Most of the farm land along the Stour has a brick earth element that can contribute to often rapid run-off of surface waters to the water courses. Current concerns in general waterbodies in the Stour catchment are nitrates and pesticide levels, as well as heightened sediment loads in streams in winter. Agricultural phosphorous is not considered to require separate consideration in the Stour catchment, and many measures primarily aimed at addressing agricultural nitrogen will also help reduce agricultural diffuse phosphorous.

3.9 In addition, the wastewater treatment works (WwTW) that enter into the catchment of Stodmarsh are the subject of an investigation under Water Industry National Environment Programme (WINEP) which will determine the extent of the connection of WwTW and sewerage assets to the Stodmarsh lakes and to what extent the existing WwTW discharges and other company assets are contributing to the existing water quality failures and risk of failures. The investigation will take account of the need to reconnect some of the lakes more closely to the main river Stour in future to ensure sufficient water for the designated sites in the face of climate change and in light of recent experience of NNR staff of insufficient water for the conservation management of the site in hot dry summer of 2018. The primary objective of the WINEP investigation is to assess what improvements are required (if any) to the water company assets needed to enable the achievement of the agreed lake standards.

Table 1 Summary of water quality targets and compliance with targets if known

Targets were agreed with Environment Agency in 2017 and 2019 for Hersden lake.

Lake name	**SSSI UNIT**	**WFD ID**	Compliance P/F/U (Pass / fail/ Unknown) No colour = no data		Natural England database (CSMI) 2018 update / threat nature
			TP Target ug/L	TN Target mg/L	
Reserve Lake/Stodmarsh Nature Reserve Pool	UNIT 10	GB30743087	F 49	F 1.5	Unfavourable Water Quality (WQ)
Collards Lake/Great Puckstone Lake	UNIT 7	GB30743097	F 49	F 1.5	Unfavourable WFD EA Assessment for 2016 MODERATE - unit fails nationally agreed WQ targets
Westbere Lake/s	UNIT 1	GB30743127	U 49	P 1.5	Unfavourable recovering Other reasons
The Fordwich Lakes/Fordwich Lake East	UNIT 2	GB30743156	U 49	U 1.5	Favourable WQ
The Fordwich Lakes/Fordwich Lakes	UNIT 2	GB30743164	U 49	P 1.5	Favourable WQ
Hersden (tidal) Lake	UNIT 5	n/a (tidal so part of the main transitional and coastal water body)	U 100	P 2.0	Favourable WQ

Other Water Quality targets:

“Chlorophyll a” for all lakes should be at Water Framework Directive (WFD) high ecological status. All other pollutants and measurements are set at WFD Good Ecological Status. The Hersden lake has mainly bird interest features only. There is nationally agreed guidance on water quality standards for ‘bird lakes’ (i.e. lakes which are not notified as a lake habitat in their own right or for macrophytes/invertebrates in their own right). This guidance says that in lakes mainly used by birds feeding on benthic invertebrates or fish severe eutrophication should be avoided.

Type of nutrient inputs to designated sites

3.10 There is evidence that inputs of both phosphorus and nitrogen influence eutrophication of the water environment. The principal nutrient that tends to drive eutrophication in the marine environment is nitrogen, the principal nutrient that drives eutrophication in flowing freshwaters is phosphorous. In still freshwaters and many estuaries both phosphorous and nitrogen can result in eutrophication (called co-limitation). In reality the picture is more complicated than this. For Stodmarsh lakes the principal nutrients are: phosphorous and nitrogen based on the water quality standards in Common Standards Monitoring Guidance for the appropriate designated sites features and the Supplementary Advice to the Conservation Objectives (SACOs) for the SPA and SAC which also cover the Ramsar site.

3.11 The best available evidence is for focus in the Stodmarsh/ Stour catchment to be on both nitrogen and phosphorus. However, this approach may be refined if greater understanding of the eutrophication issue is gained thorough new research or updated modelling or the WINEP investigation.

3.12 The nutrient budget in this report calculates levels of nutrient from development however both phosphorous (P) and nitrogen (N) come in different forms and it is important to understand which is relevant to the designated site features in this methodology.

Phosphorous

3.13 The forms of phosphorous need to be recognized when calculating nutrient budgets. The key measure for still and very slow flowing waters such as lakes or ditches is total phosphorous (TP) (plus in most cases total nitrogen) because this is available for algae and plant growth. For rivers the designated sites standards are for Soluble Reactive Phosphorous (SRP) as both an annual and a growing season mean. The relationship between SRP and TP is not straight forward and can vary between, and even within catchments (e.g. River Avon catchment). Modern WwTW permits usually have values for total phosphorous and the Environment Agency guidance on technically achievable limit (TAL) is for total phosphorous. Total phosphorous (TP), has been chosen for the current methodology as it is applicable to the lake habitats at Stodmarsh. Farmscoper reports provide amount of farm total phosphorous and this is the default setting. Though there is some uncertainty from these different forms of phosphorous, this is taken into account at the end of the methodology by the addition of a correction factor.

Nitrogen

3.14 The different forms of nitrogen need to be recognized when calculating nutrient budgets. The key measurement is total nitrogen (TN), i.e. both organic and inorganic forms of nitrogen, because this is what is available for plant growth. TN is the sum of the inorganic forms - nitrate-nitrogen (NO3-N), nitrite-nitrogen (NO2-N), ammonia, and organically bonded nitrogen.

3.15 Total nitrogen is measured by WwTW where there is a permit with a TN limit consent. However, for WwTWs without permits, measurements could be inorganic nitrogen (nitrate + nitrite + ammoniacal N) or TN or a mix. Most river/coastal quality monitoring by the Environment Agency only records the inorganic N forms. Farmscoper reports measure nitrate-nitrogen not TN. Nitrate is normally the largest component of TN but quantities of organic N can be significant. For example in the Test catchment dissolved organic nitrogen has been found to comprise 7% of the potential biologically available nitrogen in the river and 13% of that in the estuary (Purdie, 2005[8]). Thus, the land use change element of this methodology will underestimate TN leaching. We therefore advise that this uncertainty is recognised and the recommended precautionary buffer approach is adopted.

SECTION 4 NUTRIENT NEUTRALITY APPROACH FOR NEW DEVELOPMENT

Introduction

4.1 Achieving nutrient neutrality is one way to address the existing uncertainty surrounding the impact of new development on designated sites. Natural England advises that a nutrient budget (TN and TP) can be calculated for new developments. This can be used to show that development either avoids harm to protected sites from water quality issues or provides the level of mitigation required to ensure that there is no adverse effect with respect to nutrients. Natural England recommends that the proposals achieve nutrient neutrality by securing the required mitigation in compliance with the Habitats Regulations.

4.2 The nutrient budget calculation includes key inputs and assumptions that are based on the best-available scientific evidence and research. It has been developed as a pragmatic tool that can be applied by land use planners and developers without the need for specialist modelling. However, for each input there is a degree of uncertainty. For example, there is uncertainty associated with predicting occupancy levels and water use for each household in perpetuity. Also, identifying current land / farm types and the associated nutrient inputs is based on best-available evidence, research and professional judgement and is subject to a degree of uncertainty. Natural England will update this methodology if material changes to the evidence base or legal interpretation is forthcoming.

4.3 It is our advice to local planning authorities to apply the precautionary principle when addressing uncertainty and calculating nutrient budgets. This can be achieved by

[8] Purdie, D., Shaw, P., Gooday, A. and Homewood, J. (2005) Dissolved Organic Nitrogen in the River Test and Estuary, University of Southampton

choosing a precautionary option in cases of uncertainty and building in an appropriate precautionary delivery buffer. Further details of this approach are included in the following stages of the calculation. Using this precautionary approach to the calculations and solutions improves the certainty for the local planning authority and applicants for their appropriate assessments.

4.4 It is our advice that large developments and strategic solutions should seek to achieve nutrient neutrality and the LPAs have regards to whether neutrality is sufficient or whether this would undermine the ability to achieve the restore objectives described in section 2.

Other mechanisms for achieving nutrient removal

4.5 The methodology proposed in this document suggests land use change offsetting as a way of achieving mitigation for development generated nutrients in the short to medium term where uncertainty as to impacts from wastewater treatment assets (WwTW) exists and any required improvements to the assets is not yet secured. This methodology is not a substitute for the need to consider and keep under review the appropriateness and sustainability of discharge permits as part of the relevant water company planning processes. Nor is this methodology the only potential mechanism for achieving a net neutrality in nutrients into a catchment from development. The existence of this methodology should not be used as a substitute for consideration of other strategic solutions at the local plan or large development stage. For example the creation of large interceptor wetlands and extensive sustainable urban drainage scheme (SUDS) designs can reduce nutrients entering downstream sites (for further information see Appendix 5).

4.6 Other mechanisms, not covered by this methodology may be particularly appropriate to brownfield development sites, where interception wetland creation may have significant multiple benefits additional to nutrient removal. Care needs to be given to the consideration of nutrients, as some poorly designed SUDS schemes can add nutrients, in particular phosphorous to the system. We recommend discussing other mechanisms with the planning authority and Natural England via our chargeable advice on a case-by-case basis. We recommend that any scheme proposal involving wetland creation and/ or drainage is also discussed with the Environment Agency.

Type of development

4.7 This methodology is for all types of development that would result in a net increase in population served by a wastewater system, including new homes, student accommodation, tourism attractions and tourist accommodation. All such development will have inevitable wastewater implications.

4.8 Other commercial development, such as offices, not involving overnight accommodation will generally not be included unless it has other (none sewerage) water quality implications. It is assumed that anyone living in the catchment also works and uses facilities in the catchment, and therefore wastewater generated by that person can be calculated using the population increase from new homes and

other accommodation. This removes the potential for double counting of human wastewater arising from different planning uses.

4.9 Tourism attractions and tourism accommodation are exceptions as these land uses attract people into the catchment and generate additional wastewater and consequential nutrient loading on the Stodmarsh designated sites. This includes self-service and serviced tourist accommodation such as hotels, guest houses, bed and breakfasts and self-catering holiday chalets and static caravan sites. Other applications will be considered on their individual merits, for example conference facilities that generate overnight stays.

4.10 There may be cases where planning applications for new commercial or industrial development such as waste management facilities, road schemes or changes in agricultural practices could result in the release of additional nitrogen and/or phosphorus into the system. In these situations, a case-by-case approach will be adopted. Early discussions with Natural England via our chargeable services (DAS) are recommended.

Methodology

A decision tree for application of the methodology is given in Figure 1.

Stage 1 Calculate Total Nitrogen (TN) and Total Phosphorous (TP) in kilograms per annum derived from the development that would exit the Wastewater Treatment Works (WwTW) after treatment

Stage1 Step 1 Calculate additional population

4.11 To determine the additional population that would use the proposed development, it is recommended that well evidenced occupancy rates are used. Natural England recommends that an occupancy rate of 2.4 is used in the calculation. This is based on the latest Office for National Statistics figure that can be applied across all affected local authority areas and has been relatively stable over a number of years.

4.12 In order to be appropriately precautionary, the calculation needs to be based on values that take account of long term trends to address the impacts of the development in perpetuity rather than just over a local plan period. All types of new housing (market and affordable) and overnight accommodation will increase the housing stock within the catchment, which will result in an associated increase in population levels, leading to inevitable wastewater implications.

4.13 It is Natural England's view that using the latest Office for National Statistics figure is suitably precautionary and based on best available evidence. Local planning authorities, as competent authorities, may choose to use alternative occupancy rates in their assessments, when these are supported by evidence.

4.14 Competent authorities may also choose to adopt bespoke calculations for detailed planning applications. For example, it may be possible to evidence alternative figures for flats or in relation to the number of bedrooms of each household.

4.15 These are matters for each competent authority. Natural England's advice is to take an appropriately precautionary approach that recognises the uncertainty.

Stage 1 Step 2 Confirm water use

4.16 Determine the water use / efficiency standard for the proposed development to be defined in the planning application and, where relevant, the Environmental Statement. The nitrogen and phosphorous load is calculated from the scale of water use and thus the highest water efficiency standards under the building regulations will minimise the increase in nutrients from the development.

4.17 It is recommended that each Local Planning Authority impose a planning condition on all planning permissions for one or more net additional new dwellings requiring construction to the optional requirement[9] under G2 of the Building Regulations 2010.

4.18 A model condition is set out below:

"*The dwellings shall not be occupied until the Building Regulations Optional requirement of a maximum water use of 110 litres per person per day has been complied with."*

4.19 The water use figure is a proxy for the amount of wastewater that is generated by a household. New residential development may be able to achieve tighter water use figures, with or without grey water recycling systems, and this approach is supported from a water resource perspective for example in support of water company targets for the Stodmarsh area e.g. Southern Water's Target 100 litres per person per day. However, the key measurement is the amount of wastewater generated by the development that flows to the wastewater treatment works.

4.20 If tighter water use restrictions are used in the nutrient calculation – with or without grey water recycling systems – these restrictions must reflect the wastewater generated for the lifetime of the development. There is a risk that when kitchen and bathroom fittings are changed by occupants over the years, less water-efficient models could be installed. It is Natural England's view that it would be difficult to evidence and secure delivery of tighter restrictions at this time, to provide certainty for the lifetime of the development. However, if sound evidence can be provided, this will be considered on a case-by-case basis.

4.21 Given the significant commitments in water company statutory water resources management plans to drive down average per capita water consumption for all water supplies in the Stour valley area it is Natural England's view that it is reasonable for the authorities to assume that households will achieve the 110 litres per person per day target in perpetuity on average and we recommend this is adopted in the calculation.

[9] The optional requirement referred to in G2 requires installation and fittings and fixed appliances for the consumption of water at 110 litres per person per day.

Stage 1 Step 3 Confirm WwTW and permit level

4.22 Identify the wastewater treatment works (WwTW) that the development will use and identify the permit concentration limit for total nitrogen and total phosphorous at the WwTW. If the WwTW will have an agreed known tightened permit concentration limit for total nitrogen/ total phosphorous under the company's Water Industry Asset Management Plan for delivery by 2024 then use this tightened value. If a new WwTW is proposed, obtain a determination from the Environment Agency on the permit limit for Total Nitrogen /Total Phosphorous that would apply to the works and when they are likely to be built in relation to when your development is likely to be occupied. Where the WwTW has no consent limit on total nitrogen or total phosphorous derive a value for nitrogen or phosphorous in the wastewater stream based on the type of wastewater treatment at the works.

4.23 Where there is a permit limit for total nitrogen/total phosphorous, the load calculation will use a worst case scenario that the WwTW operates at 90% of its permitted limit. A water company has the option of operating the works as close to the consent limit as practicable without breaching the consent limit. Natural England and the Environment Agency have agreed in the Solent to take 90% of the consent value as the closest the water company can reasonably operate works without breaching the consent limit and Natural England accepts this can be extended into other Southern Water WwTW outside the Solent including those in the Stour and its tributaries.

4.24 For most planning applications, the WwTW provider is not confirmed until after planning permission is granted. The nutrient calculation should be based on the permit levels of the most likely WwTW. In any cases where the WwTW changes, a reassessment of the nutrient calculation will be required to ensure the development is still fully mitigated for its potential nutrient impacts.

4.25 For developments that discharge to WwTWs with no nutrient permit level, best available evidence must be used for the calculation. In the first instance, the wastewater provider should be contacted for details of the nitrogen/phosphorous effluent levels for the specific WwTW.

4.26 However, if this data is not available, an average figure based on effluent averages from WwTW in the designated site catchment which must be obtained from the waste water treatment provider. For example, in the Southern Water WwTW in the Solent an average of 27 mg/l for Nitrogen is used but this average figure may change if new evidence becomes available and evidence supporting the chosen value must be included with any application.

Stage 1 Step 4 Calculate Total Nitrogen (TN) and Total Phosphorous (TP) in Kg per annum that would exit the WwTW after treatment derived from the proposed development

4.27 The total nitrogen/total phosphorous load is calculated by multiplying the water use of the proposed development by the appropriate concentration of total nitrogen/ total phosphorous after treatment at the WwTW.

STAGE 1 - WORKED EXAMPLE TO CALCULATE TOTAL NITROGEN (TN) and (TP) LOAD FROM DEVELOPMENT WASTEWATER				
Step	**Measurement**	**Value**	**Unit**	**Explanation**
Development proposal	Development types that would increase the population served by a wastewater system	1000	Residential dwellings	
Step 1	Additional population	2400	Persons	Uses an average household size of 2.4 x 1000 dwgs (greenfield site).
Step 2	Wastewater volume generated by development	264,000	litres/day	2400 persons x 110 litres[10]
Step 3	Receiving WwTW environmental permit limit for TN Receiving WwTW permit limit for TP	9.0 2.0	mg/l TN mg/l TP	This is the permit value of the WwTWs to which the development will go
Step 4	TN discharged after WwTW treatment Receiving WwTW permit limit for TP	2,138,400 475,200	mg TN/day mg TP/day	90% of the consent limit = 8.1 mg/l TN. 264,000 x 8.1 = 1.8 mg/l TP 264000 x 1.8
	Convert mg/TN to kg/TN per day Convert mg/TP to Kg/ P per day	2.1384 0.4752	kg TN/day kg TP/day	Divide by 1,000,000
	Convert kg/TN per day to kg/TN per year Convert to kg/TP/SRP per day to kg/TP per year	781 173	kg TN/yr kg TN/yr	Multiply by 365 days
Wastewater total nitrogen load	**781 kg TN/yr** **173 kg TP/yr**			

Table 2 – Calculating wastewater Total Nitrogen/ Phosphorous load from proposed development

[10] Where relevant, deduct wastewater volume of population displaced by the proposed development

4.28 The following worked example calculates the total nitrogen and total phosphorous load of a development of 1000 dwellings based on a WwTW with a consent limit for Total Nitrogen of 9 mg/l and a Total Phosphorous limit of 2mg/l.

4.29 Where residential developments also include other overnight accommodation such as tourist accommodation and attractions, the associated water use from these additional land uses will need to be included in the calculation. This should be based on the water use associated with these facilities.

Stage 2 Adjust Nitrogen/ Phosphorous load to offset existing nitrogen from current land use

4.30 This next stage is to calculate the existing nutrient losses from the current land use. The nitrogen/phosphorous loss from the current land use will be removed and replaced by that from the proposed development land use. The net change in land use will need to be subtracted from or added to the wastewater total nitrogen/ total phosphorous load.

4.31 Nitrogen–nitrate/ phosphorous loss from agricultural land has been modelled using a Farmscoper model run for the Stour Management Catchment for Stodmarsh. This model has been used to estimate the loss of nutrients from different farm types in relevant catchments and these are provided in table 3. Further details on farm classification used in the Farmscoper model are included in Appendix 2.

4.32 If the development area covers agricultural land that clearly falls within a particular farm type used by the Farmscoper model then the modelled average nitrate-nitrogen and phosphorous loss from this farm type should be used.

AVERAGE NUTRIENT LOSS PER FARM TYPE IN STOUR MANAGEMENT CATCHMENT AREA (kg/ha)		
	Nitrate- Nitrogen (kg/ha)	Phosphorous (kg/ha)
Cereals	27.3	0.36
Dairy	58.3	0.49
General Cropping	27.9	0.28
Horticulture	18.5	0.18
Pig	60.3	0.34
Lowland Grazing	12.2	0.24
Mixed	31.5	0.27
Poultry	60.3	0.34
Average for catchment area	**23.5**	**0.28**

Table 3 Farm types and average nitrogen-nitrate loss

4.33 If the proposed development area covers several or indeterminate farm types then the average nitrate-nitrogen and phosphorous loss across all farmland may be more appropriate to use. The average figure is also included in table 3.

4.34 The figures in table 3 are taken from a Farmscoper V4 run for the Stour management catchment in September 2019 and are based on leachate kg/ha N and P for each of the individual farm types with prior mitigation measures taken up at national levels. These may be updated from time-to-time as land use and agricultural practice to control nutrient losses change.

4.35 For sites that are in use as allotments, it is recommended that the most appropriate farm type for allotments is the average rate of the catchment land use. If evidence can be provided to support an alternative figure, then this information will be reviewed by the local planning authority and Natural England.

4.36 For sites that are currently in use as horse paddocks, it is recommended that the lowland grazing figure should be used in the calculation. If evidence can be provided to support an alternative figure, then this information will be reviewed by the local planning authority and Natural England.

4.37 It is important that farm type classification is appropriately precautionary. It is recommended that evidence is provided of the farm type for the last 10 years and professional judgement is used as to what the land would revert to in the absence of a planning application. In many cases, the local planning authority, as competent authority, will have appropriate knowledge of existing land uses to help inform this process.

4.38 There may be areas of a Greenfield development site that are not currently in agricultural use and have not been used as such for the last 10 years. There is no agricultural nitrogen or phosphorous input onto this land and these areas should not be included in Stage 2 of the calculation.

4.39 Where development sites include existing wildlife areas, woodlands, hedgerows, ponds and lakes, that are to be retained, these areas should also be excluded from the calculation as there is no existing agricultural nitrogen or phosphorous input onto this land.

4.40 For sites, where existing land use is not confirmed, it is Natural England's advice to local planning authorities and applicants to apply the precautionary principle. It is important that only land that currently drains into, or is upstream of the designated sites is used for offsetting. If the development land is within a different catchment to the waste water treatment works (WwTW) that are receiving the waste and contributing to the existing failures then this land cannot be used to offset the development. Where land straddles catchments a pro-rata calculation should be made.

4.41 A worked example to calculate the nitrogen and phosphorous load from existing land use is set out in table 4.

STAGE 2 - WORKED EXAMPLE TO CALCULATE NITROGEN AND PHOSPHOROUS LOAD FROM CURRENT LAND USE				
Step	**Measurement**	**Value**	**Unit**	**Explanation**
1	Total area of existing agricultural land	40	Hectares	This is the area of agricultural land that will be lost due to development
2	Identify farm type and confirm nutrient loss from table 2. (example based on cereals)	27.3 0.36	kg N/ha/yr kg P/ha/yr	The developable area is mainly laid to cereals. Reference Appendix 2 and Table 2
3	Multiply area by nitrate/ phosphorous loss	1,092 14.4	kg N/yr kg P/yr	40 ha x 27.3kg N/yr 40 ha x 0.36 kg P/yr
Nitrogen load - current land use	1,092 kg N/yr 14.4 kg P/yr			

Table 4 Calculating nitrogen/phosphorous load from current land use

Stage 3 Adjust nitrogen/phosphorous load to account for land uses with the proposed development

4.42 The last stage is to add in the nitrogen and phosphorous loads that will result from the new development that is not received by a WwTW. This includes the nitrogen load from the new urban development and from the new open space including any Suitable Alternative Natural Greenspace (SANG), Nature Reserves or Bird Refuge Areas.

4.43 The calculation only includes the areas of the site where there will be a change in land use, for example from agricultural land to new urban development or agricultural land to Suitable Alternative Natural Greenspace (SANG) / open space. Where there is no proposed change to land use, this land should be excluded from the nutrient budget stage 2 and 3 as there will be no change to the nutrient load from this area. Where land does not drain to the designated site catchment it should be excluded from the calculation.

Urban development

4.44 The nitrogen/phosphorous load from the new urban development results from sewer overflows and from drainage that picks up nutrient sources on the urban land. Urban development includes the built form, gardens, road verges and small areas of open space within the urban fabric. These nutrient sources include atmospheric deposition, pet waste, fertilisation of lawns and gardens and inputs to surface water sewers. The

nitrogen leaching from urban land has been estimated to equate to 14.3 kg/ha/yr[11]. The phosphorous leaching from urban land has been estimated to equate to 0.83 kg/ha/ yr[12]. These figures are proxy figures from best available data however if locally robust catchment specific data is available this can and should be used. Appendix 3 sets out some of the scientific research and literature in relation to these figures.

Open Space and Green Infrastructure

4.45 Nutrient loss draining from new designated open space or Suitable Alternative Natural Greenspace (SANG) should also be included. The nitrogen leaching from this land has been estimated to equate to 5 kg/ha/yr for Solent sites and this is used as a proxy for the Stour valley. The phosphorous leaching from SANGS land has been estimated to equate to 0.14 kg/ha/yr. Appendix 4 sets out some of the scientific research and literature in relation to these figures. These figures can also be used where new nature reserves or bird refuge areas are created to address disturbance issues from development.

4.46 The competent authority will need to be assured for perpetuity that this open space will be managed as such and there will be no additional inputs of nutrients or fertilisers onto this land. Appropriate planning and legal measures will be necessary to ensure it will not revert back to agricultural use, or change to alternative uses that affect nutrient inputs on the long term. It is therefore recommended that the 5.0 kg/ha/yr for Nitrogen and 0.43 kg/ha/yr for Phosphorous rate applies to areas of designated open space on-site of around 0.5 hectares and above. These sites will also need long term management to ensure the provision of dog bins and that these are regularly emptied.

4.47 Small areas of open space within the urban fabric, such as road verges, gardens, children's play areas and other small amenity areas, should not be included within this category. The urban development figure is appropriate for these land uses as they are already taken account in the figures chosen.

Community food growing provision

4.48 For any areas of the site that are proposed for community food growing provision, it is recommended that the average farm type rate is used (see table 3).

4.49 A worked example of stage 3 is shown in the table below. This is based on a developable area of 30 hectares covering land in a mix of farm types with the removal of 10 hectares of agricultural land to create SANG.

[11] Supplementary Planning Document – Achieving Nitrogen Neutrality in Poole Harbour

[12] From relevant Water framework directive export coefficient for urban and suburban land 2006 Final Report: Updating the estimate of the sources of phosphorus in UK waters

STAGE 3 - WORKED EXAMPLE TO CALCULATE NITROGEN/PHOSPHOROUS LOAD FROM FUTURE LAND USES				
Step	**Measurement**	**Value**	**Unit**	**Explanation**
1	New urban area	30	Hectares	Area of development that will change from agricultural land to urban land use
2	Nitrogen/Phosphorous Load from future urban area	429 24.9	kg N/yr kg P/yr	30 ha x 14.3 kg N/yr 30 ha x 0.83 kg P/yr
3	New SANG / open space	10	Hectares	Area of development that will change from agricultural land to SANG / open space
4	Nitrogen/Phosphorous load from SANG / open space	50 14	kg N/yr kg P/yr	10 ha x 5.0 kg N/yr 10 ha x 0.14 kg P/yr
5	Combine Nitrogen load from future land uses Combine Phosphorous load from future land uses	479 38.9	Kg N/yr Kg P/yr	429 kg N/yr + 50 kg N/yr 24.9 Kg P/yr +14 Kg P/yr
Nitrogen Load - future land uses **Phosphorous Load - future land uses**	479 kg TN/yr 38.9 kg TP/yr			

Table 5 – Adjust Nitrogen Load to account for future land uses

Stage 4 Calculate the net change in the Total Nitrogen and Total Phosphorous load that would result from the development

4.50 The last stage is to calculate the net change in the total nitrogen and total phosphorous load to the Stodmarsh catchment with the proposed development. This is derived by calculating the difference between the total nitrogen/phosphorous load calculated for the proposed development (wastewater, urban area, open space etc.) and that for the existing land uses.

4.51 It is necessary to recognise that all the figures used in the calculation are based on scientific research, evidence and modelled catchments. These figures are the best available evidence but it is important that a precautionary buffer is used that recognises the uncertainty with these figures and ensures the approach is in line with the precautionary principle. Natural England therefore recommends that a 20% precautionary buffer is built into the calculation.

4.52 There may be instances where it is the view of the competent authority that an alternative precautionary buffer should be used based on a site-specific basis.

4.53 Table 5 sets out a worked example of stage 4.

Need for mitigation

4.54 If there is a nitrogen and/or phosphorous surplus (a positive figure), then mitigation is required to achieve nitrogen neutrality. If the calculation identifies a deficit (a negative figure) at step 4, no additional mitigation is required. Do not add the buffer if a deficit is identified. Care needs to be taken when considering the use of the deficit in strategic solution for use by other developments as the overall aim of legislation is to reduce the nutrients from the catchments to restore the site in line with the restoration duties described in section 2. This methodology must not be applied in such a way by planning authorities so that it hinders the ability to restore favourable conservation status at Stodmarsh.

4.55 In the worked example described in the methodology, the nitrogen budget with 20% buffer is 201.6 Kg TN/yr and the phosphorous budget is 237 Kg TP/yr. Natural England recommends that mitigation is achieved for at least 201.6 Kg TN/yr and 237 kg TP/yr. Mitigation can be 'direct' through upgrading sewage treatment works and through alternative measures, e.g. interceptor wetlands or 'indirect' by offsetting the nitrogen/phosphorous generated from new development by taking land out of nitrogen/phosphorous intensive uses, e.g. where fertiliser is applied to crops. Mitigation measures will need to be secured for the duration over which the development is causing the effects, generally 80-125 years. Mitigation must be in the same catchment as the waste water treatment works which drain to the affected designated site.

STAGE 4 - WORKED EXAMPLE TO CALCULATE THE NET CHANGE IN NITROGEN AND PHOSPHOROUS LOAD FROM THE DEVELOPMENT				
Step	**Measurement**	**Value**	**Unit**	**Explanation**
1	Identify Nitrogen load from wastewater (stage 1) Phosphorous load from wastewater (stage 1)	**781** **173**	kg N/yr kg P/yr	See Table 1
2	Calculate the net change in Nitrogen and Phosphorous from land use change - subtract existing land uses Nitrogen/Phosphorous load (stage 2) from future land uses Nitrogen/Phosphorous load (stage 3)	**-**613 24.5	kg N/yr kg P/yr	479 - 1,092 kg N/yr 38.9 - 14.4 Kg P/yr
3	**Determine Nitrogen/ Phosphorous Budget** – Step 1 plus step 2 of this table (the latter figure may be positive ie the change in land use will generate more nitrogen, or negative ie the change in land use will generate less Nitrogen/Phosphorous)	168 197.5	kg N/yr kg P/yr	781 kg N/yr (step 1) + (-613)(step 2) 173 kg P/yr (step 1) + 24.5 (step 2)
4	Nitrogen / Phosphorous Budget without buffer	168 197.5	kg N /yr kg P/yr	
5 (Do not apply buffer if step 4 is a negative figure)	Divide Nitrogen /phosphorous Budget without buffer by 5.	33.6 39.5	kg N /yr kg P/yr	168 kg N /yr divide by 5 197.5 divide by 5
6	Identify Nitrogen/phosphorous Buffer with 20% buffer	201.6 237	kg N /yr kg P/yr	Add step 5 to step 6 of this table
Nitrogen /Phosphorous Budget with 20% buffer	201.6 kg N /yr 237 kg P/yr			

Table 5 Nitrogen /Phosphorous Load Budget

4.56 The options for mitigation could include a combination of the following:

(i) Secured agreement with the wastewater treatment provider that they will maintain an increase in nitrogen/phosphorous removal at the WwTW though this will be unlikely to be successful until after the WINEP study is completed and the measures required to achieve favourable conservation status with regards to treatment works have been agreed.

(ii) Secured agreement with the wastewater treatment provider or others to provide and maintain an increase in nitrogen/phosphorous offsetting from catchment management measures (this may include mini-farm interceptor wetlands). This must take account of the restoration duties and must not hinder the ability to achieve the conservation objectives.

(iii) Provide measures that will remove nitrogen/phosphorous draining from the development site or discharged by the WwTW (such as wetland or reedbed) (Appendix 5).

(iv) Increase the size of the SANGs and Open Space provision for the development on agricultural land that removes more nitrogen/phosphorous loss from this source.

(v) Establish changes to agricultural land in the wider landholding in perpetuity that removes more nitrogen/phosphorous loss from this source.

(vi) Acquire, or support others in acquiring, agricultural land elsewhere within the river catchment area containing the development site (or the waste water treatment discharge if different), changing the land use in perpetuity (e.g. to woodland, heathland, saltmarsh, wetland or conservation grassland) to remove more nitrogen/phosphorous loss from this source and/or, if conditions are suitable, provide measures that will remove nitrogen/phosphorous on drainage pathways from land higher up the catchment (e.g. interception wetland).

4.57 Further information on the potential for nitrogen and phosphorous mitigation using wetlands is included in Appendix 5. Information has been provided on stormwater wetlands, constructed wetlands taking discharges from WwTW and wetlands associated with streams and rivers. Natural England will update this advice when a current research contract to collate guidance on the use of wetlands to reduced nutrients is published.

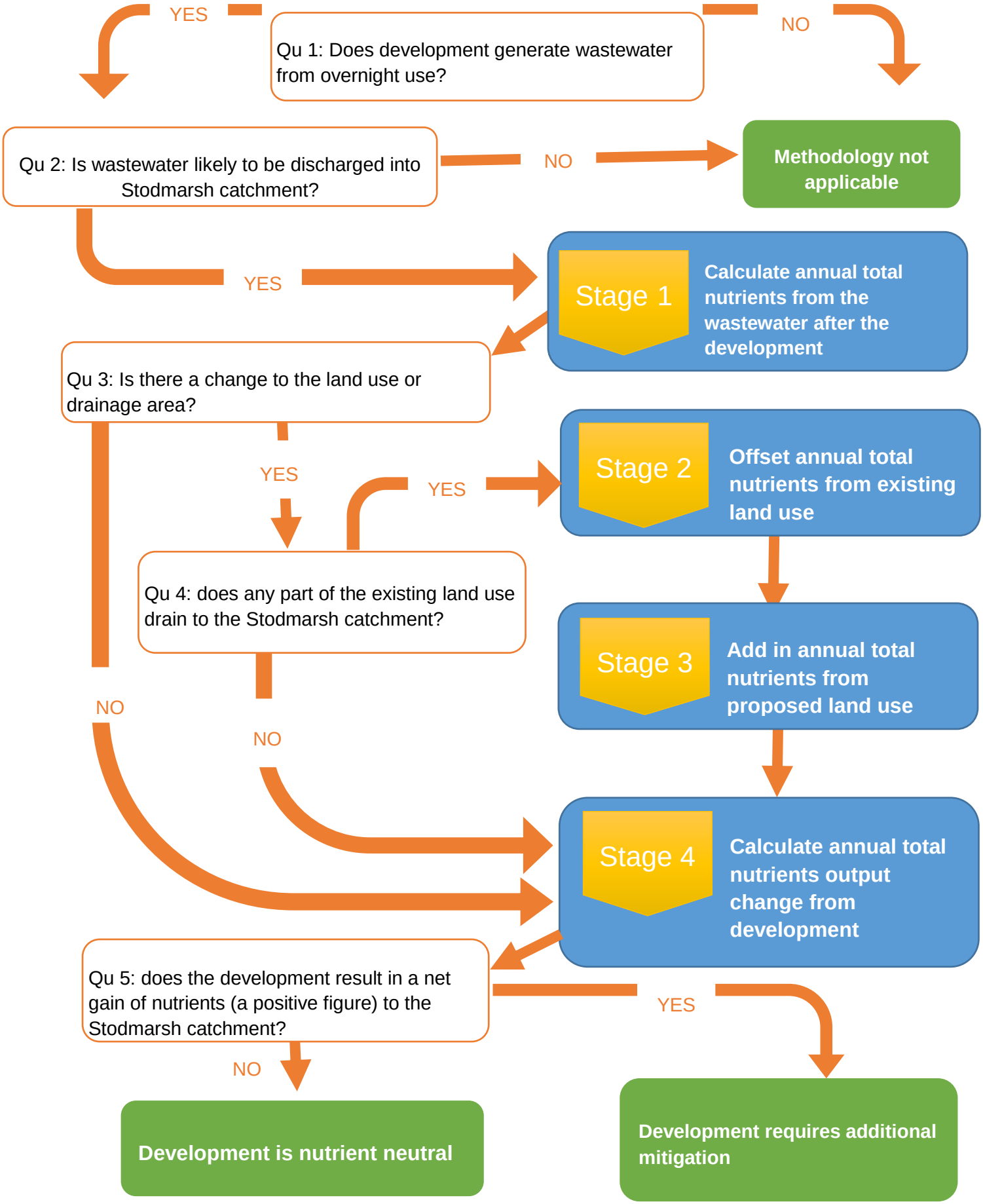
4.58 Detailed consideration will need to be given to the location and catchment of the proposed mitigation measures in relation to the impact of the development on the designated sites. We advise that this issue is examined on a case-by-case basis in consultation with the relevant local planning authority or authorities and Natural England through our chargeable services (DAS).

4.59 It is appreciated that achieving nutrient neutrality may be difficult for smaller developments, developments on brownfield land or developments that are well-progressed in the planning system. Natural England is working closely with local planning authorities to progress more strategic options that achieve net nutrient neutrality and enable this scale of development to come forward. This work is

currently on-going and it is recommended that discussions are held with the relevant local planning authorities with regard to strategic solution options.

Figure 1

Nutrient Assessment methodology – Decision Tree



Notes for Decision Tree

Question 1 – This includes housing development and tourist development. This is covered in type of development section

Question 2 – This catchment is part of the Stour Management Catchment and Stodmarsh is within the Stour Lower operational catchment See Appendix 1 for further details on location.

Question 3 – If the development is converting an existing urban use that does not generate overnight stays (such as office accommodation or employment land) to other urban use then this is not considered a change of land use for offsetting purposes. If urban land is being converted to a park or greenspace this should be included in the land use calculation. Further information on this is contained the stage 2 and 3 calculation of the methodology

Question 4 - If the land use does not drain to the catchment its existing nutrients are not contributing to the failures or risk of failures of the designated sites water quality standards and cannot be used to offset the nutrients from wastewater. If the existing site drains into two catchments only the area that currently (before proposed development) drains into the Stodmarsh catchment (within the Lower Stour) can be used for offsetting.

Question 5 - This is covered in stage 4 of the methodology.

Appendix 1

Spatial Extent Covered by this Advice

The Environment Agency's Water Industry National Environment Programme (WINEP) investigation measures specification form (scope) does not explicitly list the water company assets that are to be part of the investigation into impacts on Stodmarsh designated sites. The investigation states *the water company is to identify* [the assets including WwTW and pipes] *as part of investigation scope*.

At this time Natural England cannot rule out on objective evidence a likely significant effect on Stodmarsh European sites of development land drainage or effluent from works that discharge upstream in the Stour and downstream (for the tidal lake and during overtopping), though those that discharge below the confluence of the little Stour are less obviously connected to the designated sites. Figure A.1 shows the main rivers in the Stodmarsh area. Stodmarsh sits in the Environment Agency Stour management catchment. Links to Environment Agency maps and details of the operational management catchments within the Stour management catchment are listed in the table A.1 below.

Natural England recommend that an appropriate assessment of water quality impacts on the designated sites is undertaken for developments that are within, or discharge to, WwTW that are within those operational catchments included in table A.1. Developments that are within the catchment and their effluent goes to works in the operational catchments listed as not included do not need to assess their water quality impacts on Stodmarsh. This list has been drawn up based on expert judgement and the discharges identified by Stage 3 (appropriate assessment) Environment Agency Review of Consents (RoC) which concluded that discharges *>5km downstream of the site and those that discharge into a different catchment have no pathway into the site and therefore are considered to have no adverse effect on the integrity of the site, alone or in combination*.

Table A.1 Stour Operational Catchment Links

Stour Operational Catchments INCLUDED in the Stodmarsh Advice	**Stour Operational Catchments EXCLUDED from the Stodmarsh Advice**	**Public Waste Water Treatment Works named in Stodmarsh stage 3 RoC[13]**
Stour Lower Stour Upper Little Stour and Wingham	Dour North and South Streams Oyster Coast Brooks Stour Marshes	Ashford WwTW Canterbury Stw Herne Bay StW (Gt Stour) Minster Stw Newham Valley WwTW Wingham Dambridge Stw Westbere StW

[13] Only water company waste water treatment works have been included trade effluent and business discharges are not included in this list – but would be included in an appropriate assessment if effluent discharge from them was increasing due to a development proposal. All these WwTW were named in stage 3 Review of Consents (RoC) as having a likely significant effect (or later bought back into stage 3 in RoC) but this list will be reviewed in the initial stages of the WINEP investigation. Naming follows that used in stage 3 RoC.

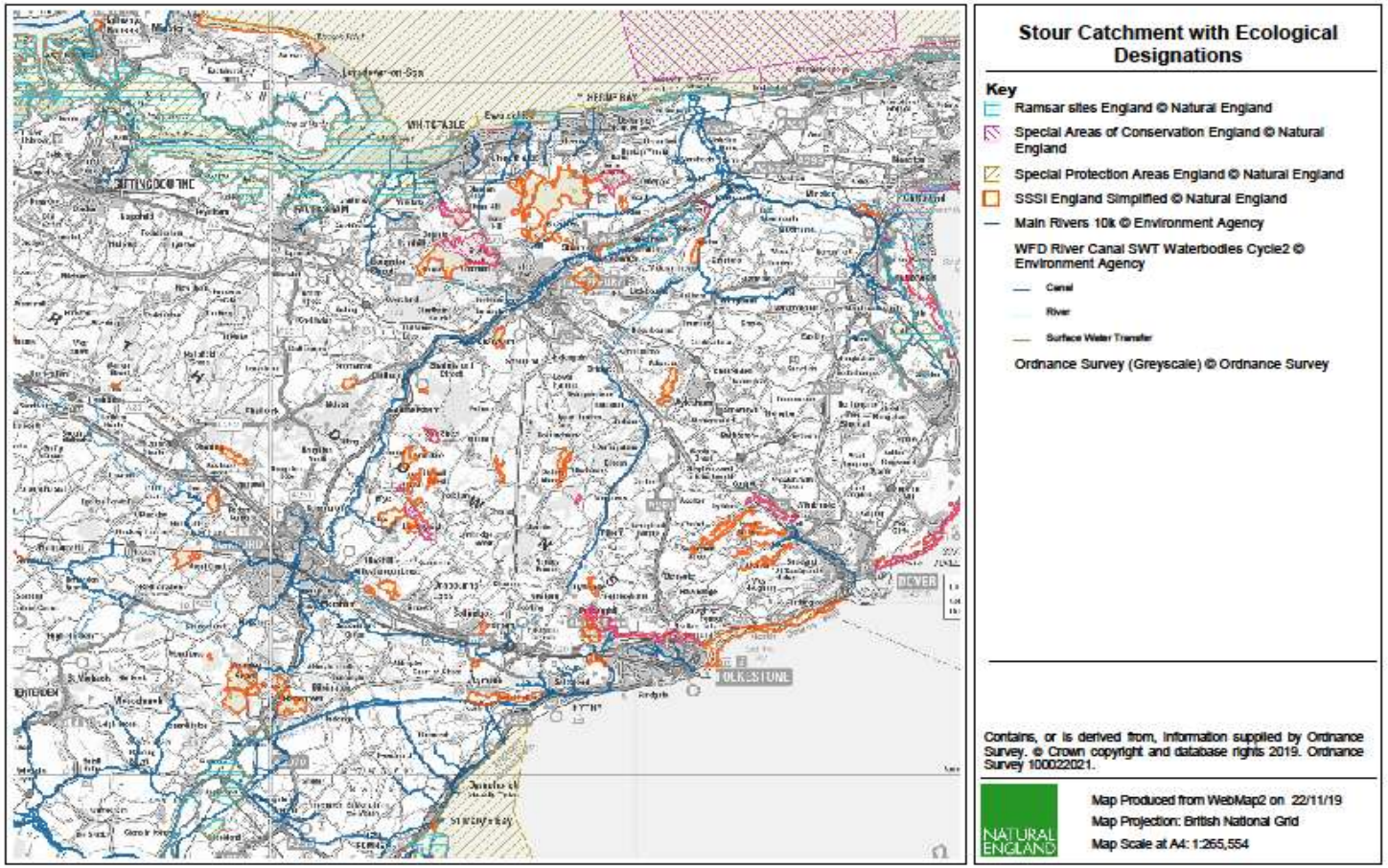


Figure A.1 Stodmarsh River Catchment

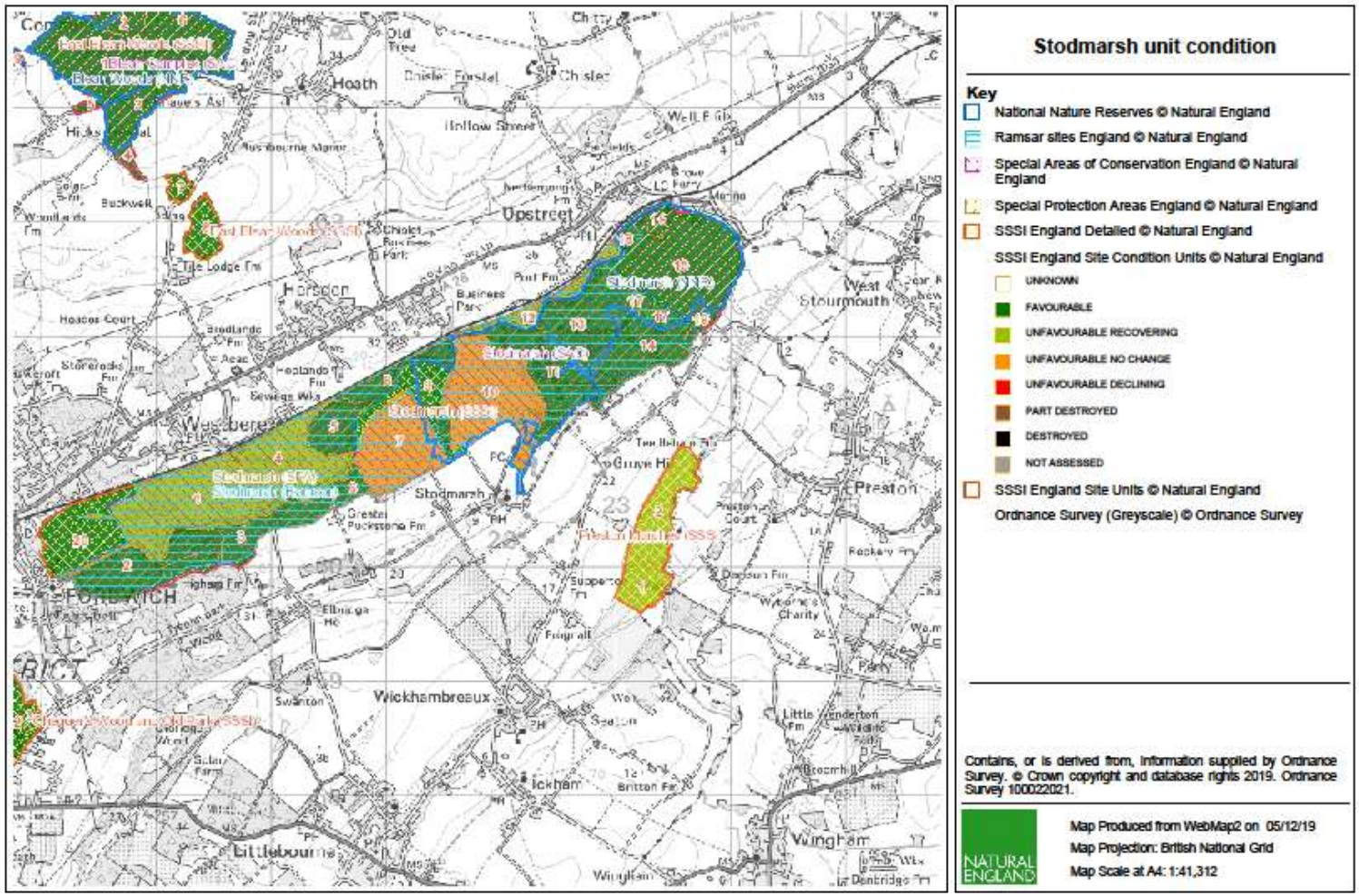


Figure A.2 Stodmarsh unit condition

Appendix 1 B

Table A.2 Designate Sites Interest Features

Designation	Links to Conservation Advice or equivalent	Interest features and links to citation or equivalent
Stodmarsh Site of Special Scientific Interest (SSSI)	Favourable condition tables	The interest features of the SSSI are described in full in the citation and are summarised below: • Wetland habitats including Swamp, fen and reedbed communities. • Standing waters- lake and ditch habitats • Desmoulin's whorl snail • Assemblage of Breeding Birds • Aggregations of rare Breeding Birds: • Aggregations of non-breeding birds • Assemblage of vascular plants • Assemblage of invertebrates (W211 open water on disturbed sediments and W314 permanent wet mire and rich fen communities)
Stodmarsh Special Protection Area	Conservation Objectives Supplementary Advice	The interest features of the SPA are described in full in the citation but are summarised below: • Great bittern (Non- Breeding) • Gadwall (Breeding and Non-Breeding) • Northern Shoveler (Non-Breeding) • Hen Harrier (Non-Breeding) • Waterbird Assemblage • Breeding Bird Assemblage
Stodmarsh Ramsar Site	The SACOs for the SPA and SAC and the FCTS for the underpinning SSSI for the SPA and SAC are considered to cover these features	The interest features of the Ramsar site are described in full in the Ramsar Information Sheet and are summarised below: Ramsar Criterion 2: • Assemblage or British Red Data book invertebrate species, • Assemblage of rare and scarce plans species • A diverse assemblage of rare wetland birds
Stodmarsh Special Area of Conservation (SAC)	Conservation Objectives Supplementary Advice	The interest features of the SAC are described in full in the citation and are summarised below: • Desmoulin's whorl snail

Appendix 2 – Farm Types

The following definition of farm types comes from the UK farm business survey guide to the farm business survey which underpins the Farmscoper model. The UK system is based on weighting the contributions of each enterprise in terms of their associated outputs. The weights used (known as 'Standard Outputs' or SOs) are calculated per hectare of crops and per head of livestock and used to calculate the total standard output associated with each part of the Farm Business.

Cereals
Holdings on which cereals, combinable crops and set-aside account for more than two thirds of the total SO and (pre-2007) where set-aside alone did not account for more than two thirds of the total SO. (Holdings where set-aside accounted for more than two thirds of total SO were classified as specialist set aside and were included in "other" below.)

General cropping
Holdings on which arable crops (including field scale vegetables) account for more than two thirds of the total SO, excluding holdings classified as *cereals;* holdings on which a mixture of arable and horticultural crops account for more than two thirds of their total SO excluding holdings classified as *horticulture* and holdings on which arable crops account for more than one third of their total SO and no other grouping accounts for more than one third.

Horticulture
Holdings on which fruit (including vineyards), hardy nursery stock, glasshouse flowers and vegetables, market garden scale vegetables, outdoor bulbs and flowers, and mushrooms account for more than two thirds of their total SO.

Specialist Pigs
Holdings on which pigs account for more than two thirds of their total SO.

Specialist Poultry
Holdings on which Poultry account for more than two thirds of their total SO.

Dairy
Holdings on which dairy cows account for more than two thirds of their total SO.

Lowland Grazing Livestock
Holdings on which cattle, sheep and other grazing livestock account for more than two thirds of their total SO except holdings classified as *dairy.* A holding is classified as lowland if less than 50 per cent of its total area is in the Less Favoured Area (LFA).

Mixed
Holdings for which none of the above categories accounts for more than 2/3 of total SO. This category includes mixed pigs and poultry farms as well as farms with a mixture of crops and livestock (where neither accounts for more than 2/3 of SOs).

Appendix 3 – Leaching of nitrogen/ phosphorous from urban areas

Urban leaching of Nitrogen

The average total nitrogen leaching rate from an urban area used in this report is taken from the work done for the Solent Nutrient Neutral methodology which is explained below with comparison to and inclusion of local Stodmarsh/ Stour catchment data where available. Evidence that was sufficiently robust to justify significant deviation from this figure has not been identified. If locally specific values for urban land use nitrogen export have been calculated based on sound local evidence then these can replace the value given below.

The original Solent value (14.3kg/ha/yr) comes from values for hydrologically effective rainfall (478mm - precipitation minus losses from evapo-transpiration) and the nitrogen concentration of leachate (3mg/l) given in Bryan *et al* (2013) the latter figure derived from an AMEC report. The value for nitrogen concentration is similar to one quoted in House *et al* (1993) who give a mean event concentration of 3.2mg/l for total nitrogen (with this value derived from other sources) with a range of 0.4-20mg/l. Thus although it is not specified by Bryan *et al* (2013), it is probably reasonable to take the 3mg/l to be total nitrogen especially since the organic component of N from urban areas is likely to be relatively small.

Mitchell (2001) gives the following event mean concentrations in mg/l total N from urban areas; Urban Open 1.68; Ind/Comm 1.52; Residential 2.85; Main roads 2.37.
It is recognised that the datasets that produced these figures are not large (n = 14 in this case), a good deal of uncertainty remains and that further sampling is needed to validate models of pollutant effects from urban runoff (Leverett *et al* 2013).

Typical nutrient concentrations in urban storm water runoff in the U.S. are 2.0 mg/l for total N (TN) (Schueler 2003). Population densities seem to be less in the most studied urban catchments (eg Groffman *et al* 2004 in Baltimore, Hobbie *et al* 2017 in Minnesota) than those in the UK but this does not necessarily lead to an increase in the rate of nitrogen leaching from the catchment as the factors affecting this value are complex. Thus although there will clearly be variation between different urban areas, there is insufficient knowledge to be able to predict N leaching from the different characteristics of these areas. And for practical purposes an overall N leaching figure is needed; nothing found in the literature indicates that another value would be more representative than 3mg/l.

An N leaching figure can also be derived by using the relationship between mean stream and river flow rate and catchment area. The ratio for the gauging station on the River Meon at Mislingford is 0.014m^3/sec/km^2 and, with a TN concentration of 3mg/l, this equates to a TN leaching rate of 13.2mg/l, similar to the value obtained when hydrologically effective rainfall is used.

Comparison can also be made with direct measurements of TN urban outputs from studies in the USA (Hobbie *et al* 2017, Groffman 2004). The values in the Hobbie paper for urban catchments in Minnesota varied from 12.5-27.2 kg/ha/yr with a mean of 17.3 kg/ha/yr. The outputs measured by Groffman (2004) were smaller (between 5.5 and 8.6kg/ha/yr) but these were less urbanised catchments, several including areas of old growth forest where nitrogen retention was very high. Thus these values are broadly of the same order as the 14.3 kg/ha/yr leaching figure initially calculated.

Nitrogen inputs in these studies come predominantly from three sources - atmospheric deposition, pet waste and lawn fertilisation. N deposition was slightly lower in both Baltimore and Minnesota than values from APIS in the around the Solent (23.8kg/ha/yr for hedgerows or woodland, 14.7kg/ha/yr for grassland) and those in the Stodmarsh area (23.52/ha/yr hedgerows and 13.44 kg/ha/yr neutral grassland). No UK studies have been found to compare with the US ones for N inputs in urban areas from pet waste or from lawn

fertilisation. Should evidence of a more appropriate value be provided or derived Natural England will update this figure.

Urban leaching of Phosphorous

No Stodmarsh/ Stour management catchment specific information was found for urban land and Farmscoper does not cover urban land. Therefore the urban/suburban export coefficient was taken from White and Hammond 2006 (0.83kg/ha/yr.) This is the coefficient used for calculating the relative source apportionment in the first river basin cycle to UK river Basin Districts (RBD). Stodmarsh sits in the South East RBD and this was shown to have the highest relative contribution of phosphorous from households (both effluent and urban diffuse) compared to other sectors, with agriculture only contributing 21.8% of the South East RBD phosphorous load during the first river basin cycle (White and Hammond 2006). Though this export coefficient is from an older study, more recent studies have used values of a similar range for example Bryan (2015) uses 0.7kg of P per hectare for urban areas in the River Avon Nutrient Management Plan modelling though this figure was based on studies mainly in Scotland. Duan *et al* (2012) found small urban catchments exported values of between 0.245 to 0.837 kg/ha/yr compared with much lower values from forested and very low density residential catchments (0.028 to 0.031 kg/ha/yr). The large range in Duan *et al* was explained by the relative density of roads and built structures in the existing catchments. The importance of housing and roads density but also proportion of impermeable surface in urban land was also reflected in a study by HR Wallingford commissioned by Natural England that looked at impacts of urban run-off of designated wetlands using a range of models (Natural England 2018). For new developments using the approach taken in this study the urban land is separated from SANGS and parks so the use of the higher end of these urban coefficients is relevant due to the relative density, though density in the Duan *et al* study were lower the average UK value even in the higher density urban catchments.

Phosphorus is made available in solution through a combination of physicochemical (adsorption/desorption and precipitation/dissolution) and biological/biochemical (mineralization/immobilization) processes. Geology is important in influencing the movement of nutrients through groundwater as it influences the minerals, pH (acidity/alkalinity) and the oxygen content of the waterbody. For example in chalk aquifers, a large proportion of the soluble reactive phosphorus (SRP) is removed from groundwater (as well as most other forms of P from agricultural sources) following a chemical reaction that results in the precipitation of phosphorus in the form calcium phosphate and adsorption (adhesion) to the rock matrix requiring regular soil testing (e.g. Mclaughlin *et al* 2011). Similar processes occur with phosphorus reacting with other minerals such as magnesium and iron. These reactions can be reversed with phosphorus moving back in to solution where the mineral content of groundwater and pH change in urban development. However recent evidence from China suggests the original soil type is still critical in urban phosphorous leaching (e.g. Wei *et al.,* 2019) provided sufficient permeable surface remains.

Phosphorous is thought to be highly conserved in natural catchments (e.g. Verry and Timmons 1982, May *et al* 1996) but urban catchments have less phosphorous retention with the rate of retention being linked to the permeability of the urban environment and soil type (e.g. Duan *et al* 2012, Natural England 2018).

Atmospheric deposition including from vehicles, leaching roads, fertilising gardens and parks including pet urine and waste have all been shown to be a significant source of P in urban catchments (e.g. Hobbie e*t al* 2017). Bryan, 2015 quotes several studies which examined levels of P in urban runoff in terms of Event Mean Concentrations (EMCs) as part of a wider project to develop a screening tool for Scotland and Northern Ireland to identify and characterise diffuse pollution pressures. The use of pulsed concentrations is relevant to urban land as the areas of impermeable surfaces tend to result in higher concentrations during rainfall events. Ockenden *et al* (2017) looks at the efficacy of different models including those that use export coefficients on predicting run-off of TP. This study found that temporal resolution of the underpinning rainfall data used in models was critical because "storm" events are so central to phosphorous transport. Few if any urban catchments have this level temporal resolution of data and therefore these models cannot be derived with any accuracy for the Stour catchment at this time.

Conclusion on urban P

Based on the information above there is insufficient evidence to move away from 0.83 kg/ha for urban P leaching. Even though soils in the Stour valley are likely to show a high degree of P retention much export from urban land is from the impermeable surfaces and during high flow events therefore urban run-off has very little attenuation by soils so export coefficients towards the upper end of those observed are justified. Should evidence of a more appropriate value be provided or derived Natural England will update this figure.

Built Design to reduce phosphorous export from urban land

Most studies have noted that the export of N and P from urban systems differ. Most P appears to export through high flows via surface drainage. Planning applications to reduce phosphorous should be designed to:

- Maximise permeable surfaces
- Implement Sustainable urban drainage schemes extensively based on larger wetlands (not ponds or detention basins) (see Appendix 5)
- Minimise composting of garden waste direct to catchment surfaces (though composting in structures should be encouraged)
- Maximise pet waste collection though this does nothing to address pet urine

References

Bryan G., Kite D., Money R., Jonas P. and Barden R. 2013. *Strategy for managing nitrogen in the Poole Harbour catchment to 2035*. Environment Agency report.

Bryan G., 2015 Phosphorous in the Hampshire Avon Special Area of Conservation Technical Report (annex iv).

Duan S., Kaushal S.S., Groffman P.M., B and L.E., Belt K.T.*(2012)* Phosphorus export across an urban to rural gradient in the Chesapeake Bay watershed*. Journal of Geophysical Research 117:G01025*

Ellis J.B. and Mitchell G. 2006 Urban diffuse pollution: key data information approaches for the Water Framework Directive. Water and Environment Journal **20** (2006) 19–26.

Groffman, P.M., Law, N.L., Belt, K.T., Band, L.E., Fisher, G.T., 2004. Nitrogen fluxes and retention in urban watershed ecosystems. Ecosystems 7: 393e403.

Hobbie Sarah E, Jacques C. Finlay, Benjamin D. Janke, Daniel A. Nidzgorski, Dylan B. Millet, and Lawrence A. Baker (2017). Contrasting nitrogen and phosphorus budgets in urban watersheds and implications for managing urban water pollution PNAS April 18, 114 (16): 4177-4182.

House, M.A., Ellis, J.B., Herricks, E.E., Hvitved-Jacobsen, T.,Seager, J., Lijklema, L., Aalderink, H. and Clifforde, I.T. (1993) Urban Drainage: Impacts on Receiving Water Quality. Water Science and Technology, 27 (12): 117–158.

Leverett D., Batty J., and Maycock D. (2013) Assessing the scale and impact of urban run-off on water quality. Report to DEFRA from WCA Environment Ltd.

May L., Place, C.J., George.D.G. (1996) Report Ed/T11059s/1: The effects of soil type and nutrient losses and run-off in the catchment of Bassenthwaite Lake. NRA North West Region

Mitchell G. 2001. The quality of urban stormwater in Britain & Europe: Database & recommended values for strategic planning models. School of Geography, University of Leeds.

McLaughlin M.J., McBeath T.M., Smernik R., Stacey S.P. Ajiboye B., Guppy C. (2011) *The chemical nature of P accumulation in agricultural soils-implications for fertiliser management and design: an Australian perspective* Plant Soil, 349 (1–2): 69-87

Natural England, HR Wallingford (2018). Nailsea Surface Water Outfall SuDS feasibility Study (2018).

Ockenden M.C., Tych W., Beven K., Collins A.L., Evans R., Falloon P.D., Forber K.J., Hiscock K.M., Hollaway M.J., Kahana R., Macleod J.A., Villamizar M.L., Wearing C., Withers P.J.A., Zhou J.G., Benskin C.Mc. H., Burke S., Cooper R. J., Freer J.E. and Haygarth P.M. (2017) *Prediction of storm transfers and annual loads with data-based mechanistic models using high frequency data.* Hydrology and Earth Systems Sciences 21: 6425-6444

Schueler, T., 2003. Impacts of Impervious Cover on Aquatic Systems. Watershed Protection Research Monograph No 1. Center for Watershed Protection, Ellicot City, MD.

Verry E.S., and Timmons D.R., *(1982) Waterborne nutrient flow through an upland-peatland watershed in Minnesota. Ecology 63:1456–1467*

Wei Z., Yan X., Lu A., and Wu J. (2019) Phosphorous sorption characteristics and related properties in urban soils in southeast China. 175: 349-355.

White P.J and Hammond J.P. (2006) *Updating the estimates of phosphorous in UK Waters*. Defra funded project WT0701CSF

Appendix 4 - Estimating the leaching of total nitrogen (TN) and Phosphorous (TP_ from natural greenspace (SANG).

The value used in this methodology is based on work from the Solent Nutrient Neutral methodology and is set out below, APIS values for the Stodmarsh area have been used for the N deposition value which is the only change from the Solent methodology. However if locally specific data on SANGS is available and evidenced this figure can be replaced by a locally derived figure, provided it is sufficiently well evidenced.

A number of assumptions must be made about the management of the SANG to allow an estimate of TN/TP leaching to be made. These are as follows:

- The vegetation of the SANG would be predominantly permanent grassland but with an element of tree and scrub cover (this will of course vary for different SANGS but a 20% average figure is used here). The degree of tree and scrub cover will not greatly affect the result as both permanent grassland and woodland/scrub exhibit a high degree of N and P retention. It matters most because of the differences in the rate of atmospheric N and to a much lesser extent P deposition between the two habitats.
- The grassland would be permanent (ploughing will release large amounts of N/P) and is not fertilised either with artificial fertiliser or manures. It may be ungrazed or grazed very lightly (<0.1LU/ha/yr) with no supplementary feeding (even without supplementary feeding, grazing can increase N and to a much lesser extent P leaching because N retention is lower when N is delivered in the form of cattle urine and dung [Wachendorf *et al* 2005]).
- The grassland may be cut with the cutting regime dependent on other factors. Cuttings may be left or removed from site as the case may be but should not be gathered and composted in heaps on site. Any gorse within the scrub should be controlled so it is no more than rare across the mitigation area since a significant amount of nitrogen fixation occurs within gorse stands.

Nitrogen leaching

A generic leaching value for N concentration from AMEC Poole Harbour study for 'rough grazing', quoted in Bryan *et al* (2013), is 2mg/l. Using this concentration together with a value of 478mm for the hydrologically effective rainfall (HER) gives a leaching value for N of 9.6 kg/ha/yr. A similar value (8.8kg/ha/yr) is obtained if the relationship between mean stream flow and catchment area (0.014 cumecs/km^2 which is the ratio for the gauging station on the nearby River Meon at Mislingford) is used instead, keeping the same N concentration of 2mg/l. It is not clear whether these AMEC Poole Harbour concentrations are for total nitrogen or for inorganic nitrogen.

The particular grassland management regime for which the 2mg/l N concentration applied is not known. However, even though studies of N leaching from natural unfertilised grasslands are rare in the literature (most are of agricultural grasslands with fertiliser inputs of some sort) it seems likely that this value is higher than might be expected from a natural grassland with no fertiliser inputs such as a SANG. Thus for example TN leachate concentrations were between 0.44 and 0.67 mg/l in an extensively managed montane grassland (that still had one slurry application per year) and the equivalent mean TN loss was 1.0, 2.6 and 3.1 kg/ha/yr for three different areas (Fu *et al* 2017).

Adjusting for a SANG with 20% woodland/scrub, using the AMEC woodland generic leaching value of 0.5mg/l (Bryan *et al* 2013) for the woodland/scrub component, results in an N output of 8.1 kg/ha/yr.

The 0.5mg/l value is also much higher than the very low nitrate concentrations in streams from purely forested catchments (Groffman 2004) and from those reported by for a large sample of forested streams by Mulholland *et al* 2008 where the mean nitrate-N concentrations were <0.1mg/l. All but a few of the samples from an unfertilised suburban lawn had nitrate-N concentrations below the detectable limit of 0.2mg/l (Gold et al 1990). The same was true for a forest plot and the average nitrate-N losses from both home lawn and the forest plots averaged 1.35 kg/ha/yr over 2 years. These studies of both grassland and woodland nutrient cycling suggest that the N output of 9.6kg/ha/yr from Amec quoted in Bryan is too high when applied to a SANG.

Despite there being no direct N fertiliser inputs on a SANG, N inputs will still occur from three main sources. These are atmospheric deposition, pet waste and N fixation from legumes and estimating the contribution of each of these sources, together with the proportion of N retained, is an alternative method of working out the N contribution from a SANG.

N deposition

The following are typical values taken from APIS for TN deposition in the Stodmarsh Area Grid reference TR214613 from Stodmarsh citation used (Solent area in brackets for comparison).

Improved grassland 13.44 (14.7) kgN/ha/yr; Arable horticultural 13.44 (14.7) kgN/ha/yr; Neutral grassland 13.44 (14.7) kgN/ha/yr

Hedgerows 23.52 (23.8) Kg N/ha/year; Broadleaved, Mixed and Yew Woodland 23.52 (23.8) Kg N/ha/year

Using the value for hedgerows and woodland for the 20% scrub component of the hypothetical SANG and the neutral grassland value for the rest results in a deposition rate of 10.75 + 4.70 = 15.45 (11.76 + 4.76 = 16.5) kg/ha/yr.

N and Pet waste

SANGs are specifically designed to attract increased levels of public access particularly dog walkers so the potential inputs of N from dog waste are likely to be significant.

Hobbie *et al* (2017) give a figures for TN inputs from this source for entire urban areas and these vary between 3.56 and 21.2kg/ha/yr for 7 urban catchments with a median of 6.9kg/ha/yr. A figure of 17kg/ha/yr can be gleaned from Baker 2001 which was worked out using information on pet numbers, nutritional needs, pet weights etc; 76% of this was from dogs.

The heavy use of SANGS by dogs suggests that N inputs would most likely be higher than these figures averaged over the whole urban area. Nevertheless, inputs to the SANG from this waste means that it is not deposited elsewhere in the urban area where N may anyway end up in the same receiving water.

TN retention in grasslands will also be higher than the average over other parts of the urban area but the characteristics of the inputs from dogs is likely to lower the amount of TN retained because the concentrated patchy nature of the input will reduce the proportion of TN retained compared with more evenly spread inputs, as mentioned above.

Picking up dog faeces will obviously reduce the input from but not remove inputs from urine. Dog urine has a high N content.

In these circumstances there is clearly uncertainty about the level of input from this source the highest figure from Hobbie *et al* 2017 (21.2kg/ha/yr) has been used but adjusted downwards because not all of this will be from dogs resulting in an overall value of 16.1 kg/ha/yr.

This has also been done on the basis that funding, together with a binding commitment, is provided for in perpetuity collection of dog waste and enforcement of pick up rather than relying on direct LA resources which could stop at any time.

TN fixation

Hobbie *et al* (2017) give a value for this of 17.5kg/ha/yr from direct investigation of unfertilised urban parks and this is the value used. Fixation would only be in the grassland part of the SANG which reduces the figure to 14 kg/ha/yr.

TN retention

A number of studies have shown high TN retention in urban areas (eg 80% Hobbie et al 2017) thought to be mainly attributable to TN retention in urban grasslands and lawns which may be in turn related to high carbon within organic matter in the soils. The release of large quantities of N when permanent grassland is ploughed illustrates the capacity of these grassland for N storage (eg Howden *et al* 2011).

Direct measurements of total N outputs from urban grasslands in the Groffman *et al* (2009) studies in Baltimore also show high N retention in urban grassland but there are difficulties in applying these results directly to SANGs partly because the plots were either quite heavily fertilised or may have had unmeasured N inputs from neighbouring land. Nitrate-N losses from an unfertilised home lawn averaged 1.35 kg/ha/yr over 2 years (Gold *et al* 1990). Generally the complex processes and uncertainties about how the management of these grasslands might affect the degree of TN retention and TN output makes estimation of the proportion retained difficult. Nevertheless a value of 90% given in Groffman *et al* (2009), and supported by a number of references given there, would seem reasonable considering also that overwatering and over fertilising, neither of which would happen on a SANG, seem to be factors that lead to more leaching.

Woodland and scrub. N retention measured in forest plots in Baltimore was very high (95%) Groffman (2004). N percolation losses measured by Gold *et al* 1990 in forest plots were low and similar to those in unfertilised lawn. However, it is probably not valid to equate a scrub/woodland part of a SANG with the forest plots measured in the Groffman studies in Baltimore for these were old growth well established forests. Nevertheless there is still likely to be high N retention in these areas even if not as much as 95%.

Given all of the above, a 90% TN retention rate over the SANG as a whole has been used in the calculation below

Inputs
Solent specific APIS value in brackets

N Deposition (APIS) = 15.45 (16.5) kg/ha/yr
Pet waste 16.1 kg/ha/yr
N fixation 14 kg/ha/yr

Total = 45.55 (46.6)kg/yr

Watershed retention of TN 90%

Total TN output = 4.55 (4.66) kgN/ha/yr

Conclusion for Nitrogen

The question of estimating TN outputs from a SANG has been approached from different angles. These investigations all indicate that the value used previously – 13 kg/ha/yr is too high. Instead a TN output of 5.0 kg/ha/yr is considered to be close to the true value but still sufficiently precautionary.

Phosphorous
Export coefficients for phosphorous for different land cover classes were assessed and compiled by White and Hammond (2006) for the first River Basin Cycle source apportionment. They note the extremely low coefficient from natural land use such as woodland and unfertilised grassland; both habitats are given an export coefficient of 0.02 kg/ha/yr based on the rough grazing value of Johnes 1996. Similar low phosphorous from natural habitats have been recorded from many other studies including more recent studies in the USA (e.g. Hobbie et al 2017, Duan *et al* 2012).

These export coefficients take account of atmospheric deposition but are for natural habitats unlike SANGS which, although ecologically functioning as natural habitats, are designed to be used for informal recreation including dog walking. It is therefore reasonable to assume that pet waste and urine *into* SANGs will be equivalent to urban areas. Hobbie *et al* 2017 found that household nutrient inputs from pet (dog) waste contributed up to 76% of total P inputs in American catchments due to high pet ownership in urban environments - values of inputs for Phosphorous in Hobbie *et al* for dog waste were from 2.7 kg/ha/yr to 0.46 kg/ha/ yr with a mean of 1.21 kg/ha/yr. However P *output* from SANGS is likely to be significantly less

as phosphorous is highly conserved in the natural land uses and the high contribution of pet waste to export coefficients of urban systems is partly due to the relative lack of permeability of the surfaces onto which the pet urine and waste are frequently deposited. In addition (as explained in Appendix 3) phosphorous is highly conserved on the types of soils found in the Stour valley. Using the mean rate of dog waste from Hobbie *et al* 2017 to be precautionary but assuming a high retention in any SANGS in the Stour valley of 90% gives a value as follows:

Mean TP loading from pet waste to urban sites - 1.21 Kg/ha/year
Mean Catchment retention TP = 90%
= TP 0.12 kg/ha/Yr

+0.02 Kg/ha/year - natural land export coefficient from Johnes 1996

= 0.14 kg TP/ha/yr

Conclusion for phosphorous
Based on best available evidence SANGS value for Stour catchment of 0.14 kg TP/ha/yr has been estimated.

References

Baker LA, Hope D, Xu Y, Edmonds J, Lauver L. 2001. Nitrogen balance for the central Arizona–Phoenix (CAP) ecosystem. Ecosystems 4:582–602.

Bryan, G, Kite, D, Money, R, Jonas, P and Barden R. 2013. Strategy for managing nitrogen in the Poole Harbour catchment to 2035. Environment Agency report.

Carey Richard O., George J. Hochmuth, Christopher J. Martinez, Treavor H. Boyer, Michael D. Dukes, Gurpal S. Toor, John L. Cisar (2012) Evaluating nutrient impacts in urban watersheds: Challenges and research opportunities. Environmental Pollution 173 (2013) 138-149.

Duan S, Kaushal S.S., Groffman P.M., Band L.E., Belt K.T.*(2012) Phosphorus export across an urban to rural gradient in the Chesapeake Bay watershed. Journal of Geophysical Research 117:G01025*

Fu, Jin, Rainer Gasche, Na Wang, Haiyan Lu, Klaus Butterbach-Bahl, Ralf Kiese (2017) Impacts of climate and management on water balance and nitrogen leaching from montane grassland soils of S-Germany. Environmental Pollution 229 (2017) 119-13.

Gold, A.J., W.R. DeRagon, W.M. Sullivan, and J.L. LeMunyon. 1990. Nitrate nitrogen losses to groundwater from rural and suburban land uses. J. Soil Water Conserv. 45:305–310.

Groffman, P.M., Law, N.L., Belt, K.T., Band, L.E., Fisher, G.T., 2004. Nitrogen fluxes and retention in urban watershed ecosystems. Ecosystems 7, 393-403.

Groffman, P.M., Williams, C.O., Pouyat, R.V., Band, L.E., Yesilonis, I.D., 2009. Nitrate leaching and nitrous oxide flux in urban forests and grasslands. Journal of Environmental Quality 38, 1848-1860.

Hobbie Sarah E, Jacques C. Finlay, Benjamin D. Janke, Daniel A. Nidzgorski, Dylan B. Millet, and Lawrence A. Baker (2017). Contrasting nitrogen and phosphorus budgets

in urban watersheds and implications for managing urban water pollution PNAS April 18, 2017 114 (16) 4177-4182.

Howden N J K, T.P. Burt, S.A. Mathias, F. Worrall, M.J. Whelan (2011) Modelling long-term diffuse nitrate pollution at the catchment-scale: Data, parameter and epistemic uncertainty. Journal of Hydrology 403 (2011) 337–351

Johnes PJ (1996) Evaluation and management of the impact of land use change on the nitrogen and phosphorous load delivered to surface waters: the export coefficient modelling approach. Journal of Hydrology 183, 323-349.

Magesan Guna N., Hailong Wang and Peter W. Clinton 2011 Nitrogen cycling in gorse-dominated ecosystems in New Zealand. New Zealand Journal of Ecology (2012) 36(1): 21-28

May L., Place, C.J., George.D.G. (1996) Report Ed/T11059s/1: The effects of soil type and nutrient losses and run-off in the catchment of Bassenthwaite Lake. NRA North West Region

Mulholland P J and 30 others (2008) Stream denitrification across biomes and its response to anthropogenic nitrate loading. Nature 452, 202-206

Wachendorf Christine, Friedhelm Taube and Michael Wachendorf (2005) Nitrogen leaching from ^{15}N labelled cow urine and dung applied to grassland on a sandy soil. Nutrient Cycling in Agroecosystems (2005) 73:89–100

White P.J and Hammond J.P. (2006) *Updating the estimates of phosphorous in UK Waters*. Defra funded project WT0701CSF

Appendix 5– Potential for Nutrient (N&P) mitigation using wetlands

Where N and or P budget calculations indicate that N and/ or P outputs from proposed developments are greater than pre development conditions, the use of new constructed wetlands to retain some of the N and P output is one mitigation option.

There are a number of possibilities for different types of constructed wetland. Wetlands can be designed as part of a sustainable urban drainage (SUDs) system, taking urban runoff stormwater; discharges from STWs can be routed through wetlands; or the flow, or part of the flow, of existing streams or rivers can be diverted through wetlands provided this does not adversely alter the ecological status of the river and does not increase flood risk. Environment Agency advice should always be sought in design of any wetland creation scheme.

Wetlands receiving nutrient-rich water can remove a proportion of this nutrient through processes sedimentation, absorbing nutrients to the sediment, plant growth and processes such as denitrification some of which were reviewed in Fisher and Acreman (2004) and numerous studies. A recent systematic review of the effectiveness of wetlands for N and P removal (Land *et al* 2016) used data from 203 wetlands worldwide of which the majority were free water surface (FWS) wetlands (similar in appearance and function to natural marshes with areas of open water, floating vegetation and emergent plants). The median removal rate for wetlands that were included in this review was 93g/m^2/yr TN and 1.2 g/m^2/yr TP (or just under a tonne/ha/year TN and 12 kg/ha/yr TP). The proportion of N removed is termed the efficiency and the median efficiency of wetlands TN removal included in the Land review was 37%. Median remail efficiency for TP in the same review was 46 % with a 95 % confidence interval of 37–55 %.

Many factors influence the rate of nutrient removal in a wetland the most important for being hydraulic loading (HLR - a function of the inlet flow rate and the wetland size), inlet N or P concentration and temperature and for TP the Area of the wetland. Together inlet N or P concentration and flow rate partially determine the amount of N or P that flows through the wetland which ultimately limits the amount of N or P saving that can be achieved.

The rate of removal can also be expressed in terms of the amount of N or P removed per unit wetland area. This removal rate will typically increase as the inlet N or P concentration increases, at least within the normal range of inlet N or P concentrations. Thus wetlands that treat the N or P rich discharges, for example from STWs, or water in rivers where the N or P concentrations are high, will remove more N or P per unit area than say, wetlands treating water in a stream where water quality is very good and the N or P concentration is low. Thus if space is at a premium, and the goal is to remove as much N or P as possible, it makes sense to site wetlands where N or P concentrations are high in other words as close to WwTW as possible.

For wetlands to work well, specialist design input based on sound environmental information will be necessary. There will be a need for consultation with relevant statutory bodies. These processes are likely to be easier where wetlands are an integral part of a larger development. Wetlands do offer additional benefits above offsetting but will also require ongoing monitoring, maintenance and adjustments beyond any particular developments

completion. Consideration of the long term security of facilities and their adoption at an early stage is advisable.

There are a number of publications which advise about constructed wetlands. For example, Kadlec and Wallace (2009) is a comprehensive source of information covering all stages related to the implementation of different types of constructed wetland. The many papers relating the results from detailed monitoring over many years of the performance of two constructed wetlands in Ohio, USA are also instructive (eg Mitsch *et al* 2005, 2006, 2014).

Stormwater/ flood wetlands

These are what is termed event-driven precipitation wetlands with intermittent flows. There will normally be baseflow and stormwater / flood water components to the inputs.

For such wetlands Kadlec and Wallace state that:-

'*A typical configuration consists of a sedimentation basin as a forebay followed by some combination of marshes and deeper pools'*

However, ponds are usually less effective at removing N and P (Newman *et al* 2015) than shallow free water surface constructed wetlands (FWS wetlands) so the emphasis here should be on the latter although a small initial sedimentation basin is desirable since this is likely to reduce the maintenance requirement for sediment removal in the FWS wetland. One advantage of this type of wetland is that it can be designed as an integral part of SUDs for the development and therefore is subject to fewer constraints.

Some wetlands with intermittent flows are prone to drying out and may need provisions for a supplemental water source. In some circumstances, this may be possible through positioning the wetland bottom so that there is some connection to groundwater. However many varieties of wetland vegetation can withstand drying out although there may be a small reduction in water quality improvement (Kadlec and Wallace 2009). Nevertheless base and stormwater flows to each wetland should be worked out to ensure that it is viable and will not add to the water resource issues of the relevant catchment. Initial flush of Phosphorous from soils on former intensively agricultural land was noted in the Land study and this may reduce the short and potentially even long term efficacy of such restored wetlands. Release of phosphorus associated with iron complexes under anaerobic conditions can also contribute to low or negative removal rates, as suggested by Healy and Cawley 2002 as an explanation for the observed low TP removal rates.

Wetlands need to be appropriately sized taking into account the HLR and N or P loading rates. To give a general idea of the areas involved, a wetland 1ha in area would serve a development area of about 50 ha for Nitrogen but given the increased importance of area a larger area would be required for TP reduction from the same development. The Land *et al* review noted the inconsistency of TP reduction was particularly acute at wetlands below 2 hectares in size with wetlands below this size more likely to be net exporters of TP especially if they were created on former intensively farmed agricultural land.

Calculating the potential N or P retention in such wetlands involves first determining the proportion of the hydraulic load that will pass through the wetland because a percentage of the water carrying N and P will go directly into groundwater, bypassing storm drains and SUDs and the constructed wetlands. This percentage will depend on such factors as the proportion of hard surface within the development and the geology. Then, assuming the inlet TN concentration is 3mg/l, a proportionate reduction of 37% can be used to work out the amount of N retained and using 37% is also reasonable for P due to the larger variation of P retention shown in the Land study and this is the bottom end (and therefore precautionary) of the 95% confidence interval for TP retention.

Provision is needed to control tree and scrub invasion, for wetlands with emergent vegetation medium height such as Typha and reed had higher rates of denitrification than those dominated by trees and woody shrubs (Alldred and Baines 2016). Phosphorus uptake and amount partitioned to roots and shoots differs between different wetlands species but as a general rule tall rapidly growing emergent species are the most likely to retain P in vegetation with *Juncus effusus* having the highest percentage of retained P in the leaf litter of 5 tall emergent species in a comparative study (Kao *et al* 2003).

Other critical aspects of design are the water control structures - inflow and outflow arrangements with water level control – and the need or otherwise for a liner. This last issue is related to soil permeability. A variety of emergent wetland plants, not only reed, can be effective within wetlands. Wetlands with a number of different plant species, rather than monocultures, are desirable both for biodiversity reasons and because they are more resilient against changes in environmental conditions; different species will have different tolerances. Guidance concerning planting can be found in Kadlec and Wallace (2009); allowance should be made in planting ratios and densities for different rates of expansion of different species. Another approach is to use material containing wetland plant seeds from a nearby wetland with a species composition similar to the one preferred. However, unless the donor site is carefully monitored, this would obviously increase the risk of importing unwanted alien plants.

Sedimentation will eventually compromise some aspects of the wetland's function and rejuvenation measures will be necessary (Kadlec and Wallace 2009). The same authors indicate a sediment accretion rate in the order of 1 or 2cm/yr and give examples of rejuvenation after 15 and 18 years but other wetlands have not needed any significant restoration in similar timespans. Various different options for the management of sediment accumulation are given by Qualls and Heyvaert (2017). There of course needs to be provisions to ensure that appropriate maintenance and restoration measures, guided by monitoring, are periodically carried out.

Other sources of information about stormwater wetlands include Wong *et a*l (1999, available on line). The papers about a stormwater wetland in the Lake Tahoe Basin in California are also useful (Heyvaert et al 2006, Qualls and Heyvaert 2017).

Constructed wetlands taking discharges from STW

Many of the considerations discussed above for stormwater wetlands apply equally here. There will obviously be constraints on the location and size of such a wetland because of land availability in the area of the STW. The flow from the STW together with the N and P concentration in the discharge are needed to determine the approximate size of a wetland. We would recommend a wetland area that gives an N loading of about 500 g/m^2/yr or lower. Because many of the discharges from STW have a high N and very high P concentration the potential for N and P retention in such wetlands is also high. The concentration of N and P in the outflow will be variable but the purpose of such wetlands is to retain N and P overall rather than to provide a specific constant standard of water quality in the outflow.

Wetlands associated with streams and rivers

Diverting part of the flow of a stream or river through a wetland, with the outflow returning to the watercourse, provides another opportunity for N and P saving. For obvious reasons such wetlands would mostly need to be located on the river floodplain. The inlet flow rate can be controlled so it is appropriate for the size of the wetland created and so that the ecology of the watercourse is not compromised in the section affected.

There can be other concerns in relation to the potential effects on the stream or river. An abstraction licence will almost certainly be required and this may have implications for the ecological status – any such proposals should always be discussed in detail with the Environment Agency.

References

Alldred, M. and Baines, S.B. (2016). Effects of wetland plants on denitrification rates: a met-analysis. Ecological Applications 26(3): 676-685.

Fischer J., and Acreman M.C. (2004) Wetland nutrient removal: a review of evidence Hydrology and Earth Systems sciences 8(4): 673-685

Healy M., Cawley A.M. (2002) Nutrient processing capacity of a constructed wetland in western Ireland. Journal of Environmental Quality. 2;31(5):1739–47.

Heyvaert, A.C., Reuter, J.E., and Goldman, C.R. (2006). Subalpine, Cold Climate, Stormwater Treatment with a Constructed Surface Flow Wetland. Journal American Water Resources Association 42(1): 45-54

Kadlec R.H., and Wallace S.D. (2009). *Treatment Wetlands*. 2nd ed. CRC press, Taylor & Francis Group.

Kao, J.T., Titus, J.E. and Zhu W-X. (2003) differential Nitrogen and Phosphorous retention by five wetland plant species. Wetlands 23: 979-987

Land M., Graneli W., Grimvall A., Hoffmann C.C., Mitsch W.J., Tonderski K.S., Verhoeven J.T.A. (2016) How effective are created or restored freshwater wetlands for nitrogen and phosphorus removal? A systematic review. Environmental Evidence 5:9

Mitsch, W.J., Zhang L., Anderson, C.J., Altor A.E, Hernandez, M.E. (2005). Creating riverine wetlands: Ecological succession, nutrient retention, and pulsing effects. Ecological Engineering (25) 510–527.

Mitsch, W.J. and Day Jr J.W. (2006) Restoration of wetlands in the Mississippi–Ohio–Missouri (MOM) River Basin: Experience and needed research. Ecological Engineering 26: 55–69

Mitsch, W.J., Zhang L., Waletzko E., Bernal, B., (2014) Validation of the ecosystem services of created wetlands: Two decades of plant succession, nutrient retention, and carbon sequestration in experimental riverine marshes. Ecological Engineering 72: 11–24

Newman, J.R., Duenas-Lopez, M.A., Acreman M.C., Palmer-Felgate,E.J.,Verhoeven J.T.A., Scholz M., Maltby E. (2015) Do on-farm natural, restored, managed and constructed wetlands mitigate agricultural pollution in Great Britain and Ireland? A Systematic Review. CEH report to DEFRA.

Qualls,R.G. and Heyvaert, A.C. (2017). Accretion of Nutrients and Sediment by a Constructed Stormwater Treatment Wetland in the Lake Tahoe Basin. Journal of the American Water Resources Association (JAWRA) 1-18. https://doi.org/10.1111/1752-1688.12595

Wong T.H.F., Breen,P.F., Somes, N.L.G., and Lloyd, S.D. (1999*). Managing Urban Stormwater Using Constructed Wetlands*. Cooperative Research Centre (CRC) for Catchment Hydrology and Department of Civil Engineering, Monash University: Clayton, Victoria, Australia.

aecom.com