Cotswold District Council Local Plan Partial Update: Water Cycle Study

Final

July 2025

Prepared for:

COTSWOLD
District Council

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This report describes work commissioned by Cotswold District Council. The Client's representative for the contract was Joanne Corbett of Cotswold District Council. Jessica Creber, James Fitton and Paul Eccleston of JBA Consulting carried out this work.

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Abbreviations

AMP	Asset Management Plan
AONB	Area of Outstanding Natural Beauty
BNG	Biodiversity Net Gain
BOD	Biological Oxygen Demand
CAMS	Catchment Abstraction Management Strategy
CC	Carbon Calculator
CDC	Cotswold District Council
CIRIA	Construction Industry Research and Information Association
CSO	Combined Sewer Overflow
DEFRA	Department of the Environment, Food and Rural Affairs
DWMP	Drainage and Wastewater Management Plan
EA	Environment Agency
EC	European Community
EN	English Nature
GIS	Geographical Information System
HM	High Mileage
ID	Identifier
JNCC	Joint Nature Conservation Committee
LFRMS	Local Flood Risk Management Strategy
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NFM	Natural Flood Management
NPPF	National Planning Policy Framework
PPG	Planning Policy Guidance
Ramsar	The intergovernmental Convention on Wetlands, signed in Ramsar, Iran, in 1971
RBMP	River Basin Management Plan
SAC	Special Area of Conservation
SFRA	Strategic Flood Risk Assessment
SHELAA	Strategic Housing and Economic Land Availability Assessment
SPA	Special Protection Area

SSSI	Site of Special Scientific Interest
STW	Sewage Treatment Works
TBC	To be confirmed
UKWIR	UK Water Industry Research Ltd
WFD	Water Framework Directive
WRMP	Water Resources Management Plan
WTW	Water Treatment Works
WWTW	Waste Water Treatment Works
AONB	Area of Outstanding Natural Beauty
CDC	Cotswold District Council
EA	Environment Agency
HoF	Hands off Flow
LPA	Local Planning Authority
NDP	Neighbourhood Development Plan
NPPF	National Planning Policy Framework
SHELAA	Strategic Housing and Economic Land Availability Assessment

1 Introduction

1.1 Terms of reference

JBA Consulting was commissioned by Cotswold District Council (CDC) to undertake a Water Cycle Study (WCS) to provide evidence to support their Local Plan Partial Update. This will provide an assessment of the impact of the preferred options on water infrastructure and the water environment[1].

This assessment commenced in 2022, but was placed on extended periods of hold, at the request of Cotswold District Council, as a result of changes in the Council's approach to the Local Plan Partial Update (LPPU) and a future fully revised Local Plan, and due to the changes in the National Planning Policy Framework in 2024. Consequently, some of the assessments reported herein were undertaken during 2022 and 2023, and the age of data used reflects this. This is considered acceptable given the minor changes to growth in the District resulting from the LPPU[2].

1.2 Structure of report

The requirements and objectives of the WCS are set out in the section below. This is followed by the planned growth in and around Cotswold District in Section 2 and Section 3 that contains the relevant environmental and water industry policy and legislation. Then the report is structured by each topic in the water cycle study with the sections assessing the impact of growth on the respective topic.

1.3 The Water Cycle

Planning Practice Guidance on Water Supply, Wastewater and Water Quality (HM Government, 2019) describes a water cycle study as:

"a voluntary study that helps organisations work together to plan for sustainable growth. It uses water and planning evidence and the expertise of partners to understand environmental and infrastructure capacity. It can identify joined up and cost-effective solutions, that are resilient to climate change for the lifetime of the development.

The study provides evidence for Local Plans and sustainability appraisals and is ideally done at an early stage of plan-making. Local authorities (or groups of local authorities) usually lead water cycle studies, as a chief aim is to provide evidence for

1 In line with the Regulation 18 consultation, February 2024.

2 **Please note that the WCS will be updated to support a full Local Plan Update (2025-2043).**

sound Local Plans, but other partners often include the Environment Agency and water companies."

The Environment Agency's guidance on WCS (Environment Agency, 2021) recommends a phased approach:

Stage 1: Scoping study, identifies if the water infrastructure capacity could constrain growth and if there are any gaps in the evidence you need to make this assessment. The scoping study will identify:

- The area and amount of proposed development;
- the existing evidence;
- main partners to work with; and
- evidence gaps and constraints on growth.

Stage 2: Detailed study, to provide the evidence to inform an integrated water management strategy. It will identify the water and flood management infrastructure that will mitigate the risks from too little or too much water. It will also identify what you need to do to protect and enhance the water environment.

As a WCS is not a mandatory document, Local Planning Authorities are advised to prioritise the stages of the WCS to integrate with their Local Plan programme. Figure 1-1 below shows the main elements that compromise the Water Cycle.

The natural water cycle describes the continuous transfers of water around the planet, from atmosphere to surface and back via evaporation, transpiration and precipitation, and the various flows and storage processes that occur. The artificial water cycle looks at the availability of water resources for human consumption, its treatment and supply to homes and business, its use and consequently the generation of wastewater. It then looks at how wastewater is taken away, treated, and finally what happens when it is returned to the environment.

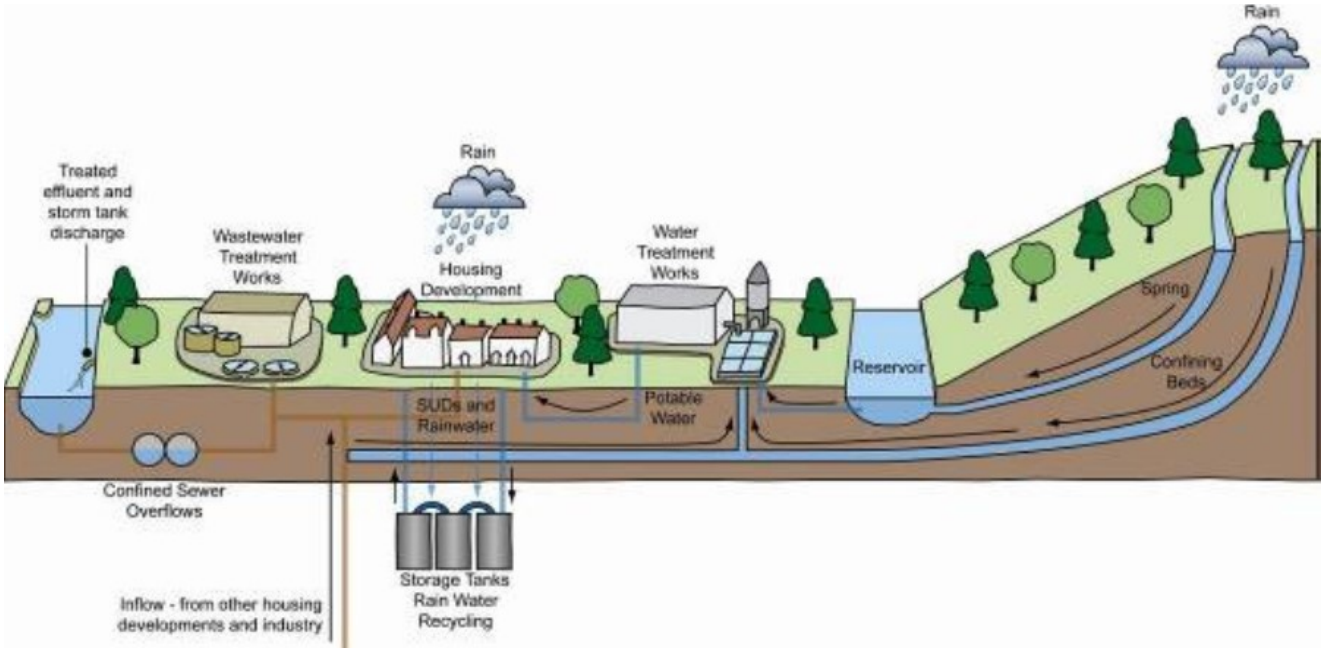

Figure 1-1: The Water Cycle

1.4 Impacts of Development on the Water Cycle

New homes require the provision of clean water, safe disposal of wastewater and limitation of flood risk. It is possible that allocating large numbers of new homes at some locations may result in the capacity of the existing available infrastructure being exceeded. This situation could potentially lead to service failures to water and wastewater customers, have adverse impacts on the environment or cause the high cost of upgrading water and wastewater assets being passed on to bill payers.

Climate change presents further challenges such as increased intensity and frequency of rainfall and a higher frequency of drought events that can be expected to put greater pressure on the existing infrastructure. Development, when planned correctly, can also offer opportunities to reduce flood risk to existing properties and increase community resilience, contribute to nature recovery, and allow a collaborative approach to infrastructure.

1.5 Objectives

At the time of writing, CDC was preparing a partial update to the adopted Local Plan (the Local Plan Partial Update (LPPU)), until July 2025 when Full Council voted to combine the Partial Update and Development Strategy and Sites Allocation Plan into a single Full Local Plan Update.[3]

The Water Cycle Study is required in order to assess the constraints and requirements that will arise from the potential growth on the water infrastructure.

3 **The WCS will be updated to support the full Local Plan Update.**

The overall objective of the Water Cycle Study is to understand the environmental and physical demands of the planned development and identify opportunities for more sustainable planning and improvements that may be required so that proposals don't exceed the existing water cycle capacity. This is assessed by considering the following issues:

- Water Resources
- Water Supply;
- Wastewater Collection and Treatment;
- Water Quality and the Environment;
- Flood Risk, and
- Climate Change.

This report focuses upon the proposed site allocations provided by the Council. The report outlines the current status of the environment and infrastructure, identifies the possible constraints to the development, the impacts and demands of the development, and gives recommendations as to any improvements or mitigation required including approximate costings.

1.6 Study Area

The study area is Cotswold District Council area within the county of Gloucestershire. The district covers a largely rural area, with the main towns being Cirencester, Tetbury, Morton-in-Marsh and Chipping Campden (see Figure 1-2). Cotswold District has a population of 90,800 (Office for National Statistics, 2022).

Significant watercourses within the study area are the River Thames, Coln, Churn, Dikler, Evenlode, Windrush, Leach and Ampney Brook.

Some of the keys transport routes passing through the study area are the A429, A40, A417, A419 and A433.

1.7 Authorities responsible for Water Resources and Wastewater Management in Cotswold District

Within Cotswold District there are several authorities and regulators responsible and involved in supply, managing and overseeing the water supply, wastewater and the environment. The table below explains the responsibilities of each.

Table 1-1: Responsibilities of authorities within Cotswold District

Authority Name	Key Responsibilities of different authorities
Environment Agency (EA)	The EA are the environmental regulators in the UK. Their responsibilities are within water quality, flood risk and administrating water abstraction licences. They are a statutory consultee for many development plan documents and for some planning applications. They advise on environmental and infrastructure capacity issues across the water cycle.
Natural England (NE)	Natural England are the Government's advisors on the natural environment, which they have a responsibility to protect and enhance. In a WCS they may provide information on the conservation objectives, and guidance on, the protection of designated sites.
Bristol Water, Severn Trent and Thames Water,	Bristol Water, Severn Trent and Thames Water are the water suppliers for the Cotswold district; therefore, they have a statutory duty under the Water Industry Act to maintain an efficient and economical system of water supply within their areas and supply households with a reliable and sufficient water supply.
Severn Trent, Thames Water and Wessex Water	Severn Trent, Thames Water and Wessex Water are the sewerage undertaker for the district. This means they have a duty under the Water Industry Act to provide, improve and extend a system of public sewers (for both domestic and trade flows) so as to cleanse and maintain those sewers (and any lateral drain), to ensure that the area that they serve is effectually drained. There is also a duty to make provision for the emptying of those sewers, normally through sewage treatment works or where appropriate through discharges direct to watercourses.

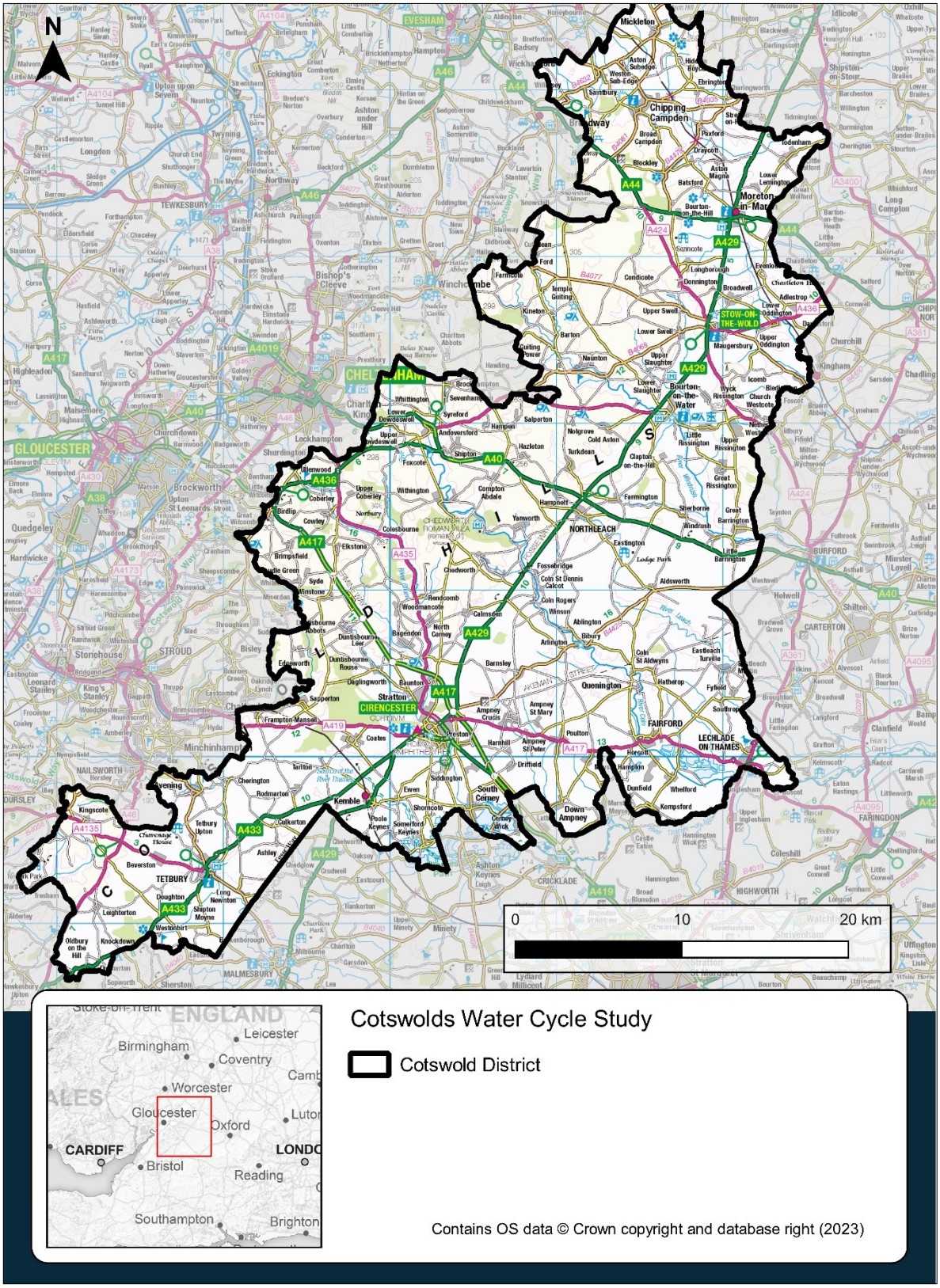

Figure 1-2: Cotswold District study area

1.8 Record of Engagement

Preparation of a WCS requires significant engagement with stakeholders, within the Local Planning Authority area, with water and wastewater utilities, with the Environment Agency, and where there may be cross-boundary issues, with neighbouring local authorities. This section forms a record of engagement for the WCS. Further engagement will take place if necessary as the Local Plan progresses.

1.8.1 Engagement

The preparation of this WCS was supported by the following engagement:

Inception meeting

Engaged parties	Cotswold District Council
Details	Scope of works and data collection requirements.

Neighbouring authorities

Engaged parties	Cheltenham Borough Council Stratford-on-Avon District Council Stroud District Council Tewkesbury Borough Council West Oxfordshire District Council Wiltshire Council Wychavon District Council
Details	Request for housing growth that would be served by WwTW within or shared with the Cotswold District.

Collaboration with Water Companies

Engaged parties	Bristol Water Severn Trent Water Thames Water Wessex Water
Details	Comments requested on housing growth impacts on infrastructure.

2 Future Growth in Cotswold District

2.1 Growth in Cotswold District

The current Local Plan, covering the period from 2011 to 2031, was adopted in August 2018 by the Cotswold District Council (CDC) (Cotswold District Council, 2018). At the time of writing, the Council was preparing a partial update of the adopted Local Plan (the Local Plan Partial Update (LPPU)). In July 2025 Full Council voted to combine the Partial Update and Development Strategy and Sites Allocation Plan into a single Full Local Plan Update. The adoption of the next plan is anticipated in 2027 (winter) (Cotswold District Council, 2025).

The Cotswold District Council's LPPU addresses changes in the development growth rate by revising policies to better align with current needs and future projections. The update aims to manage growth more effectively by incorporating new data and responding to emerging trends and challenges. This does not include adjusting housing targets or making significant additional land allocations, although one new mixed-use allocation is proposed in Moreton-in-Marsh and some additional infrastructure requirements are included to ensure sustainable development across the district. A new criteria-based policy is also proposed, which is hoped to bring forward some additional housing sites next to Principal Settlements in a plan-led way.

To assess the impact of the plan on water infrastructure and the environment, existing growth commitments and allocations from the adopted Local Plan need to be quantified alongside potential new allocations and policies. CDC provided the following information:

- Proposed site allocations and site allocations that are proposed to be extended or reduced in size in the Partial Local Plan Update
- Existing Local Plan allocations (2011-2031)
- Changes to the site allocations proposed for the Local Plan Partial Update
- Committed sites (those with planning permissions at 1 April 2023)
- Recent completions (development sites completed in 2020/21, 2021/22 and 2022/23)
- Holiday home permissions (granted between April 2020 and January 2023)

All of this growth data was collated into the site tracker, an Excel spreadsheet used to track and evaluate water and wastewater demands from development sites. This includes information such as site size, which Water Resource Zone (WRZ) the site is in and which Wastewater Treatment Works (WwTW) the site is served by.

2.2 Future changes in growth in Cotswold District

The government establishes specific housing needs for each council annually to ensure that housing development aligns with the unique demographic, economic, and social requirements of different regions. By setting tailored housing targets, the government can better manage population growth, support local economies, and provide adequate housing for communities.

In December 2024, the government increased the annual housing requirement for Cotswold District to 1,036 homes. For context, the adopted Local Plan housing requirement averages 420 homes per year. However, the Partial Local Plan Update does not establish a new housing requirement or allocate sites to deliver 1,036 homes annually. The increase in the annual housing requirement is, therefore, not considered in this study.

2.3 Development sites in Cotswold District

2.3.1 Local Plan Partial Update changes to site allocations

CDC provided details of one new housing allocation, M72 Fire Service College, Moreton-in-Marsh, that is being added for allocation within the Local Plan Partial Update. This site is listed in Table 2-1 and Table 2-6. There are four housing sites that are proposed to be removed from the Local Plan, the details of which are in Table 2-6. A total of 12 allocations in the existing plan are to be deleted due to now having full planning permission (Table 2-6) or to being no longer deliverable (Table 2-7)

Table 2-6

For employment and mixed-use sites, the potential employment space is required to calculate the likely number of employees and hence the water demand. Where this was not defined, the employment space was estimated to be 40% of the site area. This estimation has been benchmarked in other council areas where site areas and employment space was known.

Updated housing allocations can be found in Figure 2-1 below.

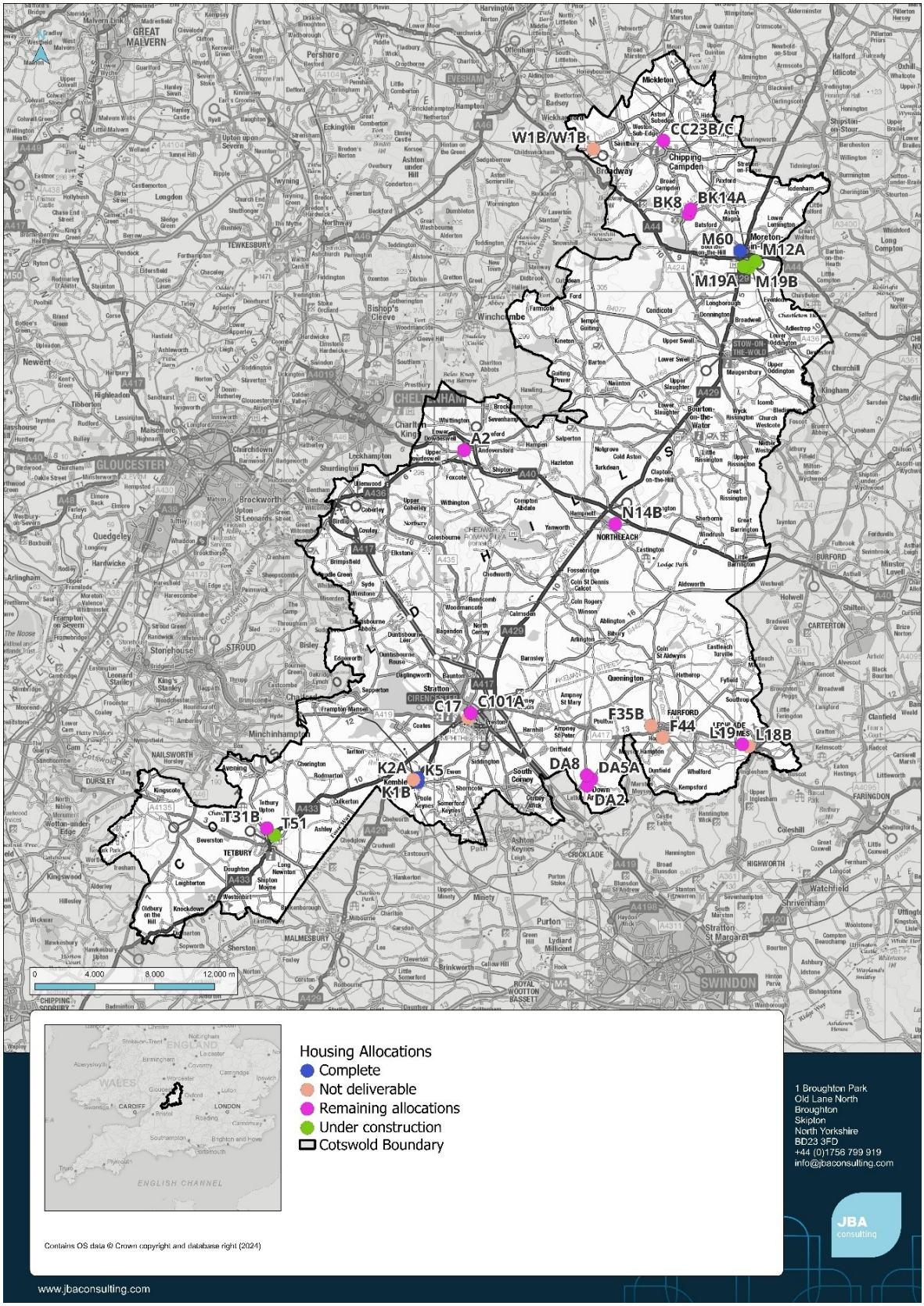

Figure 2-1 Updated local plan allocation sites

Table 2-1 Proposed new housing and employment allocations under the Local Plan Partial Update

Reference	Location	Area (ha)	Potential Housing (units)	Housing, employment or mix
M72	Fire Service College, Moreton-in-Marsh	17.55	310	Mix
C52	Allocate former Argos site for inclusion in Framework Masterplan	0.29	N/a	Employment
ME6	Allocate land at the Fire Service College for enabling employment development	12.50	N/a	Employment
Total		**30.34**	**310**	

Table 2-2 Site allocations that have been reduced or extended

Reference	Location	Previous Area (ha)	Current Area (ha)	Change in Area (ha)
C101A/B	Extend the Magistrates Court allocation to include the Police Station	0.10	0.24	+ 0.14
CIRE16A	Extend the Brewery Car Park allocation to include the southern part of the car park and the former Tesco supermarket	1.08	0.99	+ 0.09
CIR13B	Reduce the allocation at Sheep Street Island (ref: CIR13B) to exclude McGills Chartered Accountants	0.96	0.67	0.29

2.3.2 Adopted Local Plan allocations without planning permission

A total of 18 housing allocations from the adopted Local Plan are proposed to be deleted due to now having full planning permission (Table 2-3Table 2-6).Table 2-7

Table 2-3: Deleted Local Plan remaining housing allocations without planning permission

Reference	Location	Area (ha)	Potential Housing (units)	Potential Employment space (m^2)
A2	Land to rear of Templefields & Crossfields, Andoversford	2.31	52	N/a
BK8	Land at Sheafhouse Farm, Blockley	0.55	13	N/a
BK14A	The Limes, Station Road, Blockley	1.52	9	N/a
CC 23B/C	Land at Aston Road, Chipping Campden	0.00	36	N/a
C101A	Magistrates Court, Cirencester	0.10	5	N/a
DA8	Land at Broadleaze, Down Ampney	0.42	10	N/a
L19	Land south of Butler's Court, Lechlade	0.95	9	N/a
N14B	Land adjoining East End & Nostle Road, Northleach	2.73	17	N/a
T31B	Land adjacent to Blind Lane, Tetbury	2.01	43	N/a
C101A/B	Magistrates Court and Police Station	0.10	0	410
BOWE1	Land north of Bourton Industrial Estate / Business Park, Bourton-on-the-Water	3.38	N/A	N/a
M72	Fire Service College, Moreton-in-Marsh	17.55	310	N/a
M12A	Land at Evenlode Road, Moreton-in-Marsh	3.59	63	N/a
M19A & M19B	Land south-east of Fosseway Avenue, Moreton-in-Marsh	14.42	119	N/a
T51	Northfield Garage, Tetbury	0.69	18	N/a

Reference	Location	Area (ha)	Potential Housing (units)	Potential Employment space (m^2)
K1B	Land between Windmill Road and A429, Kemble	0.54	13	N/a
K5	Land north-west of Kemble Primary School, Kemble	0.38	11	N/a
M60	Former Hospital site, Moreton-in-Marsh	0.79	21	N/a
Total		**52.03**	**749**	**410**

CDC have provided the locations and number of units of remaining sites that are allocated in the adopted Local Plan, but which do not yet have planning permission. This includes 18 housing sites (Table 2-7), three employment sites (Table 2-4) and six mixed used sites (Table 2-5).

Table 2-4: Local Plan remaining employment allocations without planning permission

Reference	Location	Area (ha)	Potential Housing (units)	Potential Employment space (m^2)
LECE1	Land north of Butler's Court	1.25	N/A	5,000
CCNE1	Battle Brook / Extension to Campden Business Park, Chipping Campden	0.67	N/A	N/A
M72	Fire Service College B, Moreton-in-Marsh	17.55	310	N/a
Total		**19.47**	**310**	**5,000**

Table 2-5: Local Plan remaining mixed-use allocations without planning permission

Reference	Location	Area (ha)	Potential Housing (units)	Potential Employment space (m^2)
CIR13B	Sheep Street Island, Cirencester	0.96	N/A	3,840

Reference	Location	Area (ha)	Potential Housing (units)	Potential Employment space (m^2)
CIRE16A	Brewery Car Park Cirencester	1.08	N/a	4,320
CIRE10	Forum Car Park, Cirencester	0.54	24	900
C97	Old Memorial Hospital Site & Car Park, Sheep Street, Cirencester	0.38	0	1,520
W7A	Land north of B4632 and east of employment estate, Willersey	3.95	49	1,970
CIRE14	Waterloo Car Park, Cirencester	0.67	N/A	2,680
Total		**7.58**	**73**	**15,230**

A total of 12 allocations in the existing plan are to be deleted due to now having full planning permission (Table 2-6) or to being no longer deliverable (Table 2-7)

Table 2-6: Existing Local Plan Allocations deleted due to having planning permission

Reference	Location	Area (ha)	Potential Housing (units)	Potential Employment space (m^2)	Status
M12A	Land at Evenlode Road, Moreton-in-Marsh	3.59	63	N/a	Under construction
M19A & M19B	Land south-east of Fosseway Avenue, Moreton-in-Marsh	14.42	119	N/a	Under construction
T51	Northfield Garage, Tetbury	0.69	18	N/a	Under construction
K1B	Land between Windmill Road and A429, Kemble	0.54	13	N/a	Complete
K5	Land north-west of Kemble Primary School, Kemble	0.38	11	N/a	Complete
M60	Former Hospital site, Moreton-in-Marsh	0.79	21	N/a	Complete
Total		**16.82**	**182**	**N/a**	

Table 2-7: Existing Local Plan allocations deleted in the Local Plan Partial Update due to not being deliverable

Reference	Location	Area (ha)	Potential Housing (units)	Potential Employment space (m^2)
C17	42-54 Querns Lane	0.18	6	N/a
F35B	Land behind Milton Farm and Bettertons Close	1.95	49	N/a
F44	Land to rear of Faulkner Close, Horcott	1.14	12	N/a
K2A	Land at Station Road	0.35	8	N/a
L18B	Land west of Orchard Close, Downington	0.54	9	N/a
W1A/W1B	Garage Workshop and Garden behind the Nook, Main Street	0.17	5	N/a
Total		**4.33**	**89**	**N/a**

2.3.3 Commitments and completions

CDC provided details of 284 commitment sites where planning permission has been approved. All of these sites are residential, with a total of 3,553 homes across all sites. Similarly, details of 124 sites completed between 2021/22 and 2023/24, totalling 1,074 homes, were provided, see Table 2-8. These were included in the site tracker to ensure that recently completed housing, which may not yet fully show up in the wastewater flow data, is accounted for in the WCS assessments.

Table 2-8 Commitments and completions from 2020/21, 2021/22 and 2022/23

Years	Number of homes
2020/21	376
2021/22	349
2022/23	349
Total	**1,074**

Additionally, CDC provided the location and size for 68 holiday home sites with planning permission. This totals a net gain of 1,000 holiday homes. Within the WCS, these are treated as if they were new residential units, although it is acknowledged that their occupancy density and seasonality will be different to residential units.

2.3.4 Windfall

Windfall sites are sites that are not specifically allocated in the Local Plan. The adopted Local Plan includes an allowance for windfall, consistent with the National Planning Policy Framework (NPPF). CDC have provided the windfall allowances for each parish; an overall summary can be found in

Table 2-9.

Table 2-9: Windfall allowances summary

Period	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31
Windfall allowances	52	91	136	136	137	136	136	137	136

2.4 Growth in neighbouring authorities

2.4.1 General Approach

Where growth within a neighbouring Local Planning Authority (LPA) area may be served by infrastructure within or shared with the Cotswold District, the LPA were contacted as part of a duty to cooperate request to provide information on:

- The latest growth forecast (housing and employment) for the district.
- Details of future growth within the catchments of the WwTW which serve part of their council area and that of Cotswold District.

2.4.2 Cheltenham

Cheltenham Borough Council provided information on significant sites from the adopted 2020 Cheltenham Plan and those within the Gloucester, Cheltenham and

Tewkesbury Joint Core Strategy. These sites are served by Severn Trent but will not share infrastructure with Cotswold District's existing or potential site allocations.

2.4.3 Tewkesbury

Tewkesbury Borough Council provided the development allocation data from both the Tewkesbury Borough Plan and the Gloucester, Cheltenham and Tewkesbury Joint Core Strategy. These sites are within the Severn Trent catchment but will not share infrastructure with the Cotswold District's existing or potential site allocations.

2.4.4 Joint Core Strategy[4]

Sites within the Gloucester, Cheltenham and Tewkesbury Joint Core Strategy have been provided. These sites are served by Severn Trent but will not share infrastructure with the Cotswold District's existing or potential site allocations.

2.4.5 South Gloucestershire

No data on growth in shared wastewater catchments has been provided by South Gloucestershire District Council.

2.4.6 Stratford-on-Avon

Stratford-on-Avon District Council provided their most recently published data in their Core Strategy, from the 2021 - 2022 monitoring year. These sites are within the Severn Trent catchment, but will not share infrastructure with Cotswold District's existing or potential site allocations.

2.4.7 Stroud

Stroud District Council's planning team provided the proposed allocations included in the Draft Local Plan 2021. These sites are within the Severn Trent catchment, but will not share infrastructure with Cotswold District's existing or potential site allocations.

2.4.8 Swindon

No data on growth in shared wastewater catchments has been provided by Swindon Borough Council.

2.4.9 Vale of White Horse

No data on growth in shared wastewater catchments has been provided by Vale of White Horse District Council.

4 Now known as the Strategic Local Plan or 'SLP'

2.4.10 West Oxfordshire

No data on growth in shared wastewater catchments has been provided by West Oxfordshire District Council.

2.4.11 Wiltshire

Wiltshire Council provided the location and size of future housing development sites from their Neighbourhood Plan and outlined permissions. None of the sites share a common WwTW with the Cotswold District.

2.4.12 Wychavon

Wychavon District Council provided the allocated sites from the draft South Worcestershire Development Plan. These sites are within the Severn Trent catchment, and will be served by the Honeybourne WwTW, which serves Cotswold District and would be serving the proposed allocations.

WwTW	Proposed number of dwellings	Potential employment space (m^2)	Period
Honeybourne	None identified	31	Up to 2041

2.5 Preparing the development scenario for testing

Site information covering proposed new allocations, existing commitments and recent completions, alongside commitments in neighbouring local authorities, were collated into the "site tracker" spreadsheet. This was used to allocate development sites to water supplier and Water Resource Zones (WRZ), and to sewerage undertakers and wastewater catchments. The spreadsheet then forecasts the future growth in water and wastewater demand, which is then used in the following sections to assess the capacity of the water and wastewater systems, and the environment, to accommodate this growth.

3 Policy and legislation

3.1 Introduction

The following sections introduce several national, regional, and local policies that must be considered by the Local Planning Authority (LPA), water companies and developers during the planning stage. Key extracts from these policies are presented as well as links to the full text. Whilst care has been taken to ensure that the information presented in this report was up to date at the time of writing, policy and guidance can change rapidly and the reader should ensure that the most up to date information is sought.

3.2 Plan-making

The National Planning Policy Framework (NPPF) (Department for Levelling Up, Housing and Communities, 2023) was originally published in 2012, as part of reforms to make the planning system less complex and more accessible, to protect the environment and to promote sustainable growth.

Local Plans are the primary mechanism by which plan-led spatial planning is implemented in England. Local Plans must be prepared by Local Planning Authorities (LPAs) and include:

- Strategic policies which set out the "overall strategy for the pattern, scale and design duality of places", including for the provision of infrastructure, transportation and community facilities.
- Non-strategic policies, which "set out more detailed policies for specific areas, neighbourhoods or types of development. This can include allocating sites, the provision of infrastructure and community facilities at a local level."

Under the Localism Act (HM Government, 2011) new rights were provided to allow local communities to come together and shape the development and growth of their area by preparing Neighbourhood Development Plans, or Neighbourhood Development Orders, where the ambition of the neighbourhood is aligned with strategic needs and priorities for the area. Neighbourhood Plans can make non-strategic policies, aligned to the strategic policies of the Local Plan. As neighbourhoods draw up their proposals, Local Planning Authorities are required to provide technical advice and support to communities.

3.3 Water and the Planning System

3.3.1 National Planning Policy Framework and water

The NPPF provides guidance to planning authorities to take account of flood risk and water and wastewater infrastructure delivery in their Local Plans. Key paragraphs include:

- Paragraph 34: “Plans should set out the contributions expected from development. This should include setting out the levels and types of affordable housing provision required, along with other infrastructure (such as that needed for education, health, transport, flood and water management, green and digital infrastructure). Such policies should not undermine the deliverability of the plan.”
- Paragraph 158: “Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply...”
- Paragraph 180e: “…preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans”.

3.3.2 Planning Practice Guidance overview

Planning Practice Guidance (PPG) was originally issued in 2014 by the Department for Communities and Local Government, with the intention of providing guidance on the application of the NPPF. The individual guidance documents are updated periodically. The following guidance documents are particularly relevant to a WCS:

- Water Supply, Wastewater and Water Quality (HM Government, 2019)
- Housing - Optional Technical Standards (HM Government, 2015a)
- Flood Risk and Coastal Change (HM Government, 2022)

3.3.3 PPG - Water Supply, Wastewater and Water Quality

Two key passages from the PPG (Para 002) provide an overview of what needs to be considered plan-making authorities, and provide a basis for the work contained in a WCS or IWMS:

"Early discussions between strategic policy-making authorities and water and sewerage companies can help to ensure that proposed growth and environmental objectives are reflected in company business plans. Growth that requires new water

supply should also be reflected in companies' long-term water resources management plans. This will ensure that the necessary infrastructure is funded through the water industry's price review."

"Strategic policy-making authorities will also need to consider the objectives in the government's 25 Year Environment Plan to reduce the damaging abstraction of water from rivers and groundwater, and to reach or exceed objectives for rivers, lakes, coastal and ground waters that are specially protected."

A summary of the advice for plan-makers and for planning applications is contained below but it is recommended that the full text is reviewed.

Plan-making considerations - Infrastructure (Para 005)

- Identification of suitable sites for new or enhanced infrastructure, including the location of existing and proposed development.
- Consider whether new development is appropriate near to water and wastewater infrastructure (for example due to odour concerns).
- Phasing new development so that water and wastewater infrastructure will be in place when needed. Infrastructure should also be in place before any environmental effects occur on designated sites of importance for biodiversity.

Plan-making considerations - Water quality (Para 006)

- How to help protect and enhance local surface water and groundwater in ways that allow new development to proceed and avoids costly assessment at the planning application stage.
- The type or location of new development where an assessment of the potential impacts on water bodies may be required.
- Whether measures to improve water quality, (e.g., SuDS schemes) can be used to address water quality in addition to flood risk.

Plan-making considerations - Wastewater (Para 007)

- The sufficiency and capacity of wastewater infrastructure.
- The circumstances where wastewater from new development would not be expected to drain to a public sewer (such as via a package treatment sewage treatment works or septic tank).
- The capacity of the environment to receive effluent from development without preventing statutory objectives being met.

Early engagement with the LPA, the EA, and relevant water and sewerage companies can help establish whether any particular water and wastewater issues need to be considered.

Considerations for planning applications - Water supply (Para 016)

Water supply planning would normally be addressed through the LPA's strategic policies and reflected in the water companies WRMPs. Water supply is therefore

unlikely to be a consideration for most planning applications. However, some exceptions might include:

- Large developments not identified in plans that are likely to require a large volume of water; and/or
- significant works required to connect the water supply; and/or
- where a plan requires enhanced water efficiency in new development as part of a strategy to manage water demand locally.

Considerations for planning applications - Water quality (Para 016)

Water quality is only likely to be a significant planning concern where a proposal would:

- Involve physical modifications to a water body such as flood storage areas, channel diversions and dredging, removing natural barriers, construction of new locks, new culverts, major bridges, new barrages or dams, new weirs, and removal of existing weirs; and/or
- indirectly affect water bodies, for example:
- As a result of new development such as the redevelopment of land that may be affected by contamination, mineral workings, water and wastewater treatment, waste management facilities and transport scheme including culverts and bridges.
- Result in runoff into surface water sewers that drain directly, or via a combined sewer, into sensitive waterbodies e.g., waterbodies with a local, national or international habitat designation.
- Through a lack of adequate infrastructure to deal with wastewater.
- Through a local of adequate infrastructure to deal with wastewater where development occurs in an area where there is strategic water quality plan e.g., a nutrient management plan, River Basin Management Plan, Water Cycle Study, Diffuse Water Pollution plan or sewerage undertakers' drainage strategy which set out strategies to manage water quality locally and help deliver new development.

3.3.4 PPG - Housing - Optional Technical Standards

This guidance advises planning authorities on how to gather evidence to set optional requirements, including for water efficiency. It states that “all new homes already must meet the mandatory national standard set out in the Building Regulations (of 125 litres /person /day). Where there is a clear local need, local planning authorities can set out Local Plan policies requiring new dwellings to meet the tighter Building Regulations optional requirement of 110 litres/person/day. Planning authorities are advised to consult with the EA and water companies to determine where there is a clear local need, and also to consider the impact of setting this optional standard on housing viability. Viability is reviewed in section 3.4.4.

3.4 Water and design

3.4.1 Building regulations

The Building Regulations (2010) Part G was amended in early 2015 to require that all new dwellings must ensure that the potential water consumption must not exceed 125 litres/person/day, or 110 litres/person/day where required under planning conditions (HM Government, 2015b) (see Section 3.3.4).

The Environmental Improvement Plan (discussed in 3.7.2) contains a commitment to consider a new standard for new homes in England of 105 litres per person per day (l/p/d) and 100 l/p/d where there is a clear local need, such as in areas of serious water stress. Whilst this new standard is only under consideration, it demonstrates the direction of travel for water efficiency standards, and it is highly likely that this or a similar standard will be adopted.

3.4.2 Building Research Establishment

The Building Research Establishment (BRE) publish an internationally recognised environmental assessment methodology for assessing, rating, and certifying the sustainability of a range of buildings.

New homes are most appropriately covered by the Home Quality Mark (BRE, BRE, 2023a), and commercial, leisure, educational facilities and mixed-use buildings by the Building Research Establishment Environmental Assessment Methodology (BREEAM) UK New Construction Standard (BRE, BREEAM, 2018b).

Using independent, licensed assessors, BREEAM/HQM assesses criteria covering a range of issues in categories that evaluate energy and water use, health and wellbeing, pollution, transport, materials, waste, ecology, and management processes.

In the Homes Quality Mark, 400 credits are available across 11 categories and lead to a star rating. 18 credits are available for water efficiency and water recycling. A greater number of credits are awarded for homes using water efficient fittings (with the highest score achieving 100l/p/d or less), and further credits are awarded for the percentage of water used in toilet flushing that is either sourced from rainwater or from grey water.

The BREEAM New Construction Standard awards credits across nine categories, four of which are related to water: water consumption, water monitoring, leak detection and water efficient equipment. This leads to a percentage score and a rating from “Pass” to “Outstanding”.

Through the Local Plan, the Council has the opportunity to seek BREEAM or HQM status for all new, residential, and non-residential buildings.

3.4.3 Energy and Water

18% of the UK's domestic energy usage is for water heating (Department for Energy Security and Net Zero, 2022). If less water was being used within the home, for instance through more water efficient showers, less water would need to be heated, and overall domestic energy usage would be reduced.

The Government is currently analysing the results of a 2019 consultation on a Future Homes Standard that will involve changes to Part L (conservation of fuel and power) of the Building Regulations for new dwellings. Whilst there is no direct mention of water efficiency in this consultation, there is an important link between water use and energy use, and therefore between water use and the whole-life carbon cost of developments.

3.4.4 Viability

The evidence for the costs of meeting the optional 110l/p/d water efficiency target in new homes indicate that the costs are minimal:

- A 2014 study into the cost of implementing sustainability measures in housing found that meeting a standard of 110 litres per person per day would cost only £12 (at 2023 prices) for a four-bedroom house (EC Harris, 2014).
- The Committee on Climate Change report - UK Housing: Fit for the Future - stated that the cost of "requiring all homes in England to be built to 110 l/p/d is possible under Part G of regulations and would be no additional cost." (Committee on Climate Change, 2019)
- Heating water accounts for 18% of energy used in the home (Department for Energy Security and Net Zero, 2022) This would cost a 2-3 person, 3-bed household an average of £352 per year in energy at 2023 costs (British Gas, 2023). Water efficiency is therefore not only viable but of positive economic benefit to both private homeowners and tenants.

There is less evidence available on the costs of going below 110l/p/d. The Sussex North Water Neutrality Strategy (JBA Consulting, 2022) found that the additional cost to meet 85l/p/d using water efficient fittings would be between £349 and £431 per dwelling, or £1,049 to £1,531 where white-goods appliances would not otherwise have been installed in the dwelling (2022 prices).

3.5 The Water Industry

3.5.1 The Water Industry in England

Water and sewerage services in England and Wales are provided by eleven Water and Sewerage Companies (WaSCs) and six 'water-only' companies. The central legislation relating to the industry is the Water Industry Act 1991. The companies operate as regulated monopolies within their supply regions, although very large water

users and developments are able to obtain water and/or wastewater services from alternative suppliers - known as inset agreements.

The Water Act 2014 aims to reform the water industry to make it more innovative and to increase resilience to droughts and floods. Key measures could influence the future provision of water and wastewater services include:

- Non-domestic customers will be able to switch their water supplier and/or sewerage undertaker (from April 2017);
- new businesses will be able to enter the market to supply these services;
- measures to promote a national water supply network; and
- enabling developers to make connections to water and sewerage systems.

The water industry is primarily regulated by three regulatory bodies:

- **Economic regulation:** Office of Water Services (Ofwat) are the economic regulator. They have a statutory duty to protect the interests of consumers, ensuring water companies carry out their functions (customer service standards, environmental rules, drinking water standards etc) and can finance them. Part of this role is setting the limits on pricing of water and sewerage services.
- **Environmental regulation:** The Environment Agency are the environmental regulator. They are responsible for monitoring the impact of the water industry (as well as others) on the environment and issuing permits for abstraction of water and discharge of wastewater.
- **Drinking water regulation:** Finally, the Drinking Water Inspectorate (DWI) implement standards for drinking water and can take enforcement measures against water companies if those standards are not met.

3.5.2 Planning and funding of the water industry

The water industry works on a five-year cycle called the Asset Management Plan period or AMP periods. Every five years a water company submits a Business Plan to Ofwat for a Price Review. These plans set out the companies' operational expenditure (OPEX) and capital expenditure (CAPEX) required to maintain service standards, enhance service (for example where sewer flooding occurs), to accommodate growth and to meet environmental objectives defined by the Environment Agency. Ofwat assesses and compares the plans with the objective of ensuring what are effectively supply monopolies are operating efficiently, and that the company is meeting its obligations. It then sets the allowable price increase for consumers based on the retail prices index, the business plan, and taking into consideration affordability for consumers. The current AMP period is AMP 7 (2020-2025), and the price of water for this period was set by Ofwat late in 2019 in a process referred to as Price Review 19 (PR19). The new price came into effect in April 2020. Ofwat's new price review, known as PR24, is set to come into effect on 1 April 2025. This review will determine the price limits and performance commitments for water companies in England and Wales

for the period from April 2025 to March 2030. This system gives stability in pricing. Within this price review process there may also be incentives and penalties on the water company for exceeding or failing to meet targets.

When considering investment requirements to accommodate growing demand, water companies are required to ensure a high degree of certainty that additional assets will be required before funding them. Longer term growth is, however, considered by the companies in their internal asset planning processes and in their 25-year Strategic Direction Statements and WRMPs.

The Water Industry National Environment Programme (WINEP) is a set of actions that are defined by the EA and given to all water companies operating in England for completion during a particular AMP period. The aim of the programme is to support the objectives in the Water Framework regulations. Examples of typical actions could include investigations into the sustainability of an abstraction, a reduction in an abstraction to support river flows, or new permit limits at a wastewater treatment works.

Water and wastewater infrastructure requires significant lead-times to plan, obtain planning and other permissions, finance and construct. The time required to provide new or upgraded infrastructure to serve a development or a larger spatial plan is highly locally specific. The following is provided as an indicative guide to lead-times.

Table 3-1: Indicative lead-times (years) for new infrastructure to serve development

Scale of development	Water supply	Water resources	Wastewater network	Wastewater treatment
Minor	1	N/A	1	N/A
Major	1-3	5-10	1-5	3-5
Strategic / Plan	3-5	10-20	5-10	5-10

3.5.3 Planning for Water

Water resource management plans

Water Resource Management Plans (WRMPs) are 25-year strategies that water companies are required to prepare, with updates every five years. In reality, water companies prepare internal updates more regularly. WRMPs are required to assess:

- Future demand (due to population and economic growth).
- Future water availability (including the impact of sustainability reductions).
- Demand management and supply-side measures (e.g., water efficiency and leakage reduction, water transfers and new resource development).
- How the company will address changes to abstraction licences.
- How the impacts of climate change will be mitigated.

- Where necessary, they set out the requirements for developing additional water resources to meet growing demand and describe how the balance between water supply and demand will be balanced over the period 2015 to 2040.
- Using cost-effective demand management, transfer, trading and resource development schemes to meet growth in demand from new development and to restore abstraction to sustainable levels.
- In the medium to long term, ensuring that sufficient water continues to be available for growth and that the supply systems are flexible enough to adapt to climate change.

Thames Water's final WRMP is published here. Severn Trent Water's revised WRMP is published here. Bristol Water's final WRMP is published here.

Drought Plan

Linked to the WRMP is a water company's drought plan. This is a requirement under the Water Industry Act 1991 (as amended by the water Act 2003). A water company must state how it will maintain a secure water supply and protect the environment during dry weather and drought. The plan will contain:

- Drought triggers - these are points where a water company will take action to manage supply and demand. They are based on monitoring of rainfall levels, river flows, groundwater levels and reservoir stocks.
- Demand management actions - how a water company will reduce demand for water during a drought. Actions that save water before taking more water from the environment must be prioritised. These could include:
- reducing leakage;
- carrying out water efficiency campaigns with customers;
- reducing mains pressure; and
- restricting water use, for example through temporary use bans which limit hosepipe and sprinkler use.
- Supply management actions - how a water company will maintain water supply during a drought. Actions that have the least effect on the environment must be prioritised. This could include:
- carrying out engineering work to improve its supply;
- transferring water in bulk from other water companies;
- using drought permits and drought orders to abstract more water;
- using desalination - permanent or temporary plants; and
- using tankers to supply customers with water directly.
- Extreme drought management actions - the actions it could take in an extreme drought. These could delay the need to use emergency restrictions standpipes and rota cuts.

- Communicating during a drought - a water company must set out how it will communicate in a clear and timely way during a drought with customers, partners or other stakeholders.
- Environmental assessment, monitoring and mitigation. A drought plan must include:
- an environmental assessment;
- an environmental monitoring plan for each supply management action; and
- details of mitigation measures the company plans to take for each supply management action.
- End of a drought - a water company must explain how it will identify when a drought is over or ending and the actions it will take during this stage, communicate this information to customers, and review its performance.

Regional water resource planning

Water resource planning is taking an increasingly regional focus, recognising the need for collaboration between water companies and sectors in order to address the challenges of climate change, increasing demand for water and protecting the water environment. Five regional groupings having been formed, including the Water Resources South East (WRSE) group which covers most of Cotswold District Council. An advisory group consisting of their regulators (Environment Agency and Ofwat) and Defra regularly attend meetings of WRSE.

WRSE are preparing a regional water resource plan for publication in 2023, which in turn will inform the next round of company WRMPs to be published in 2024/5. As part of this process, they have published an initial water resource position statement which sets out the water resources challenges and opportunities within the region.

The West Country Water Resources (WCWR) group covers the south-west area of the Cotswold that is supplied by Bristol Water. WCWR published their draft regional plan in January 2023

The Water Resources West (WRW) group covers the north area and areas along the western boundary of Cotswold District that is supplied by Severn Trent. WRW published their draft regional plan in November 2023

3.5.4 Planning for Wastewater

21st Century Drainage

The UK Water Industry Research (UKWIR) “21st Century Drainage” programme has brought together water companies, governments, regulators, local authorities, academics, and environmental groups to consider how planning can help to address the challenges of managing drainage in the future. These challenges include climate change, population growth, urban creep and meeting the Water Framework Directive.

The group recognised that great progress has been made by the water industry in its drainage and wastewater planning over the last few decades, but that, in the future, there needs to be greater transparency and consistency of long-term planning. The Drainage and Wastewater Management Plan (DWMP) framework (Water UK, 2018) sets out how the industry intends to approach these goals. Companies were required to published finalised DWMPs in 2023 to inform their business plans for the 2024 Price Review.

Drainage and Wastewater Management Plans (DWMPs)

DWMPs are consistently structured plans delivered at three spatial scales; company-wide, regional groupings and individual wastewater catchments. The framework defines drainage to include all organisations and all assets which have a role to play in drainage, although, as the plans will be water company led, it does not seek to address broader surface water management within catchments.

LPAs and LLFAs are recognised as key stakeholders and are invited to join, alongside other stakeholders, the Strategic Planning Groups (SPGs) organised broadly along river basin district catchments.

DWMPs aim to provide more transparent and consistent information on sewer flooding risks and the capacity of sewerage networks and treatment works, and this should be taken into account in SFRAs, Water Cycle Studies, as well as in site-specific FRAs and Drainage Strategies.

Thames Water's final DWMP, including interactive mapping, is published here and is reviewed in detail for the study area in sections 6.2.1 and 7.2.1.

Severn Trent Water's final DWMP, including interactive mapping, is published here and is reviewed in detail for the study area in sections 6.2.2 and 7.2.2.

Wessex Water's final DWMP, including interactive mapping, is published here, and is reviewed in detail for the study area in sections 6.2.3 and 7.2.3.

3.5.5 Developer Contributions and connection charges

A significant part of water company business is the interface with developers to facilitate connection to the public water supply and sewerage systems, through their developer services functions. Developments with planning permission have a right to connect to the public water and sewerage systems, however, there is no guarantee that the capacity exists to serve a development.

Developers may requisition a water supply connection or sewerage system or self-build the assets and offer these for adoption by the water company or sewerage undertaker. Self-build and adoption are usually practiced for assets within the site boundary, whereas requisitions are normally used where an extension of upgrading the infrastructure requires construction on third party land. The cost of requisitions is

shared between the water company and developer as defined in the Water Industry Act 1991.

The above arrangements are third party transactions because the Town and Country Planning Act Section 106 agreements and Community Infrastructure Levy agreements may not be used to obtain funding for water or wastewater infrastructure.

OfWAT, the water industry's economic regulator, published revised rules covering how water and wastewater companies may charge customers for new connections (OfWAT, 2020). These rules have applied to all companies in England since April 2018. The key changes include:

- More charges will be fixed and published on water company websites. This will provide greater transparency to developers and will also allow alternative connection providers to offer competitive quotations more easily.
- There will be a fixed infrastructure charge for water and one for wastewater.
- The costs of network reinforcement will no longer be charged directly to the developer in their connection charges. Instead, the combined costs of all of the works required on a company's networks, over a five-year rolling period, will be covered by the infrastructure charges paid for all new connections.
- The definition of network reinforcement has changed and will now apply only to works required as a direct consequence of the increased demand due to a development. Where the water company has not been notified of a specific development, for example when developing long-term strategic growth schemes, the expenditure cannot be recovered through infrastructure charges.

Thames Water publish their charging arrangements annually here. These include incentives to encourage good design by developers, including:

- £2,500 per property for designing rainwater or greywater harvesting technologies in the development
- £3,200 per property for water neutral developments (does not add additional water demand pressures to its water resource zone supply needs)
- £280 per property for reducing the surface water run-of leaving the property into the sewerage network.

Severn Trent publish their charging arrangements annually here. These include incentives to encourage good design by developers, including:

- £380 for building new homes to 100 litres or less
- £124 if there is no surface water connection made to the public sewer

Wessex Water publish their charging arrangements annually here. These include discounted charges based on the separation of surface water run-off produced by the development to encourage good design by developers. This is based upon the development having no separation, surface water attenuation or full surface water separation.

Bristol Water publish their charging arrangements annually here. There is a discount on the charge to encourage good design by developers based on water usage, including:

- 75% reduction is 95 litres/person/day is achieved.
- 50% reduction of the infrastructure charge if 100 litres/person/day is achieved.
- 0% reduction of infrastructure charge if the current Building Regulation standard of 110 litres/person/day is achieved.

3.5.6 Water companies and the planning system

Water companies are currently not statutory consultees to planning applications, although they do monitor planning applications and respond to potentially significant applications, or where requested to do so by the LPA. Defra are intending to consult on making water companies statutory consultees for some applications (Department for Environment, Food & Rural Affairs, 2023).

Where a water company is concerned that a new development may impact upon their service to customers or the environment (for example by causing foul sewer flooding or pollution) they may request the LPA to impose a Grampian condition, whereby the planning permission cannot be implemented until a third-party secures the necessary upgrading or contributions.

3.6 Flood Risk and Surface Water

3.6.1 Flood and Water Management Act 2010

The Flood and Water Management Act (FWMA) aims to improve both flood risk management and the way water resources are managed (HM Government, 2010).

The FWMA has created clearer roles and responsibilities and helped to define a more risk-based approach to dealing with flooding. This included the creation of a lead role for LAs, as LLFAs, designed to manage local flood risk (from surface water, ground water and ordinary watercourses) and to provide a strategic overview role of all flood risk for the EA.

The content and implications of the FWMA provide considerable opportunities for improved and integrated land use planning and flood risk management by LAs and other key partners. The integration and synergy of strategies and plans at national, regional, and local scales, is increasingly important to protect vulnerable communities and deliver sustainable regeneration and growth.

Schedule 3 of the Act has not been enacted in England. If enacted in the future, Schedule 3 will have the following implications for the planning process:

- Designation of local authorities as SuDS Approval Bodies (SAB) which have a duty to adopt new drainage systems.

- The cessation of the automatic right for new developments to connect to the existing sewer system.
- Developers must ensure that drainage systems are built as per the approved drainage plan that complied with mandatory national standards as outlined in the NPPF and the PPG.

3.6.2 Local Flood Risk Management Strategy (LFRMS)

Local Flood Risk Management Strategies set out how Lead Local Flood Authorities (LLFA) will manage local flood risk from surface water runoff, groundwater and ordinary watercourses, for which they have a responsibility as LLFA. They also set out the work that other Risk Management Authorities are doing to manage flood risk within the area.

Gloucester County Council's Local Flood Risk Management Strategy (2014) (found here) sets out the following objectives:

- improve our understanding of local flood risk;
- put in place plans to manage these risks;
- avoid inappropriate development and ensure new development does not increase flooding elsewhere;
- increase public awareness of flooding and encourage local communities to take action;
- ensure close partnership working and co-ordination with other risk management authorities in Gloucestershire, and;
- support response to, and recovery from, flooding incidents.

3.6.3 Strategic Flood Risk Assessment (SFRA)

All LPAs are required, under NPPF, to prepare a SFRA, which forms a key part of the evidence base for their Local Plan. The SFRA must consider flood risks from all sources, collating up-to-date flood risk data and in some cases developing new flood risk modelling. The SFRA is used to inform the Sequential Test, by which Local Plan allocations should be sequentially selected to direct development towards areas of lower flood risk, taking into consideration the vulnerability to flooding of the proposed land use. Cotswold District Council's current Level 1 SFRA was published in 2023 (which can be found here).

3.6.4 Surface Water Management Plan

Surface Water Management Plans (SWMPs) outline the preferred surface water management strategy in a given location and establish a long-term action plan to manage surface water. SWMPs are undertaken, when required, by LLFAs in consultation with key local partners who are responsible for surface water

management and drainage in their area. Gloucestershire County Council has published SWMPs for four locations but these cover areas outside of the Cotswold District. (Which can be found here).

3.6.5 Sustainable Drainage Systems

From April 2015, Local Planning Authorities (LPA) have been given the responsibility for ensuring that sustainable drainage is implemented on developments of ten or more homes or other forms of major development through the planning system. Under the new arrangements, the key policy and standards relating to the application of SuDS to new developments are:

- The National Planning Policy Framework, which requires that development in areas already at risk of flooding should give priority to sustainable drainage systems.
- The House of Commons written statement (Pickles, 2014) setting out governments intentions that LPAs should "ensure that sustainable drainage systems for the management of run-off are put in place, unless demonstrated to be inappropriate" and "clear arrangements in place for ongoing maintenance over the lifetime of the development." This requirement is also now incorporated in the 2019 update of the NPPF (paragraph 165). In practice, this has been implemented by making Lead Local Flood Authorities (LLFAs) statutory consultees on the drainage arrangements of major developments.
- The Defra non-statutory technical standards for sustainable drainage systems (HM Government, 2015c). These set out the government's high-level requirements for managing peak flows and runoff volumes, flood risk from drainage systems and the structural integrity and construction of SuDS. This very short document is not a design manual and makes no reference to the other benefits of SuDS, for example water quality, habitat, and amenity.

Gloucestershire County Council are the LLFA and play a key role in ensuring that the proposed drainage schemes for all new developments comply with technical standards and policies in relation to SuDS. Further information on surface water drainage can be found here.

An updated version of the CIRIA SuDS Manual was published in 2015. The guidance covers the planning, design, construction and maintenance of SuDS for effective implementation within both new and existing developments. The guidance is relevant for a range of roles with the level of technical detail increasing throughout the manual. The guidance does not include detailed information on planning requirements, SuDS approval and adoption processes and standards, as these vary by region and should be checked early in the planning process. The manual itself can be found here.

CIRIA also publish "Guidance on the Construction of SuDS" (C768), which contains detailed guidance on all aspects of SuDS construction, with specific information on

each SuDS component available as a downloadable chapter. The downloadable chapter is available here.

Thames Water provides guidance on their website through their Surface Water Management Programme available here. Applications for projects should be made through their website.

Wessex Water provides their adoption requirements here.

Severn Trent Water provides guidance on their website through their surface water drainage page, available here.

3.6.6 Design and Construction Guidance

The Design and Construction Guidance (DCG), part of a new Codes for Adoption covering the adoption of new water and wastewater infrastructure by water companies, contains details of the water sector's approach to the adoption of SuDS, which meet the legal definition of a sewer. This replaces the formerly voluntary Sewers for Adoption The new guidance came into force in April 2020 and compliance by water companies in England is mandatory.

The previous standards, up to and including Sewers for Adoption Version 7, included a narrow definition of sewers to mean below-ground systems comprising of gravity sewers and manholes, pumping stations and rising mains. This essentially excluded the adoption of SuDS by water companies, except for below-ground storage comprising of oversized pipes or chambers.

The new guidance provides a mechanism for water companies to secure the adoption of a wide range of SuDS components which are now compliant with the legal definition of a sewer. There are however several non- adoptable components such as green roofs, pervious pavements, and filter strips. These components may still form part of a drainage design so long as they remain upstream of the adoptable components.

The Design and Construction Guidance states that the drainage layout of a new development should be considered at the earliest stages of design. It is hoped that the new guidance will lead to better managed and more integrated surface water systems which incorporate amenity, biodiversity, and water quality benefits.

3.7 Environmental Protection and Biodiversity

3.7.1 The Environment Act 2021

The Environment Act (HM Government, 2021) came into UK law in November 2021 with the aim of protecting and enhancing the environment. The Act has objectives to improve air and water quality, biodiversity, waste reduction and resource efficiency. The implementation of the policies within the Environment Act has begun and legally binding environmental targets are being developed. This will be enforced by the newly created Office for Environmental Protection (OEP, more information available here).

The Environment Act (Part 5) contains policies concerning improvements to the water environment. These policies have the following aims:

- Effective collaboration between water companies through statutory water management plans.
- Minimise the damage that water abstraction may cause on environment.
- Modernise the process for modifying water and sewerage company licence conditions.

Further to this, there is specific legislation regarding storm overflows aiming to reduce the discharge of untreated sewage into waterways. This plan includes requirements for water companies to:

- report on the discharges from storm overflows;
- monitor the quality of water potentially affected by discharges;
- progressively reduce the harm caused by storm overflows; and
- report on elimination of discharges from storm overflows.

3.7.2 25-year Environment Plan

The Environmental Improvement Plan (EIP) is the first revision of the 25-year environment plan (25YEP) published in 2018. It contains ten goals which are shown in Figure 3-1. The full text of the EIP can be found here. Government must review and revise the plan, if needed, every five years to ensure continued progress against the ten 25YEP goals.

Of particular importance to a WCS is Goal 3 - Clean and plentiful water.

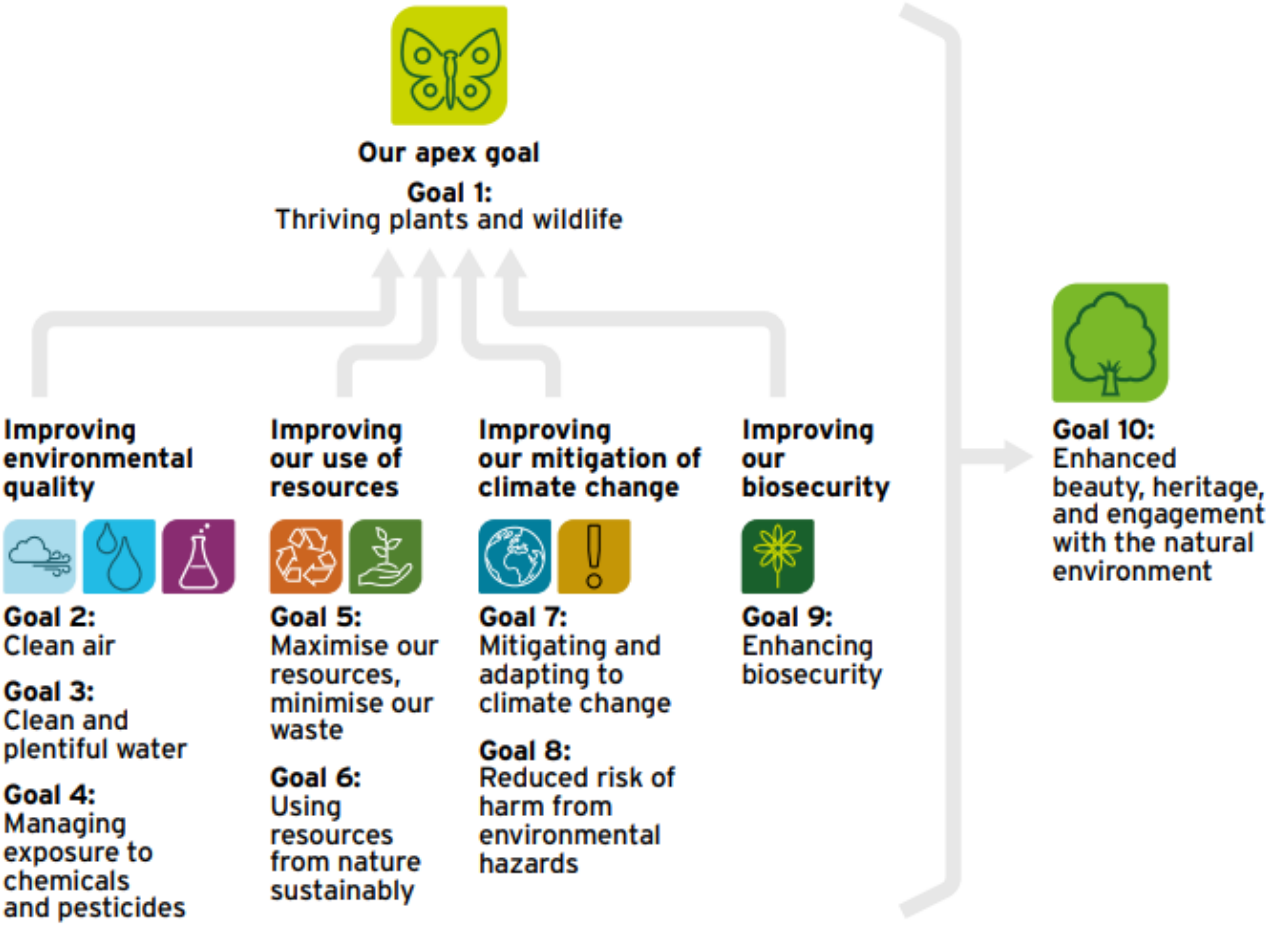

Figure 3-1: the 10 Environmental Improvement Plan goals

Under Goal 3 - Clean and plentiful water, there are eight sets of targets and commitments relating to different aspects of the water environment:

- "Reduce nitrogen, phosphorus, and sediment pollution from agriculture into the water environment by at least 40% by 2038, compared to a 2018 baseline, with an interim target of 10% by 31 January 2028, and 15% in catchment containing protected sites in unfavourable condition due to nutrient pollution by 2028.
- Reduce phosphorus loadings from treated wastewater by 50% by 2028 and 80% by 2038 against a 2020 baseline.
- Halve the length of rivers polluted by harmful metals from abandoned mines by 2038, against a baseline of around 1,500km (approximately 930 miles)...
- Reduce the use of public water supply in England per head of population by 20% from the 2019-20 baseline, 2038, with interim targets of 9% by 2027 and 14% by 2032, and to reduce leakage by 20% 2027 and 30% by 2032.
- Restore 75% of our water bodies to good ecological status.
- Water companies to cut leaks by 50% by 2050. Leakage will be cut by 20% by 2027 and 30% by 2032.

- Require water companies to have eliminated all adverse ecological impact from sewage discharges at all sensitive sites by 2035, and at all overflows by 2050.
- Target a level of resilience to drought so that emergency measures are needed only once in 500-years."

To deliver these goals, the EIP outlines action across these areas:

- Ensure water companies are delivering on our targets and commitments through enhanced transparency and monitoring mechanisms in the Environment act, targeted enforcement from regulators and increasing the maximum fines.
- Direct water company fines relating to environmental breaches to improving the water environment.
- Crack down on sewage pollution by holding water companies to account for delivering the targets set out in the Storm Overflows Discharge Reduction Plan.
- Require water companies to upgrade 160 of their wastewater treatment works to meet the strictest phosphorus limits by 2028, and upgrade a further 400 by 2038, to reduce harmful nutrient pollution from wastewater.
- Reduce agricultural pollution across England by paying farmers to protect and enhance watercourses through new farming schemes, and investing in improved slurry storage and management through our grants, providing advice to farmers to improve their practices through the expanded Catchment Sensitive Farming partnership scheme, and ensuring farmers are meeting legal standards of responsible farming through our expanded and targeted farm visits programme.
- Increase our resilience to drought by working with regulators and water companies to reduce household and non-household water use, and ensuring water companies are delivering a 50% reduction in leakage by 2050.
- Roll out new water efficiency labelling and deliver our ten actions in the Roadmap to Water Efficiency in new developments.
- Deliver a ten-fold increase in the Water and Abandoned Metal Mines programme, upscaling the existing three treatment schemes with 40 more by 2038, to tackle harmful pollutants from abandoned metal mines.
- Protect our chalk streams by supporting the Chalk Stream Strategy.
- Make Sustainable Drainage Systems mandatory in new developments subject to final decisions, following consultation, on scope, threshold and process.

Progress towards delivering the EIP will be monitored annually.

3.7.3 Defra Plan for Water

Defra's Plan for Water (Department for Environment, Food & Rural Affairs, 2023) provides further detail on the actions towards achieving Goal 3 of the EIP23. It promotes an integrated approach to water management as the foundation of the plan. Whilst many of the actions contained within the Plan for Water are outside of the

responsibilities of areas of influence of the LPAs, the following summarises those actions that LPAs should have regard to:

- Require standardised sustainable drainage systems (SuDS) in new housing developments in 2024, subject to final decisions on scope, threshold, and process following consultation in 2023.
- Designate all chalk catchments as water stressed and high priority under the sewer overflows reduction plan, driving action to improve water management.
- The plan reflects the predicted 4 billion litre per day (4,000 ml/d) gap between supply and demand across England and contains measures to both boost supply and reduce demand. Of interest to LPAs is the plan to reduce demand which will address half of the gap.
- A key component in reducing demand for water is improving water efficiency and there is a target under the Environment Act to reduce the use of public water supply in England per head of population by 20% by 2038.A road map on water efficiency in new developments and retrofits has been developed with ten actions to improve water efficiency:
- **Action 1** - Implement schedule 3 to the Flood and Water Management Act 2010. The 2024 consultation will consider rainwater harvesting in developing the statutory SuDS National Technical Standards.
- **Action 2** - Review the Water Supply (Water Fittings) Regulations 1999, the Water Supply (Water Quality) Regulations 2016 and/or any other relevant legislation to address wasteful product issues with toilets and enable new water efficient technologies.
- **Action 3** – Develop clear guidance on ‘water positive’ or ’net zero water’ developments and roles for developers and water companies.
- **Action 4** – Review water efficiency options in planning, building regulations and through voluntary schemes for non-household buildings.
- **Action 5** – Work with Ofwat to ensure the water industry can play a central role in retrofitting water efficient products in households, businesses, charities and the public sector.
- **Action 6** – Work across government to integrate water efficiency into energy efficiency advice and retrofit programmes.
- **Action 7** - Review the Building Regulations 2010, and the water efficiency, water reuse and drainage standards including considering a new standard for new homes in England of 105l/p/d and 100 l/p/d where there is a clear local need.
- **Action 8** –Mandatory water efficiency labelling scheme.
- **Action 9** – Investigate dual pipe systems (rainwater harvesting) and water reuse options for new housing development as part of the review of the planning framework.
- **Action 10** – Enable innovative water efficiency approaches in buildings, including technologies and approaches to funding and maintenance.

3.7.4 Biodiversity Net Gain

Biodiversity net gain (BNG) is designed to contribute to the recovery of nature while developing land. The principle is that the natural environment is in measurably better state after development than it was before. The Environment Act 2021 requires all planning permissions granted in England (except for small sites) to achieve 10% BNG since January 2024. This will be required on small sites from April 2024.

Defra publishes a biodiversity metric tool, the latest version of which must be used for calculating the BNG deriving from a proposed development.

3.7.5 Local Nature Recovery Strategy

The Environment Act (HM Government, 2021) also established a duty to prepare, by March 2025, Local Nature Recovery Strategies (LNRS), recognising that England is one of the most nature-depleted countries in the world. Gloucestershire County Council are the authority responsible for preparing the LNRS In the study area. They are tasked with working with local partners to agree priorities for nature recover and identify "practical, achievable proposals" (Department for Environment Food & Rural Affairs, 2023) to address these priorities. The LNRS should also co-ordinate with neighbouring strategies to form a national Nature Recovery Network.

There is a close linkage with BNG, as developments proposing to create, enhance or recover habitat in locations mapped by the LNRS receive a higher value in the biodiversity metric calculator than in other locations.

3.7.6 Storm Overflow Reduction Plan

The Environment Act placed a legal duty on water companies to progressively reduce the adverse impacts of discharges from storm overflows. The storm overflow reduction plan (Department for Environment, Food & Rural Affairs, 2023) sets the following targets:

- By 2035, water companies will have: improved all overflows discharging into or near every designated bating water; and improved 75% of overflows discharging to high priority sites.
- By 2050, no storm overflows will be permitted to operate outside of unusually heavy rainfall or to cause any adverse ecological harm.

There is also an expectation that water companies ensure their infrastructure keeps pace with increasing external pressures, such as urban growth and climate change, without these pressures leading to greater numbers of discharges.

3.7.7 The Water Framework Directive (WFD) and Water Environment Regulations

Introduction

The European Union Water Framework Directive (WFD) 2000 is currently transposed into English and Welsh law by the Water Environment Regulations (HM Government, 2017). They apply to all waterbodies (watercourses, canals, lakes, estuaries and coastal waters), with the objective of meeting Good Ecological Status (GES) or, where heavily modified, Good Ecological Potential (GEP) To meet GES or GEP, a water body must achieve a good or high score for all elements - in the case of surface water, these are biological, physico-chemical, specific pollutants and hydromorphology (Figure 3-2). UK policy remains to meet GES or GEP for all waterbodies by 2027.

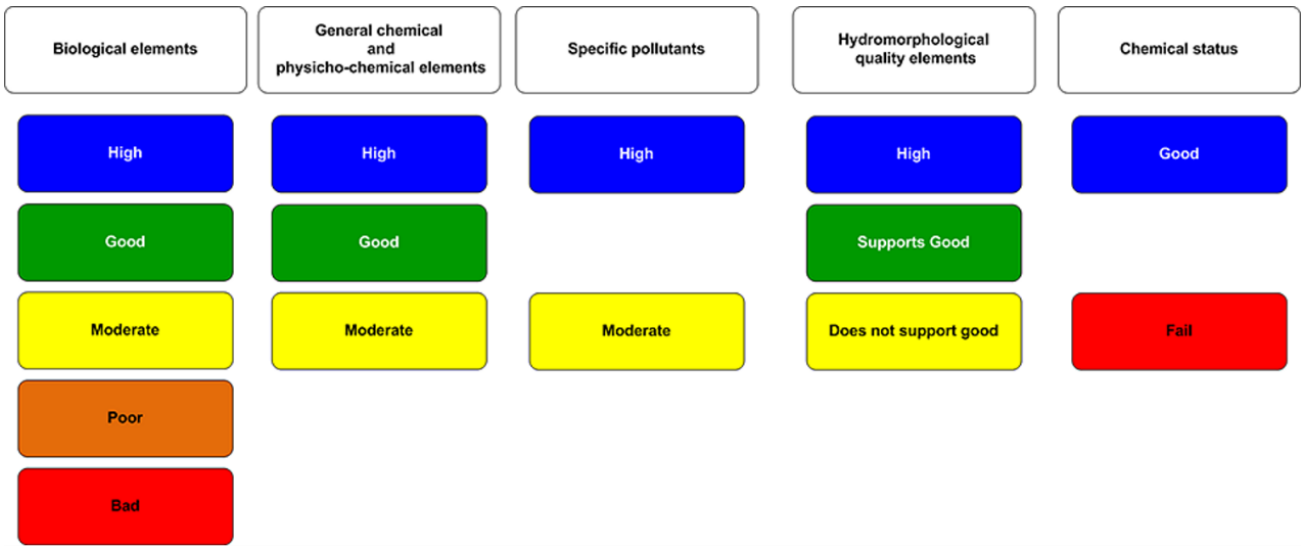

Figure 3-2: Status classification for surface water (Environment Agency, 2023a)

Chemical Status is separately assessed. The Water Framework Directive and the EA recognise a group of ubiquitous chemicals which are persistent, bioaccumulative or toxic (uPBT), and without which over 90% of England's waterbodies would achieve Good Chemical Status. Mercury, PFOS and PBDE are the most ubiquitous causes of failures. Due to the persistent nature of these chemicals, the date for getting all waterbodies to Good Chemical Status is set for 2063.

River Basin Management Plans

River Basin Management Plans (RBMP) are required under the WFD and document the baseline classification of each waterbody in the plan area, the objectives, and a programme of measures to achieve those objectives. The Cotswold District falls within the Thames RBD (Environment Agency, 2022). The third cycle RBMPs were published in 2022. A primary WFD objective is to ensure ‘no deterioration’ in environmental status, therefore all water bodies must meet the class limits for their status class as declared in the Anglian and Thames River Basin Management Plan. Another equally important objective requires all water bodies to achieve good ecological status. Future development needs to be planned carefully so that it helps towards achieving the WFD and does not result in further pressure on the water environment and compromise WFD objectives. The WFD objectives as outlined in the updated RBMPs are summarised below:

- Preventing deterioration of the status of surface waters and groundwater.
- Achieving objectives and standards for protected areas.
- Aiming to achieve good status for all water bodies.
- Reversing any significant and sustained upward trends in pollutant concentrations in groundwater.
- Cessation of discharges, emissions and losses of priority hazardous substances into surface waters.
- Progressively reducing the pollution of groundwater and preventing or limiting the entry of pollutants.
- Local Planning Authorities (LPAs) must have regard to the Water Framework Directive as implemented in the RBMPs. It is of primary importance when assessing the impact of additional wastewater flows on local river quality.
- Alongside the RBMP documents, the data behind them can be explored further using the Catchment Data Explorer (Environment Agency, 2023a) and map viewer (Environment Agency, 2023b).

Protected Area Objectives

The Water Environment Regulations specify that areas requiring special protection under other EC Directives, and waters used for the abstraction of drinking water, are identified as protected areas. These areas have their own objectives and standards.

Some areas may require special protection under more than one piece of EU-derived legislation or may have additional (surface water and/or groundwater) objectives. In these cases, all the objectives and standards must be met.

The types of protected areas are:

- Areas designated for the abstraction of water for human consumption (Drinking Water Protected Areas);
- areas designated for the protection of economically significant aquatic species (Freshwater Fish and Shellfish);
- bodies of water designated as recreational waters, including Bathing Waters;
- nutrient-sensitive areas, including areas identified as Nitrate Vulnerable Zones under the Nitrates Directive or areas designated as sensitive under Urban Waste Water Treatment Regulations; and
- areas designated for the protection of habitats or species where the maintenance or improvement of the status of water is an important factor in their protection including relevant Natura 2000 sites.

3.7.8 Conservation of Habitats Regulations 2017 (as amended)

The Conservation of Habitats and Species Regulations 2010 (commonly referred to as the Habitats Regulations) consolidated the Conservation (Natural Habitats, &c.) Regulations 1994, and transposed the EU Habitats Directive in England and Wales

which was aimed at protecting plants, animals and habitats that make up the natural environment. The regulations were further amended in 2017.

The Habitats Regulations define the requirement for a Habitats Regulations Assessment (HRA) to be carried out. The purpose of this is to determine if a plan or project may affect the protected features of a “habitats site”. These include:

- A special area of conservation (SAC).
- A site of Community Importance.
- A site hosting a priority natural habitat type or priority species protected in accordance with Article 5(4) of the Habitats Directive.
- A Special Protection Area (SPA).
- A potential SPA.

All plans and projects (including planning applications) which are not directly connected with, or necessary for the conservation management of a habitat site require consideration of whether the plan or project is likely to have significant effects on that site.

This is referred to as the “Habitats Regulations Assessment screening” and should take into account the potential effects of both the plan/project itself and in combination with other plans or projects.

Part 6 of the conservation of Habitats and Species Regulations 2017 states that 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.

If adverse effects cannot be rules 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.

The “People over Wind” ECJ ruling (C-323/17) clarifies that when making screening decisions for the purposes of deciding whether an appropriate assessment is required, competent authorities cannot take into account any mitigation measures. This must be part of the appropriate assessment itself.

The implementation of the Conservation of Habitats Regulations have had particular significant implications in two areas related to water and planning:

- Nutrient Neutrality. Natural England (NE) has identified a number of catchment areas where Habitats Sites are in unfavourable condition due to eutrophication (an excess of the nutrients phosphorous and/or nitrogen in water). NE have advised that developments in these catchments must demonstrate that they do not cause harm, and that one way to do this is to introduce mitigation measures

in the catchment area which offset the additional nutrients emitted as a result of the development, an approach known as nutrient neutrality. There are no parts of the study area which are currently within a nutrient neutrality catchment area, however NE may designate additional areas in the future.

- Water Neutrality. Natural England (NE) has issued a position statement that it cannot be concluded with sufficient certainty that groundwater abstractions in the Arun Valley, West Sussex are causing no adverse effect on Habitats Sites. NE have advised that developments in Sussex North Water Resource Zone must demonstrate that they do not cause harm, and that one way to do this is to introduce mitigation measures in the zone which offset the additional water consumed as a result of the development, an approach known as water neutrality. There are no parts of the study area which are currently within a water neutrality zone, however NE may designate additional areas in the future.

Both nutrient and water neutrality designations have resulted in significant impacts on the granting of planning permission in the designated areas.

3.7.9 Wildlife and Countryside Act

Sites of Special Scientific Interest (SSSI) are designated and legally protected under the Wildlife and Countryside Act 1981, Section 28G places a duty to take reasonable steps, consistent with the proper exercise of the authority's functions, to "further to the conservation and enhancement of the flora, fauna or geological or physiographical features by reason of which the site is of special scientific interest." (HM Government, 1981).

The Government's 25-year Environment Plan has a target of "restoring 75% of our one million hectares of terrestrial and freshwater protected sites to favourable condition, securing their wildlife value for the long term." In line with this, and the Wildlife and Countryside Act 1981, Local Authorities should look put forward options that contribute to conservation or restoration of favourable condition, and at the very least must not introduce policies that hinder the restoration of favourable condition by increasing existing issues.

A site is said to be in "favourable condition" when the designated feature(s) within a unit are being adequately conserved and the results from monitoring demonstrate that the feature(s) in the unit are meeting all the mandatory site-specific monitoring targets set out in the favourable condition targets (FCT).

3.7.10 Ramsar

The Convention on Wetlands of International Importance, more commonly known as the Ramsar convention, aims to protect important wetland sites. Member counties commit to:

- Wise use of all their wetlands.

- Designating sites for the Ramsar list of “Wetlands of International Importance” (Ramsar Sites) and their conservation.
- Cooperating on transboundary wetlands and other shared interests.
- “Wise use” of wetlands is defined under the convention as “the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development”. (Ramsar Convention Secretariat, 2010)
- In the UK, Ramsar Sites are designated by the Joint Nature Conservation Committee (JNCC).

In general, the designation of UK Ramsar sites is underpinned through prior notification of these areas as Sites of Special Scientific Interest (SSSIs). Additionally, the NPPF states that Ramsar sites should be given the same protection in the planning process as sites designated under the EU Habitats Directive.

3.7.11 Bathing Water Regulations

The Bathing Water Directive was first published in 2006 and are currently transposed into English and Welsh law through the Bathing Water Regulations 2013. The aims of the directive are the protection of public health whilst bathing, standardisation of publicly available water quality information and to improve management practices at bathing waters.

The UK has over 600 designated bathing waters defined as areas of inshore waters designated for public swimming, these areas are typically characterised by large numbers of swimmers and visitors per year. The Environment Agency are required to monitor water quality at these sites regularly (usually weekly) throughout the Bathing Water season, between 15th May and 30th September.

Water quality standards are based on the incidence of potentially harmful bacteria, E. coli and intestinal enterococci and are categorised as ‘excellent’, ‘good’, ‘sufficient’ or ‘poor’ on the basis of bacteria levels. Sites are rated annually and on a short-term basis in response to any temporary pollution incidents.

Achieving compliance with the Bathing Water Directive has driven some £2.5bn of investment by UK water companies since the early 1990s to reduce the impact of sewerage systems and treated wastewater discharges. Measures have included storage and surface water management to reduce storm overflow spills, moving or extending effluent outfalls and improving wastewater treatment, including ultra-violet (UV) treatment of final effluent.

Unlike some other European countries, the UK had not previously designated river stretches as bathing waters. However, in late 2024, 27 new inland bathing waters were designated. Among these, two sites are within the Cotswold District Council area: Cotswold Water Park, Lake 32, and the River Windrush at Bourton-on-the-Water.

Across England there are numerous campaigns by NGOs and members of the public to designate other stretches of river. Defra has published guidance on applying for bathing water status, including a requirement for at least 100 bathers per day during the season (Department for the Environment, Food and Rural Affairs, 2023).

3.7.12 Environmental Permitting Regulations

Environmental permitting is a process used to manage and regulate activities which may cause harm to the environment. The Environmental Permitting Regulations (HM Government, 2016) were introduced in order to streamline a wide-ranging number of environmental permitting laws under one set of regulations. These include permits for emissions to air, water and land, and cover a range of industrial sectors and waste management streams.

Of particular relevance to this study are the regulations for permitting sewage effluent discharges to surface waters and groundwaters, known as water discharge activities (Environment Agency, 2022).

- The regulations are used to permit discharges from water company and private wastewater treatment works, and for sewer overflows.
- The Environment Agency will usually object to applications for a new private Package Treatment Plan (PTP) or septic tank where it is feasible to connect the development to a public sewerage system. A general rule of 30m per dwelling is used to define a reasonable distance from the site boundary to a public sewer. Hence a development of 10 homes should connect to a public sewer within 300m of the boundary, unless there are significant barriers, such as a river or motorway.
- Where an existing or new development treats its own wastewater, a PTP must be installed if the discharge is directly to surface water. Where the discharge is to ground, a PTP or septic tank may be used, but must be connected to a suitably designed drainage field.

3.7.13 Groundwater protection

Under the regulations, the EA have published a set of position statements on protecting groundwater from various activities (Environment Agency, 2018). The position statements that are relevant to this study with regard to discharges to groundwaters, include surface water drainage and the use of SuDS, discharges from contaminated surfaces (e.g., lorry parks) and from treated sewage effluent.

The EA also maintain a set of maps of Source Protection Zones (SPZs) to help identify high risk areas within which pollution prevention measures should be implemented. The SPZs show the risk of contamination to public water supplies from activities that may cause pollution in the area, the closer the activity, the greater the risk:

- **Zone 1 (Inner protection zone)** This zone is designed to protect against the transmission of toxic chemicals and water-borne disease. It indicates the area in which pollution can travel to the borehole within 50 days from any point within the zone and applies at and below the water table. There is also a minimum 50 metre protection radius around the borehole.
- **Zone 2 (Outer protection zone)** This zone indicates the area in which pollution takes up to 400 days to travel to the borehole, or 25% of the total catchment area, whichever area is the largest. This is the minimum length of time the Environment Agency think pollutants need to become diluted or reduce in strength by the time they reach the borehole.
- **Zone 3 (Total catchment)** This is the total area needed to support removal of water from the borehole, and to support any discharge from the borehole.
- **Zone of special interest** This is defined on occasions, usually where local conditions mean that industrial sites and other polluters could affect the groundwater source even though they are outside the normal catchment.

3.8 Summary of key new and emerging policy and legislation

The policy and legislation covering the water environment, water and wastewater services and planning is wide and frequently changing. The new and emerging policy and legislation below have been identified as particularly important for consideration in the development of the Local Plan:

- Schedule 3 of the Flood and Water Management Act was expected to be enacted in England in 2024, however since the change of Government no clear timeline for implementation has been published. If enacted, Schedule 3 will designate Lead Local Flood Authorities as SuDS Approval Bodies (SABs) with a duty to adopt new SuDS and removing the automatic right to connect to public sewers.
- Defra have signalled their intention, with the Plan for Water, to review the water efficiency standards for new homes, including consideration of a new national 105l/p/d standard and 100l/p/d where there is a clear local need.
- All development sites have been expected to demonstrate at least a 10% net-gain in biodiversity from 2024.
- The designation of specific catchments in England as requiring to demonstrate Nutrient Neutrality under the Conservation of Habitats Regulations has led to significant limitations to development in these areas, as well as the development of offsetting schemes to enable nutrient-neutral development.
- Similarly, the availability of water resources, and the impact of new water demand on the environment, has led to restrictions on granting planning permission in Sussex North WRZ and a requirement to demonstrate water-neutral development in Cambridge Water WRZ. It is anticipated that LPAs will be increasingly required to demonstrate that there will be sufficient water resources

to supply development without causing further harm to the environment through the life of their Local Plans.

4 Water Resources

4.1 Introduction

4.1.1 Objectives

The aim of the water resources assessment is to ensure that sufficient water is available in the region to serve the proposed level of growth, and that it can be abstracted without a detrimental impact on the environment, both during the plan period and into the future. The report characterises the study area, identifying the key surface water and groundwater bodies, and local geology. It highlights the pressures on water resources in the region, identifies existing constraints on abstraction and provides evidence for adopting tighter water efficiency targets.

All of the Local Plan Partial Update successful allocations and the Local Plan allocations are within the supply zones of Thames Water, none are located within the supply zones of Bristol Water, Severn Trent Water or Wessex Water.

4.1.2 Surface Water

The main watercourses within the study area, shown in Figure 4-1, are summarised below:

- The source of the River Thames can be found near Kemble, and it runs south-east through Somerford Keynes and then along the eastern boundary of the Cotswold District. The River Churn, Ampney Brook, River Coln, River Leach, River Windrush, and the River Evenlode are all tributaries to the River Thames, the sources of each can be found in the Cotswold District.
- The River Churn begins in Coberly, running south through Cirencester and then through South Cerney where it begins to join the River Thames.
- Ampney Brook begins just east of Cirencester, outside of Ampney Crucis and runs south through Down Ampney.
- Brockhampton, in the west of the district, is where the source of the River Coln is. The River Coln then runs south-east towards and through Fairford and then east towards Lechlade where it joins the River Thames.
- The River Leach begins in Northleach, running south-east, around the west and south of Aldsworth and towards Eastleach. The River Leach joins the River Thames just south-east of Lechlade.
- The source of the River Windrush can be found to the east of Taddington (Gloucestershire) where it flows south through Guiting Power, and then east towards Bourton-on-the-Water where it is joined by the River Dikler. The River Windrush then runs south towards Windrush where it is joined by the Sherbourne Brook before running east towards Oxfordshire.

- The River Evenlode runs south from Moreton-in-Marsh, through Evenlode and towards Bledington.

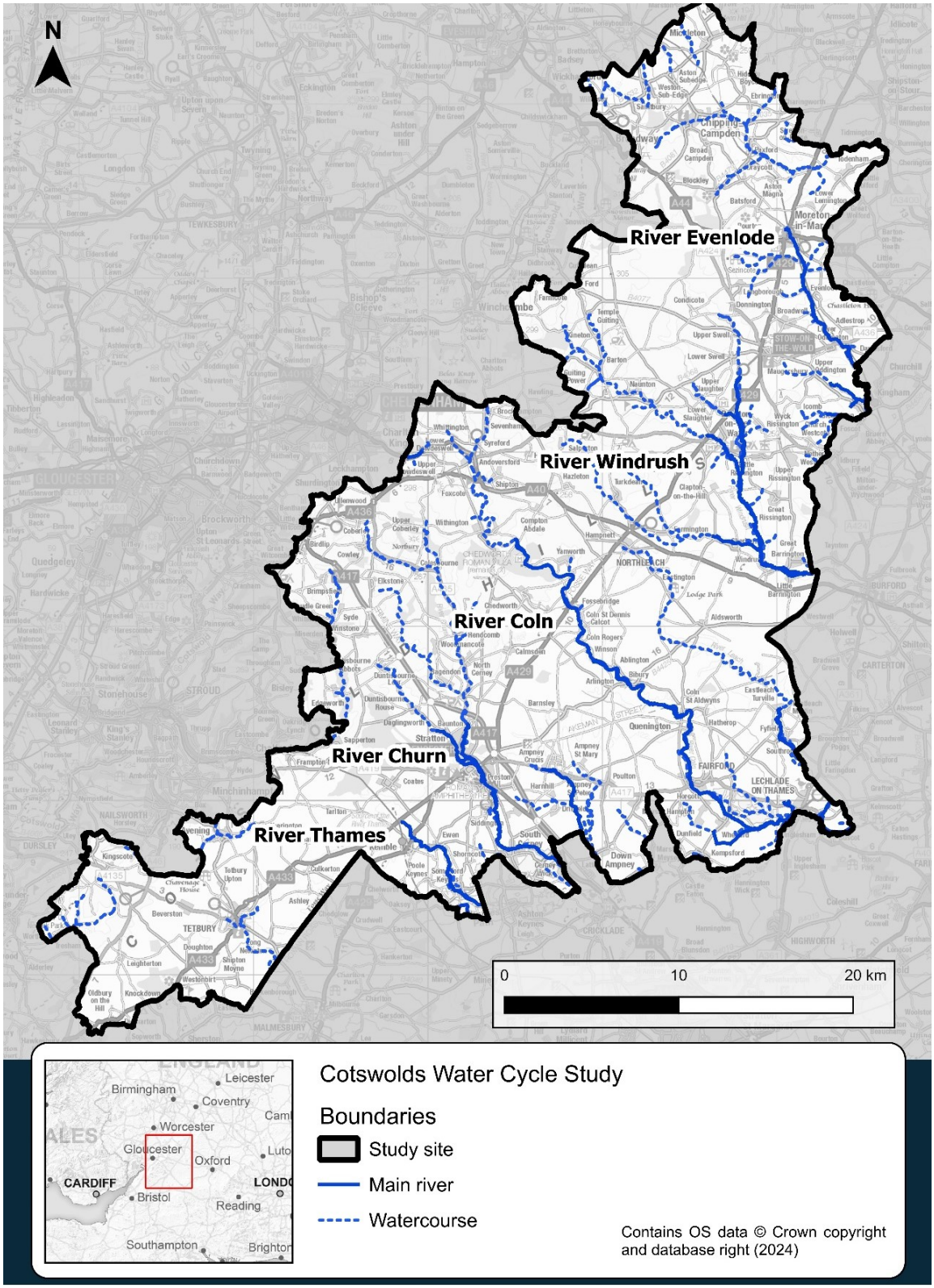

Figure 4-1: Significant watercourse within the Cotswold district

4.1.3 Geology

The geology of a catchment can be an important factor that influences the way that water runs off the ground surface. It also an influencing factor on the type of SuDS that are appropriate for development sites due to the variation of permeability of the bedrock and surface material.

The Cotswold district is underlaid by four different bedrock geologies, shown in Figure 4-2. The south of the district, including Burford, Cirencester and Tetbury, is made up of bedrock from the Great Oolite Group, which is sandstone, limestone and argillaceous rock. There are also pockets of this geology in the northwest. There is a band of Lias group along the north and northeast of the District under Chipping Campden and Moreton-in-Marsh. The Lias group consists of mudstone, siltstone, limestone and sandstone. In the northwest there is a section of Inferior Oolite group (limestone, sandstone, siltstone and mudstone) between the pockets of the Great Oolite Group. Stow-on-the-Wold is underlain by both these geologies.

Figure 4-3 shows the superficial geology in the district. In the Northeast of the district Diamicton can be found with small areas of Sand and Gravel, as well as Clay, Silt and Sand. In the South there are deposits of Sand and Gravel, and Clay, Silt and Sand.

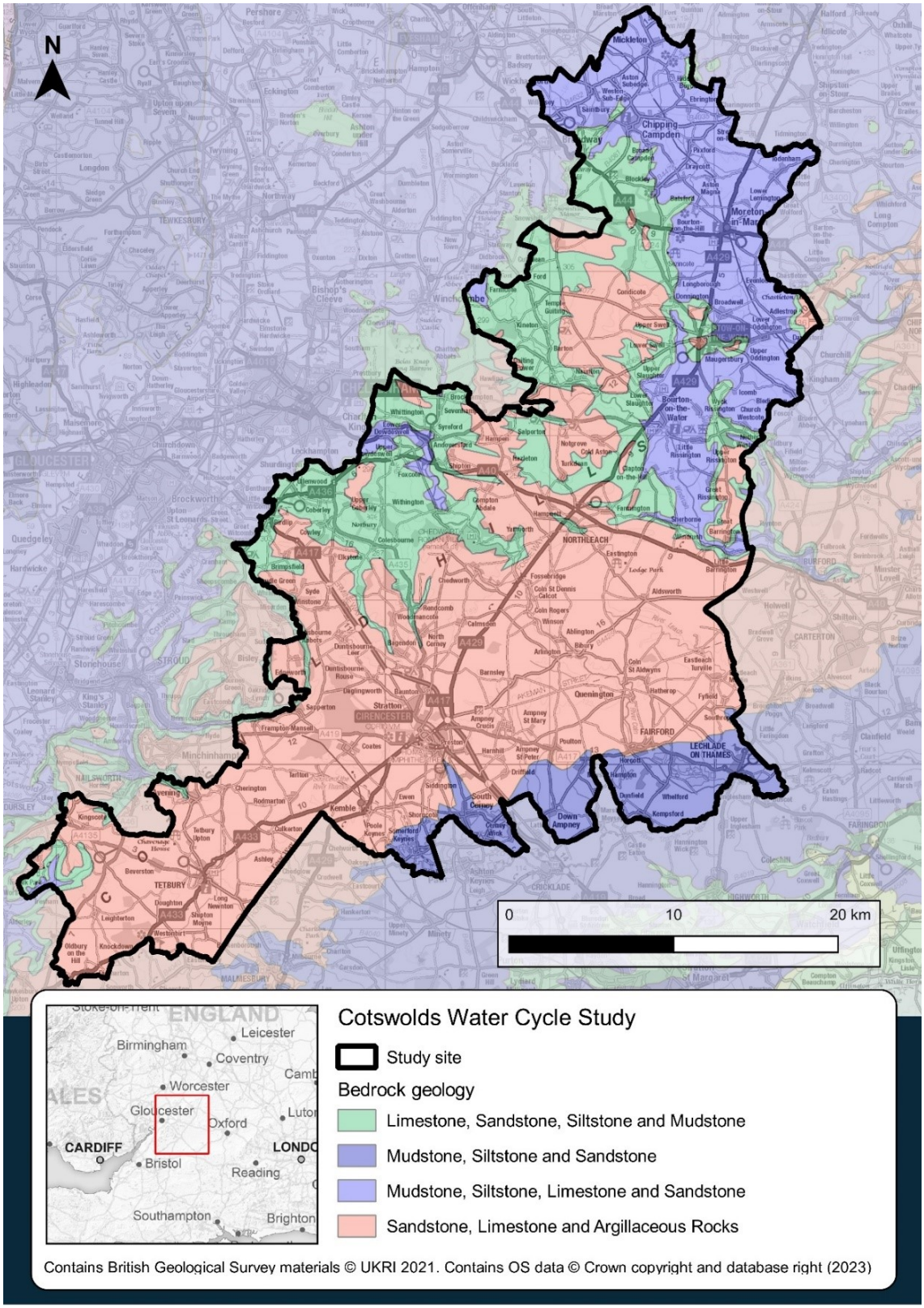

Figure 4-2: Bedrock geology of the Cotswold District

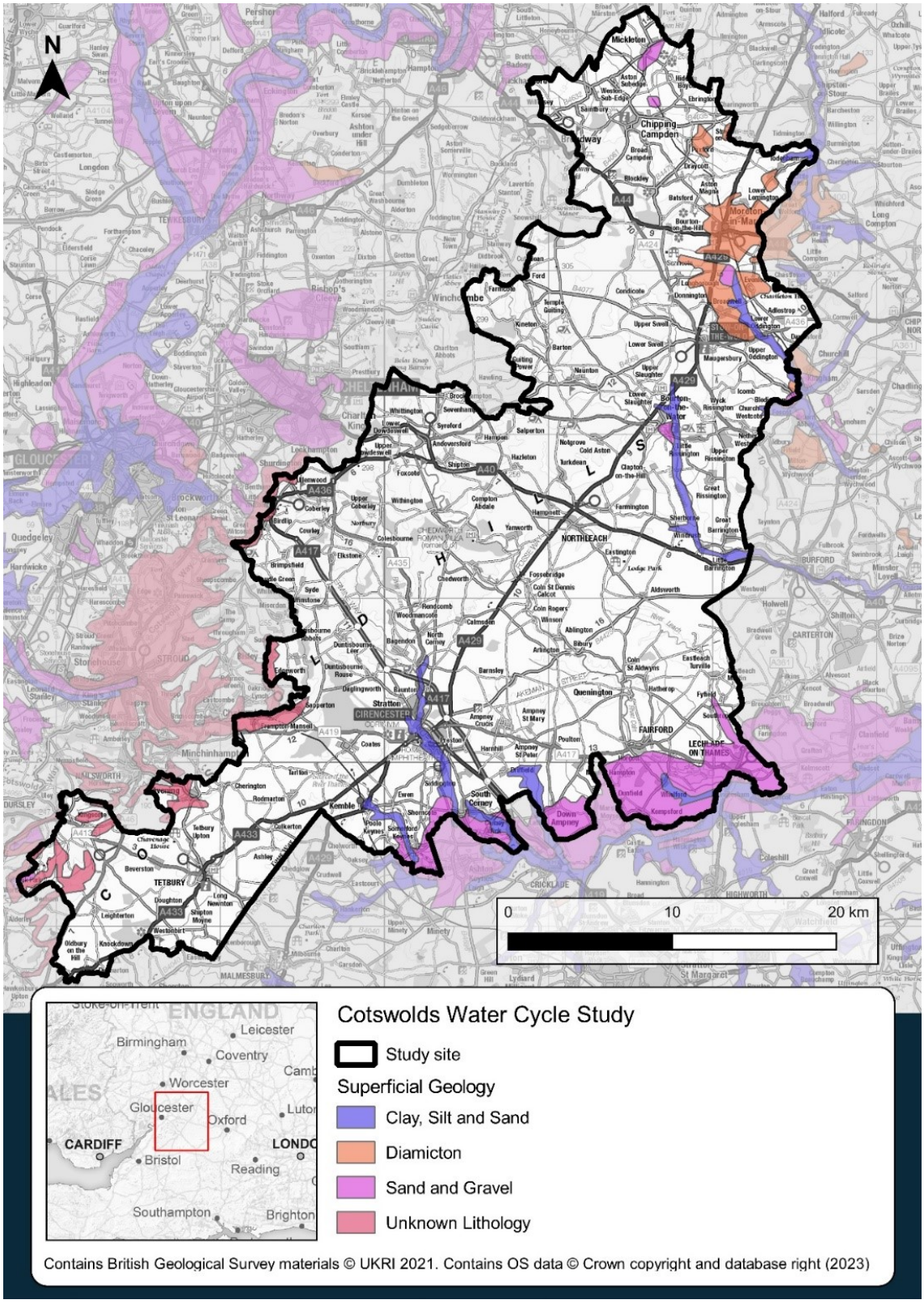

Figure 4-3: Superficial geology within the Cotswold District

4.2 Availability of water resources

4.2.1 Abstraction licensing strategy

The Environment Agency (EA), working through their Catchment Abstraction Management Strategy (CAMS) process, prepare an Abstraction Licensing Strategy (ALS) for each sub-catchment within a river basin. This licensing strategy sets out how water resources are managed in different areas of England and contributes to implementing the Water Framework Directive (WFD). The ALS report provides information on the resources available and what conditions might apply to new licences. The licences require abstractions to stop or reduce when a flow or water level falls below a specific threshold, as a restriction to protect the environment and manage the balance between supply and demand for water users. The CAMS process is published in a series of ALSs for each river basin. Details of the ALS areas can be found in Figure 4-4.

Groundwater availability in all ALS regions is guided by the surface water assessment unless specific information on principal aquifers exists or local issues that need protecting overrule it.

Consumptive groundwater licences which do not have a direct impact upon main river flows may be permitted but may be subject to restrictions such as prescribed groundwater levels. Restrictions will be determined on a case-by-case basis, dependent upon the nature and scale of any abstraction.

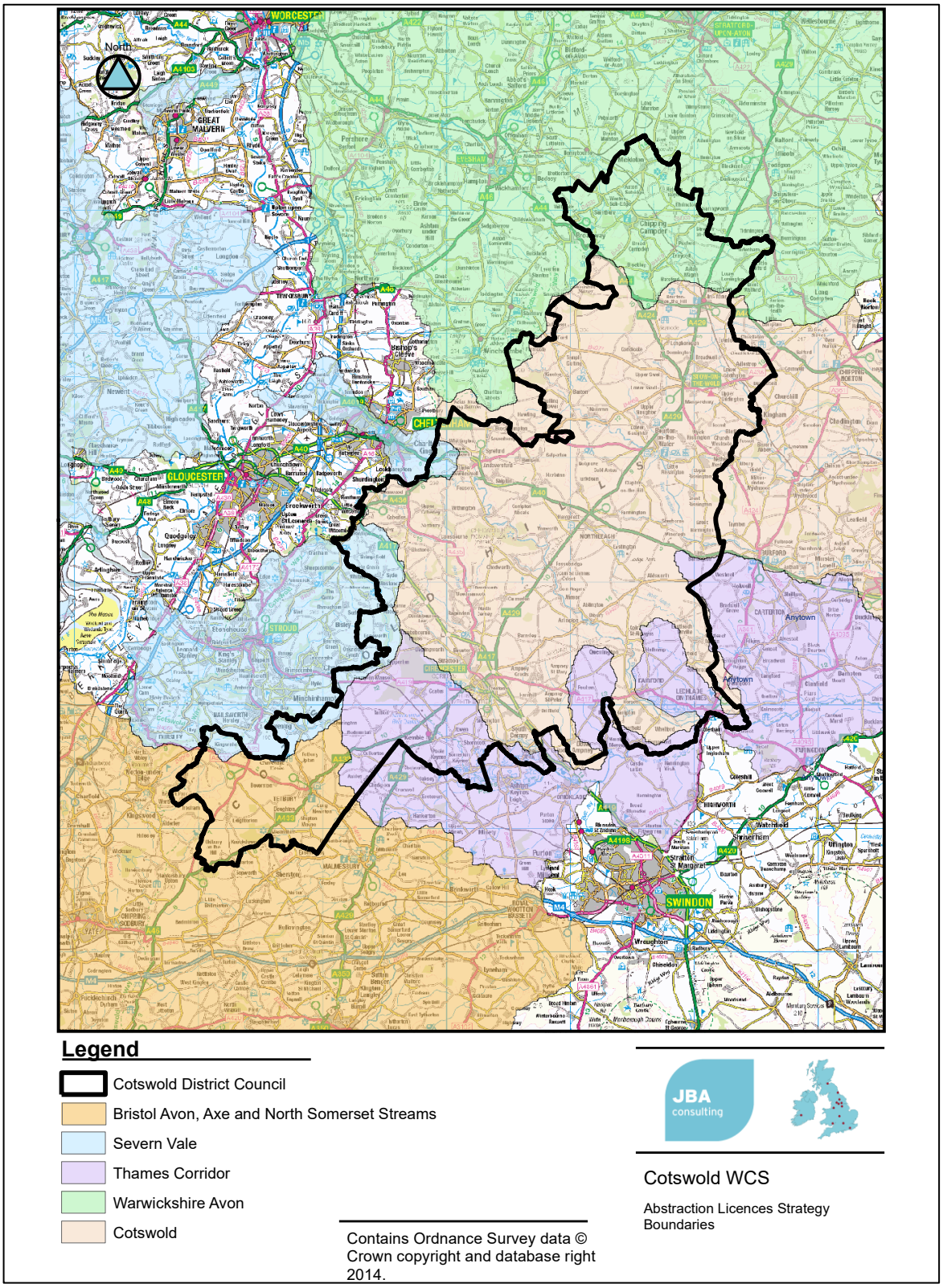

Figure 4-4: Abstraction Licences Strategy Boundaries for the Cotswold District

4.2.2 Resource Availability Assessment

To abstract surface water, it is important to understand what water resources are available within a catchment and where abstraction for consumptive purposes will not pose a risk to resources or the environment. The Environment Agency has developed a classification system which shows:

- The relative balance between the environmental requirements for water and how much has been licensed for abstraction;
- Whether there is more water available for abstraction in the area; and
- Areas where abstraction may need to be reduced.

The availability of water for abstraction is determined by the relationship between the fully licensed (all abstraction licences being used to full capacity) and recent actual flows (amount of water abstracted in the last six years) in relation to the Environmental Flow Indicator (EFI). Results are displayed using different water resource availability colours, further explained in Table 4.2. In some cases, water may be scarce at low flows, but available for abstraction at higher flows. Licences can be granted that protect low flows, this usually takes the form of a "Hands-off Flow" (HOF) or Hands-off Level (HOL) condition on a licence.

The assessment is performed at Assessment Points (APs), which are usually significant points on a river such as a confluence or gauging station.

Groundwater availability as a water resource is assessed similarly, unless better information on principle aquifers is available or if there are local issues that need to be considered.

Table 4-1: Implications of surface water resource availability colours

Water Resource Availability Colour	Implications for Licensing
BLUE- High hydrological regime	There is more water than required to meet the needs of the environment. Due to the need to maintain the near pristine nature of the water body, further abstraction is severely restricted.
GREEN-Water available for licensing	There is more water than required to meet the needs of the environment. Licences can be considered depending on local/downstream impacts.
YELLOW-Restricted water available for licensing	Fully Licensed flows fall below the Environmental Flow Indicator (EFI). If all licensed water is abstracted there will not be enough water left for the needs of the environment. No new consumptive licences would be granted. It may also be appropriate to

Water Resource Availability Colour	Implications for Licensing
	investigate the possibilities for reducing fully licensed risks. Water may be available via licence trading.
RED- Water not available for licensing	Recent Actual flows are below the Environmental Flow Indicator (EFI). This scenario highlights water bodies where flows are below the indicative flow requirement to help support Good Ecological Status. No further licences will be granted. Water may be available via licence trading.
GREY-HMWBs (and /or discharge rich water bodies)	These water bodies have a modified flow that is influenced by reservoir compensation releases, or they have flows that are augmented. There may be water available for abstraction in discharge rich catchments.

Water resource availability is assessed under four different flow conditions:

- At Q95 conditions - very low flows which are exceeded 95% of the time
- At Q70 conditions - low flows which are exceeded 70% of the time
- At Q50 conditions - median flows which are exceeded 50% of the time
- At Q30 conditions - high flows which are exceeded 30% of the time

The resource availability for Shropshire Middle Severn, Severn Corridor, and Worcestershire Middle Severn ALSs are summarised below, and for completeness the Water resource ALSs within the study area are presented graphically in Figure 4-4. The resource availability for each flow condition is presented in Figure 4-5.

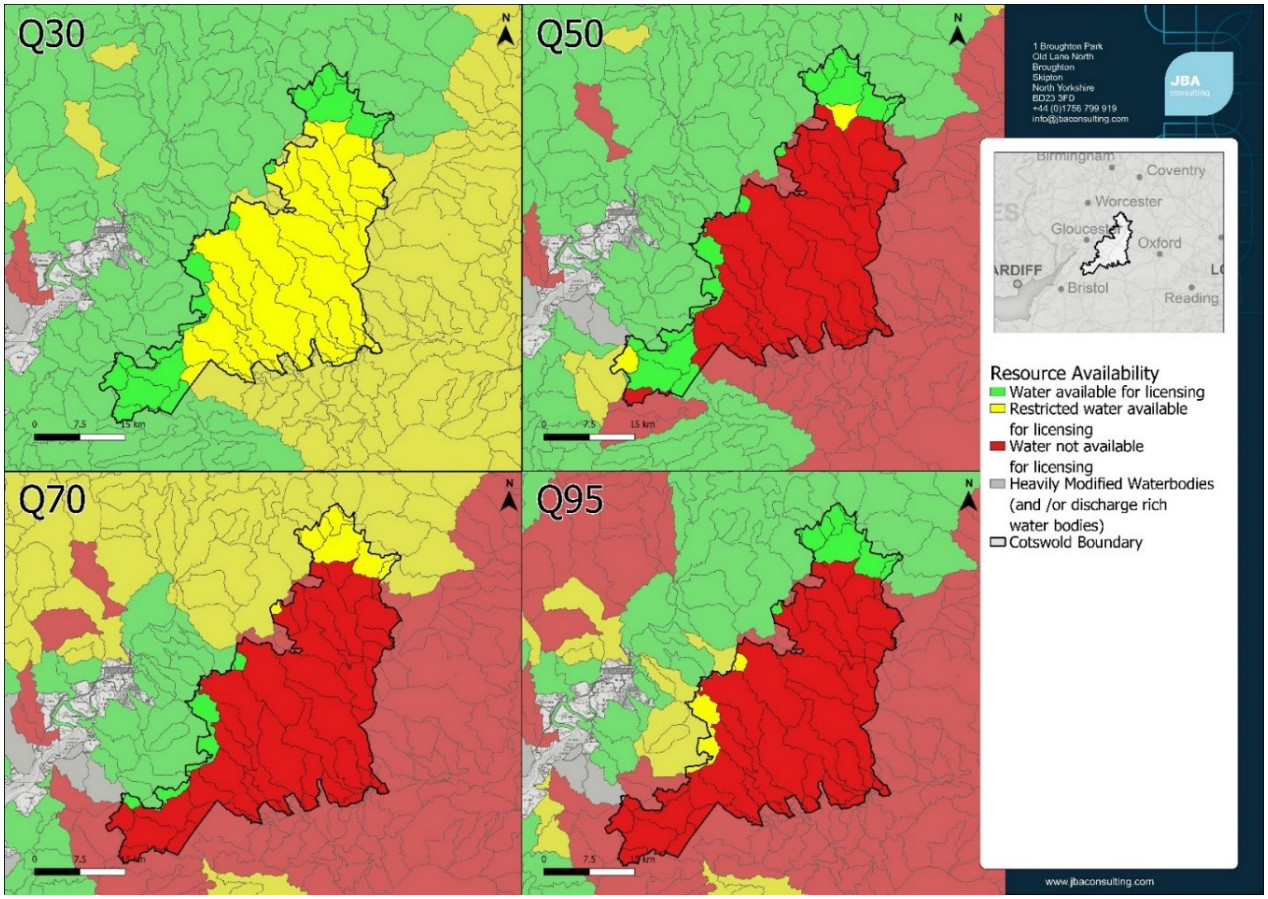

Figure 4-5 Water resources availability in Cotswold District

Figure 4-5 shows that within most of Cotswold District there is restricted water available for licensing at the 30% exceedance flow. There is not water available for licensing at the 50%, 70% and 95% exceedance flows.

4.2.3 ALS Overviews

4.2.3.1 Bristol Avon, Axe and North Somerset (Bristol Avon and Little Avon)

Significant tributaries in the ALS area include the Tetbury and Sherston Avon and the Bristol Frome from the Cotswolds. The Little Avon rises at Horton, on the edge of the Cotswolds (Environment Agency, Gov.uk, 2012).

There are no Assessment Points (AP) within the overlapping area of the ALS and the Cotswold boundary. The ALS report mapping shows that within the overlap area water resources are available less than 30% of the time and water resources are available at least 30% of the time.

At Q30 and Q50, 'water is available for licensing' and at Q70 and Q95 there is 'restricted water availability for licensing' in the overlap area.

4.2.3.2 Severn Vale

To the southeast of the Severn Vale ALS are the Cotswold Hills which are composed of Jurassic limestones that form the basis for the Cotswold principal aquifer. This feeds into the springs and watercourses in the Cotswold Hills. There are no Assessment Points (AP) within the overlapping area of the ALS and the Cotswold boundary.

The Severn Vale ALS is split into two groundwater management units (GWMUs) nominally; Cotswold North and Cotswold South. The area in Cotswold South that overlaps with the LPA boundary is listed as 'restricted water available GWMU' at Q30, Q50 and Q70. At Q95 the overlap area is partially in a 'restricted water available' area and a 'water not available' area. There is a reliable resource in this area less than 30% of the time.

The Severn Vale-Jurassic Limestone Cotswold Edge South, the groundwater body within the South Cotswold GWMU, is listed to be in 'good quantitative status not at risk of deterioration' (Environment Agency B, 2022). The ALS report states that:

" Resources are available from this unit for further groundwater development. New groundwater licences from this unit will be granted with a Hands off Flow (HoF) condition to be measured at Ebley Mill gauging station. The condition will offer the same level of protection as the surface water HoF on the River Frome. This is required as the surface water and groundwater in this area is extremely well connected."

It needs to be noted that there will still be license restrictions:

"Any application will be subject to the assessment of impacts on existing water users, groundwater dependent terrestrial ecosystems, surface water level and flow impacts. This is to ensure that no deterioration of the water environment is allowed to occur. Opportunities to reduce fully licensed risks will be taken where surface water body deterioration is a risk. In these locations, time limited license renewals will require changes to reflect historic usage to manage the risk of future deterioration to the environment."

4.2.3.3 Thames Corridor

The Thames ALS covers 2,700 km^2 encompassing both tidal and non-tidal watercourses. The River Thames is a major abstraction source for the south of England as well as being highly valued for navigational and recreational uses. The River Thames originates from the Cotswold Hills, from where it flows towards and through London. There are no Assessment Points (AP) within the overlapping area of the ALS and the Cotswold boundary.

The majority of the ALS has 'restricted water available' at Q30, including the LPA boundary overlap area. Water availability at Q50, Q75 and Q95 has 'water not available' across the whole ALS area. Additionally, consumptive abstraction is

available across the whole ALS area for 'less than 30% of the time' (Environment Agency C, 2019).

4.2.3.4 Warwickshire Avon

The Warwickshire Avon covers a small portion to the north of the LPA boundary. The Warwickshire Avon ALS area covers 2900 km^2 with agriculture being a major land use in the area. There are no Assessment Points (AP) within the overlapping area of the ALS and the LPA boundary.

At Q30, Q50 and Q75 there is water available for abstraction in the overlap area of the LPA boundary and the ALS, apart from an area close to Moreton in Marsh that has 'water not available for abstraction' across all scenarios. At Q95 the larger area has 'restricted water available' with the area close to Moreton-in-Marsh still having 'water not available for abstraction' (Environment Agency D, 2023).

4.2.3.5 Cotswold

The Cotswold ALS area covers most of the LPA boundary. The ALS area covers 1200 km^2 with main rivers such as River Churn, Ampney Brook and the River Coln to the west, and the Rivers Leach, Windrush, and Evenlode to the northeast running through it.

Seven APs are present within the overlap area of the LPA boundary and the ALS area:

- Assessment point 1, Upper Churn
- Assessment point 2, Lower Churn
- Assessment point 3, Ampney Brook
- Assessment point 4, Upper Coln and Unconfined Oolites
- Assessment point 5, Lower Coln
- Assessment point 6, Leach
- Assessment point 7, Upper Windrush and Unconfined Oolites
-

Assessment points 1,2, and 3 have HoF restrictions to protect from over-abstraction. Assessment point 1 has a HoF of 9.8 Ml/d to "protect AP2". AP2 has a HoF restriction of 8.3 Ml/d, and AP3 a restriction of 7.9 Ml/d. APs 4-7 do not have a specific HoF but have additional restrictions. The additional restrictions are listed as Thames Q50 HoF (182 days). This means that for 182 days of a year, there is a HoF restriction of water abstraction at Q50.

At Q30 the whole ALS area has restricted water availability. As for the area at Q50, Q75 and Q90, 'water is not available' for licensing. Consumptive abstraction is available at least 30% of the time.

4.3 Water Resource Assessment: Water Resource Management Plans

4.3.1 Introduction

When new developments are planned it is important to ensure that there are enough water resources in the area to cover the increase in demand without the risk of shortage in the future or in periods of high demand.

Thames Water (TWUL) is responsible for supplying water for most of the District, with small areas being served by Bristol Water (BW), Severn Trent Water (STW) and Wessex Water (WW), as illustrated in Figure 4-6.

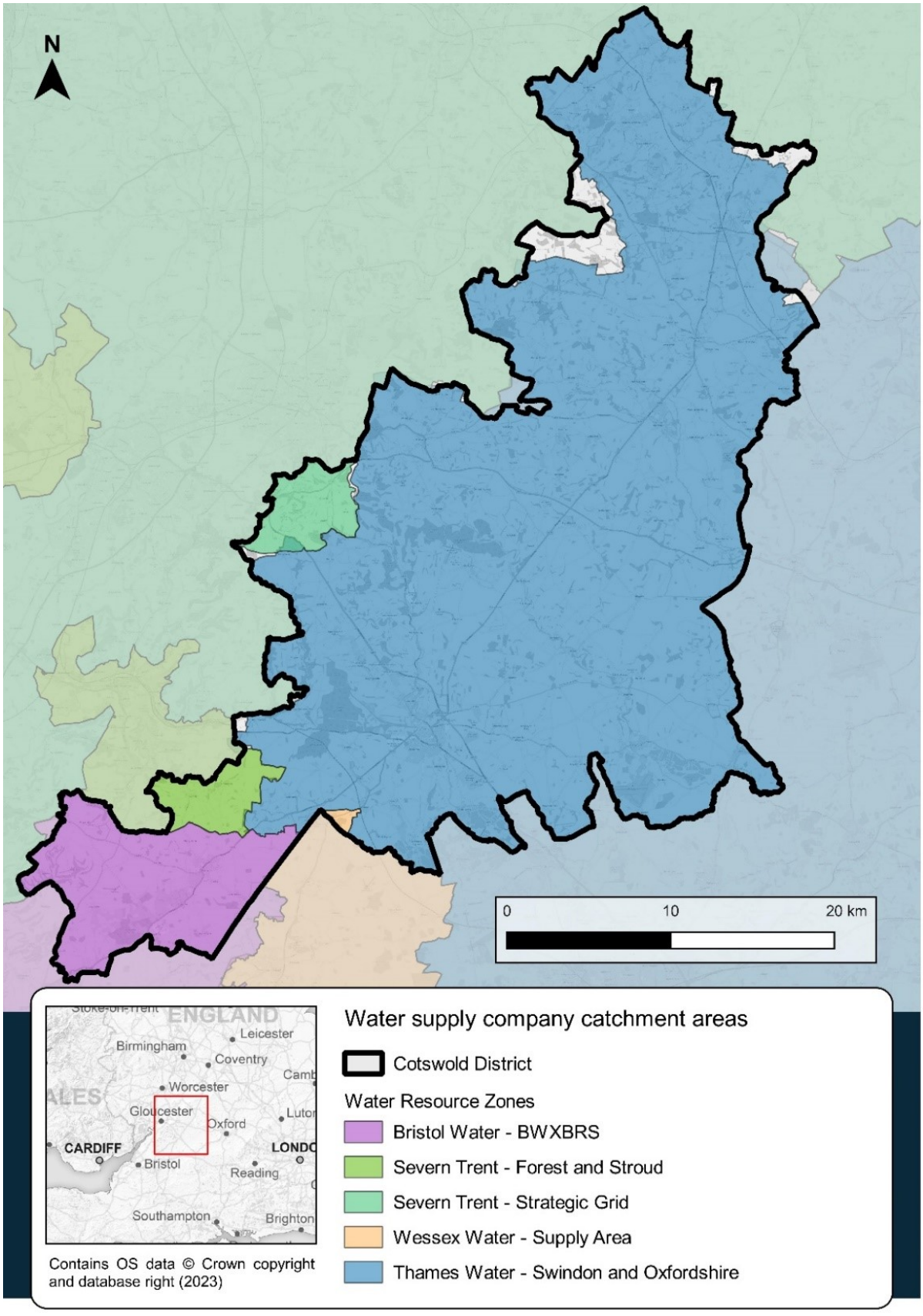

Figure 4-6: Water supply company water resource zones for the Cotswold District

The aims of this assessment are to flag if the actual housing number proposed by CDC exceeds what BW, ST, TW and WW have considered in planning the future demands so that actions can be implemented and resources planned to overcome future shortages.

The datasets used to assess the water resource capacity were:

- Site locations in GIS format (provided by the CDC)
- Number of planned houses and employment for each year for each site (provided by the CDC)
- Company and water resource zone boundaries (BW, ST, TW and WW).
- 2024 draft Water Resource Management Plans (BW, ST, TW and WW)

4.3.2 Bristol Water

Bristol Water serves the south west of the District around the town of Tetbury. There are no proposed site allocations or the existing Local Plan site allocations within this area. Consequently, there will be no significant change in demand for water supplied by Bristol Water within the District. Bristol Water's WRMP has not been reviewed.

4.3.3 Severn Trent

The Severn Trent Water supply boundary covers small areas of Cotswold District including the villages of Avening, Cherington, Coberley and Cowley, shown in Figure 4-6. There are no proposed site allocations or existing Local Plan site allocations within this area. Consequently, there will be no significant change in demand for water supplied by Severn Trent within the District. Severn Trent's WRMP has not been reviewed.

4.3.4 Thames Water

Thames Water manage water resources in six Water Resource Zones (WRZs). Their Swindon and Oxfordshire (SWOX) zone covers the majority of Cotswold District, along with Swindon, north Wiltshire and the majority of Oxfordshire. The extents of the SWOX zone are illustrated in Figure 4-6.

In the Thames Valley region, approximately 60% of the water supply is drawn from groundwater sources in the upper Kennet Valley and the Cotswolds, while the remaining 40% is sourced from surface water, including the River Thames.

Thames Water's WRMP projects a surplus in water supply relative to demand during AMP8 (2025 to 2030) but anticipates a shift to a deficit in the early 2030s. To address this, alternative methods for meeting customer demand must be developed as existing water sources become less reliable. The company plans to address this challenge in

the SWOX WRZs through the combinations of demand-management and supply measures as follows:

- Roll out of metering programme with the installation of household smart meters (achieving 95% penetration by the end of AMP8 and 98% by 2045).
- Reduction in leakage by 5.45Ml/d during AMP8.
- Promotion of water efficiency and metering to improve water use.
- Mains rehabilitation to reduce leakage.
- Further long-term demand reduction actions will need to be driven by Government to alter water use through societal changes and the adoption of minimum standards and building regulations changes.

The draft WRMP24 can currently be found at: https://thames-wrmp.co.uk/

4.3.5 Wessex Water

The Wessex Water supply boundary covers a very small triangle of land within Cotswold District, to the south west of the village of Kemble (see Figure 4-6). There are no proposed site allocations or existing Local Plan site allocations within this area. Consequently, there will be no significant change in demand for water supplied by Wessex Water within the District. Wessex Water's WRMP has not been reviewed.

4.3.6 Methodology

The TW Water Resource Management Plan (WRMP) was reviewed. Attention was focused upon:

- The available water resources and future pressures which may impact the supply element of the supply/demand balance.
- The allowance within those plans for housing and population growth and its impact upon the demand side of the supply/demand balance.

In addition, TW were provided with the list of sites including the number of houses planned each year and the population equivalent and were invited to comment upon these.

4.3.7 Population and household growth

Table 4-2 shows the household growth forecasts for the WRZs which serve growth within Cotswold from the MHCLG 2018 forecast, the emerging Local Plan and TWULs WRMP24. Direct comparisons between growth forecasts in Cotswold and SWOX are challenging due to their differing geographies. However, the growth projected by TWUL in the SWOX WRZ is higher than that anticipated in the Local Plan Partial Update.

Table 4-2: Comparison of household growth forecast

Forecast	2023	2033	% increase
Thames Water WRMP24- SWOX (2023-2024 and 2033-34) *	468,670	540,680	14.3
MHCLG 2018-based forecast – Cotswold**	94,387	104,103	9.8
Expected growth in Local Plan Partial Update	94,387	98,587***	4.4

* These figures are based on the Water Resources Market Information tables published as part TWULs WRMP24- Water resources | Regulation | About us | Thames Water.

** Household projections for England - Office for National Statistics

*** Based off of an average of 420 dwellings per year from CDCs Local Plan. The MHCLG figure was used as a 2023 baseline to add this annual growth to.

4.4 Water demand reduction

4.4.1 Water efficiency

It is important therefore that new development does not result in an unsustainable increase in water abstraction. This can be done in several ways from reducing the water demand from new houses through to achieving “water neutrality” in a region by offsetting a new development's water demand by improving efficiency in existing buildings.

Building regulations currently state that new build housing should achieve a minimum of 125 l/p/d. A tighter target of 110l/p/d is allowed if the local authority can establish a clear need based on available evidence. Water resources are under significant pressure in the UK, and the direction of travel in water resources planning is to reduce per capita consumption in new build development below the optional building regulations standard of 110 l/p/d. The Defra Plan for Water proposes changes to building regulations to include a target of 105l/p/d and 100l/p/d in water stressed areas.

Many LPAs are going further than the optional standard of 110l/p/d and specifying 100l/p/d or lower in their Local Plans.

This section will outline the evidence to support the optional target and go beyond it.

Available evidence supporting the optional water efficiency target usually includes:

- The Environment Agency classification of water stress;

- Water resource management plans produced by water companies;
- River Basin Management Plans which describe the river basin district and the pressure that the water environment faces. These include information on where water resources are contributing to a water body being classified as 'at risk' or 'probably at risk' of failing to achieve good ecological status, due to low flows or reduced water availability;
- Defra Plan for Water
- consultations with the local water and sewerage company, the Environment Agency and catchment partnerships; and
- consideration of the impact on viability and housing supply of such a requirement

4.4.2 Climate change

Climate change is predicted to increase pressure on water resources, increasing the potential for a supply-demand deficit in the future, and making environmental damage from over abstraction of water resources more likely. Furthermore, the delivery of water and wastewater services and the heating of water in the home require high energy inputs and therefore contribute directly to emissions of greenhouse gases. Water efficiency therefore reduces energy use and carbon emissions.

According to EU statistics (Eurostat 2023), 14.5% of the UK's domestic energy usage is for water heating, a reduction from years prior but still a significant percentage. If less water was being used within the home, for instance through more water efficient showers, less water would need to be heated, and overall domestic energy usage would be reduced.

In 2020-2021 the Government consulted on a Future Homes Standard that will involve changes to Part L (conservation of fuel and power) of the Building Regulations for new dwellings. However, the Future Homes Standard is to be updated and implemented by 2025, and as such usage may change to reflect the updates.

4.4.3 Water Stress

Water stress is a measure of the level of demand for water (from domestic, business and agricultural users) compared to the available freshwater resources, whether surface or groundwater. Water stress causes deterioration of the water environment in both the quality and quantity of water and consequently restricts the ability of a waterbody to achieve a "Good" status under the Water Framework Directive.

The Environment Agency has undertaken an assessment of water stress across the UK. This defines a water stressed area as where:

- The current household demand for water is a high proportion of the current effective rainfall which is available to meet that demand; or

- The future household demand for water is likely to be a high proportion of the effective rainfall available to meet that demand.

In the Environment Agency assessment, the Bristol Water, Thames Water and Wessex Water supply regions were classified as being an area of serious water stress.

4.4.4 River Basin Management Plans

The study area is located within the South West, Thames and Severn River Basin Districts. The management recommendations from these RBMP's are listed below:

- **Government and agencies (Environment Agency)** grant licences under the Water Resources Act 1991 to regulate how much water is taken from rivers, lakes estuaries and groundwater. The Environment Agency reviews the sustainability of time-limited abstraction licences as they expire, and the licence holders seek replacement licences.
- **All sectors** take up or encourage water efficiency measures, including water industry work on metering, leakage, audits, providing water efficient products, promoting water efficiency and education.
- **Local Government** sets out local plan policies requiring new homes to meet the tighter water efficiency standard of 110 litres per person per day as described in Part G of Schedule 1 to the Building Regulations 2010.
- **Industry manufacturing and other business** implement tighter levels of water efficiency, as proposed by changes to the Building Regulations.
- **Agriculture and rural land management** manage demand for water and use water more efficiently to have a sustainable water supply for the future.
- **Local government** commissions water cycle studies to inform spatial planning decisions around local water resources.

The RBMPs goes on to state that "dealing with unsustainable abstraction and implementing water efficiency measures is essential to prepare and be able to adapt to climate change and increased water demand in the future."

4.4.5 Defra Plan for Water

Through their Plan for Water (DEFRA, 2023) Defra has signalled their intention to review the water efficiency standards for new homes, including consideration of a new national 105l/p/d standard and 100l/p/d where there is a clear local need.

4.4.6 National Water Resources Framework

A National Framework for Water Resources was published by the Government in March 2020. This outlines the water resources challenges facing England and sets out the strategic direction for the work being carried out by regional water resource groups.

A range of options were explored, and the most ambitious scenarios rely on policy change to introduce mandatory labelling of water using fittings and associated standards. The Government is currently reviewing policy on water efficiency following a recent consultation. The framework proposes that regional groups plan to help customers reduce their water use to around 110 l/p/d. This is achievable without policy interventions.

In order to achieve an average water efficiency of 110l/p/d across the UK, which includes both new build housing and existing housing, new build housing would need to go beyond the optional building regulations target of 110l/p/d or it may make the overall target harder to achieve.

4.4.7 Water company advice

- Wessex Water offers incentives to development achieving water efficiency below the target of 110l/p/d and provides water saving advice on their website here. Additionally, to address water use in existing development, Wessex Water has an ongoing programme focussing on education, water efficiency improvements and rainwater storage.
- Bristol Water recognises that to achieve the per capita consumption target of 110l/p/d, a collaborative approach between LPAs and water companies is needed and offers reduced infrastructure charges to developers.
- Thames Water offer discounts on connection charges to developers adopting low water use devices. It has a focus on designing water efficient homes using a fittings-based approach. In their response to the CDC Infrastructure Requirements Consultation (Thames Water, 2022), Thames Water supported the optional water efficiency standard of 110l/p/d.

4.4.8 Defra Plan for Water

Through their Plan for Water (Defra, 2023) Defra has signalled its intention to review the water efficiency standards for new homes, including consideration of a new national 105l/p/d standard and 100l/p/d where there is a clear local need.

The Future Homes Hub was established to "facilitate the collaboration needed within and beyond the new homes sector to help meet the climate and environmental challenges ahead" (Future Homes Hub, 2024). It consists of representatives from the building industry, regulators, water companies, and environmental groups. Defra asked them to support them in the creation of the roadmap towards greater water efficiency. They have proposed a road map for water efficient homes in England and sets out a framework for the homebuilding sector to work in partnership with other stakeholders such as the water sector, local authorities and regulators to deliver it. The proposed roadmap is shown in Figure 4-7 below and outlines a staged approach to reducing per capita consumption. It also allows for a tighter figure of 90l/p/d by 2025 in seriously water stressed areas to enable sustainable growth.

Figure 4-7 Future Homes Hub proposed water efficiency roadmap

4.4.9 Impact on viability

The Future Homes Hub provide some indicative costs for achieving different water efficiency targets. They state that there is no additional cost to achieve 110l/p/d. The cost of achieving 100l/p/d is estimated to be £350 per unit (Future Homes Hub, 2024).

Research undertaken for the devolved Scottish and Welsh governments by the Energy Saving Trust indicated potential annual savings on water and energy bills for householders of approximately £31 per year as a result of water efficiency measures that would allow a target of 100l/p/d to be met (Energy Saving Trust, 2020). Water efficiency is therefore not only viable but of positive economic benefit to both private homeowners and tenants. In addition, financial incentives are available from the water companies to developers to encourage water-efficient design.

Research published by Building Research Establishment (BRE) on the delivery of sustainable buildings reports that the cost of achieving lower BREEAM ratings incurs little or no additional cost and targeting higher BREEAM ratings incurs a typical cost of less than 2% above the baseline for that development. The same study reports that the cost of achieving 3 credits in WAT01 (a 40% reduction in water consumption for baseline) would be £13,361 and payback could be achieved between 1 and 2.5 years depending on the price of water (BRE, 2018).

4.4.10 Summary

Cotswold District Council's existing adopted Local Plan has a water efficiency policy of designing new dwellings to 110 litres per person per day, The LPPU Regulation 18 Consultation included a similar policy for domestic water demand and BREEAM Water efficiency credits for non-household development.

Given the evidence of pressures on the environment and on public water supply, as well as guidance from water companies, it is advised that the Council's domestic water efficiency target policy should aim to align with the standards proposed in the Future Homes Hub roadmap, which recommends 100l/p/d by 2025 down to 80l/p/d by 2035.

For non-household development, it is recommended that the policy requires a minimum of 3 credits under the BREEAM New Construction Standard measure "Wat01," which provides a 40% improvement in water consumption compared to the baseline for that type of building.

4.4.11 Implementation of water efficiency standard

Within Part G of the Building Regulations, the water efficiency targets can be achieved either through the calculation method or the fittings approach. It is strongly recommended that the fittings-based approach is required to evidence whichever target is adopted in the Local Plan. This approach provides clear flowrate and volume metrics for each fitting or appliance. This provides a greater confidence that the target will be met once constructed. Insight gained from a recent Thames Water study of customers with smart meters (unpublished) showed that where the calculation method was applied, households did not achieve the intended performance level.

4.5 Water neutrality concept

Water neutrality is a relatively new concept for managing water resources, but one that is receiving increased interest as deficits in future water supply/demand are identified. The definition adopted by the Government and the Environment Agency (2009) is:

"For every development, total water use in the wider area after the development must be equal to or less than total water use in the wider area before development".

It is useful to also refer to the refined definition developed by Ashton:

"For every new significant development, the predicted increase in total water demand in the region due to the development should be offset by reducing demand in the existing community, where practical to do so, and these water savings must be sustained over time" (V Ashton, 2014)

This definition states the need to sustain water saving measures over time, and the wording "predicted increase in total water demand" reflects the need for water neutrality to be designed in at the planning stage.

Both definitions refer to water use in the region or "wider area", and the extent of this area should be appropriate to local authority boundaries, water resource zones, or water abstraction boundaries depending on what is appropriate for that particular location. For instance, if a development site is in an area of water stress relating to a particular abstraction source, offsetting water use in a neighbouring town that is served by a different water source will not help to achieve water neutrality.

In essence water neutrality is about accommodating growth in a region without increasing overall water demand.

Water neutrality can be achieved in a number of ways:

- Reducing leakage from the water supply networks
- Making new developments more water-efficient
- "Offsetting" new demand by retrofitting existing homes with water-efficient devices
- Encouraging existing commercial premises to use less water
- Implementing metering and tariffs to encourage the wise use of water
- Education and awareness-raising amongst individuals

4.5.1 Consumer water efficiency measures

Suggestions for water-efficiency measures are listed in Table 4-3

Table 4-3 Consumer water efficiency measures

Type of measure	Examples
Education and promotional campaigns	Encourage community establishments (e.g., schools, hospitals) to carry out self-audits on their water use Deliver water conservation message to schools and provide visual material for schools Building awareness with homeowners/tenants
Water-efficient measures for toilets	Cistern displacement devices to reduce volume of water in cistern Retro-fit or replacement dual flush devices Retro-fit interruptible flush devices Replacement low-flush toilets

Type of measure	Examples
Water-efficient measures for taps	Tap inserts, such as aerators Low flow restrictors Push taps Infrared taps
Water-efficient measures for showers and baths	Low-flow shower heads Aerated shower heads Low-flow restrictors Shower timers Reduced volume baths (e.g. 60 litres) Bath measures
Rainwater harvesting and water reuse	Large-scale rainwater harvesting Small-scale rainwater harvesting for example with a water butt, or rainwater tank for toilet flushing Grey water recycling
Water-efficient measures addressing outdoor use	Hosepipe flow restrictors Hosepipe siphons Hose guns (trigger hoses) Drip irrigation systems Mulches and composting
Commercial properties	Commercial water audits Rainwater recycling Grey water recycling Optimising processes Provide water efficiency information to all newly metered businesses
Metering	Promote water companies free meter option Compulsory metering (in water stressed areas) Smart metering (to engage customer with their consumption) Provide interactive websites that allow customers to estimate the savings associated with metering (environmental and financial) Innovative tariffs (seasonal, peak, rising block) Customer supply pipe leakage - supply pope repair and replacement
Other	Household water audits, including DIY or with help of plumber Seek-and-fix internal leaks and/or dripping taps Water efficient white goods, included washing machines and dishwashers Ask customers to spot and report leaks

Source: Adapted from Booth and Charleswell 2014

4.5.2 Rainwater and Greywater Recycling

Rainwater harvesting

Rainwater recycling or rainwater harvesting (RwH) is the capture of water falling on buildings, roads or pathways that would normally be drained via a surface water sewer, infiltrate into the ground or evaporate. In the UK this water cannot currently be used as a drinking water supply as there are strict guidelines on potable water, but it can be used in other systems within domestic or commercial premises.

Systems for collection of rainwater can be simple water butts attached to a drainpipe on a house, or it could be a complex underground storage system, with pumps to supply water for use in toilet flushing and washing machines. By utilising rainwater in this way there is a reduced dependence on mains water supply for a large proportion of the water use in a domestic property

Benefits of RwH

- RwH reduces the dependence on mains water supply – reducing bills for homeowners and businesses
- Less water needs to be abstracted from river, lakes and groundwater
- Stormwater is stored in a RwH system reducing the peak surface water runoff leaving a site providing a flood risk benefit (for smaller storms)
- By reducing surface water flow, RwH can reduce the first flush effect whereby polluted materials adhering to pavement surfaces during dry periods are removed by the first flush of water from a storm and can cause pollution in receiving watercourses.

Challenges of RwH

- Dependency on rainfall can limit availability of harvested rainwater during drought and hot weather events.
- Increased capital (construction) costs to build rainwater harvesting infrastructure into new housing (£900 to £3,000 for a small-scale domestic system)
- Payback periods are long as the cost of water is low so there is little incentive for homeowners to invest.

Greywater harvesting

Greywater refers to water that has been “used” in the home in appliances such as washing machines, showers and hand basins. Greywater recycling or greywater harvesting (GwH) is the treatment and re-use of this water in other systems such as for toilet flushing. By their nature, GwH systems require more treatment and are more complex than RwH systems, and there are limited examples of their use in the UK.

Greywater re-use refers to systems where wastewater is taken from source and used without further treatment. An example of this would be water from a bath or shower being used on plants in the garden. This sort of system is easy to install and maintain,

however as mentioned above the lack of treatment to remove organic matter means the water cannot be stored for extended periods.

Greywater recycling refers to systems where wastewater undergoes some treatment before it is used again. These systems are complex and require a much higher level of maintenance than RwH or greywater re-use systems.

Domestic water demand can be significantly reduced by using GwH, and unlike with a RwH system where the availability of water is dependent on the weather, the source of water is usually constant (for instance if it is from bathing and showering). However, the payback period for a GwH system is usually long, as the initial outlay is large, and the cost of water relatively low.

Viability of greywater systems for domestic retrofit applications is therefore currently limited. However, communal systems may offer more opportunities where the cost can be shared between multiple households particularly on larger new build developments, or in new settlements.

4.5.3 Energy and Water use

According to EU statistics (Eurostat 2017), 17% of the UK's domestic energy usage is for water heating. If less water was being used within the home, for instance through more water efficient showers, less water would need to be heated, and overall domestic energy usage would be reduced.

In 2020-2021 the Government consulted on a Future Homes Standard that will involve changes to Part L (conservation of fuel and power) of the Building Regulations for new dwellings. Unfortunately, this fails to identify the role of water efficiency in the home in also reducing energy usage.

4.5.4 Funding for water neutrality

Water neutrality is unlikely to be achieved by just one type of measure, and likewise it is unlikely to be achieved by just one funding source. Funding mechanisms that may be available could be divided into the following categories:

- Infrastructure-related funding (generally from developer payments)
- Fiscal incentives at a national or local level to influence buying decisions of households and businesses
- Water company activities, either directly funded by the five-year price review or as a consequence of competition and individual company strategies
- Joint funding through energy efficiency schemes (and possibly to integrate with the heat and energy saving strategy).

Currently in the UK, the main funding resource for the delivery of water efficiency measures is the water companies, with some discretionary spending by property

owners or landlords. For water neutrality to be achieved, policy shifts may be required in order to increase investment in water efficiency. Possible measures could include:

- Further incentivisation of water companies to reduce leakage and work with customers to reduce demand
- Require water efficient design in new development
- Developer funding to contribute towards encouraging water efficiency measures
- Require water efficient design in refurbishments when a planning application is made
- Tighter standards on water using fittings and appliances.

4.6 Water Efficiency Incentives

Thames Water offer significant reductions in the developer connection charges for new building housing that achieves water efficiency better than the Building Regulations 125l/p/d standard. A tiered approach is taken as follows:

Tier 1: Basic water efficiency

"You'll need to submit evidence that your development has been designed (as per the planning application) to achieve the 'Optional Requirement' of 110 litres/person/day, using the 'Fittings Approach' as outlined in Part G2 of the Building Regulations 2010 Approved Document G."

Discount £200 per property

Tier 2: Rainwater Harvesting and Greywater Recycling

In addition to fulfilling the requirements of Tier 1, a further discount is offered if RwH or GwR is incorporated into the developer's design.

Discount £1,000 per property

Tier 3: Water neutrality

"A water neutral development does not add additional water demand pressures to its water resource zone supply needs. This is achieved by making the development as water efficient as possible (by adhering to Tiers 1 and 2) and then offsetting the development's remaining water demand through savings made on existing homes and businesses in the same water resource zone."

Discount £1,800 per property

Developers should be strongly encouraged to take up at least the Tier 2 incentives. These may be particularly applicable to larger developments where community scale RwH schemes could be applied, pooling the incentives and sharing cost.

4.6.1 Wessex Water Incentive

As part of their 2024-2025 charging arrangements, Wessex Water offer a new environmental incentive for developers who provide evidence that new properties will consume less than 100l/p/d.

4.6.2 Bristol Water Incentive

To incentivise water usage reduction for developer customers, Bristol Water propose the following scheme in their infrastructure charging arrangements for 2024/2025.

- 75% reduction of the infrastructure charge if 95 litres/person/day is achieved.
- 50% reduction of the infrastructure charge if 100 litres/person/day is achieved.
- 0% reduction of infrastructure charge if the current Building Regulation standard of
- 110 litres/person/day is achieved.

4.7 Conclusions

- In Cotswold District, potable water is supplied by Thames Water, Severn Trent Water, Bristol Water and Wessex Water.
- Bristol Water and Severn Trent both serve smaller areas within the District and do not anticipate significant changes in water demand due to the absence of new site allocations. Their respective Water Resource Management Plans (WRMPs) have not been reviewed.
- Thames Water supplies the majority of the District through its Swindon and Oxfordshire (SWOX) zone. Despite projecting a surplus in water supply during AMP8 (2025-2030), Thames Water anticipates a future deficit and plans to implement a combination of demand-management and supply measures to address this challenge.
- Thames Water's growth allowance for the SWOX WRZ significantly exceeds the percentage growth allowed for within the LPPU, indicating that there is sufficient allowance for growth within the WRMP (although the LPPU and this supporting WCS does not make allowance for the increased housing growth targets resulting from the 2024 update to the NPPF.
- It is important that new development does not result in an unsustainable increase in water abstraction. This can be done in a number of ways from reducing the water demand from new houses through to achieving “water neutrality” in a region by offsetting a new developments water demand by improving efficiency in existing buildings.
- Water resources are under significant pressure in the UK, and the direction of travel in water resources planning is to reduce per capita consumption in new build development below the optional building regulations standard of 110 l/p/d.

4.8 Recommendations

Table 4-4 Water resources recommendations

Action	Responsibility	Timescale
Continue to regularly review forecast and actual household growth across the supply region through WRMP Annual Update reports, and where significant change is predicted, engage with Local Planning Authorities.	TW	Ongoing
Provide yearly profiles of projected housing growth to water companies to inform the WRMP update.	CDC	Ongoing
Consider a policy on water efficient design aligned with the standards proposed in the Future Homes Hub roadmap, which recommends 100l/p/d by 2025 down to 80l/p/d by 2035. For non-household development, it is recommended that the policy requires a minimum of 3 credits under the BREEAM New Construction Standard measure “Wat01.”	CDC	LPPU

5 Water supply infrastructure

5.1 Introduction

Increase in water demand adds pressure to the existing supply infrastructures. An assessment is required to identify whether the existing infrastructure is adequate or whether upgrading will be required. The time required to plan, obtain funding and construct major pipeline works can be considerable and therefore water companies and planners need to work closely together to ensure that the infrastructure is able to meet growing demand.

Water supply companies make a distinction between supply infrastructure, the major pipelines, reservoirs and pumps that transfer water around a WRZ, and distribution infrastructure, smaller scale assets which convey water around settlements to customers. This assessment is focussed on the supply infrastructure. It is expected that developers should fund assessments and the modelling of the distribution systems to assess requirements for local capacity upgrades.

5.2 Recommendations

Table 5-1 Water supply infrastructure recommendations.

Actions	Responsibility	Timescale
Undertake network modelling where appropriate as part of the planning application process to ensure adequate provision of water supply is feasible	CDC TW STW WW	As part of the planning process
Cotswold and Developers should engage early with water companies to ensure infrastructure is in place prior to occupation.	CDC TW STW WW	Ongoing

6 Wastewater collection

6.1 Sewerage undertakers

Thames Water (TW) is the Sewerage Undertaker (SU) across most of the District, with areas around Chipping Campden and Avening being served by Severn Trent Water Limited (STWL) and the Tetbury area being served by Wessex Water (WW), as shown in Figure 6-1. The role of sewerage undertaker includes collection and treatment of wastewaters from domestic and commercial premises, and in some areas drainage of surface water from building curtilages to combined or surface water sewers. It excludes, unless adopted by TW, systems that do not connect directly to the wastewater network, e.g. SuDS or highway drainage.

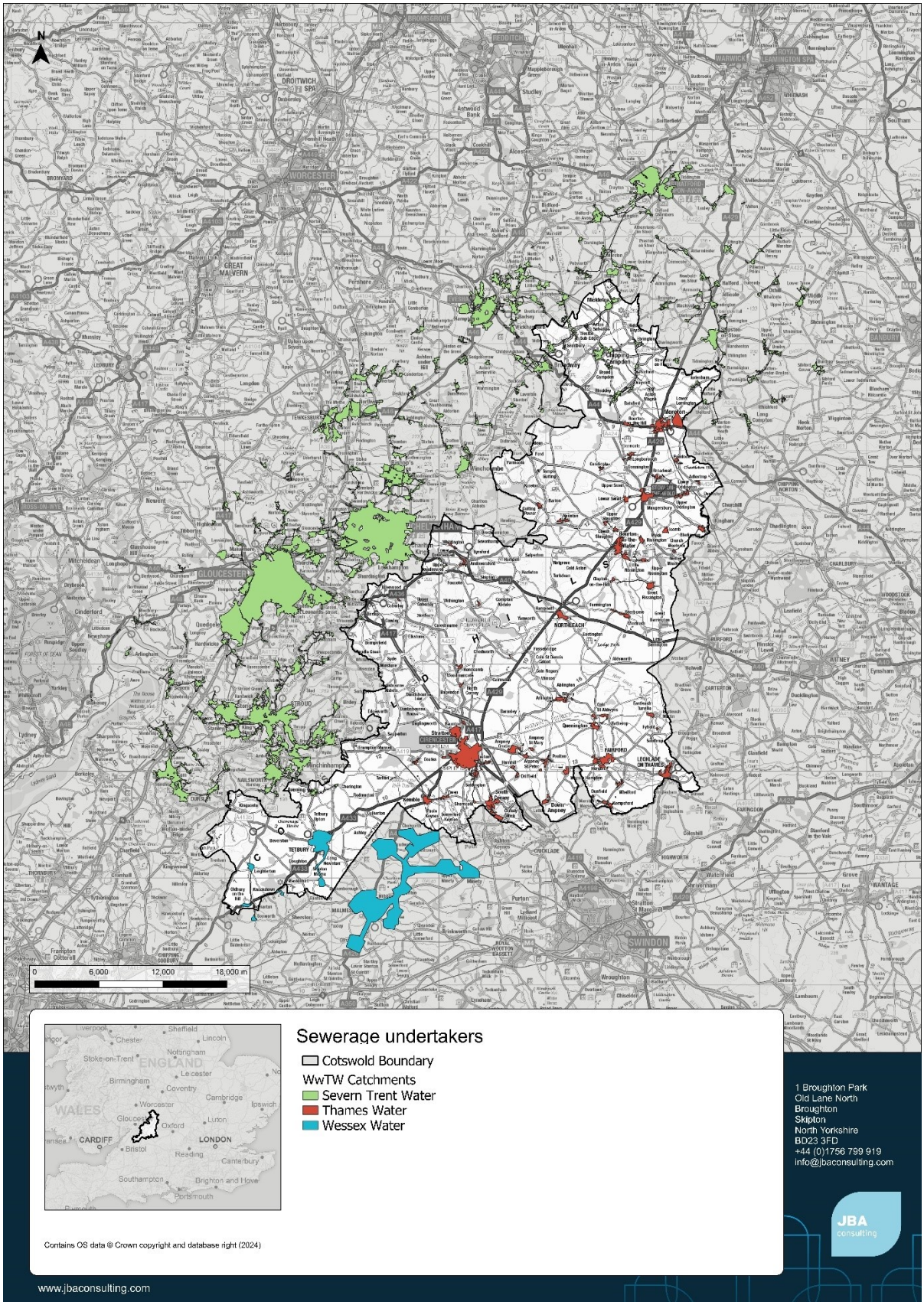

Figure 6-1 Sewerage undertakers for Cotswold District

Increased wastewater flows into collection systems due to growth in population or per-capita consumption can lead to overload of infrastructure, increasing the risk of sewer flooding and, where present, increasing the frequency of discharges from Combined Sewer Overflows (CSOs).

Likewise, headroom at wastewater treatment works can be eroded by growth in population or per-capita consumption, requiring investment in additional treatment capacity. As the volume of treated effluent rises, even if the effluent quality is maintained, the pollutant load discharged to the receiving watercourse will increase. In such circumstances the Environment Agency, as the environmental regulator, may tighten the permitted effluent permits in order to achieve a "load standstill", i.e. ensuring that as effluent volumes increase the pollutant load discharged does not increase. Again, this would require investment by the water company to improve the quality of the treated effluent.

In combined sewerage systems, or foul systems with surface water misconnections, there is potential to create headroom in the system, thus enabling additional growth, by removal of surface water connections. This can most readily be achieved on redevelopment of brownfield sites with combined sewerage, where there is potential to discharge surface water via sustainable drainage systems (SuDS) to groundwater, watercourses or surface water sewers.

6.2 Assessment of the Drainage and Wastewater Management Plans (DWMPs)

6.2.1 Thames Water DWMP

Thames Water's DWMP outlines their strategy for addressing future challenges in wastewater services, detailing the necessary investments to expand, enhance, and sustain wastewater systems and drainage networks over the next 25 years. The overall vision of the DWMP is ‘to identify future catchment risks to our drainage and wastewater treatment systems and develop sustainable, efficient solutions to address them.’ With the aim to deliver in three areas:

- Customers and communities – fair charges for the services we provide, improved health and wellbeing, increased amenity, and a resilient service.
- Drainage and wastewater services – reduce sewer flooding and achieve 100% Sewage Treatment Works (STW) compliance.
- The environment – restore river health, increase biodiversity, environmental net gain.

Thames Water's DWMP includes Catchment Strategic Plans (CSPs) for each Thames regional Flood and Coastal Committee (TRFCC) area. The study area falls under the Swindon and Oxfordshire (SWOX) (Level 2) CSP, which then falls into one of the 382 planning catchments (Level 3). Initial risk-based screening found that 77% of the L3

catchments in this CSP were vulnerable to growth and climate change, warranting long-term planning. 7% of properties are forecast to be at risk of internal hydraulic sewer flooding in a 1 in 50-year storm by 2050. With no action, by 2050 Thames Water predict that 44% of L3 catchments will have storm overflow discharge of greater than 10 discharges per year on average by 2050.

The targets for catchments in this CSP are to:

- Reduce the number of customers at risk of internal and external hydraulic sewer flooding up to a 1 in 50-year storm by 100%.
- Reduce storm discharges (where overflows are present) to <10 in an average year by 2050
- Achieve 100% STW permit compliance

6.2.2 Severn Trent DWMP

The Severn Trent DWMP explains that "the overall objective of DWMP is to provide visibility of the current and future challenges, outline what strategic interventions are best to mitigate these future pressures and inform the appropriate pace of investment to meet the long term aims".

Severn Trent Water's Drainage and Wastewater Management Plan (DWMP) outlines eight key goals:

- Secure future water supply
- Promote efficient water use
- Provide a high-quality, affordable service
- Reduce the risk of flooding and pollution
- Protect and enhance the environment
- Support a circular economy
- Make a positive social impact
- Maintain a safe, inclusive workplace

The region contains 2,647 storm overflows, with 1,097 predicted to become high priority by 2050, as they activate more than 10 times annually, exceeding national guidelines. Severn Trent aims to address 39% of harmful storm overflows and 26% of those that exceed the annual activation limit by 2030, aligning with the Storm Overflow Discharge Reduction Plan. Reducing the frequency of storm overflow operations will involve upgrading wastewater treatment works (WwTWs) and sewer systems to ensure overflows occur only during extreme rainfall.

A Baseline Risk and Vulnerability Assessment (BRAVA) evaluated the risk of sewer flooding for various climate change scenarios (no temperature change, and 2°C or 4°C increases). Currently, around 112,000 properties (2.58% of connected properties) are at risk of flooding. Without WwTW upgrades, this could increase by 39% (to 155,998 properties) by 2050 under a 2°C rise in temperature.

The DWMP identifies investment opportunities to reduce flooding and storm overflow spills, such as separating surface water from combined sewers and improving pollutant screening. There is also a focus on maximising nature-based solutions, like Sustainable Drainage Systems (SuDS), to sustainably manage surface water and reduce its impact on the sewer network.

Overall, the plan emphasises reducing storm overflow events, upgrading WwTWs, and developing sustainable water management strategies like SuDS

6.2.3 Wessex Water DWMP

Wessex Water's DWMP outlines their strategy to manage current and future challenges to drainage and wastewater systems while increasing investment in infrastructure and environmental protection. In addition to the national planning goals, six objectives specific to Wessex Water were established in the DWMP process:

- Reducing groundwater infiltration
- Promoting sustainable drainage
- Expanding partnership opportunities
- Improving river water quality
- Reducing the risk of flow compliance failures at water recycling centres
- Minimizing the risk of blockages

To achieve these objectives, protect public health, and enhance the environment, Wessex Water plans the following investments by 2030:

- Continue maintaining and operating assets to high standards
- Invest £1.4 billion to upgrade water recycling centres, meet stricter treatment standards, and support population growth
- Spend £550 million to improve the performance of 148 storm overflows
- Implement nature-based solutions where they provide the best value
- Allocate nearly £100 million to monitor the water quality impacts of treatment works and storm overflow discharges
- Increase investment to reduce groundwater infiltration into sewers and manholes.

Wessex Water's DWMP contains an assessment of risk at catchment level, which has been carried out using a Baseline Risk and Vulnerability Assessment (BRAVA), including how risk is anticipated to change over the next 5, 10 and 25 years. Overall, BRAVA results showed predicted flooding in 2050 to be 57% higher than 2025 for the 1 in 30-year event.

6.3 Storm overflows

Storm overflows are an essential component in the sewer network – however when they operate frequently, they can cause environmental damage. They occur on combined sewer systems where the sewer takes both foul flow (sewage from homes and offices) and rainwater runoff. In normal conditions (Figure 6-2) all of this flow passed through the sewer network and is treated at a wastewater treatment works.

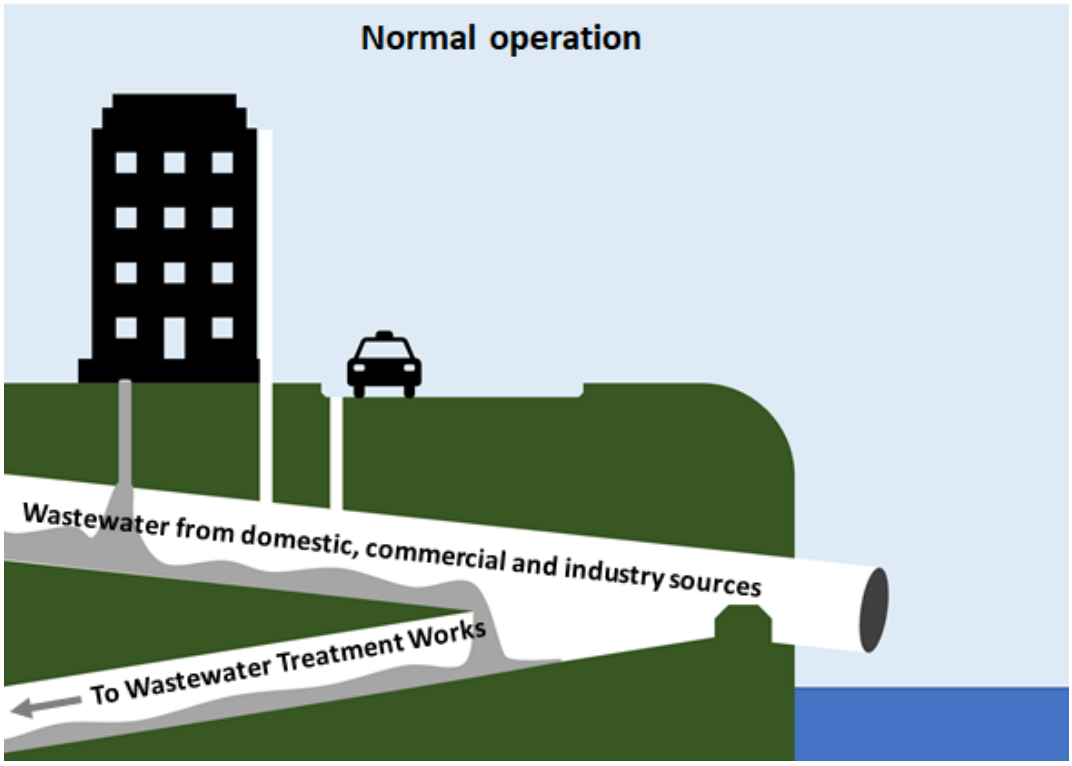

Figure 6-2: Storm overflow operation in normal conditions

In periods of exceptional rainfall (Figure 6-3), the capacity in a combined sewer may be used up by the additional flow from rooftops and storm drains. Once the capacity is exceeded, wastewater would back up into homes, businesses and on to roads. A storm overflow acts as a relief valve, preventing this from happening.

Storm overflows become problematic when they operate frequently in moderate or light rainfall, or for long periods as a result of groundwater infiltration in the sewerage system – possibly in breach of their permit.

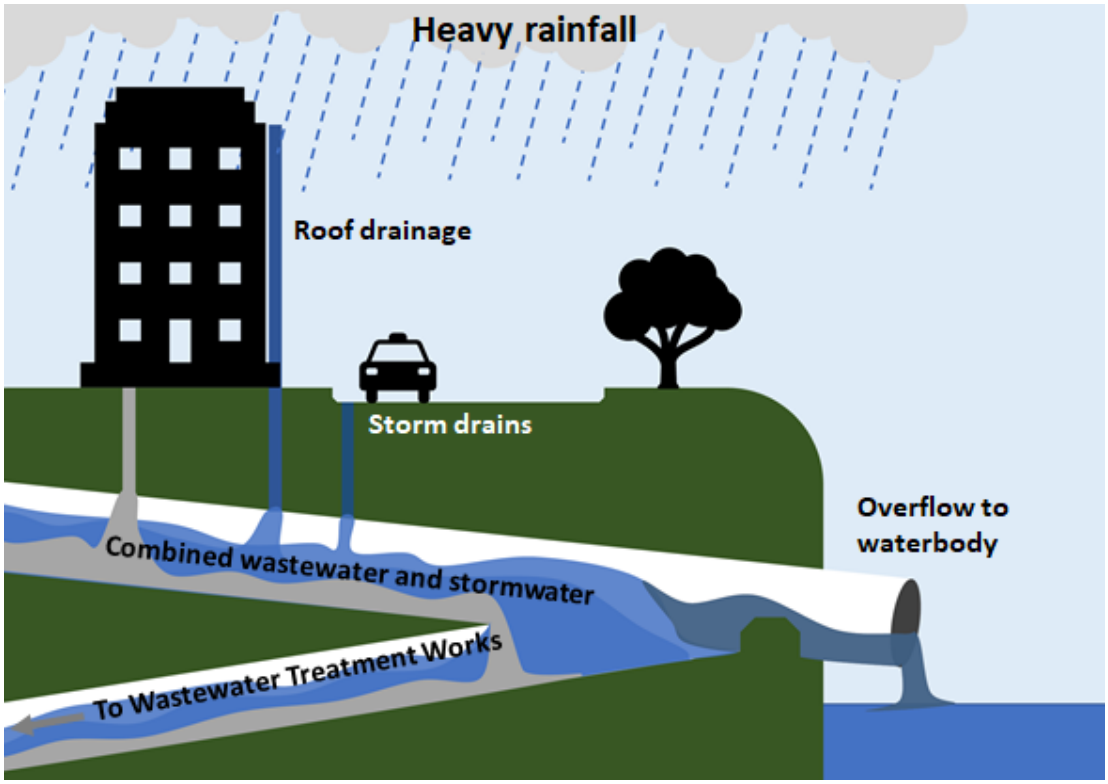

Figure 6-3: Storm overflow operation in exceptional rainfall

6.4 Methodology

6.4.1 Sewerage System Capacity Assessment

New residential developments add pressure to the existing sewerage systems. An assessment is required to identify the available capacity within the existing systems, and the potential to upgrade overloaded systems to accommodate future growth. The scale and cost of upgrading works may vary significantly depending upon the location of the development in relation to the network itself and the receiving WwTW.

It may be the case that an existing sewerage system is already working at its full capacity and further investigations have to be carried out to define which solution is necessary to implement an increase in its capacity. New infrastructure may be required if, for example, a site is not served by an existing system. Such new infrastructure will normally be secured through private third-party agreements between the developer and utility provider.

Sewerage Undertakers must consider the growth in demand for wastewater services when preparing their five-yearly Strategic Business Plans (SBPs) which set out investment for the next Asset Management Plan (AMP) period. Typically, investment is committed to provide new or upgraded sewerage capacity to support allocated growth with a high certainty of being delivered. Additional sewerage capacity to service windfall sites, smaller infill development or to connect a site to the sewerage

network across third party land is normally funded via developer contributions, as third-party arrangements between the developer and utility provider.

6.4.2 Storm overflow assessment

The Environment Act now requires water companies to report and monitor storm overflows as well as reduce the harm caused to the rivers they discharge to.

The Storm Overflow Taskforce has agreed a long-term goal to end the damaging pollution caused by the operation of storm overflows. An important component of this is the monitoring of overflows, and the target to monitor the frequency and duration of operation at all storm overflows was met at the end of 2023. This is called Event Duration Monitoring (EDM). The EDM dataset (which contains performance data on the 14,318 storm overflows monitored in 2023) has been used to provide information on storm overflows in Cotswold District (Environment Agency, Environment Agency, 2024). The EA have set thresholds above which a storm overflow should be investigated (Environment Agency, 2018). Where there is one year of EDM data this should be if there are over 60 operations per year, over 50 operations for two years of data and 40 operations for three years of data. We have included a maximum of 3 years of data in our assessment, where less years were available, we have applied the above corresponding threshold, shown in Table 6-1.

Table 6-1: Definition of RAG scoring applied

Sewer Overflows RAG Score	Number of operations per year (average of available data)	Commentary
Green	0-10	Overflow is currently operating within the long-term (2050) target. Need to ensure that this is maintained in the long-term considering upstream development, climate change and urban creep.
Amber	11 - threshold for individual CSO	An investigation is not required at present, but improvements will need to be made in the network and/or catchment to meet the long-term target.
Red	Above threshold	The overflow may already be operating beyond the threshold which would trigger an investigation. Upstream development could further increase the discharge frequency, so mitigation should be required prior to significant development.

An overview of the EDM network storm overflow data from 2020-2022 can be found in Table 6-2 and Figure 6-4

Table 6-2: Network storm overflow frequency of operation and duration from 2020-2022

Overflow name (Permit number)	Number of operations in 2020	Duration of Operation in 2020 (hours)	Number of operations in 2021	Duration of Operation in 2021 (hours)	Number of operations in 2022	Duration of Operation in 2022 (hours)	Averages*	RAG rating
TBC (TBC)	N/A**	N/A	5	10.91	0***	0	N/A*#	Green
Sheafhouse Farm CSO (S/14/25382/O)	10	38.75	34	538.94	1	1.62	15.0	Amber
Mickleton - Cotswold Edge SPS (S/13/09102/O)	7	39.5	6	23.91	4	13.87	5.7	Green
Bourton-On-The-Water STW (CTCR.2036)	N/A	N/A	58	1085.22	20	167.63	39.0	Amber
CSO At Moreton-In-Marsh SPS (CTCR.2092)	N/A	N/A	N/A	N/A	3	39.02	N/A	Green
Storm Sewage Irrigation Area, Moreton-In-Marsh (CTCR.2093)	62	910.57	N/A	N/A	64	710.03	63.0	Red

Overflow name (Permit number)	Number of operations in 2020	Duration of Operation in 2020 (hours)	Number of operations in 2021	Duration of Operation in 2021 (hours)	Number of operations in 2022	Duration of Operation in 2022 (hours)	Averages*	RAG rating
Springfields Pumping Station (103899)	N/A	N/A	0	0.00	0	0	0.0	Green

*Averages from either 2 or 3 years.
** Data not available for this storm overflow or this year.
*** No spills.
*# Average not calculated because data was not available.

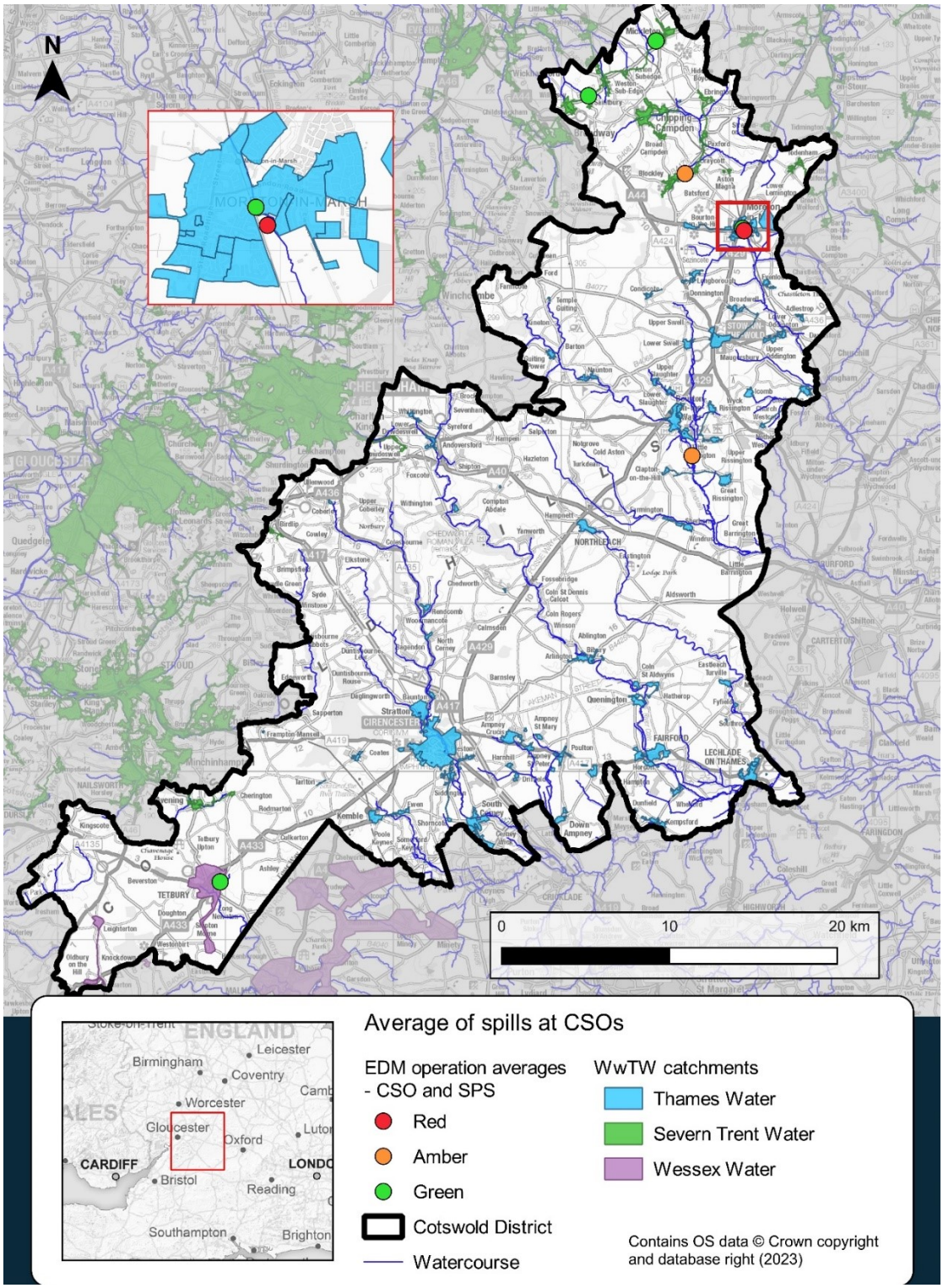

Figure 6-4: Averages of CSO spills that serve the Cotswold District.

6.5 Conclusions

- The primary sewage undertaker for Cotswold District is Thames Water. Areas around Chipping Campden and Avening being served by Severn Trent Water Limited (STWL) and the Tetbury area being served by Wessex Water (WW).
- Thames Water's DWMP outlines a 25-year strategy to tackle future wastewater challenges. It aims to ensure fair charges, improved health, reduced sewer flooding, and enhanced river health. The plan includes specific targets for each Thames regional Flood and Coastal Committee (TRFCC) area, focusing on long-term planning to address growth and climate change risks. Key goals include reducing hydraulic sewer flooding, limiting storm discharges, and achieving 100% compliance at Sewage Treatment Works (STW).
- Severn Trent Water's Drainage and Wastewater Management Plan (DWMP) aims to address current and future challenges in water management. By setting goals such as securing future water supply, promoting efficient water use, and reducing the risk of flooding and pollution, the DWMP outlines a path towards sustainable and resilient water infrastructure. The plan's focus on upgrading wastewater treatment works, implementing nature-based solutions like Sustainable Drainage Systems (SuDS), and separating surface water from combined sewers highlights its commitment to reducing storm overflow events and mitigating the impacts of climate change. Through strategic interventions and informed investment, Severn Trent Water aims to protect the environment, support a circular economy, and provide a high-quality, affordable service to its customers, ensuring a positive social impact and a safe, inclusive workplace.
- Wessex Water's DWMP is designed to tackle both current and future challenges in drainage and wastewater systems. By setting specific objectives such as reducing groundwater infiltration, promoting sustainable drainage, and improving river water quality, the plan aims to enhance environmental protection and public health. Significant investments, including £1.4 billion for upgrading water recycling centres and £550 million for improving storm overflow performance, demonstrate Wessex Water's commitment to infrastructure improvement. The incorporation of nature-based solutions and increased monitoring of water quality impacts further underscores their dedication to sustainable practices. The DWMP's risk assessment highlights the importance of proactive measures to mitigate flooding risks.
- The storm overflow "Storm Sewage Irrigation Area, Moreton-In-Marsh" (CTCR.2093) is RAG rated ‘Red’ meaning that the overflow may already be operating beyond the threshold which would trigger an investigation. Upstream development could further increase the discharge frequency, so mitigation should be required prior to significant development.

- Sheafhouse Farm CSO and Bourton-on-the-Water STW are both RAG rated 'Amber'. This means that an investigation is not required at present, but improvements will need to be made in the network and/or catchment to meet the long-term target.
- There may be opportunities for the Council to work with the sewerage undertakers to implement surface water management measures and the retro-fit of SuDS in existing settlements to disconnect surface water runoff from combined sewerage systems, thereby contributing to reducing the frequency of storm overflow operations. This could include using public spaces for SuDS and using the planning system to manage the paving of front gardens.

6.6 Recommendations

Table 6-3 Wastewater Collection recommendations

Actions	Responsibility	Timescale
Early engagement between Developers, CDC and TWULTW is required to ensure that where upgrades to infrastructure is required, it can be planned in by TW.	CDC Developers TW STW WW	Ongoing
Take into account wastewater infrastructure constraints in phasing development in partnership with the sewerage undertaker	CDC TW STW WW	Ongoing
Developers will be expected to work with the sewerage undertaker closely and early in the planning promotion process to develop an outline foul Drainage Strategy for sites to the satisfaction of the LPA that the development will not increase sewer flooding or the frequency or duration of storm overflow operation. The Outline Foul Drainage strategy should set out the following: What – What is required to serve the site Where – Where are the assets / upgrades to be located When – When are the assets to be delivered (phasing) Which – Which delivery route is the developer going to use s104 s98 s106 etc. The Outline Drainage Strategy should be submitted as part of the planning application submission, and where required, used as	Developers TW STW WW	Ongoing

Actions	Responsibility	Timescale
a basis for a drainage planning condition to be set.		
Developers will be expected to demonstrate to the Lead Local Flood Authority (LLFA) that surface water from a site will be disposed using a sustainable drainage system (SuDS) with connection to foul sewers seen as the last option. New connections for surface water to foul sewers will be resisted by the LLFA. Where a surface water connection is proposed to the public sewerage network, it should be demonstrated to Thames Water that there is no other technically feasible option by selecting options as high as possible within the surface water hierarchy.	Developers LLFA TW STW WW	Ongoing

7 Wastewater Treatment

7.1 Wastewater Treatment Works in Cotswold District

Thames Water (TW), Severn Trent Water (STW) and Wessex Water (WW) provide wastewater services for development in the Cotswold District. Sewerage undertakers may refer to their wastewater processing plants as Wastewater Treatment Works (WwTW), Water Recycling Centres (WRC) or Sewage Treatment Works (STW), for consistency, WwTW will be used in this report.

There are 15 WwTWs in the district, with 13 WwTWs expected to serve planned growth. 13 WwTWs serve the 17 key settlements highlighted in the Local Plan. They also serve parts of neighbouring authorities surrounding the district. This cross over of catchments into neighbouring authorities has been accounted for by including proposed development in these WwTWs catchments within the assessment.

The following section provides an evaluation of the WwTWs for the three water companies. Each DWMP is unique to its respective water company, therefore presents data in a distinct way. As a result, the level of detail of the information in the upcoming sections differs.

7.2 Assessment of DWMP - treatment

7.2.1 Thames Water

There are 25 WwTWs operated by Thames Water in the Cotswold District (Table 7-1). The DWMP predicts that under a do-nothing scenario, 25% of WwTWs (within the Oxfordshire, Swindon, Wiltshire, Gloucestershire and Warwickshire CSP area) are at risk of water quality compliance failure by the year 2020. This will increase to nearly 40% by 2050.

Table 7-1: WwTW's under the jurisdiction of Thames Water in Cotswold District

WwTW name	Indicators breached	Proceed to BRAVA
Ampney St Peter	Catchment Characterisation (Tier 2). Pollution incidents. Planned residential development. WINEP.	Yes
Andoversford	Pollution incidents and sewer blockages.	Yes

WwTW name	Indicators breached	Proceed to BRAVA
Bibury	Waste water treatment DWF compliance permit failure. Planned residential development.	Yes
Bledington	Pollution incidents, storm overflows and sewer blockages.	Yes
Bourton-on-the-water	Catchment Characterisation (Tier 2) Planned residential development. External sewer flooding, pollution incidents and sewer blockages.	Yes
Broadwell	Catchment Characterisation (Tier 2) Planned residential development Breached the capacity assessment framework, historical external sewer flooding and pollution incidents.	Yes
Cirencester	Bathing water. Pollution incidents. Internal and external flooding. Sewer collapses.	Yes
Coates	Sewer blockages.	No
Coberley	Pollution incidents and sewer blockages	Yes
Ebrington	Other RMA systems	Yes
Fairford	Catchment Characterisation (Tier 2). Planned residential development. WINEP. External sewer flooding and sewer blockages.	Yes
Guiting Power	Sewer blockages. Planned residential development.	Yes
Hemplands	Not mentioned in the DWMP	-

WwTW name	Indicators breached	Proceed to BRAVA
Highfields	Nothing recorded in the DWMP at this works.	No
Kempsford	Sewer collapses.	No
Lechlade	Catchment Characterisation (Tier 2). Pollution incidents and sewer blockages.	Yes
Longborough	Sewer blockages.	No
Moreton-in-Marsh	Catchment Characterisation (Tier 2) Historic pollution incidents, and sewer blockages. Planned residential development	Yes
Naunton	Sewer blockages.	No
North Leach	Internal sewer flooding, pollution incidents and sewer blockages.	Yes
Pike Hill Rise	Sewer blockages.	No
Southrop	Nothing recorded in the DWMP at this works.	No
Syreford	Planned residential development	Yes
Tarlton	Sewer blockages.	No
Withington	Sewer blockages.	No

7.2.2 Severn Trent Water

There are 10 WwTWs operated by Severn Trent Water in the Cotswold There are 10 WwTWs operated by Severn Trent Water in Cotswold District (Table 7-3). The table shows capacity issues from each WwTW. The DWMP provides details of the WwTW capacity assessment from the baseline risk and vulnerability assessment (BRAVA). STW outline the priority level for capacity at each works over five-year periods up to 2050. These priority levels are short term (ST), medium term (MT) and long term (LT). In addition, ST provided their Level 1 WwTW Assessment which categorises works by

the amount of spare capacity and watercourse constraints (usually the receiving water quality).

A 'very high' rating indicates a potential capacity issue in the future, while a 'low' rating indicates the opposite. STW has also commented on the current status of each WwTW and any planned improvements.

Table Figure 7-1 DWMP WwTW capacity assessment and STW Level 1 assessment for works receiving growth in the plan period

WwTW	2021	2025	2030	2035	2050	Estimated Spare Capacity (RAG)	Watercourse Constraints	Any other Comments
Avening	LT	LT	LT	LT	LT	N/a	N/a	N/a
Birdlip	LT	LT	LT	LT	LT	N/a	N/a	N/a
Hayden	LT	LT	ST	ST	ST	N/a	N/a	N/a
Aston Magna	NA	NA	NA	NA	NA	N/a	N/a	N/a
Blockley	LT	LT	LT	LT	MT	Current estimate of spare capacity is 50 dwellings 0-50 dwellings could be fine	N/a	Existing sewer flooding locations within catchment which are dependent on location. Connections in the north

WwTW	2021	2025	2030	2035	2050	Estimated Spare Capacity (RAG)	Watercourse Constraints	Any other Comments
						unless additional to existing planned development if additional capacity is needed/ altered permits will be limited due to environmental constraints to receiving watercourse		east will be better than south west. Infrastructure works scheme planned to increase flow being treated at the works, which is to be completed in 2025.
Broadway	LT	LT	LT	LT	MT	N/a	N/a	AMP7
Chipping Camden	LT	LT	LT	LT	LT	Estimated spare capacity of 50-100dw	N/a	It's possible that investment upgrades may be required - could be to look at removing surface water inflows into sewer network (disconnecting

WwTW	2021	2025	2030	2035	2050	Estimated Spare Capacity (RAG)	Watercourse Constraints	Any other Comments
								highways and adding suds) might have to upgrade main sewer to the WWTW No infrastructure works are planned.
Honeybourne	LT	LT	LT	LT	LT	N/a	N/a	N/a
Long Compton	ST	ST	ST	ST	ST	N/a	N/a	AMP8 Planned
Nethercote	LT	LT	LT	LT	LT	N/a	N/a	N/a

7.2.3 Wessex Water

There are 2 WwTWs operated by Wessex Water in the Cotswold District Table 7-2.

Table 7-2 WwTWs under the jurisdiction of Wessex Water in the Cotswold District

WwTW name	Comments
Didmarton	Storm overflows - need to proceed to BRAVA
Tetbury	Low risk for sewer incapacity no planned schemes in 2020-2025

7.3 Wastewater Treatment Works Flow Permit Assessment

7.3.1 Introduction

The Environment Agency is responsible for regulating sewage discharge releases via a system of Environmental Permits (EPs). Monitoring for compliance with these permits is the responsibility of both the EA and the plant operators. Figure 7-2 summarises the different types of wastewater releases that might take place, although precise details vary from works to works depending on the design.

During dry weather, the final effluent from the Wastewater Treatment Works (WwTW) should be the only discharge (1). With rainfall, the storm tanks fill and eventually start discharging to the watercourse (2) and Combined Sewer Overflows (CSOs) upstream of the storm tanks start to operate (3). The discharge of storm sewage from treatment works is allowed only under conditions of heavy rain or snow melt, and therefore the flow capacity of treatment systems is required to be sufficient to treat all flows arising in dry weather and the increased flow from smaller rainfall events. After rainfall, storm tanks should be emptied back to full treatment, freeing their capacity for the next rainfall event.

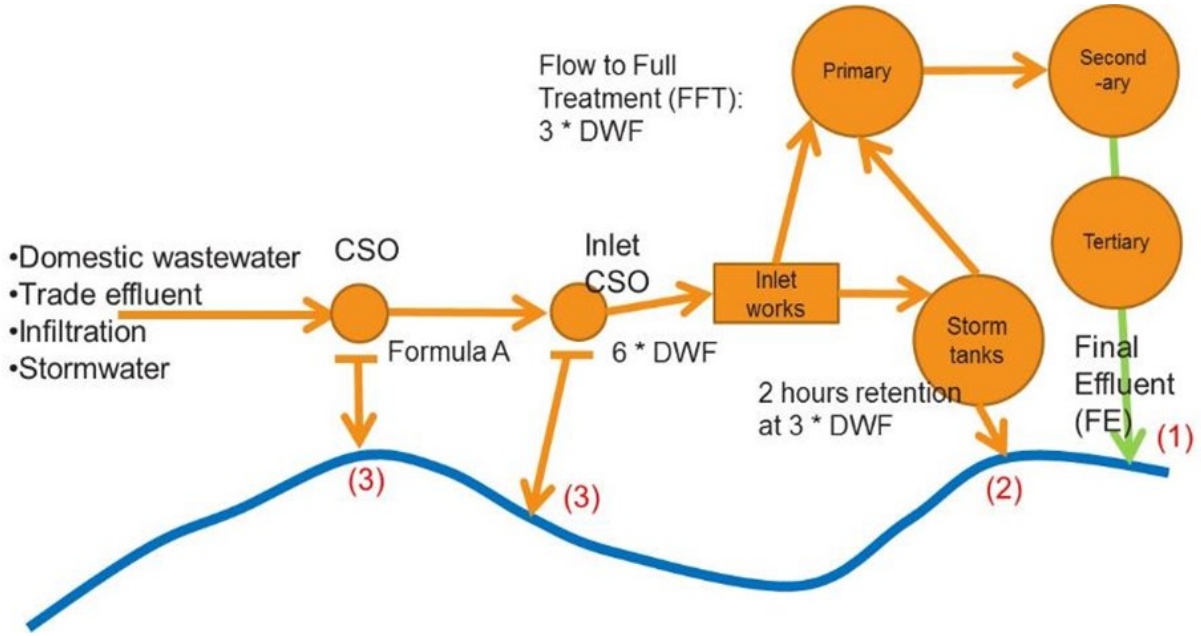

Figure 7-2: Overview of a typical combined sewerage system and WwTW discharges

Environmental permits are used alongside water quality limits as a means of controlling the pollutant load discharged from a water recycling centre to a receiving watercourse. Sewage flow rates must be monitored for all WwTW where the permitted discharge rate is greater than 50 m^3/day in dry weather.

Permitted discharges are based on a statistic known as the Dry Weather Flow (DWF). As well as being used in the setting and enforcement of effluent discharge permits, the DWF is used for WwTW design, as a means of estimating the 'base flow' in sewerage modelling and for determining the flow at which discharges to storm tanks will be permitted by the permit (Flow to Full Treatment, FFT).

WwTW Environmental Permits also consent for maximum concentrations of pollutants, in most cases Suspended Solids (SS), Biochemical Oxygen Demand (BOD) and Ammonia (NH4). Some works (usually the larger works) also have permits for Phosphorous (P). These are determined by the Environment Agency with the objective of ensuring that the receiving watercourse is not prevented from meeting its environmental objectives, with specific regard to the Chemical Status element of the Water Framework Directive (WFD) classification.

Increased domestic population and/or employment activity can lead to increased wastewater flows arriving at a WwTW. Where there is insufficient headroom at the works to treat these flows, this could lead to failures in flow consents.

Areas not covered by catchments shown in Figure 7-2 may not have an existing public sewer system. Where this is the case, small developments in more rural areas may be suitable for on-site treatment and discharge, however the Environment Agency will not usually permit this where there is a public sewerage system within a distance calculated as 30m per dwelling from any part of the site boundary.

7.4 Methodology

Thames Water, Severn Trent and Wessex Water were provided with the list of proposed development sites and the potential housing numbers for each site. They were then invited to provide an assessment of the receiving WwTW and provide any additional comments about the impacts of the development.

A capacity assessment of the 13 WwTW that serve the 17 Key settlements in the catchment area was also carried out using measured flow data supplied by the water companies. The process was as follows:

- Calculate the current measured Dry Weather Flow (DWF). This was calculated as the 80-percentile exceedance flow for the period January 2019 to December 2022 where available.
- The flow data was cleaned to remove zero values and low outlier values which would bring the measured DWF down.
- Potential development sites, the Local Plan Allocations, existing commitments and recent commitments were assigned to a WwTW using the sewerage drainage area boundaries.
- For each site, the future DWF was calculated using the occupancy rates and per-capita consumption values obtained from the Water Resource Management Plans (Table 7-3), and the assumption that 95% of water used is returned to sewer. Permitted headroom was used as a substitute for actual designed hydraulic capacity for each WwTW being assessed.
- For employment sites, wastewater demand was estimated based on the predicted number of new employees. Floor space, employment use types, and employment densities were used to estimate the number of employees.

Table 7-3: Values used in water demand calculations

Water Company	Water Resource Zone	Occupancy rate (persons per dwelling)	Per capita consumption (m^3/person/day)
Thames Water	SWOX	2.5	0.1
Wessex Water	Supply Area	2.1	0.1
Severn Trent	Strategic Grid	2.2	0.1
Severn Trent	Forest and Stroud	2.2	0.1

The following definition was used to score each WwTW:

LOW GREEN	MEDIUM- AMBER	HIGH- RED
Capacity for growth during local plan period >10% capacity	Limited capacity during local plan period 0-10% capacity	Issues identified – WwTW capacity could be a constraint to growth <0% capacity

In general, in the case that a WwTW is likely to exceed its flow permit, the permit would be reviewed by the EA and if a higher flow consent was agreed, a tighter permit limit for substance concentrations is very likely to be required. In some cases, this may not be possible if that means concentrations tighter than the Technically Accepted Limit (TAL) which is 0.25 mg/l for P for example.

Table 7-4 WwTW capacity assessment

WwTW	JBA Assessment	Estimated spare hydraulic capacity following planned development (number of dwellings)
Andoversford STW	Green	59
Ampney St Peter STW	N/a	N/a
Blockley (WRW)	Red	-44
Bourton-On-The-Water STW	Green	572
Broadwell STW	N/a	N/a
Chipping Campden (WRW)	Green	194
Cirencester STW	Green	1637
Fairford STW	Red	-28
Honeybourne (WRW)	Red	-555
Lechlade STW	Green	55
Moreton-In-Marsh STW	Red	-302
Northleach STW	N/a	N/a
Tetbury STW	Amber	19

Ampney St Peters, Broadwell and Northleach WwTWs are listed as 'N/a' because of the permit limit is unavailable within the Environment Agency consents database.

The spare capacity in number of dwellings was assessed using the methodology above, as well as the RAG rating for the JBA assessment notes in Table 7-4.

WwTWs Honeybourne (-59%) and Moreton in Marsh (-47%) have the lowest capacity for new development of the assessed WwTWs. Moreton in Marsh serves a high proportion of growth in Cotswold LPA so has been further assessed in Section 8. The

above information is based on the figures at the end of AMP8 (2030) due to the local plan ending in 2031.

7.5 Results

Only two wastewater catchments, Cirencester and Moreton-in-Marsh, are forecast to experience growth as a result of policies in the Local Plan Partial Update. Growth from allocations within the existing Local Plan, and from commitments and completions was assumed to have already been factored into the water companies plans. It needs to be noted that 98% of the -555 number of dwellings available for Honeybourne WwTW in Table 7-4 is due to neighbouring growth. The information below is based on the capacity figures at the end of AMP11 (2045).

Cirencester WwTW is currently within permit and predicted to stay within the permit for the remainder of the planning period. Existing commitments account for 79% of the forecast growth in wastewater demand to 2035. However, this assessment is at odds with the average of 76 annual spill events from the WwTW storm tanks (see section 7.6). Cirencester WwTW is therefore given an AMBER RAG rating for wastewater treatment capacity, but it is noted that the LPPU new allocations represent less than 1% of growth planned to 2035 and are therefore insignificant to the capacity issues at this works.

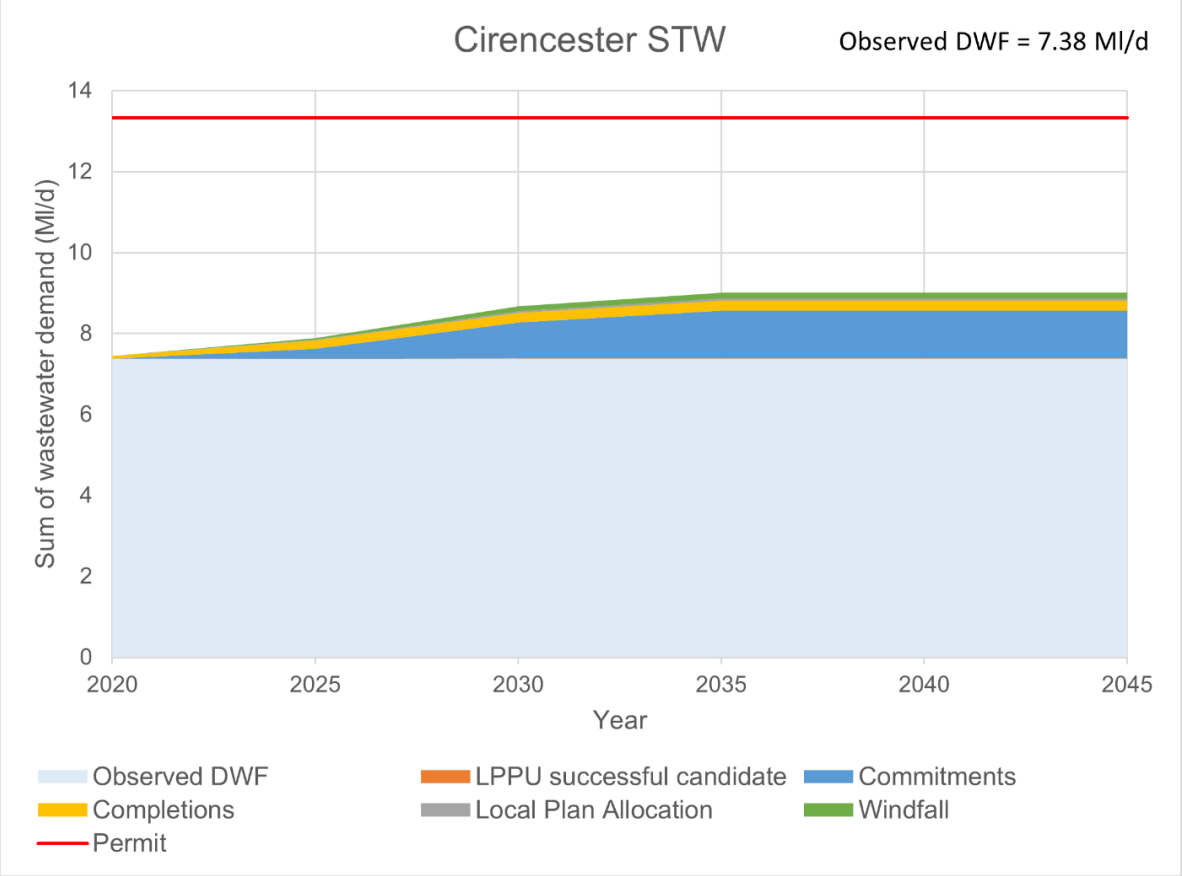

Figure 7-3: Dry-weather flow forecast, Cirencester WwTW

Longborough WwTW catchment has no uncommitted Local Plan allocations, and no new allocations in the LPPU. However, the Environment Agency has raised significant concerns about capacity at this works (see below under Moreton-in-Marsh).

Moreton-in-Marsh WwTW was identified as being essentially at capacity based on observed flow to full treatment for 2020-2022. It is forecast to already be exceeding its flow permit, and to exceed its permit by some 57% as a result of planned growth by 2035. Of this growth, some 24% is predicted to come from the new LPPU allocation at the Fire Service College (M72).

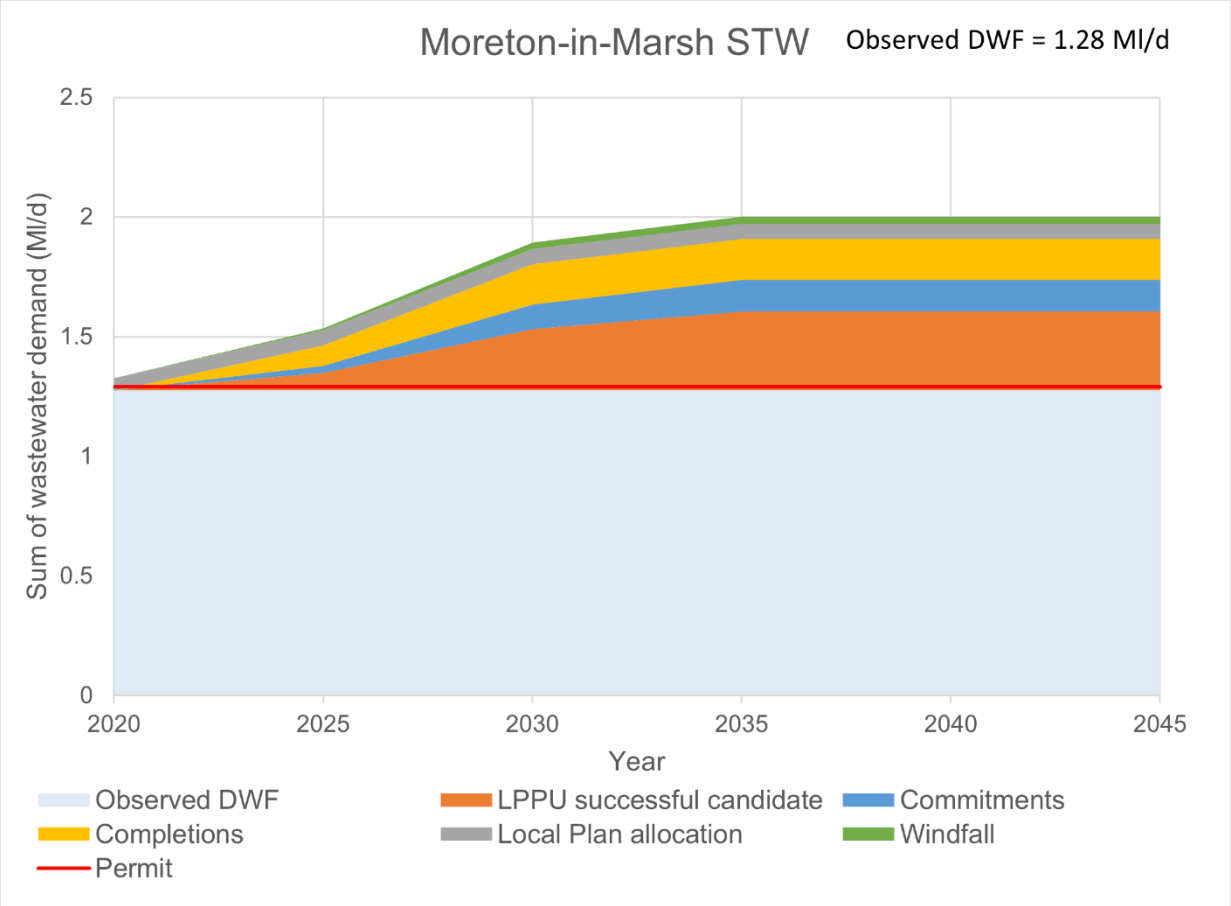

Figure 7-4: Dry-weather flow forecast, Moreton-in-Marsh WwTW

In addition, the Council received the following comment from the EA[5]: *"The Environment Agency is aware that the Sewage Treatment Works (STW) at Moreton-in-Marsh and Longborough is (are) not complying with its current permit limits. Upgrades and/or improvements need to be undertaken there in order to make the STW fit for purpose.*

5 Email from EA Customer & Engagement Team - Thames to the Cities & Local Growth Unit, dated 05/11/2024, forwarded to Cotswold District Council

Any development connecting to Morton-in-Marsh and Longborough STWs may lead to a deterioration of the water environment ... This will be contrary to the advice and guidance in paragraph 180 (e) of the NPPF and the Thames River Basin Management Plan and is of grave concern to the Environment Agency."

This advice aligns with our analysis above for Moreton-in-Marsh STW.

The TW PR24 Business Plan and the AMP8 WINEP actions were reviewed to identify proposed actions at Moreton-in-Marsh WwTW. TW has actions to reduce Cypermethrin and Nonylphenol concentrations by 2027, and Phosphate by 2030, but no plans to upsize the works flow capacity have been identified.

In summary, Moreton-in-Marsh WwTW appears to already be at or over capacity, and that the proposed new allocation at Fire Service College will significantly contribute to this works exceeding its permit. The EA has raised significant concerns, and no planned actions to address this are identified in the AMP8 business plan. Consequently, we consider that a RED RAG rating is appropriate, as there are significant concerns that this works does not have capacity to accommodate the proposed new allocation.

7.6 Storm tank overflows

The EDM data for the WwTW storm overflows, was available for 1, 2 and 3 years depending on the overflow. An average was calculated where 2 or 3 years were available. The RAG classification is shown for each overflow in Table 7-5 and Figure 7-5.

Table 7-5: WwTW storm overflow frequency of operation and duration from 2020-2022

Wastewater Treatment Works (Permit number)	Number of operations in 2020	Duration of Operation in 2020 (hours)	Number of operations in 2021	Duration of Operation in 2021 (hours)	Number of operations in 2022	Duration of Operation in 2022 (hours)	Averages*	RAG rating
Blockley STW (S/14/25492/R)	212	3330.10	111	962.82	156	3296.84	159.67	Red
Chipping Campden STW (S/14/25988/R)	49	406.96	61	484.95	62	367.36	57.33	Red
Avening STW (S/22/26628/R)	90	282.98	190	305.39	101	84.97	127	Red
Ampney St Peter WwTW (CSSC.2452)	108	2316.11	55	1168.53	48	944.72	70.33	Red
Bledington WwTW (TEMP.2395)	92	1535.72	62	1028.41	25	322.59	59.67	Red
Broadwell (TEMP.2418)	31	480.63	32	525.24	13	110.23	25.33	Amber

Wastewater Treatment Works (Permit number)	Number of operations in 2020	Duration of Operation in 2020 (hours)	Number of operations in 2021	Duration of Operation in 2021 (hours)	Number of operations in 2022	Duration of Operation in 2022 (hours)	Averages*	RAG rating
Cirencester WwTW (CTCR.1750)	72	735.33	88	1216.07	67	405.91	75.67	Red
Fairford STW (CATM.3518)	138	2491.52	65	1221.41	65	1023.57	89.33	Red
Kempsford STW, (CATM.3520)	0***	0.00	0	0.00	0	0.00	0.00	Green
Lechlade STW (CTCR.1797)	51	845.12	35	597.61	3	14.16	29.67	Amber
Northleach WwTW (CNTD.0012)	70	983.83	50	445.74	0	0.00	40	Amber
Didmarton WRC (10031)	96	1886	37	640.20	23	310.80	52	Red
Tetbury Inlet SO WwTW (102818)	73	1222.25	86	182.27	69	192.83	76	Red

Wastewater Treatment Works (Permit number)	Number of operations in 2020	Duration of Operation in 2020 (hours)	Number of operations in 2021	Duration of Operation in 2021 (hours)	Number of operations in 2022	Duration of Operation in 2022 (hours)	Averages*	RAG rating
Tetbury WwTW (102818)	122	502.17	58	841.75	41	519.50	73.67	Red
Andoversford (CNTD.0001)	50	822	84	1333.78	51	801.12	62	Red

*Averages from either 2 or 3 years.
** Data not available for this storm overflow or this year.
*** No spills.

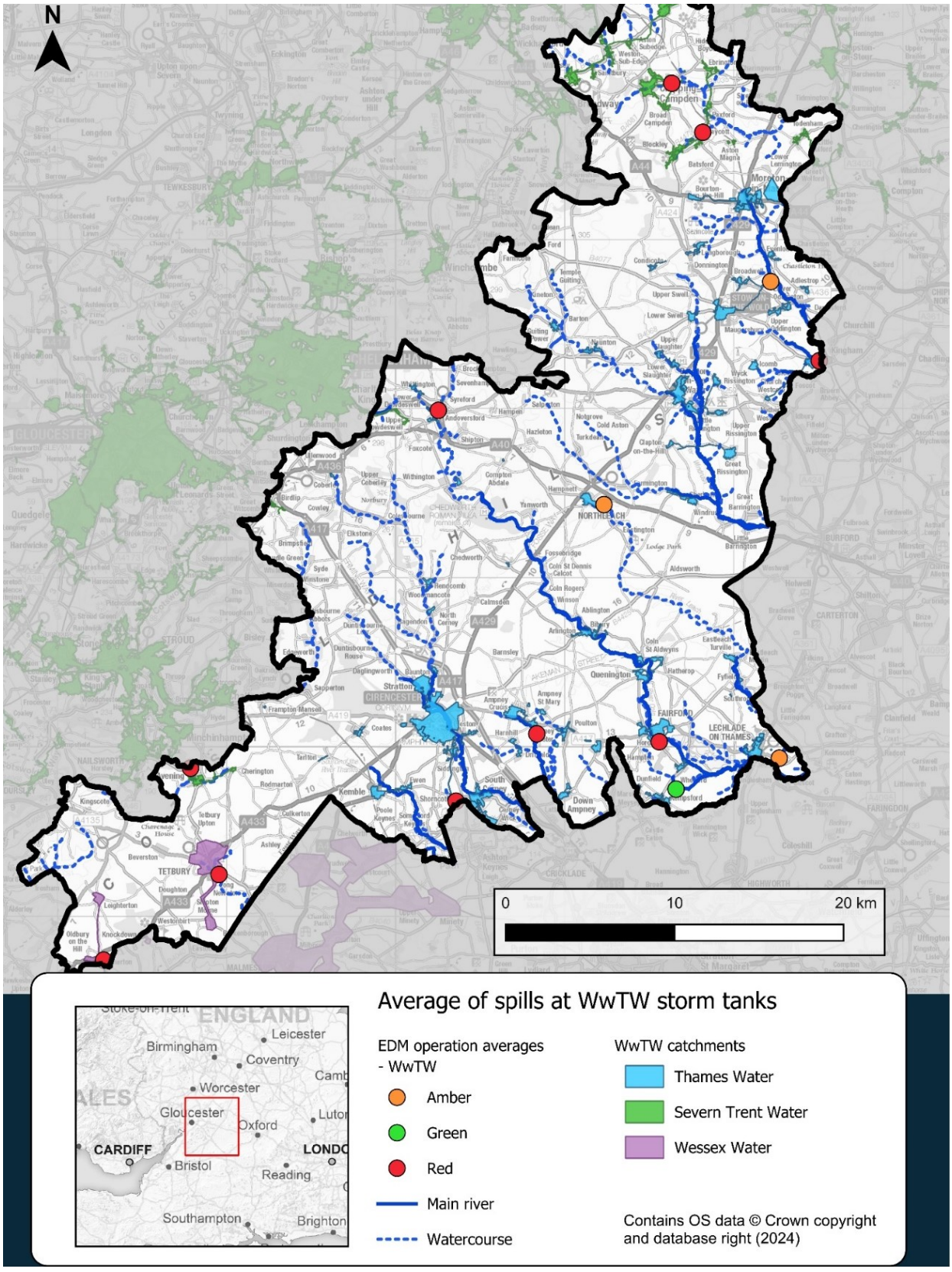

Figure 7-5 RAG classification for storm tank overflows

7.7 Conclusions

- Wastewater services in the Cotswold District are provided by Thames Water, Severn Trent Water, and Wessex Water.
- 13 WwTWs serve the 17 key settlements highlighted in the Local Plan. Some also serve parts of neighbouring authorities surrounding the district. This cross over of catchments into neighbouring authorities has been accounted for by including proposed development in these WwTWs catchments within the assessment.
- Only two treatment works, Cirencester and Moreton-on-Marsh, are expected to receive growth from proposed new allocations in the LPPU. An analysis of present day and future dry-weather flows indicates that Cirencester works has capacity for this development, however the frequency of storm overflows from the WwTW storm tanks indicates a potential issue at this works, which has been given an AMBER RAG rating for capacity.
- Moreton-in-Marsh WwTW appears to already be at or over capacity, and that the proposed new allocation at Fire Service College will significantly contribute to this works exceeding its permit. The EA has raised significant concerns, and no planned actions to address this are identified in the AMP8 business plan. Consequently, we consider that a RED RAG rating is appropriate, as there are significant concerns that this works does not have capacity to accommodate the proposed new allocation.
- Considering discharges from storm tanks, Blockley, Chipping Campden, Ampney St Peter, Bledington, Cirencester, Fairford, Didmarton, Tetbury Inlet, Tetbury and Andoversford WwTWs are all RAG rated 'RED'. This means that the overflow may already be operating beyond the threshold which would trigger an investigation. Upstream development could further increase the discharge frequency, so mitigation should be required prior to significant development.
- Broadwell, Lechlade and Northleach WwTWs are RAG rated 'Amber', meaning that an investigation is not required at present, but improvements will need to be made in the network and/or catchment to meet the long-term target.
- Kempsford WwTW is rated 'Green' for storm overflow performance.

7.8 Recommendations

Table 7-6 Wastewater Treatment Recommendations

Action	Responsibility	Timescale
Discussions with the EA and TW are advised regarding capacity at Moreton-in-Marsh WwTW to accommodate planned development, including the new LPPU allocation at Fire Service College (M72)	CDC TW EA	ASAP
Consider the available WwTW capacity when phasing development.	CDC TW STW WW	Ongoing
Provide Annual Monitoring Reports to TW, STW and WW detailing projected housing growth.	CDC	Ongoing
TW, STW and WW to assess growth demands as part of their wastewater asset planning activities during the next AMP period to enable growth to come forward and feedback to the Council if concerns arise.	CDC TW STW WW	During AMP8 (2025-2030)

8 Water quality

8.1 Introduction

An increase in the discharge of effluent from Wastewater Treatment Works (WwTW) as a result of development and growth in the area in which they serve can lead to a negative impact on the quality of the receiving watercourse. Under the Water Framework Directive (WFD), a watercourse is not allowed to deteriorate from its current WFD classification (either as an overall watercourse or for individual elements assessed).

It is Environment Agency (EA) policy to model the impact of increasing effluent volumes on the receiving watercourses. Where the scale of development is such that a deterioration is predicted, a variation to the Environmental Permit (EP) may be required for the WwTW to improve the quality of the final effluent, so that the increased pollution load will not result in a deterioration in the water quality of the watercourse. This is known as "no deterioration" or "load standstill". The need to meet river quality targets is also taken into consideration when setting or varying a permit.

The EA operational instructions on water quality planning and no-deterioration are currently being reviewed. Previous operational instructions (Environment Agency, 2012) (now withdrawn but with no published replacement) set out a hierarchy for how the no-deterioration requirements of the WFD should be implemented on inland waters. The potential impact of development should be assessed in relation to the following objectives:

- **Could the development cause a greater than 10% deterioration in water quality?** This objective is to ensure that all the environmental capacity is not taken up by one stage of development and there is sufficient capacity for future growth.
- **Could the development cause a deterioration in WFD class of any element assessed?** This is a requirement of the Water Framework Directive to prevent a deterioration in class of individual contaminants. The "Weser Ruling" (European Court of Justice, 2015) by the European Court of Justice in 2015 specified that individual projects should not be permitted where they may cause a deterioration of the status of a water body. If a water body is already at the lowest status ("bad"), any impairment of a quality element was considered to be a deterioration. Emerging practice is that a 3% limit of deterioration is applied.

- **Could the development alone prevent the receiving watercourse from reaching Good Ecological Status (GES) or Potential?** Is GES possible with current technology or is GES technically possible after development with any potential WwTW upgrades.

The overall WFD classification of a water body is based on a wide range of ecological and chemical classifications. This assessment focuses on three physio-chemical quality elements; Biochemical Oxygen Demand (BOD), Ammonia, and Phosphate which are key to Water Framework Directive compliance.

BOD – Biochemical Oxygen Demand

BOD is a measure of how much organic material – sewage, sewage effluent or industrial effluent – is present in a river. It is defined as the amount of oxygen taken up by micro-organisms (principally bacteria) in decomposing the organic material in a water sample stored in darkness for 5 days at 20°C. Water with a high BOD has a low level of dissolved oxygen. A low oxygen content can have an adverse impact on aquatic life.

Ammonia

Nitrogen is an essential nutrient required by all plants and animals for the formation of amino acids. In its molecular form nitrogen cannot be used by most aquatic plants, and so it is converted into other forms. One such form is ammonia (NH3). This may then be oxidized by bacteria into nitrate (NO3) or nitrite (NO2). Ammonia may be present in water in either the unionized form NH3 or the ionized form NH4. Taken together these forms care called Total Ammonia Nitrogen.

Although ammonia is a nutrient, in high concentrations it can be toxic to aquatic life, in particular fish, affecting hatching and growth rates.

The main sources in rivers include agricultural sources, (fertilizer and livestock waste), residential sources (ammonia containing cleaning products and septic tank leakages), industrial processes and WwTWs.

Phosphate

Phosphorus is a plant nutrient and elevated concentrations in rivers can lead to accelerated plant growth of algae and other plants. Its impact on the composition and abundance of plant species can have adverse implications for other aspects of water quality, such as oxygen levels. These changes can cause undesirable disturbances to other aquatic life such as invertebrates and fish.

Phosphorus (P) occurs in rivers mainly as Phosphate (PO4), which are divided into Orthophosphates (reactive phosphates), and organic Phosphates.

Orthophosphates are the main constituent in fertilizers used in agriculture and domestic gardens and provide a good estimation of the amount of phosphorus available for algae and plant growth and is the form of phosphorus that is most readily utilized by plants.

Organic phosphates are formed primarily by biological processes and enter sewage via human waste and food residues. Organic phosphates can be formed from orthophosphates in biological treatment processes or by receiving water biota.

Although it is phosphorus in the form of phosphates that is measured as a pollutant, the term phosphorus is often used in water quality work to represent the total phosphorus containing pollutants.

8.2 Water quality modelling

8.2.1 General approach

The methodology for modelling water quality was discussed with the Environment Agency and the EA's RQP (River Quality Planning) tool selected as the most appropriate tool to assess water quality for the Moreton-in-Marsh WwTW.

RQP uses a Monte Carlo mass balance statistical approach predict the concentration of pollutants at the point of discharge for a WwTW. It is used by the Environment Agency to identify where permit changes are needed to prevent deterioration or improve water quality as well as supporting decision making to guide development to locations where environmental deterioration will be reduced.

Within RQP, the determinands modelled were Biochemical Oxygen Demand (BOD), Ammonia (NH4) and Phosphorus (P). In fresh waterbodies, phosphate is usually the limiting nutrient for algal growth. However, in marine environments, nitrogen is considered to be the limiting nutrient.

The methodology followed is summarised in Figure 8-1 below. In this flow chart, all of the questions in the top row must be answered.

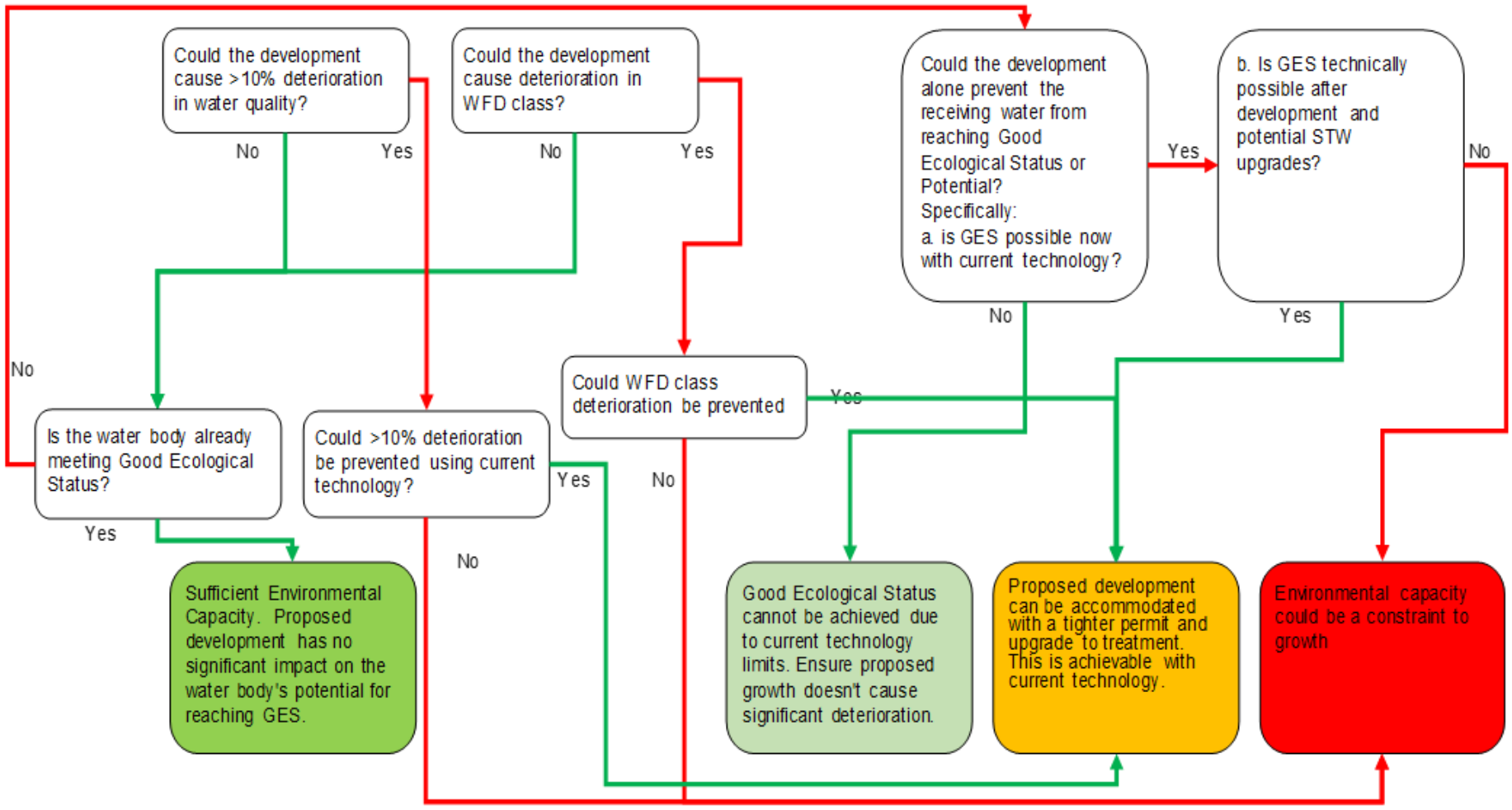

Figure 8-1: Water quality impact assessment following EA guidance

Where modelling indicated that growth may lead to a deterioration in the watercourse, or where the watercourse is not currently meeting at least a 'Good' class for each determinant, the models were used to test whether this could be addressed by applying stricter discharge limits. In such cases, a Technically Achievable Limit (TAL) was considered.

The EA advised that the following permit values are achievable using treatment at TAL, and that these values should be used for modelling all WwTW potential capacity irrespective of the existing treatment technology and size of the works:

- Ammonia (90%ile): 1 mg/l
- BOD (90%ile): 5 mg/l
- Phosphorus (mean): 0.25 mg/l

This assessment did not take into consideration whether it is feasible to upgrade each existing WwTW to TAL due to constraints of costs, timing, space, carbon costs etc.

8.2.2 Methodology

RQP is first used to predict a baseline water quality based on the current discharge from the WwTW. A "future" scenario is then run where wastewater discharge is increased to account for growth. It is assumed in this case the quality of the discharge remains the same. Should deterioration in any of the modelled determinands exceed 10% or result in a change in WFD class, a further test is carried where the WwTW is set to its technically achievable limit (TAL) assessed to determine if deterioration could be prevented.

Lastly, a third test investigates whether, if improvements in water quality were made elsewhere in the catchment to improve the water body's condition to good ecological status (GES), growth alone could prevent GES being achieved downstream.

No deterioration test

The results from the baseline and future versions of the model were compared to assess the predicted percentage deterioration for each of the modelled determinands. WFD targets for each river reach were provided by the EA and used to determine if there was a risk of a class deterioration.

Where a deterioration of 10% or greater was predicted or a change in class (considered to be a significant deterioration under WFD) a further test was conducted to see if this deterioration could be prevented by upgrades to treatment processes. This used another version of the model with each WwTW set to operate at their Technically Achievable Limit (TAL).

Good Ecological Status assessment

Where treatment at TAL and reductions in diffuse sources in the present day could improve water quality to achieve Good Ecological Status (GES), it is important to

understand whether this could be compromised as a result of future growth within the catchment.

Guidance from the EA suggests breaking this down into two questions:

a) Is GES possible now with current technology?

b) Is GES technically possible after development and any potential WwTW upgrades?

If the answer to questions a) and b) are both 'Yes' or both 'No' then the development can be assessed as having no significant impact on the water bodies potential for reaching GES, i.e., the development alone is not preventing GES from being achieved. An "amber" score is given where GES could be achieved with improvements in treatment technology reflecting the need for an intervention at that WwTW, but growth is not preventing this. It is given a "yellow" score where a WwTW would need to be upgraded beyond the current technically achievable limit in order to achieve GES, but as for the amber rating it is not growth that is preventing this.

If the answer to a) is 'Yes' and the answer for b) is 'No' then development is having a significant impact, i.e., before development GES could be achieved with upstream improvements, and after growth the additional effluent from growth prevents GES being achieved - so it is growth that is preventing GES from being achieved leading to a "red" score.

The possible answers are summarised in Figure 8-1.

Table 8-1: Possible GES assessment results

Predicted to achieve GES after growth	Could achieve GES today with improvements in upstream water quality? (a)	Could achieve GES in the future with improvements in upstream water quality? (b)	Assessment Result
YES	N/A	N/A	GREEN - Sufficient environmental capacity. Proposed development has no significant impact on the water body's potential for meeting GES.
NO	YES	YES	AMBER - Proposed development can be accommodated with a tighter permit and upgrade to treatment. This is achievable with current technology.
NO	NO	NO	YELLOW - Good ecological

Predicted to achieve GES after growth	Could achieve GES today with improvements in upstream water quality? (a)	Could achieve GES in the future with improvements in upstream water quality? (b)	Assessment Result
			status cannot be achieved due to current technology limits. Ensure proposed growth doesn't cause significant deterioration.
NO	YES	NO	RED - Environmental capacity could be a constraint to growth.

8.2.3 Data

To calculate downstream water quality, RQP requires an upstream river flow, an upstream river water quality, a WwTW discharge flow and a WwTW discharge quality.

The EA advised that the following permit values are achievable using treatment at TAL, and that these values should be used for modelling all WwTW potential capacity irrespective of the existing treatment technology and size of the works:

- Ammonia (90%ile): 1 mg/l
- BOD (90%ile): 5 mg/l
- Phosphorus (mean): 0.25 mg/l

This assessment did not take into consideration whether it is feasible to upgrade each existing WwTW to TAL due to constraints of costs, timing, space, carbon costs etc.

8.2.4 Water quality statistics

In water quality monitoring, sometimes the laboratory tests cannot distinguish between a very low concentration and complete absence of a particular substance. In these cases, the data point may be marked with a "qualifier" indicating the true result is less than the measurable limit of the laboratory test. EA guidance recommends that, in these cases, two calculations should be performed, one with the qualified values set to zero, the second with the qualified value set to its face value to give a range in which the true result lies.

Further information on the Environment Agency guidance (Environment Agency b, 2025).

8.3 Results

8.3.1 Water Framework Directive Overview

The Water Framework Directive (WFD) aims to ensure "no deterioration" in the environmental status of rivers and sets objectives to improve rivers to meet "good" status. LPAs must have regard to the WFD and associated statutory objectives as implemented in the EA's River Basin Management Plans (RBMPs).

Further details of the WFD Groundwater and Surface water catchments can be found in Appendix B, Table 12-1.

Table 8-2 WFD Groundwater body classifications

Groundwater body name	RBD	Groundwater body ID	Overall Status*
Warwickshire Avon - Jurassic Limestones Cotswold Edge North	Severn	GB40901G304400	Good
Severn Vale - Jurassic Limestone Cotswold Edge South	Severn	GB40901G305700	Good
Inferior Oolite and Bridport Sands	Severn	GB40901G305800	Good
Bath Oolite	Severn	GB40901G805500	Poor
Severn Vale - Secondary Combined	Severn	GB40902G204900	Good
Warwickshire Avon - Secondary Mudrocks	Severn	GB40902G990900	Good
Burford Jurassic	Thames	GB40601G600400	Poor
Chipping Norton Jurassic	Thames	GB40602G600300	Poor
Kemble Forest Marble	Thames	GB40602G600500	Poor
Upper Thames Gravels	Thames	GB40603G000200	Poor

*England | Catchment Data Explorer

Table 8-3: WFD Surface water body classifications

Surface water body name	RBD	Groundwater body ID	Overall Status*
Sherston Avon	Severn	GB109053027690	Poor
Tetbury Avon - unnamed trib to conf Sherston Avon	Severn	GB109053027780	Poor
Shire bourne	Severn	GB109053027790	Moderate
Tetbury Avon - source to conf unnamed trib	Severn	GB109053027800	Good
Horsley Str - source to conf Nailsworth Str	Severn	GB109054026510	Moderate
Nailsworth Stream - source to conf R Frome	Severn	GB109054026531	Good
Ozleworth Bk - source to conf Little Avon R	Severn	GB109054026610	Good
R Frome - source to conf Slad Bk	Severn	GB109054032470	Moderate
Chelt - source to M5	Severn	GB109054032820	Moderate
Bretforton Bk - source to conf Broadway-Badsey Bk	Severn	GB109054039341	Moderate
Badsey Bk - source to conf Bretforton Bk	Severn	GB109054039350	Moderate
Nethercote Bk - source to conf R Stour	Severn	GB109054039820	Poor
Blockley Bk - source to conf Knee Bk	Severn	GB109054039830	Moderate
Knee Bk conf Blockley Bk to conf St Giles's Chapel	Severn	GB109054039840	Good
Knee Bk - source to conf Blockley Bk	Severn	GB109054039870	Moderate
Stour - conf Nethercote Bk to conf Back Bk	Severn	GB109054039922	Moderate

Surface water body name	RBD	Groundwater body ID	Overall Status*
Thames (Waterhaybridge to Cricklade) and Chelworth Brook	Thames	GB106039022960	Moderate
Thames (Churn to Coln)	Thames	GB106039022990	Moderate
Dudgrove Brook	Thames	GB106039023110	Moderate
Swill Brook (source to Ashton Keynes)	Thames	GB106039023700	Moderate
Thames (Kemble to Waterhay Bridge)	Thames	GB106039023760	Moderate
Cerney Wick Brook (source to Thames)	Thames	GB106039023800	Poor
Kemble Ditch at Kemble	Thames	GB106039023810	Moderate
Marston Meysey Brook	Thames	GB106039023860	Good
Churn (Baunton to Cricklade)	Thames	GB106039029750	Moderate
Thornhill Ditch and tributaries at Cotswolds Water Park	Thames	GB106039029760	Moderate
Daglingworth Stream (Source to Churn)	Thames	GB106039029770	Moderate
Elkstone Brook	Thames	GB106039029790	Moderate
Churn (source to Perrots Brook)	Thames	GB106039029810	Moderate
Westcote Brook (source to Evenlode at Bledington)	Thames	GB106039029950	Moderate
Evenlode (Bledington to Glyme confluence)	Thames	GB106039029960	Moderate
Coln (Source to Coln Rogers)	Thames	GB106039029991	Moderate
Coln (from Coln Rogers) and Thames (Coln to Leach)	Thames	GB106039029992	Poor

Surface water body name	RBD	Groundwater body ID	Overall Status*
Bledington Brook (Source to Evenlode)	Thames	GB106039030000	Poor
Leach (Source to Thames)	Thames	GB106039030040	Poor
Radcot Cut	Thames	GB106039030231	Moderate
Ampney and Poulton Brooks (Source to Thames)	Thames	GB106039030300	Moderate
Thames (Leach to Evenlode)	Thames	GB106039030333	Poor
Windrush and tributaries (Little Rissington to Thames)	Thames	GB106039030440	Moderate
Hazelford and Coombe Brook	Thames	GB106039030450	Poor
Sherbourne Brook	Thames	GB106039030460	Poor
Dikler (Wyck Rissington to Windrush) and Lower Eye	Thames	GB106039030470	Moderate
Windrush (Slade Barn Stream to Dikler)	Thames	GB106039030480	Moderate
Little Compton Brook and tributaries (Source to Evenlode)	Thames	GB106039037390	Moderate
Cornwell Brook and tributaries (Source to Evenlode)	Thames	GB106039037400	Moderate
Evenlode (Compton Bk to Bledington Bk) & 4 Shires	Thames	GB106039037410	Moderate
Evenlode (Source to Four Shires S) and Longborough Stream	Thames	GB106039037420	Moderate

Surface water body name	RBD	Groundwater body ID	Overall Status*
Slade Barn Stream (Source to Windrush)	Thames	GB106039037440	Moderate
Eye (Source to Dikler)	Thames	GB106039037450	Moderate
Windrush (Source to Slade Barn Stream)	Thames	GB106039037460	Moderate
Dikler (Source to Wyck Rissington)	Thames	GB106039037470	Moderate

*England | Catchment Data Explorer

8.3.2 Priority substances

As well as the physico-chemical water quality elements (BOD, Ammonia, Phosphate etc.) addressed above, a watercourse can fail to achieve Good Ecological Status due to exceeding permissible concentrations of hazardous substances. Currently 33 substances are defined as hazardous or priority hazardous substances, with others under review. Such substances may pose risks both to humans (when contained in drinking water) and to aquatic life and animals feeding in aquatic life. These substances are managed by a range of different approaches, including EU and international bans on manufacturing and use, targeted bans, selection of safer alternatives and end-of-pipe treatment solutions. There is considerable concern within the UK water industry that regulation of these substances by setting permit values which require their removal at wastewater treatment works will place a huge cost burden upon the industry and its customers, and that this approach would be out of keeping with the "polluter pays" principle.

Consideration should be given to how the planning system might be used to manage priority substances:

- Industrial sources – whilst this report covers potential employment sites, it doesn't consider the type of industry and therefore likely sources of priority substances are unknown. It is recommended that developers should discuss potential uses which may be sources of priority substances from planned industrial facilities at an early stage with the EA and, where they are seeking a trade effluent consent, with the sewerage undertaker.
- Agricultural sources - There is limited scope for the planning system to change or regulate agricultural practices. UK water companies are involved in a range of “Catchment-based Approach” schemes aimed at reducing diffuse sources of pollutants, including agricultural pesticides.
- Surface water runoff sources - some priority substances e.g., heavy metals, are present in urban surface water runoff. It is recommended that future

developments would manage these sources by using SuDS that provide water quality treatment, designed following the CIRIA SuDS Manual. This is covered in more detail in section 10.5.4.

- Domestic wastewater sources - some priority substances are found in domestic wastewater because of domestic cleaning chemicals, detergents, pharmaceuticals, pesticides or materials used within the home. Whilst an increase in the population due to housing growth could increase the total volumes of such substances being discharged to the environment, it would be more appropriate to manage these substances through regulation at source, rather than through restricting housing growth through the planning system.

8.3.3 WINEP

The actions from the AMP7 Water Industry National Environment Programme that relate to actions on groundwater bodies in Cotswold District are presented below in Table 8-4. Appendix A presents actions relating to water quality of surface water bodies. A summary of the drivers listed in Appendix A.1 can be found in Table 8-5.

Table 8-4 AMP7 WINEP actions on groundwater bodies in Cotswold District.

Waterbody name	WINEP ID	Unique ID	Scheme name(s)	Type of scheme/notes
Burford Jurassic	THM00059	7TW200222	Upper Swell	DrWPA_ND
Bath oolite	WSX00388	7BW200008	Egford Main and Sub Well - DrWPA GW SGZ - nitrate (Frome WTW)	DrWPA_ND

Table 8-5 Summary of WINEP drivers relating to water quality and surface water bodies

Driver	Count
U_MON3 - EDM (Event Duration monitoring)	45
U_INV2 - FFT monitoring (Flow to Full Treatment)	27
U_MON4 - FFT monitoring	15
U_IMP5 - The WwTW FFT must be increased to 3PG + IMAX + 3E	9
U_IMP6 - The WwTW storm tank capacity must be increased to 68 litres/head or to 2 hours at max flow through the tanks	8
WFD_NDINV_WRFlow (Water Framework Directive - No Deterioration Investigation for Water Resources Flow)	4
WFD_IMPg (WFD Improvements general)	2

Driver	Count
WFD_ND (No Deterioration)	2
U_INV (Investigation)	2
WFDNDLSChem1 (No Deterioration Low Standards Chemical 1)	2
U_MON1 - Installation of EDM	1
U_MON4 - MCERTS monitor for FFT	1
WFDINVCHEM11 (Chemical investigation 11)	1
WFD_ND - Upper tier 46 mg/l	1
WFDINVCHEM13 (Chemical investigation 13)	1

8.4 Modelling results

The first test applied compares the future scenario to the baseline and assesses whether a significant deterioration in water quality occurs – either a 10% deterioration in water quality or a deterioration in WFD class. Where a significant deterioration is predicted, the TAL scenario then assesses whether this deterioration could be prevented by improvements in treatment processes.

RQP predicts the concentration at the point of mixing (i.e., where the WwTW discharges to the river) so does not always match the stated WFD status for that waterbody which may be based on observed values further downstream.

At Moreton-in-Marsh WwTW the increase in wastewater discharge during the plan period is not likely to cause a significant deterioration in water quality for ammonia or BOD but may cause a significant deterioration in phosphate. No change in WFD class is predicted for the determinands assessed.

Good ecological status for ammonia and BOD is currently being achieved (at the point of mixing).

The modelling shows no deterioration in concentration of ammonia or BOD during the plan period. BOD is not currently part of the WFD assessment for that waterbody, although the value predicted by RQP is in the range for moderate status.

The deterioration in phosphate during the plan period is predicted to be 13%, with no change in WFD class, however phosphate is shown to be at Bad WFD status and will deteriorate by greater than 3%. Following improvements in treatment to TAL this deterioration can be prevented.

Results are presented in Table 8-6.

Table 8-6: Percentage WFD deterioration

Determinand	Baseline Conc. (mg/l)	Future Conc. (mg/l)	% Deterioration	TAL concentration	% TAL deterioration
Ammonia (90th percentile)	0.08	0.08	0%	0.08	0%
BOD (90th percentile)	5.36	5.21	-3%	5.06	-6%
Phosphate (Mean)	1.1	1.24	13%	0.18	-84%

Table 8-7 summarises the results of the GES assessment. Four different assessments are possible which are shown in Table 8-6: Percentage WFD deterioration above.

- If good ecological status is predicted to be achieved within the receiving waterbody following growth during the plan period, a green assessment is given. In this case, it can be said that there is environmental capacity to accommodate growth.
- Where GES is not currently being achieved but could be achieved if upstream water quality were improved, then an amber score is given – growth could be accommodated without preventing a waterbody achieving GES in the future.
- Where GES cannot be achieved either today or in the future, despite upgrades in treatment processes, and improvements in upstream water quality, then a yellow assessment is given – and it can be said that GES cannot be achieved due to the limits of current technology. Growth alone is not predicted to prevent GES being achieved in the future.
- Should GES be achievable today, but not in the future due to growth, a red assessment would be given, and it can be said that environmental capacity could be a constraint to growth, i.e., growth alone could prevent good ecological status being achieved in the future.

Table 8-7: GES assessment

Determinand	Moreton-in-Marsh WwTW
Ammonia	GREEN-Sufficient environmental capacity. Proposed development has no significant impact on the water body's potential for meeting GES.
Biochemical Oxygen Demand (BOD)	AMBER-Proposed development can be accommodated with a tighter permit and upgrade to treatment. This is achievable with current technology
Phosphate	YELLOW-Good ecological status cannot be achieved due to current technology limits. Ensure proposed growth doesn't cause significant deterioration

8.5 Conclusions

- The overall WFD classification of a water body is based on a wide range of ecological and chemical classifications. This assessment focuses on three physio-chemical quality elements; Biochemical Oxygen Demand (BOD), Ammonia, and Phosphate which are key to Water Framework Directive compliance.
- Groundwater bodies; Bath Oolite, Burford Jurassic, Chipping Norton Jurassic, Kemble Forest Marble and Upper Thames Gravels all have an overall WFD classification of 'poor'.
- Surface water bodies; Sherston Avon, Tetbury Avon- unnamed trib to conf Sherston Avon, Nethercote Bk - source to conf R Stour, Cerney Wick Brook (source to Thames), Coln (from Coln Rogers) and Thames (Coln to Leach), Bledington Brook (Source to Evenlode), Leach (Source to Thames), Thames (Leach to Evenlode), Hazelford and Coombe Brook and Sherbourne Brook all have an overall WFD classification of 'poor'.
- 45 surface water bodies have their WINEP driver listed as 'U_MON3 – EDM', meaning that the waterbodies have a requirement for the monitoring wastewater treatment processes.
- At Moreton-in-Marsh WwTW, the proposed growth is not predicted to cause a significant deterioration in water quality for ammonia and BOD. A 13% deterioration in phosphate is predicted, however this is preventable with improvements in treatment to TAL.
- Growth alone will not prevent good ecological status being prevented in the future should improvements in upstream water quality be made.

8.6 Recommendations

Table 8-8 Water quality recommendations

Actions	Responsibility	Timescale
Provide annual monitoring reports to TW detailing projected housing growth in the Local Authority.	CDC	Ongoing
Take into account the full volume of growth (from CDC and neighbouring authorities) within the catchment.	CDC TW STW WW	Ongoing

9 Environmental Opportunities and Constraints

9.1 Introduction

Development has the potential to cause an adverse impact on the environment through several routes such as worsening of air quality, pollution to the aquatic environment, or disturbance to wildlife. Of relevance in the context of a Water Cycle Study is the impact of development on the aquatic environment.

A source-pathway-receptor approach can be taken to investigate the risk and identify where further assessment or action is required.

9.2 Sources of pollution

Water pollution is usually categorised as either diffuse or point source. Point source sources come from a single well-defined point, an example being the discharge from a WwTW.

Diffuse pollution is defined as “unplanned and unlicensed pollution from farming, old mine workings, homes and roads. It includes urban and rural activity and arises from industry, commerce, agriculture and civil functions and the way we live our lives.”

Examples of diffuse sources of water pollution include:

- Contaminated runoff from roads – this can include metals and chemicals.
- Drainage from housing estates
- Misconnected sewers (foul drains to surface water drains)
- Accidental chemical/oil spills from commercial sites
- Surplus nutrients, pesticides, and eroded soils from farmland
- Septic tanks and non-mains sewer systems

The most likely sources of diffuse pollution from new developments include drainage from housing estates, runoff from roads and discharges from commercial and industrial premises. The pollution risk posed by a site will depend on the sensitivity of the receiving environment, the pathway between the source of the runoff and the receiving waters, and the level of dilution available. After or during heavy rainfall, the first flush of water carrying accumulated dust and dirt is often highly polluting.

Whilst the threat posed by an individual site may be low, several sites together may pose a cumulative impact within the catchment.

Runoff from development sites should be managed by a suitably designed SuDS scheme.

Potential impacts on receiving surface waters include the blanketing of riverbeds with sediment, a reduction in light penetration from suspended solids, and a reduction in natural oxygen levels, all of which can lead to a loss in biodiversity.

9.3 Pathways

Pollutants can take several different pathways from their source to a “receptor” – a habitat or species that can be impacted. This could be overland via surface water flow paths, via the river system, or via groundwater or a combination of all three.

9.4 Receptors

A receptor in this case is a habitat or species that is adversely impacted by a pollutant. Both the rivers and groundwater as well as being pathways, can also be receptors.

Within the study area and downstream are many sites with environmental designations such as:

- Special Areas of Conservation (SAC)
- Special Protection Areas (SPA)
- Sites of Special Scientific Interest (SSSI)
- Ramsar sites (Wetlands of International Importance)

A description of these, and the relevant legislation that defines and protects them, can be found in Section 3.7.

To identify protected sites that may be at risk, Flood Zone 2 from the Risk of Flooding from Rivers and the Sea mapping was used to define an area that was either adjacent to a river or could be reasonably expected to receive surface water from a river. This area will henceforth be referred to as the 'search area'. Where a WwTW was present in the catchment upstream of the protected site, it was considered that there was a risk of deterioration in water quality due to growth during the local plan period, all upstream WwTWs must also be considered in future analysis. Where there were no WwTWs serving growth upstream, risk of deterioration is considered to be low, and would not be shown by water quality modelling. However, in these cases the overall catchment water quality should be considered where for example they are designated for migratory fish species that may spend part of their lifecycle elsewhere in the catchment.

Priority Habitats are available to view on the DEFRA Magic Map website, which can be accessed on the Defra website (GOV.UK).

9.4.1 Results

No Ramsar or SPA sites were found within the search area. There are 86 SSSIs and three SAC sites within the search area. Several SSSIs that are notable because of their proximity to watercourses:

- **Cotswold Water Park**: This site includes numerous lakes and watercourses, providing important habitats for aquatic species. Cotswold Water Park is in close proximity to the River Thames.
- **Salmonsbury Meadows**: Located along the River Windrush, this site features floodplain meadows that are crucial for water management and biodiversity.
- **Elmlea Meadows**: Known for its wet meadow habitats sustained by watercourses. Elmlea Meadows is in the floodplain of the River Thames.
- **Acres Farm Meadow**: Falls within the Upper Thames catchment.
- **Bourton Down**: Close proximity to the River Windrush.
- **Hampen Railway Cutting**: Close proximity to the River Windrush.

Natural England publish Impact Risk Zones (IRZs) for SSSIs. This is a tool development by NE to make a rapid initial assessment of the potential risks to terrestrial SSSIs posed by development proposals. They define zones around each SSSI which reflect the sensitivities of the features for which the site is notified and indicates the types of development which could potentially have adverse impacts and need further consideration. In certain locations they also include NE's statutory advice for certain development types. The SSSI IRZs also cover the interest features and sensitivities of those European Sites (habitats sites) that are underpinned by a terrestrial SSSI designation and include a number of "Compensation Sites", which have been secured as compensation for impacts on European Sites (habitats sites).

The Cotswold district is home to several Special Areas of Conservation (SACs), which are designated to protect and enhance the region's unique natural habitats and species. The SACs within the search area are:

- **North Meadow & Clattinger Farm** is located near the River Thames and its tributaries.
- **Cotswold Beechwoods** are situated near the River Frome and its tributaries. foetidus)
- **Rodborough Common** is bounded by the Nailsworth Valley and the Frome Valley.

Their proximity to rivers enhances their ecological value but also makes them more vulnerable to deterioration from poor water quality.

Receptor sites can be found in Table 9-1 and Figure 9-1.

Table 9-1 Designated sites within the Cotswold District boundary that fall within 5km of Flood Zone 2

Designation	Name	OS Reference
SSSI	Acres Farm Meadow	SU024927
SSSI	Badgeworth	SO909206
SSSI	Barnsley Warren	SP058053
SSSI	Barton Bushes	SP110259
SSSI	Bodkin Hazel Wood	ST780849
SSSI	Bould Wood	SP253206
SSSI	Bourton Down	SP142313
SSSI	Box Farm Meadows	ST864996
SSSI	Boxwell	ST815927
SSSI	Brassey Reserve and Windrush Valley	SP139221
SSSI	Broadway Hill	SP108368
SSSI	Bull Cross, The Frith and Juniper Hill	SO871080
SSSI	Bushley Muzzard, Brimpsfield	SO942134
SSSI	Campden Tunnel Gravel Pit	SP161409
SSSI	Clattinger Farm	SU011933
SSSI	Cleeve Common	SO993258
SSSI	Cloatley Farm	ST997905
SSSI	Cloatley Manor Farm Meadows	ST980910
SSSI	Coaley Wood Quarries	ST786994
SSSI	Cockleford Marsh	SO977132
SSSI	Coombe Hill	ST762941
SSSI	Cotswold Commons and Beechwoods	SO895124
SSSI	Cotswold Water Park	SU030942
SSSI	Crickley Hill and Barrow Wake	SO929161
SSSI	Cross Hands Quarry	SP269290
SSSI	Daneway Banks	SO938036
SSSI	Distillery Farm Meadows	SU028893
SSSI	Drybank Meadow, Cherington	SP284380
SSSI	Easter Park Farm Quarry	SO810009

Designation	Name	OS Reference
SSSI	Elmlea Meadows	SU078948
SSSI	Emmett Hill Meadows	SU008900
SSSI	Foss Cross Quarry	SP055092
SSSI	Grafton Lock Meadow	SU273989
SSSI	Hampen Railway Cutting	SP061204
SSSI	Harford Railway Cutting	SP138217
SSSI	Hawkesbury Meadow	ST754873
SSSI	Hawkesbury Quarry	ST771872
SSSI	Hornsleasow Quarry	SP131322
SSSI	Hornsleasow Roughs	SP116323
SSSI	Hucclecote Meadows	SO872162
SSSI	Huntsman's Quarry	SP124259
SSSI	Jackdaw Quarry	SP077309
SSSI	Juniper Hill, Edgeworth	SO928058
SSSI	Kemble Railway Cuttings	ST976976
SSSI	Kingscote and Horsley Woods	ST831970
SSSI	Knap House Quarry, Birdlip	SO925146
SSSI	Lark Wood	SP104262
SSSI	Leckhampton Hill and Charlton Kings Common	SO954185
SSSI	Lineover Wood	SO986186
SSSI	Lower Woods	ST745878
SSSI	Midger	ST798894
SSSI	Midsummer Meadow	SP238411
SSSI	Minchinhampton Common	SO855011
SSSI	New Park Quarry	SP174281
SSSI	Nibley Knoll	ST744957
SSSI	North Meadow, Cricklade	SU093945
SSSI	Notgrove Railway Cutting	SP085209
SSSI	Pike Corner	SU036933
SSSI	Puckham Woods	SP008223
SSSI	Ravensroost Wood	SU022882
SSSI	Rodborough Common	SO848035

Designation	Name	OS Reference
SSSI	Rough Bank, Miserden	SO907087
SSSI	Salmonsbury Meadows	SP178214
SSSI	Sarsgrove Wood	SP304243
SSSI	Selsley Common	SO828032
SSSI	Stoke Common Meadows	SU064903
SSSI	Stony Furlong Railway Cutting	SP063104
SSSI	Strawberry Banks	SO909032
SSSI	Stretton-on-Fosse Pit	SP219380
SSSI	Swift's Hill	SO877066
SSSI	Taynton Quarries	SP235150
SSSI	Upper Waterhay Meadow	SU068937
SSSI	Upton Coombe	ST789877
SSSI	Veizey's Quarry, Tetbury	ST881944
SSSI	Wellacre Quarry	SP179371
SSSI	Westwell Gorse	SP219113
SSSI	Whelford Meadow	SP168000
SSSI	Whichford Wood	SP304342
SSSI	Wildmoorway Meadows	SU065973
SSSI	Winson Meadows	SP093081
SSSI	Wolford Wood and Old Covert	SP237334
SSSI	Woodchester Park	SO819012
SSSI	Wotton Hill	ST753942
SSSI	Yarley Meadows	ST757888
SAC	North Meadow & Clattinger Farm	SU014932
SAC	Cotswold Beechwoods	SO893143
SAC	Rodborough Common	SO848035

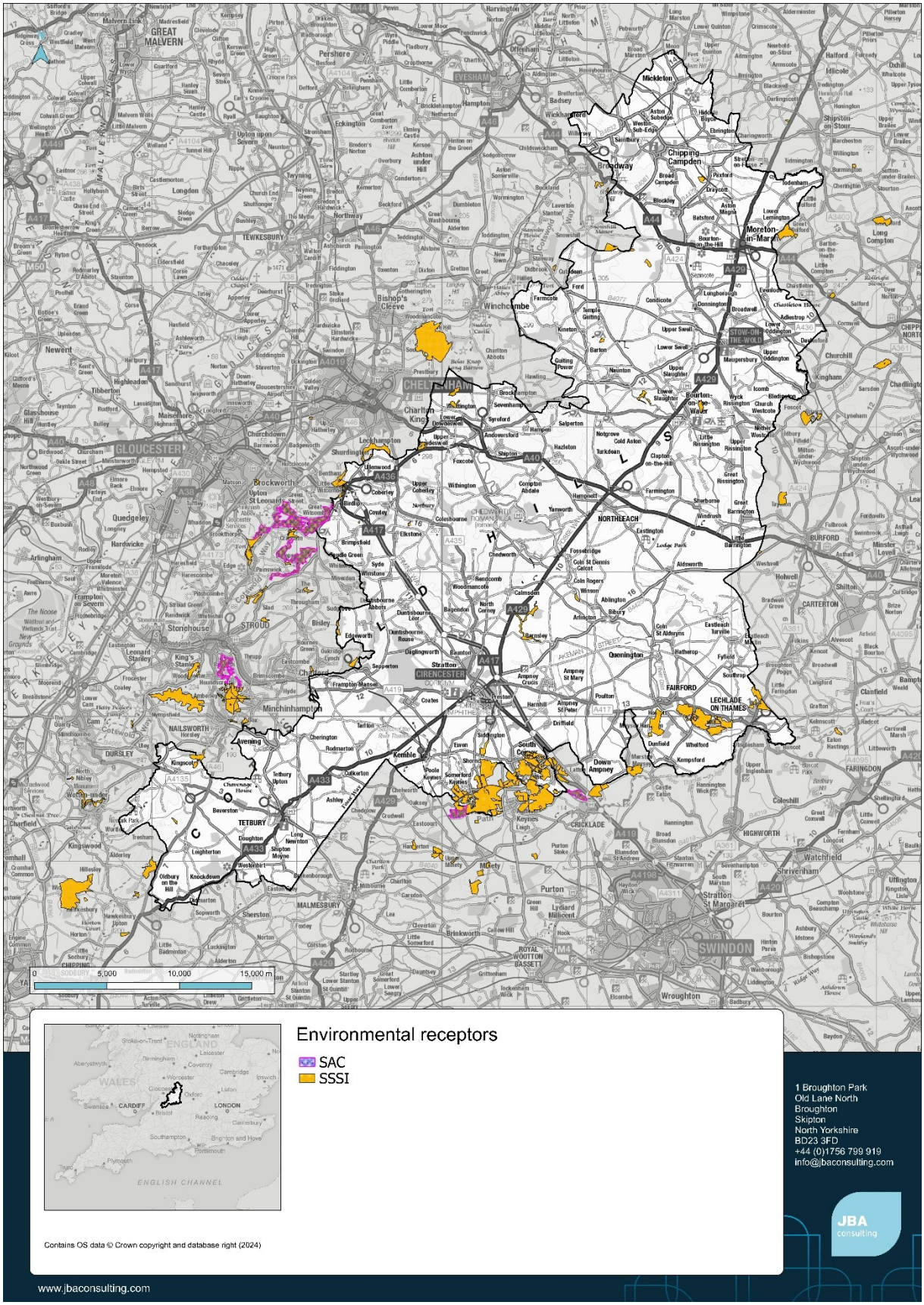

Figure 9-1 Environmental receptors within 5km of Cotswold District

9.5 Protection and mitigation

9.5.1 Groundwater Protection

Groundwater is an important source of water in England and Wales.

The Environment Agency is responsible for the protection of “controlled waters” from pollution under the Water Resources Act 1991. These controlled waters include all watercourses and groundwater contained in underground strata.

The zones are based on an estimate of the time it would take for a pollutant which enters the saturated zone of an aquifer to reach the source of abstraction or discharge point (Zone 1 = 50 days, Zone 2 = 400 days, Zone 3 is the total catchment area). The Environment Agency will use SPZs (alongside other datasets such as the Drinking Water Protected Areas (DrWPAs) and aquifer designations as a screening tool to show:

- areas where it would object in principle to certain potentially polluting activities, or other activities that could damage groundwater;
- areas where additional controls or restrictions on activities may be needed to protect water intended for human consumption; and
- how it prioritises responses to incidents.

The EA have published a position paper outlining its approach to groundwater protection (Environment Agency, 2018) which includes direct discharges to groundwater, discharges of effluents to ground and surface water runoff. This is of relevance to this water cycle study where a development may manage surface water through SuDS.

Sewage and trade effluent

Discharge of treated sewage of 2m^3 per day or less to ground are called small sewage discharges (SSDs). Most SSDs do not require an environmental permit if they comply with certain qualifying conditions. A permit will be required for all SSDs in source protection zone 1 (SPZ1).

For treated sewage effluent discharges, the EA encourages the use of shallow infiltration systems, which maximise the attenuation within the drainage blanket and the underlying unsaturated zone. Whilst some sewage effluent discharges may not pose a risk to groundwater quality individually, the cumulative risk of pollution from aggregations of discharges can be significant. Improvement or pre-operational conditions may be imposed before granting an environmental permit. The EA will only agree to developments where the addition of new sewage effluent discharges to ground in an area of existing discharges is unlikely to lead to an unacceptable cumulative impact.

Generally, the Environment Agency will only agree to developments involving release of sewage effluent, trade effluent or other contaminated discharges to ground if it is

satisfied that it is not reasonable to make a connection to the public foul sewer. The EA would normally expect to only permit new private discharges where the distance to connect to the nearest public sewer exceeds the number of dwellings multiplied by 30m. So, for example, a development of 100 dwellings would need to be more than 3km from a public sewer. The developer would have to provide evidence of why the proposed development cannot connect to the foul sewer in the planning application. This position will not normally apply to surface water run-off via sustainable drainage systems and discharges from sewage treatment works operated by sewerage undertakers with appropriate treatment and discharge controls.

Deep infiltration systems (such as boreholes and shafts) are not generally accepted by the EA for discharge of sewage effluent as they bypass soil layers and reduce the opportunity for attenuation of pollutants.

Discharges of surface water run-off to ground at sites affected by land contamination, or from sites for the storage of potential pollutants are likely to require an environmental permit. This could include sites such as garage forecourts and coach and lorry parks. These sites would be subject to a risk assessment with acceptable effluent treatment provided.

Discharge of clean water

“Clean water” discharges such as runoff from roofs or from roads, may not require a permit. However, they are still a potential source of groundwater pollution if they are not appropriately designed and maintained.

Where infiltration SuDS schemes are proposed to manage surface runoff they should:

- be suitably designed, meet Government non-statutory technical standards (DEFRA, 2015) for sustainable drainage systems – these should be used in conjunction with the NPPF and PPG; and
- use a SuDS management treatment train

A hydrogeological risk assessment is required where infiltration SuDS is proposed for anything other than clean roof drainage in a SPZ1.

Deep infiltration systems (such as boreholes and shafts) could be accepted by the EA for discharge of clean roof water via sealed system. Separation of clean roof water and other runoff should be considered at an early stage of design in a project.

Source Protection Zones in Cotswold District

Within Cotswold District there are numerous areas covered by Source Protection Zones, as shown below in Figure 9-2. A groundwater Source Protection Zone 1 is the area immediately around an abstraction point for domestic supply or for food production purposes. Groundwater in this zone is most vulnerable to pollution given the close proximity of the abstraction point and the water’s intended use for human

consumption. It is defined within the Environmental Permitting (England and Wales) Regulations 2016 as one of the following:

- The area within 50 metres of a point where the groundwater is abstracted for domestic supply or food production purposes.
- The area where it takes groundwater that is intended to be used to supply water for domestic or food production purposes up to 50 days to travel to the groundwater abstraction point.

For any given abstraction point, whichever area is largest applies.

A groundwater Source Protection Zone 2 is the area around an abstraction point for domestic supply or for food production purposes that meets one of the following definitions.

The area within 250 metres of the abstraction point if the maximum allowable annual volume, divided by 365, is less than 2,000 cubic metres per day. This is when this is authorised by either:

- an abstraction licence under section 24 of the Water Resources Act 1991
- the right to abstract small quantities under section 27 of the Water Resources Act 1991

The area within 500 metres of the abstraction point if the maximum allowable annual volume, divided by 365, is equal to or greater than 2,000 cubic metres per day. This is when this is authorised by an abstraction licence under section 24 of the Water Resources Act 1991

The area where it takes groundwater that is used to supply water for domestic or food production purposes up to 400 days to travel to the groundwater abstraction point. For any given abstraction point, whichever area is largest applies.

A groundwater Source Protection Zone 3 is the Total catchment and represents the area around a supply source within which all the groundwater ends up at the abstraction point. This is the point from where the water is taken. This could extend some distance from the source point.

Some zones include areas where there is protective geology cover, such as clay. This is because activities below the surface, such as deep drilling, could create pathways for pollutants to enter the groundwater. The map show them as zones 1c and 2c.

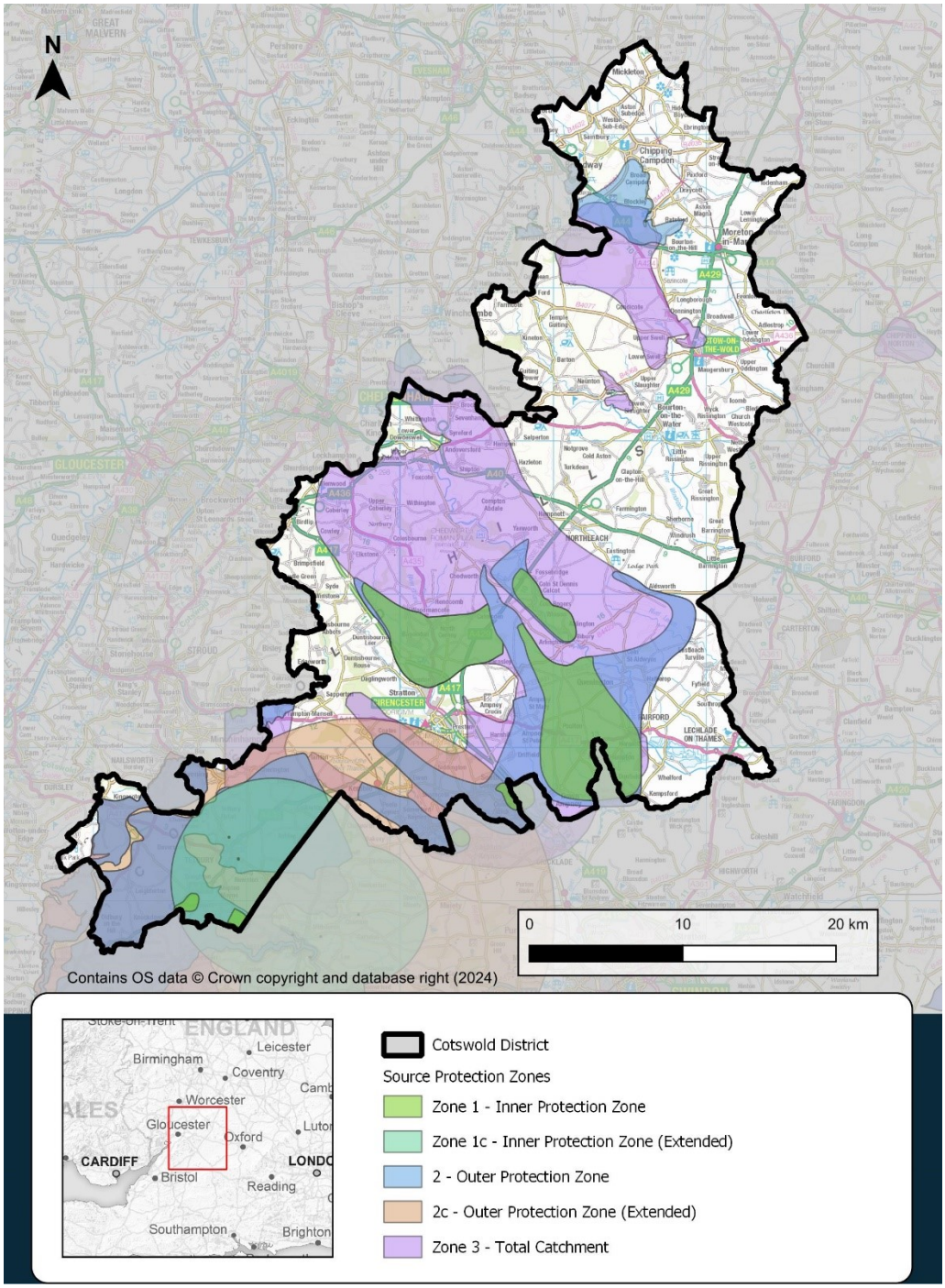

Figure 9-2 Source Protection Zones in Cotswold District

A list of the development sites, and the appropriate EA guidance for each is contained in

Table 9-2.

Table 9-2: Cotswold Local Plan review sites in SPZs and management advice

Source Protection Zone	Sites	Management advice/EA position statement
Zone 1 - Inner Protection Zone	Down Ampney	Avoiding deep borehole soakaways; and the restrictions on deep penetrative foundation methods, if contamination is encountered.
Zone 1 - Inner Protection Zone	Tetbury	Avoiding deep borehole soakaways; the restrictions on deep penetrative foundation methods, if contamination is encountered; avoiding foul sewage discharge to groundwater; avoiding direct discharge of hazardous substances to groundwater; avoiding discharge of trade effluent to ground water; and avoiding underground oil storage tanks.

9.5.2 Surface Water Drainage and SuDS

Since April 2015 (Department for Communities and Local Government, 2014), management of the rate and volume of surface water has been a requirement for all major development sites, using Sustainable Drainage Systems (SuDS).

Gloucester County Council as Lead Local Flood Authority (LLFA), is a statutory consultee to the planning system for surface water management within major development, which covers the following development scenarios:

- 10 or more dwellings
- a site larger than 0.5 hectares, where the number of dwellings is unknown
- building greater than 1,000 square metres
- a site larger than 1 hectare

SuDS are drainage features which attempt to replicate natural drainage patterns, through capturing rainwater at source, and releasing it slowly into the ground or a water body. They can help to manage flooding through controlling the quantity of surface water generated by a development, improve water quality by treating urban runoff and provide a useful function in aquifer recharge. SuDS can also deliver multiple benefits, through creating habitats for wildlife and green spaces for the community. SuDS also have the advantage of providing effective Blue and Green infrastructure and ecological and public amenity benefits when designed and maintained properly.

National standards on the management of surface water are outlined within the Defra Non-statutory Standards for Sustainable Drainage Systems (DEFRA, 2015). The CIRIA C753 SuDS Manual (CIRIA, 2015) and Guidance for the Construction of SuDS

(CIRIA, 2017) provide the industry best practice guidance for design and management of SuDS.

9.5.3 Use of SuDS in Water Quality Management

SuDS allow the management of diffuse pollution generated by urban areas through the sequential treatment of surface water reducing the pollutants entering lakes and rivers, resulting in lower levels of water supply and wastewater treatment being required. This treatment of diffuse pollution at source can contribute to meeting WFD water quality targets, as well as national objectives for sustainable development.

This is usually facilitated via a SuDS Management Train of several components in series that provide a range of treatment processes delivering gradual improvement in water quality and providing an environmental buffer for accidental spills or unexpected high pollutant loadings from the site. Considerations for SuDS design for water quality are summarised in Table 9-3 below.

Table 9-3Considerations for SuDS design for water quality

Objective	Advice
Manage surface water close to source	Where practicable, treatment systems should be designed to be close to source of runoff. It is easier to design effective treatment when the flow rate and pollutant loadings are relatively low. Treatment provided can be proportionate to pollutant loadings and the sensitivity of receptors. Accidental spills or other pollution events can be isolated more easily without affecting the downstream drainage system. Encourages ownership of pollution. Poor treatment performance or component damage/ failure can be dealt with more effectively without impacting on the whole site.

Objective	Advice
Treat surface water runoff on the surface	Where practicable, treatment systems should be designed to be on the surface. Where sediments are exposed to UV light, photolysis and volatilisation processes can act to break down contaminants. If sediment is trapped in accessible parts of the SuDS, it can be removed more easily as part of maintenance. It enables use of evapotranspiration and some infiltration to the ground to reduce runoff volumes and associated total contamination loads (provided risk to groundwater is managed appropriately). It allows treatment to be delivered by vegetation. Sources of pollution can be easily identified. Accidental spills or misconnections are visible immediately and can be dealt with rapidly. Poor treatment performance can be easily identified during routine inspections, and remedial works can be planned efficiently.
Treat surface water runoff to remove a range of contaminants	SuDS design should consider the likely presence and significance of any contaminant that may pose a risk to the receiving environment. The SuDS component or combination of components selected should include treatment processes that, in combination, are likely to reduce this risk to acceptably low levels.
Minimise risk of sediment remobilisation	The SuDS design should consider and mitigate the risks of sediments (and other contaminants) being remobilised and washed into receiving surface waters during events greater than those which the component has been specifically designed for.
Minimise impacts from accidental spills	By using a number of components in series, SuDS can help ensure that accidental spills are trapped in/on upstream component surfaces, facilitating contamination management and removal. The selected SuDS components should deliver a robust treatment design that manages risks appropriately - taking into account the uncertainty and variability of pollution loadings, sensitivity of receptors and treatment processes.

9.5.4 Additional Benefits

Flood Risk

The Strategic Flood Risk Assessment contains recommendations for SuDS to manage surface water on development sites, with the primary aim of reducing flood risk.

SuDS are most effective at reducing flood risk for relatively high intensity, short and medium duration events, and are particularly important in mitigating potential increases in surface water flooding, sewer flooding and flooding from small and medium sized watercourses resulting from development.

Water Resources

A central principle of SuDS is the use of surface water as a resource. Traditionally, surface water drainage involved the rapid disposal of rainwater, by conveying it directly into a sewer or Water Recycling Centres.

SuDS techniques such as rainwater harvesting, allow rainwater to be collected and re-used as non-potable water supply within homes and gardens, reducing the demand on water resources and supply infrastructure.

Climate Resilience

Climate projections for the UK suggest that winters may become milder and wetter, and summers may become warmer, but with more frequent higher intensity rainfall events. This would be expected to increase the volume of runoff, and therefore the risk of flooding from surface water, and diffuse pollution, and reduce water availability.

SuDS offer a more adaptable way of draining surfaces, controlling the rate and volume of runoff leaving urban areas during high intensity rainfall, and reducing flood risk to downstream communities through storage and controlled release of rainwater from development sites.

Through allowing rainwater to soak into the ground, SuDS are effective at retaining soil moisture and groundwater levels, which allows the recharge of the watercourses and underlying aquifers. This is particularly important where water resource availability is limited, and likely to become increasingly scarce under future drier climates.

Biodiversity

The water within a SuDS component is an essential resource for the growth and development of plants and animals, and biodiversity benefits can be delivered even by very small, isolated schemes. The greatest value can be achieved where SuDS are planned as part of a wider green landscape, providing important habitat, and wildlife connectivity. With careful design, SuDS can provide shelter, food, foraging and breeding opportunities for a variety of species including plants, amphibians, invertebrates, birds, bats, and other animals.

Amenity

Designs using surface water management systems to help structure the urban landscape can enrich its aesthetic and recreational value, promoting health and well-being and supporting green infrastructure. Water managed on the surface rather than underground can help reduce summer temperatures, provide habitat for flora and fauna and act as a resource for local environmental education programmes and working groups and directly influence the sense of community in an area.

9.6 Nutrient reduction options

9.6.1 Natural Flood Management

Natural Flood Management (NFM) is used to protect, restore, and re-naturalise the function of catchments and rivers to reduce flood risk. A wide range of techniques can be used that aim to reduce flooding by working with natural features and processes to store or slow down flood waters before they can damage flood risk receptors (e.g., people, property, infrastructure, etc.). NFM involves taking action to manage flood and coastal erosion risk by protecting, restoring, and emulating the natural regulating functions of catchments, rivers, floodplains, and coasts. Techniques and measures, which could be applied include:

- Offline storage areas.
- Re-meandering streams.
- Targeted woodland planting.
- Reconnection and restoration of functional floodplains.
- Restoration of rivers and removal of redundant structures.
- Installation or retainment of large woody material in river channels.
- Improvements in management of soil and land use.
- Creation of rural and urban SuDS.

In 2017, the Environment Agency published on online evidence base to support the implementation of NFM and with JBA produced maps showing locations with the potential for NFM measures. These maps are intended to be used alongside the evidence directory to help practitioners think about the types of measure that may work in a catchment and the best places in which to locate them. There are limitations with the maps; however, it is a useful tool to help start dialogue with key partners.

9.6.2 Multiple Benefits of NFM

In addition to flood risk benefits, there are also significant benefits in other areas such as habitat provision, air quality, climate regulation and of note for the water cycle study - Water Quality.

Many NFM measures can reduce nutrient and sediment sources by reducing surface runoff flows from higher ground, reducing soil erosion, trapping sediment at the edge

of agricultural land, or encouraging deposition of sediments behind natural dams upstream in watercourses.

Suitable techniques may include:

- Leaky dams.
- Woodland planting.
- Buffer strips.
- Runoff retention ponds.
- Land management techniques (soil aeration, cover crops etc).
-

Case study Littlestock Brook

Littlestock Brook is a sub-catchment of the River Evenlode. Phase 1 of the Natural Flood Management (NFM) measures began in March 2017 with the installation of 12 woody dams in a deeply incised northern tributary channel just upstream of Milton-under-Wychwood. These dams were designed to reduce the movement of coarse bed material that was hindering water flow. In the following three phases (2018-2020), additional interventions were carried out in the upper catchment. These included soil management on steep clay slopes, creating nutrient retention ponds and sediment traps, building 15 riparian field corner bunds to store overland runoff, and installing another 15 in-channel woody dams. Additionally, 100 meters of watercourse were de-culverted, and 230 meters of new watercourse were constructed. A Forestry Commission Woodland Grant scheme also supported the creation of 14.4 hectares of new riparian woodland, aimed at enhancing rainfall interception and carbon sequestration.

Phase 5, implemented in 2020/21, introduced more retention ponds, further riparian tree planting, and the construction of 900 meters of field edge nutrient-trapping swales. The primary NFM strategy involved building flood storage bunds at field corners. The leaky woody dams helped redirect floodwaters into scrapes and field corner flood storage areas (FSAs), which intercepted runoff and temporarily stored high flows from the brook. Across the trial area, these NFM measures provided approximately 30,000 cubic meters of temporary water storage. The FSAs included in the study were located in the two sub-catchments upstream of Milton-under-Wychwood.

9.6.3 Integrated Constructed Wetlands

An integrated constructed wetland (ICW) is an artificial wetland created for the purpose of treating polluted water, whether this is municipal wastewater, grey water from residential properties, or agricultural runoff.

They are usually unlined, free surface flow wetlands, designed to contain and treat influents within emergent vegetated areas.

Defra carried out a systematic review of the effectiveness of various wetland types, including ICWs for mitigating agricultural pollution such as phosphate and nitrate. The overall conclusion was that all wetland types are very effective at reducing major nutrients and suspended sediments, with the exception of nitrite in ICWs. Nitrate is only reduced when passing through overland buffer strips and through constructed wetlands with vegetation, where the systematic review showed a mean reduction of 29% across the evidence included in the study. The mean reduction in Total Phosphorus across the evidence base was 78%.

Case study - Cromhall South Gloucestershire

The study in South Gloucestershire was designed to remove phosphorus from sewage effluent and evaluated the wetland's ability to eliminate nutrients, organic pollutants, and chemicals, while also enhancing biodiversity after its construction.

The analysis revealed the effectiveness of the wetland appeared to be at its greatest during summer months, with lower water flows, warmer temperatures, more daylight and significant macrophyte growth all contributing to the positive findings.

On average, annually the wetland reduced concentrations of phosphorus to within the proposed permit limit of three milligrams of phosphorus per litre. The wetland can maintain phosphorus levels in effluent within legal limits. Additionally, ongoing academic research indicates that these wetlands are effective in removing microplastics and over 70 percent of certain compounds from the water, as well as reducing the release of bacteria into the environment by more than 95 percent. Similarly, the wetland also increased biodiversity. The summary of water quality results are as follows:

- 27.5% reduction in total phosphorus
- 19% reduction in suspended solids
- 62% reduction in ammonia
- >60% reduction in nitrogen
- >70% removal of specific emerging contaminants
- >95% removal of antimicrobial resistance genes
- >95% reduction in microplastics

9.6.4 Agricultural Management

There is a big potential to improve water quality by interventions aimed at agricultural sources, especially considering the measures already taken by STW to reduce their contribution to phosphate load.

Potential schemes could include:

- Buffer strips.
- Cross slope tree planting.
- Runoff retention basins.

- Contour ploughing.
- Cover crops.

There is considerable overlap with NFM measures, and the challenges are also very similar. Exact impacts are difficult to measure, although modelling tools such as Farmscoper exist to help with this. Once a scheme is implemented it relies on the landowner to continue to maintain it in order to maintain the mitigation benefit.

Funding for agricultural interventions could come from Catchment Sensitive Farming or a Payment for Ecosystem Services approach.

Case Study – Wessex Water - EnTrade

Wessex Water catchment team used EnTrade to invite farmers to bid to grow cover crops over winter to reduce the nitrogen leaching into the watercourse.

This avoided the need to upgrade Dorchester WwTW to provide the same nitrogen removal capacity.

A trial auction was held in 2015, and two further auctions have since taken place attracting 557 bids from 63 farmers to save 153 tonnes of nitrogen.

“Using EnTrade to create a market in measures to deliver reductions in nitrogen has delivered a 30% saving for Wessex Water compared to traditional catchment approaches.” Ruth Barden, Director of Environmental Strategy, Wessex Water.

9.6.5 Barriers

- **Landowner Cooperation**: Effective nutrient reduction measures often rely on the cooperation and ongoing maintenance by landowners. Without their active participation, the long-term success of these measures can be compromised.
- **Funding and Resources**: Implementing and maintaining nutrient reduction schemes require significant financial investment. Securing consistent funding can be challenging, and limited resources may hinder the scope and scale of interventions.
- **Technical Challenges**: The effectiveness of nutrient reduction measures can be difficult to quantify and model accurately. Tools like Farmscoper help, but there are still uncertainties in predicting exact impacts.
- **Coordination and Collaboration**: Successful nutrient reduction often requires collaboration between multiple stakeholders, including local authorities, farmers, environmental groups, and the community. Coordinating these efforts can be complex and time-consuming.
- **Awareness and Education**: Raising awareness and educating stakeholders about the benefits and methods of nutrient reduction is crucial. Without sufficient knowledge and understanding, stakeholders may be less likely to support or implement necessary measures.

- Regulatory and Policy Frameworks: Existing regulations and policies may not always support or incentivize nutrient reduction measures. Adapting these frameworks to encourage sustainable practices is essential.

Addressing these barriers requires a comprehensive and collaborative approach, involving all relevant stakeholders to ensure the successful implementation and maintenance of nutrient reduction measures.

9.7 Conclusions

- No Ramsar or SPA sites were found within the search area. There are 86 SSSIs and three SAC sites within the search area.
- Actions such as SuDS and NFM can be used to help manage surface water as well as aid in improving water quality.
- Integrated Constructed Wetlands (ICWs) offers significant potential for reducing nutrient pollution and improving water quality in the CDC area. These approaches leverage natural processes and features to mitigate flood risks and enhance environmental benefits, such as habitat provision, air quality improvement, and climate regulation.
- Case studies, such as the Littlestock Brook NFM measures and the Cromhall ICW, demonstrate the effectiveness of these techniques in reducing nutrient loads, enhancing biodiversity, and improving water quality. However, the barriers listed above in Section 9.6.5 must be addressed to enable water quality improvements within CDC.

9.8 Recommendations

Action	Responsibility	Timescale
Consider the environmental impact of development on protected sites downstream of receiving wastewater treatment works in the Habitats Regulations Assessment	CDC	Local Plan development
The Local Plan should include policies that require all development proposals with the potential to impact on areas with environmental designations to be considered in line with the relevant legislation and where stated, in consultation with Natural England (for national and international designations and priority habitats).	CDC	Local Plan development
The Local Plan should include policies that require development sites to adopt SuDS to manage water quality of surface runoff.	CDC	Local Plan development
In partnership, identify opportunities for incorporating SuDS into open spaces and green infrastructure, to deliver strategic flood risk management and meet WFD water quality targets.	CDC Developers TW STW WW EA	Ongoing
Developers should include the design of SuDS at an early stage to maximise the benefits of the scheme.	Developers	Ongoing
Opportunities for Natural Flood Management that include schemes aimed at reducing / managing runoff should be considered to reduce nutrient and sediment pollution within Cotswold.	CDC EA NE	Ongoing

10 Water and net zero

10.1 Introduction

The Local Plan Partial Update is taking a “green to the core" approach. This section quantifies the carbon costs associated with providing water and wastewater services in Cotswold District, and qualitatively assesses the carbon impacts of district-wide policies and development scenarios.

The water industry accounts for approximately one third of all of the UK's industrial and waste management emissions (Water UK, 2019). In 2019, the industry set itself a goal of reaching net zero on operational emissions by 2030, with a fully net zero sector by 2050 in line with the UK Government's commitments. Operationally net zero by 2030 is interpreted as meeting the requirements of the UK Government's Sixth Carbon Budget (Climate Change Committee, 2020), to reduce emissions by 68% compared to the 1990 baseline. The companies' latest business plans show some divergence in plans:

- Thames Water has delayed meeting operational net-zero until 2035, and full net zero by 2050 (Thames Water, 2023).
- Severn Trent Water is committed to be operationally net zero for Scope 1 and 2 emissions by 2030, and has had its plans approved by the Science Based Targets Initiative (SBTi) (Severn Trent Water, 2023).
- Wessex Water continues to work to be operationally net zero by 2030 and fully net zero by 2040 (Wessex Water, 2023).
- Bristol Water (now part of South West Water) continues to be committed to be operationally net zero by 2030 (South West Water, 2023).

10.2 The carbon cost of providing water and wastewater services

Water company plans and performance are reported across a number of regulated documents, including:

- Annual Performance Reports (APRs) for 2023-24.
- Price Review 2024 (PR24) business plans and accompanying responses to Ofwat's draft determination.

These include reporting in a consistent set of tables, enabling direct comparisons between companies. Emissions are reported following the standard three scopes:

- Scope one are emissions from sources that an organisation directly controls or owns. Within the sector, the majority of these emissions are from wastewater treatment, especially nitrous oxide and methane.

- Scope two are emissions caused indirectly from the energy that the company consumes, and are predominantly carbon dioxide emissions from fossil fuels used to generate electricity.
- Scope three are emissions within companies supply chain, for example including those produced in the production of chemicals, or for concrete and steel within capital projects.

Figure 10-1 shows the total emissions from the four companies serving Cotswold District by scope 1, 2 and 3. The relative scale is largely a factor of their customer base and whether they deliver water and wastewater (Thames, Severn Trent and Wessex) or just water (Bristol). A further breakdown for Thames Water's emissions (Figure 10-2) shows that 69% were from wastewater, with scope one wastewater emissions being the single largest category at 37%.

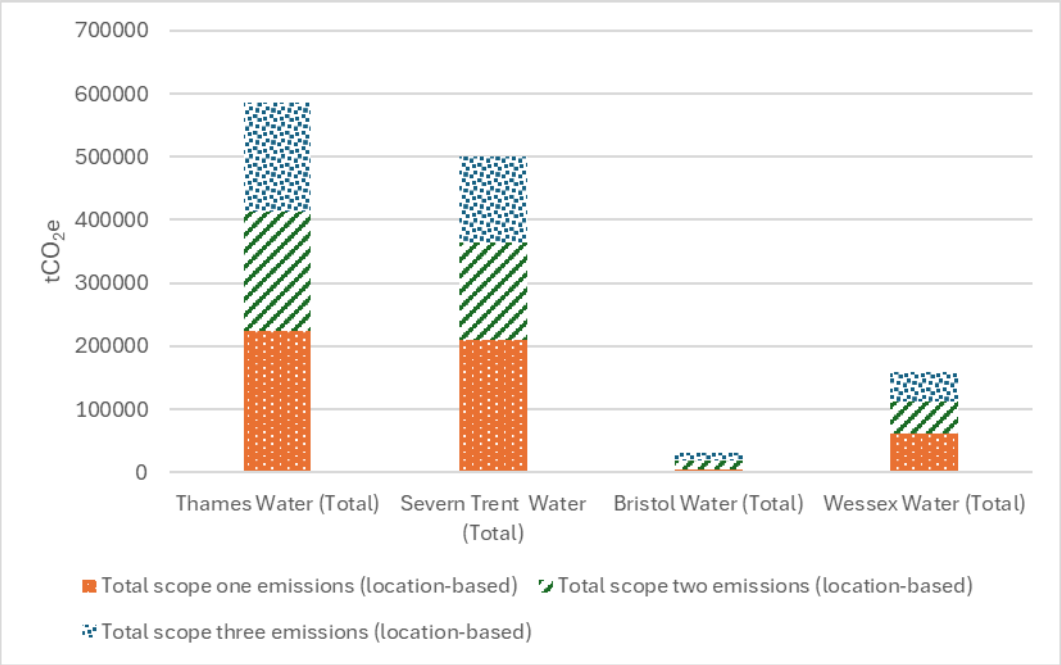

Figure 10-1: Water company scope 1, 2 and 3 emissions, 2023-24

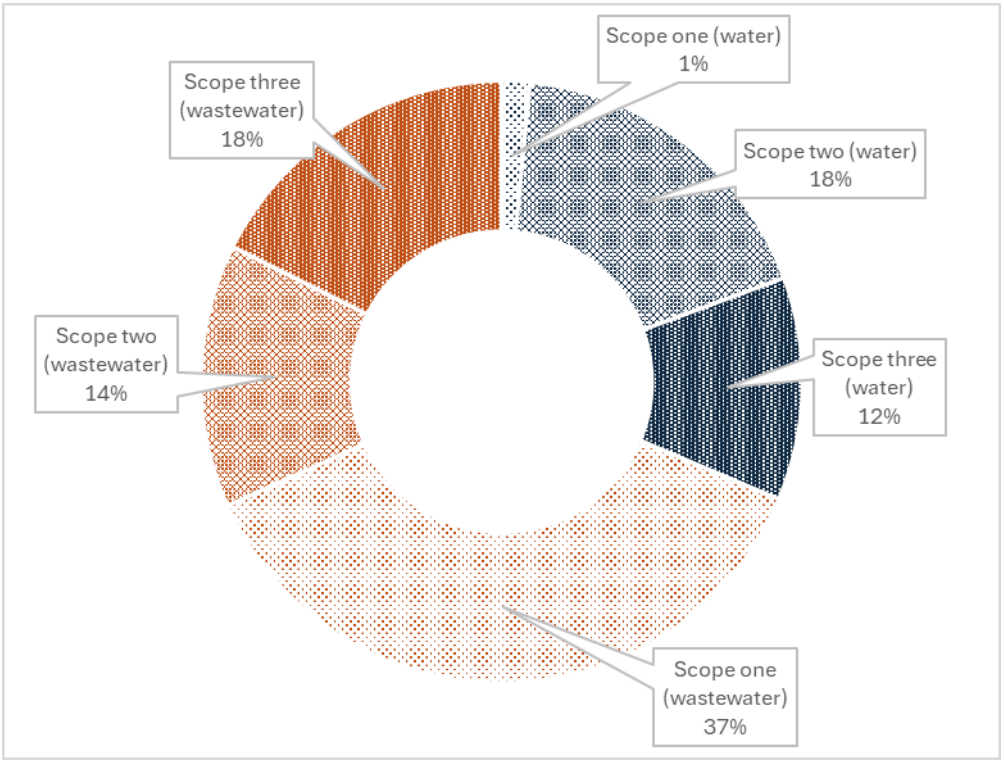

Figure 10-2: Thames Water 2023-24 emissions by scope and service

Company business plans include future projections for emissions related to water (Figure 10-3) and wastewater (Figure 10-4). These are normalised by emissions per megalitre per year. Thames Water's current unit emissions are notably lower; this is thought to reflect the increased efficiency of serving a largely highly urbanised customer base, so may not be reflective of any advantage in serving Cotswold District, one of the most rural in the Thames Water supply region.

Severn Trent report that their scope three emissions will rise over AMP8 as a results of their environmental (WINEP) and water resources obligations.

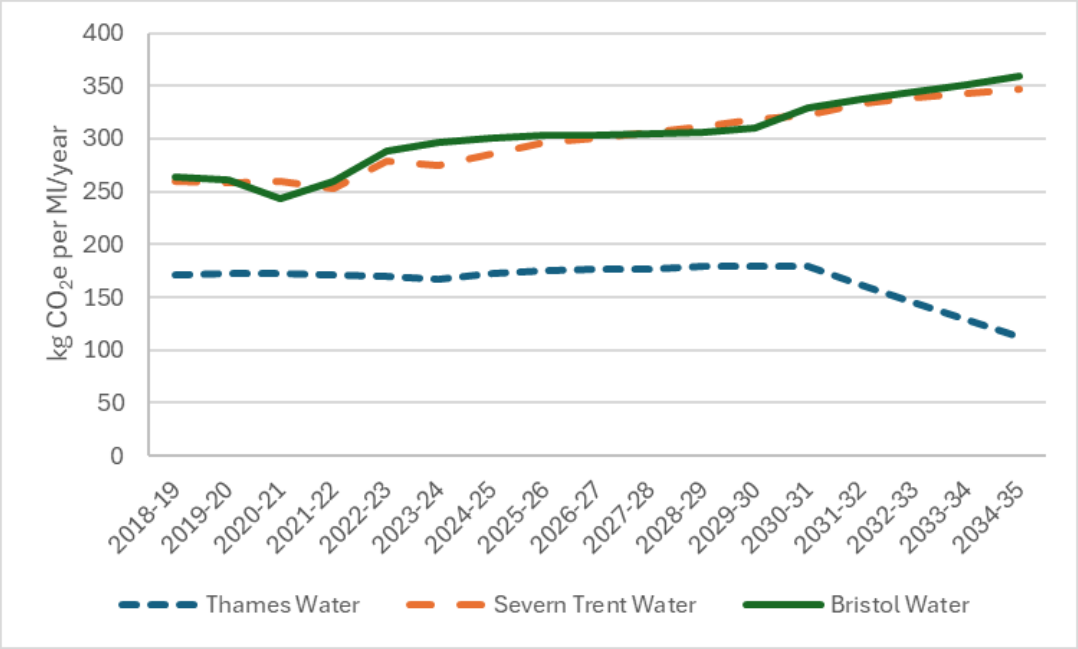

Figure 10-3: Projected emissions (water)

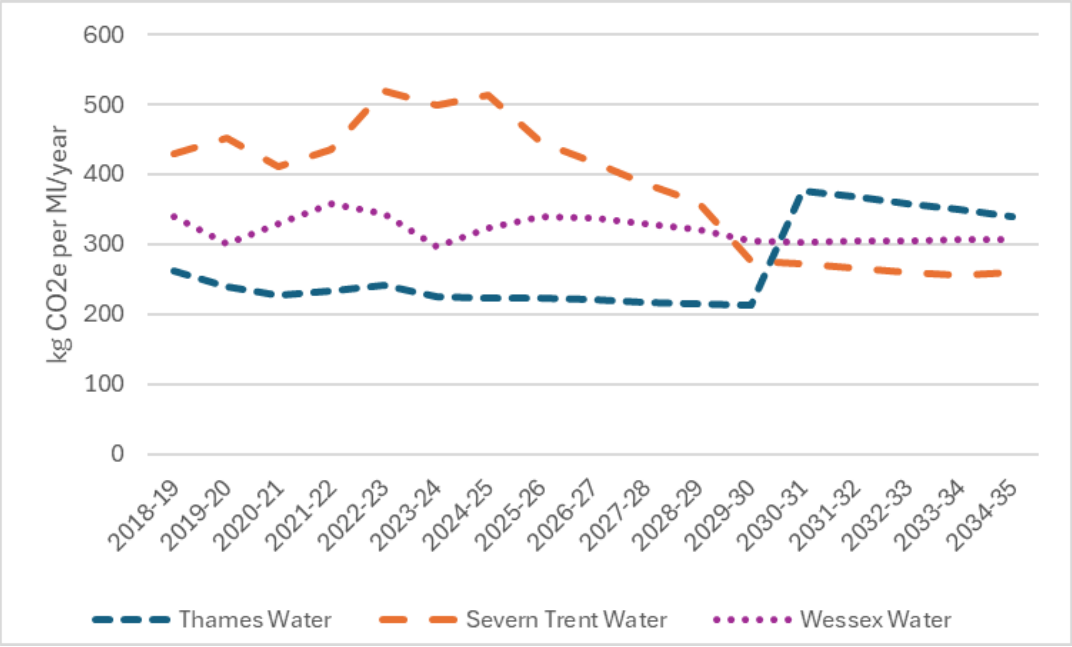

Figure 10-4: Projected emissions (wastewater)

The consumption of water by households and businesses is, therefore, a significant driver of operational emissions, along with losses due to leakage on the water side and the volume of rainwater and infiltration that has to be conveyed and treated on the wastewater side. Figure 10-5 converts the emissions per megalitre into emissions per capita, using forecasts of per capita consumption. Again the emissions per capita in the Thames Water are significantly lower and are projected to continue to reduce, whereas those in the Bristol Water and Severn Trent areas continue to rise.

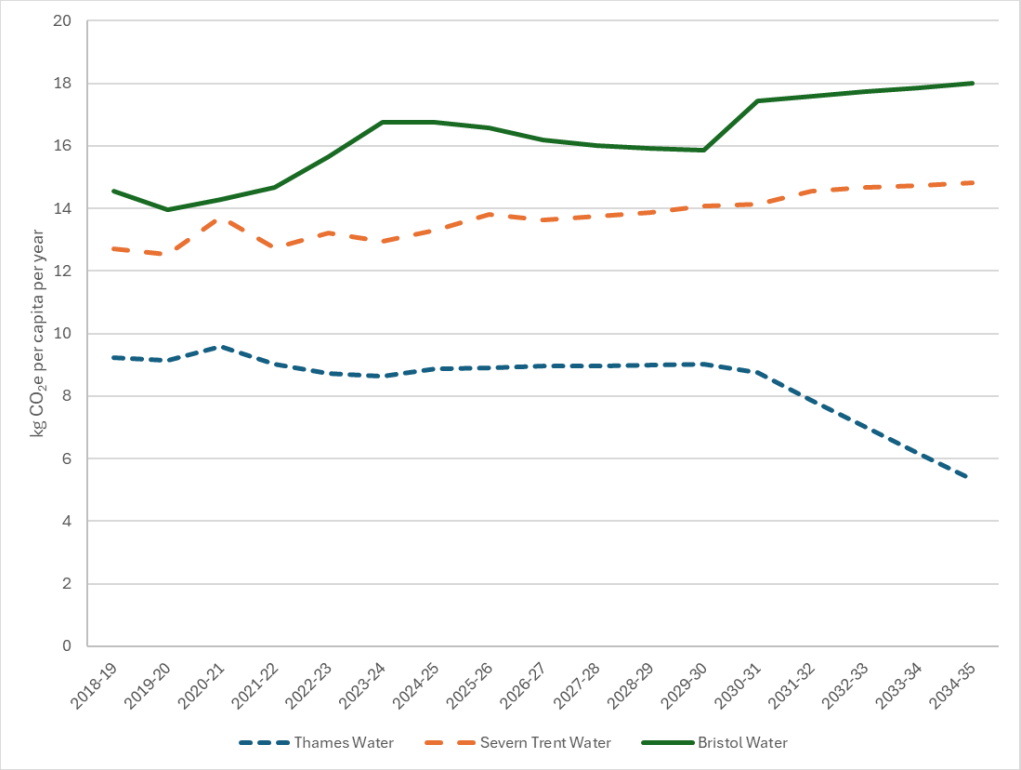

Figure 10-5: Water supply emissions per capita per year

To this point we have focussed on operational emissions. Cradle to build emissions from capital projects (covering emissions from the manufacture of materials and products, transport to site and construction) range between 12% of operational emissions for Bristol Water to 70% for Thames Water (Figure 10-6).

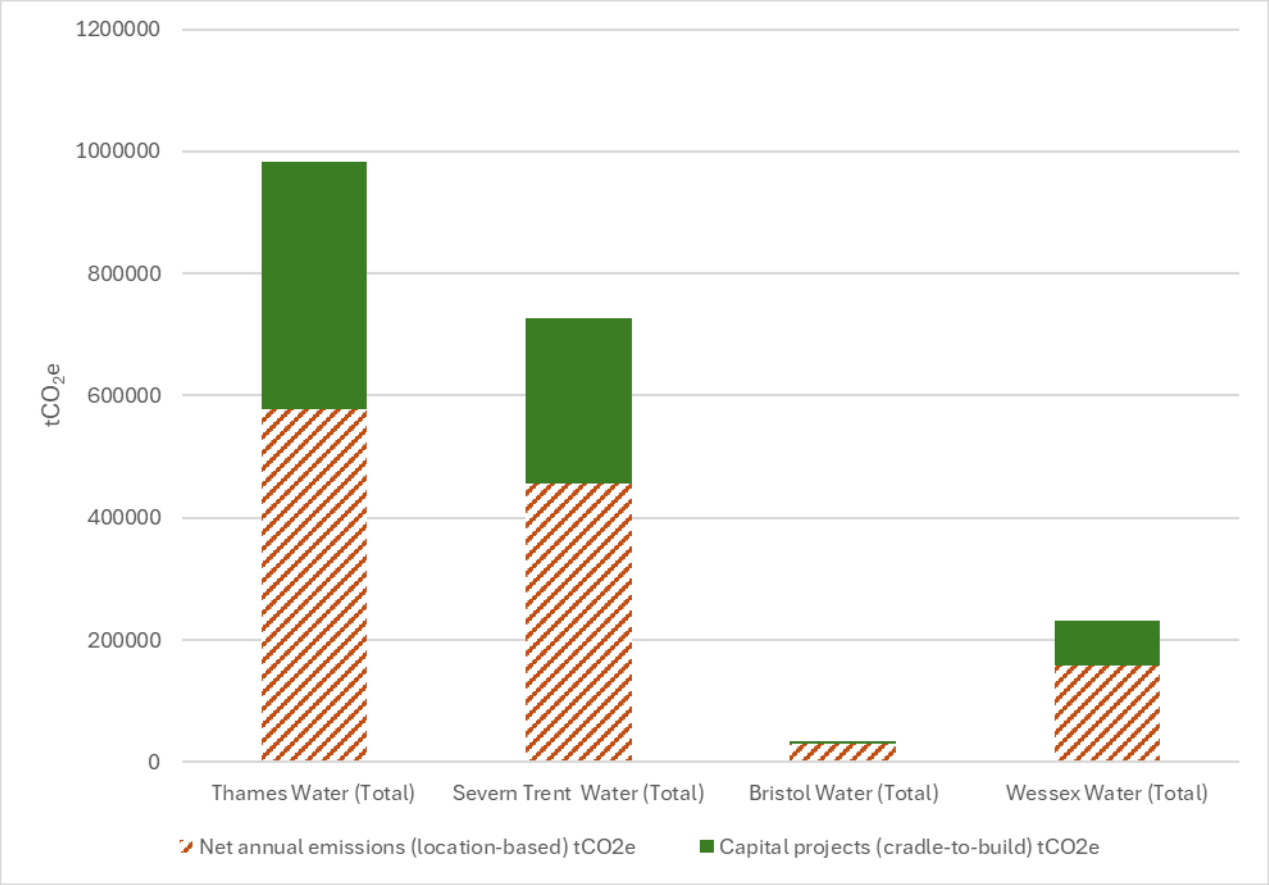

Figure 10-6: Operational emissions versus capital projects, 2023-24

Company plans for meeting their emissions targets were initially published following the sector-wide commitment to meet operational net zero by 2030, but have also been recently updated for their PR24 business plans. The key strategies being adopted to meet this target over AMP8 (2025-2030) include:

- Reducing process scope one emissions from wastewater treatment by changing processes to eliminate emissions, optimising existing processes to reduce or by capturing and treating emissions once produced. Process emissions will not benefit from actions being taken in other sectors, so they are a key area of focus for the industry.
- Use of imported natural gas for heating is expected to increase as a result of process improvements required to meet higher environmental standards for sewage sludge (biosolids). This poses a challenge, so there will be a focus on other heat and fuel sources.
- Nature-based solutions as low-carbon alternatives to grey infrastructure, for example integrated constructed wetlands to remove phosphate as smaller, rural treatment works. However, a coalition of environmental organisations has criticised company plans for including only 2% by value of nature-based investment in their AMP8 plans (Wildlife and Countryside Link, 2024).

- Completing the move to decarbonised electricity supplies using a combination of self-generation and decarbonised electricity contracts.
- No offsetting is proposed. This is consistent with the carbon management hierarchy (avoid - reduce - replace - offset).

10.3 Net zero and development scenarios

- Development that minimises the cost of new water and wastewater assets will lead to lower emissions in the short-term, although factored over the lifetime of a development the impact is not likely to be large as capital works are one-off investments. Repurposing existing buildings, brownfield development and smaller infill or edge of settlement developments in locations identified by the WCS as having some capacity are all likely to minimise emissions from capital works.
- By contrast, large greenfield development or new settlements are likely to require increased capital works and associated emissions.
- There is a clear link between per capita consumption and the carbon emissions associated with producing that water and the resulting wastewater. Lower water consumption in the home also reduces energy use and therefore household emissions, as heating water accounts for 18% of household energy consumption (see section 3.4.3). Therefore Local Plan policies which support the 110l/p/d optional household water efficiency standard or lower will contribute to lower water and wastewater related emissions.
- Likewise, policies which require high standards of water efficiency from employment development will also reduce the lifetime emissions associated with providing water and wastewater services.
- SuDS systems should be designed to provide water treatment utilising natural processes, without requiring inputs of chemicals or energy. Discharge destination should be to groundwater or to watercourses. By contrast, discharges to sewerage systems, and especially combined systems, will contribute to higher wastewater treatment capital and operational emissions; another reason to avoid the connection of surface water to combined sewers.
- The water industry plans a significant and ongoing investment to address storm overflows, with £11bn planned in England and Wales between 2025 and 2030. Current plans (Water UK, 2024) identify 21 overflows in Cotswold District which require spill improvements. Of these, 9 are currently planned to be delivered using nature-based solutions, which could include SuDS and wetlands treatment systems. These investments offer significant opportunities to local authorities, for example to improve the amenity and biodiversity of publicly owned land within settlements.

10.4 Conclusion

- The Local Plan Update emphasizes the importance of reducing carbon emissions in Cotswold District's water and wastewater services. While the water industry aims for net zero operational emissions by 2030 and full net zero by 2050, differing timelines among companies highlight the challenges ahead. Continued collaboration and innovation will be crucial for achieving these goals.
- Figures show emissions from four companies serving Cotswold District, with Thames Water having the highest wastewater emissions. Future projections indicate varying emissions per capita, with Thames Water showing lower emissions due to urban efficiency. Severn Trent's scope 3 emissions are expected to rise due to environmental obligations. Operational emissions are driven by water consumption, leakage, and rainwater treatment, while capital project emissions vary significantly among companies.
- Water companies have updated their plans to meet net zero operational emissions by 2030, focusing on AMP8 (2025-2030). Key strategies include:
    i. Reducing process emissions from wastewater treatment.
    ii. Increasing use of natural gas for heating due to higher environmental standards.
    iii. Implementing nature-based solutions, though currently limited in investment.
    iv. Transitioning to decarbonised electricity supplies.
    v. Avoiding offsetting, following the carbon management hierarchy.

- Development scenarios highlight that minimising new water and wastewater assets can reduce emissions. Policies supporting water efficiency standards and SuDS systems can further lower emissions. Significant investments are planned to address storm overflows, with opportunities for nature-based solutions to enhance local amenities and biodiversity.

10.5 Recommendations

Action	Responsibility	Timescale
Implement Water Efficiency Standards: Enforce water-saving standards and promote efficient fixtures in new developments.	CDC Developers	Ongoing
Support Nature-Based Solutions: Invest in green infrastructure and integrate Sustainable Urban Drainage Systems (SuDS).	CDC	Ongoing
Transition to Decarbonised Energy Sources: Support renewable energy projects and improve energy efficiency in water facilities.	CDC Developers TW STW WW EA	Ongoing
Focus on direct emission reductions and establish transparent monitoring.	CDC Developers TW STW WW EA	Ongoing
Address Storm Overflows: Upgrade stormwater infrastructure and enhance local amenities with nature-based solutions.	CDC TW STW WW EA	Ongoing
Plan for Future Emissions: Consider long-term emissions in planning and adapt to new environmental regulations.	CDC TW STW WW EA	Ongoing

11 Overall conclusions and recommendations

11.1 Conclusions

11.1.1 Water resources

- In Cotswold District, potable water is supplied by Thames Water, Severn Trent Water, Bristol Water and Wessex Water.
- Bristol Water and Severn Trent both serve smaller areas within the District and do not anticipate significant changes in water demand due to the absence of new site allocations. Their respective Water Resource Management Plans (WRMPs) have not been reviewed.
- Thames Water supplies the majority of the District through its Swindon and Oxfordshire (SWOX) zone. Despite projecting a surplus in water supply during AMP8 (2025-2030), Thames Water anticipates a future deficit and plans to implement a combination of demand-management and supply measures to address this challenge.
- Thames Water's growth allowance for the SWOX WRZ significantly exceeds the percentage growth allowed for within the LPPU, indicating that there is sufficient allowance for growth within the WRMP (although the LPPU and this supporting WCS does not make allowance for the increased housing growth targets resulting from the 2024 update to the NPPF.
- It is important that new development does not result in an unsustainable increase in water abstraction. This can be done in a number of ways from reducing the water demand from new houses through to achieving “water neutrality” in a region by offsetting a new developments water demand by improving efficiency in existing buildings.
- Water resources are under significant pressure in the UK, and the direction of travel in water resources planning is to reduce per capita consumption in new build development below the optional building regulations standard of 110 l/p/d.

11.1.2 Wastewater Collection:

- The primary sewage undertaker for CDC is Thames Water. Areas around Chipping Campden and Avening being served by Severn Trent Water Limited (STWL) and the Tetbury area being served by Wessex Water (WW).
- Thames Water's DWMP outlines a 25-year strategy to tackle future wastewater challenges. It aims to ensure fair charges, improved health, reduced sewer flooding, and enhanced river health. The plan includes specific targets for each Thames regional Flood and Coastal Committee (TRFCC) area, focusing on long-

term planning to address growth and climate change risks. Key goals include reducing hydraulic sewer flooding, limiting storm discharges, and achieving 100% compliance at Sewage Treatment Works (STW).

- Severn Trent Water's Drainage and Wastewater Management Plan (DWMP) aims to address current and future challenges in water management. By setting goals such as securing future water supply, promoting efficient water use, and reducing the risk of flooding and pollution, the DWMP outlines a path towards sustainable and resilient water infrastructure. The plan's focus on upgrading wastewater treatment works, implementing nature-based solutions like Sustainable Drainage Systems (SuDS), and separating surface water from combined sewers highlights its commitment to reducing storm overflow events and mitigating the impacts of climate change. Through strategic interventions and informed investment, Severn Trent Water aims to protect the environment, support a circular economy, and provide a high-quality, affordable service to its customers, ensuring a positive social impact and a safe, inclusive workplace.
- Wessex Water's DWMP is designed to tackle both current and future challenges in drainage and wastewater systems. By setting specific objectives such as reducing groundwater infiltration, promoting sustainable drainage, and improving river water quality, the plan aims to enhance environmental protection and public health. Significant investments, including £1.4 billion for upgrading water recycling centres and £550 million for improving storm overflow performance, demonstrate Wessex Water's commitment to infrastructure improvement. The incorporation of nature-based solutions and increased monitoring of water quality impacts further underscores their dedication to sustainable practices. The DWMP's risk assessment highlights the importance of proactive measures to mitigate flooding risks.
- The storm overflow "Storm Sewage Irrigation Area, Moreton-In-Marsh" (CTCR.2093) is RAG rated ‘Red’ meaning that the overflow may already be operating beyond the threshold which would trigger an investigation. Upstream development could further increase the discharge frequency, so mitigation should be required prior to significant development.
- Sheafhouse Farm CSO and Bourton-on-the-Water STW are both RAG rated ‘Amber’. This means that an investigation is not required at present, but improvements will need to be made in the network and/or catchment to meet the long-term target.

11.1.3 Wastewater Treatment:

- Wastewater services in the Cotswold District are provided by Thames Water, Severn Trent Water, and Wessex Water.
- 13 WwTWs serve the 17 key settlements highlighted in the Local Plan. Some also serve parts of neighbouring authorities surrounding the district. This cross over of

catchments into neighbouring authorities has been accounted for by including proposed development in these WwTWs catchments within the assessment.

- Only two treatment works, Cirencester and Moreton-on-Marsh, are expected to receive growth from proposed new allocations in the LPPU. An analysis of present day and future dry-weather flows indicates that Cirencester works has capacity for this development, however the frequency of storm overflows from the WwTW storm tanks indicates a potential issue at this works, which has been given an AMBER RAG rating for capacity.
- Moreton-in-Marsh WwTW appears to already be at or over capacity, and that the proposed new allocation at Fire Service College will significantly contribute to this works exceeding its permit. The EA has raised significant concerns, and no planned actions to address this are identified in the AMP8 business plan. Consequently, we consider that a RED RAG rating is appropriate, as there are significant concerns that this works does not have capacity to accommodate the proposed new allocation.
- Considering discharges from storm tanks, Blockley, Chipping Campden, Ampney St Peter, Bledington, Cirencester, Fairford, Didmarton, Tetbury Inlet, Tetbury and Andoversford WwTWs are all RAG rated 'RED'. This means that the overflow may already be operating beyond the threshold which would trigger an investigation. Upstream development could further increase the discharge frequency, so mitigation should be required prior to significant development.
- Broadwell, Lechlade and Northleach WwTWs are RAG rated 'Amber', meaning that an investigation is not required at present, but improvements will need to be made in the network and/or catchment to meet the long-term target.

11.1.4 Water quality

- The overall WFD classification of a water body is based on a wide range of ecological and chemical classifications. This assessment focuses on three physio-chemical quality elements; Biochemical Oxygen Demand (BOD), Ammonia, and Phosphate which are key to Water Framework Directive compliance.
- Groundwater bodies; Bath Oolite, Burford Jurassic, Chipping Norton Jurassic, Kemble Forest Marble and Upper Thames Gravels all have an overall WFD classification of 'poor'.
- Surface water bodies; Sherston Avon, Tetbury Avon- unnamed trib to conf Sherston Avon, Nethercote Bk - source to conf R Stour, Cerney Wick Brook (source to Thames), Coln (from Coln Rogers) and Thames (Coln to Leach), Bledington Brook (Source to Evenlode), Leach (Source to Thames), Thames (Leach to Evenlode), Hazelford and Coombe Brook and Sherbourne Brook all have an overall WFD classification of 'poor'.

- 45 surface water bodies have their WINEP driver listed as ‘U_MON3 – EDM’, meaning that the waterbodies have a requirement for the monitoring wastewater treatment processes.
- At Moreton-in-Marsh WwTW, the proposed growth is not predicted to cause a significant deterioration in water quality for ammonia and BOD. A 13% deterioration in phosphate is predicted, however this is preventable with improvements in treatment to TAL.
- Growth alone will not prevent good ecological status being prevented in the future should improvements in upstream water quality be made.

11.1.5 Environmental opportunities and constraints

- No Ramsar or SPA sites were found within the search area. There are 86 SSSIs and three SAC sites within the search area.
- Actions such as SuDS and NFM can be used to help manage surface water as well as aid in improving water quality.
- Integrated Constructed Wetlands (ICWs) offers significant potential for reducing nutrient pollution and improving water quality in the CDC area. These approaches leverage natural processes and features to mitigate flood risks and enhance environmental benefits, such as habitat provision, air quality improvement, and climate regulation.
- Case studies, such as the Littlestock Brook NFM measures and the Cromhall ICW, demonstrate the effectiveness of these techniques in reducing nutrient loads, enhancing biodiversity, and improving water quality. However, the barriers listed above in Section 9.6.5 must be addressed to enable water quality improvements within CDC.

11.1.6 Water and net zero

- The Local Plan Update emphasizes the importance of reducing carbon emissions in Cotswold District's water and wastewater services. While the water industry aims for net zero operational emissions by 2030 and full net zero by 2050, differing timelines among companies highlight the challenges ahead. Continued collaboration and innovation will be crucial for achieving these goals.
- Figures show emissions from four companies serving Cotswold District, with Thames Water having the highest wastewater emissions. Future projections indicate varying emissions per capita, with Thames Water showing lower emissions due to urban efficiency. Severn Trent's scope 3 emissions are expected to rise due to environmental obligations. Operational emissions are driven by water consumption, leakage, and rainwater treatment, while capital project emissions vary significantly among companies.
- Water companies have updated their plans to meet net zero operational emissions by 2030, focusing on AMP8 (2025-2030). Key strategies include:

vi. Reducing process emissions from wastewater treatment.
vii. Increasing use of natural gas for heating due to higher environmental standards.
viii. Implementing nature-based solutions, though currently limited in investment.
ix. Transitioning to decarbonised electricity supplies.
x. Avoiding offsetting, following the carbon management hierarchy.

- Development scenarios highlight that minimizing new water and wastewater assets can reduce emissions. Policies supporting water efficiency standards and SuDS systems can further lower emissions. Significant investments are planned to address storm overflows, with opportunities for nature-based solutions to enhance local amenities and biodiversity.

11.2 Recommendations

11.2.1 Water resources:

Action	Responsibility	Timescale
Continue to regularly review forecast and actual household growth across the supply region through WRMP Annual Update reports, and where significant change is predicted, engage with Local Planning Authorities.	TW	Ongoing
Provide yearly profiles of projected housing growth to water companies to inform the WRMP update.	CDC	Ongoing
Consider a policy on water efficient design aligned with the standards proposed in the Future Homes Hub roadmap, which recommends 100l/p/d by 2025 down to 80l/p/d by 2035. For non-household development, it is recommended that the policy requires a minimum of 3 credits under the BREEAM New Construction Standard measure “Wat01.”	CDC	LPPU

11.2.2 Water supply infrastructure

Actions	Responsibility	Timescale
Undertake network modelling where appropriate as part of the planning application process to ensure adequate provision of water supply is feasible	CDC TW STW WW	As part of the planning process

Actions	Responsibility	Timescale
Cotswold and Developers should engage early with water companies to ensure infrastructure is in place prior to occupation.	CDC TW STW WW	Ongoing

11.2.3 Wastewater Collection:

Actions	Responsibility	Timescale
Early engagement between Developers, CDC and TWULTW is required to ensure that where upgrades to infrastructure is required, it can be planned in by TW.	CDC Developers TW STW WW	Ongoing
Take into account wastewater infrastructure constraints in phasing development in partnership with the sewerage undertaker	CDC TW STW WW	Ongoing
Developers will be expected to work with the sewerage undertaker closely and early in the planning promotion process to develop an outline foul Drainage Strategy for sites to the satisfaction of the LPA that the development will not increase sewer flooding or the frequency or duration of storm overflow operation. The Outline Foul Drainage strategy should set out the following: What – What is required to serve the site Where – Where are the assets / upgrades to be located When – When are the assets to be delivered (phasing) Which – Which delivery route is the developer going to use s104 s98 s106 etc. The Outline Drainage Strategy should be submitted as part of the planning application submission, and where required, used as a basis for a drainage planning condition to be set.	Developers TW STW WW	Ongoing

Actions	Responsibility	Timescale
Developers will be expected to demonstrate to the Lead Local Flood Authority (LLFA) that surface water from a site will be disposed using a sustainable drainage system (SuDS) with connection to foul sewers seen as the last option. New connections for surface water to foul sewers will be resisted by the LLFA. Where a surface water connection is proposed to the public sewerage network, it should be demonstrated to Thames Water that there is no other technically feasible option by selecting options as high as possible within the surface water hierarchy.	Developers LLFA TW STW WW	Ongoing

11.2.4 Wastewater Treatment:

Action	Responsibility	Timescale
Discussions with the EA and TW are advised regarding capacity at Moreton-in-Marsh WwTW to accommodate planned development, including the new LPPU allocation at Fire Service College (M72)	CDC TW EA	ASAP
Consider the available WwTW capacity when phasing development.	CDC TW STW WW	Ongoing
Provide Annual Monitoring Reports to TW, STW and WW detailing projected housing growth.	CDC	Ongoing
TW, STW and WW to assess growth demands as part of their wastewater asset planning activities during the next AMP period to enable growth to come forward and feedback to the Council if concerns arise.	CDC TW STW WW	During AMP8 (2025-2030)

11.2.5 Water Quality

Actions	Responsibility	Timescale
Provide annual monitoring reports to STW detailing projected housing growth in the Local Authority.	CDC	Ongoing

Actions	Responsibility	Timescale
Take into account the full volume of growth (from TWC and neighbouring authorities) within the catchment.	CDC TW STW WW	Ongoing

11.2.6 Environmental opportunities and constraints

Action	Responsibility	Timescale
Consider the environmental impact of development on protected sites downstream of receiving wastewater treatment works in the Habitats Regulations Assessment	CDC	Local Plan development
The Local Plan should include policies that require all development proposals with the potential to impact on areas with environmental designations to be considered in line with the relevant legislation and where stated, in consultation with Natural England (for national and international designations and priority habitats).	CDC	Local Plan development
The Local Plan should include policies that require development sites to adopt SuDS to manage water quality of surface runoff.	CDC	Local Plan development
In partnership, identify opportunities for incorporating SuDS into open spaces and green infrastructure, to deliver strategic flood risk management and meet WFD water quality targets.	CDC Developers TW STW WW EA	Ongoing
Developers should include the design of SuDS at an early stage to maximise the benefits of the scheme.	Developers	Ongoing
Opportunities for Natural Flood Management that include schemes aimed at reducing / managing runoff should be considered to reduce nutrient and sediment pollution within Cotswold.	CDC EA NE	Ongoing

11.2.7 Water and net zero:

Action	Responsibility	Timescale
Implement Water Efficiency Standards: Enforce water-saving standards and promote efficient	CDC Developers	Ongoing

Action	Responsibility	Timescale
fixtures in new developments.		
Support Nature-Based Solutions: Invest in green infrastructure and integrate Sustainable Urban Drainage Systems (SuDS).	CDC	Ongoing
Transition to Decarbonised Energy Sources: Support renewable energy projects and improve energy efficiency in water facilities.	CDC Developers TW STW WW EA	Ongoing
Focus on direct emission reductions and establish transparent monitoring.	CDC Developers TW STW WW EA	Ongoing
Address Storm Overflows: Upgrade stormwater infrastructure and enhance local amenities with nature-based solutions.	CDC TW STW WW EA	Ongoing
Plan for Future Emissions: Consider long-term emissions in planning and adapt to new environmental regulations.	CDC TW STW WW EA	Ongoing

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A Appendix F - WINEP water quality actions in Cotswold District

Waterbody Name	WINEP ID	Unique ID	Scheme Name(s)	Type of scheme/notes	Completion date
Ampney and Poulton Brooks (Source to Thames)	THM00008 FLO01230 THM00113 THM00294	7TW110001 7TW200890 7TW200275 7TW200456	Ampney Brook and Lower Churn (No deterioration) AMPNEY ST PETER STW AMPNEY ST PETER STW AMPNEY ST PETER STW AMPNEY ST PETER STW	WFD_NDINV_WRFlow U_IMP5 - The WwTW FFT must be increased to 3PG + IMAX + 3E U_MON3 - EDM U_MON4 - FFT monitoring	31/03/2022 31/03/2025 31/03/2022 31/03/2021
Radcot Cut	THM00160 THM00341	7TW200322 7TW200503	CLANFIELD STW CLANFIELD STW	U_MON3 - EDM U_INV2 - FFT monitoring	31/03/2021 31/03/2022
Shill Brook and Tributaries	FLO01235 THM00121 THM00302 THM00142 THM00323	7TW200892 7TW200283 7TW200464 7TW200304 7TW200485	BAMPTON STW BAMPTON STW BAMPTON STW CARTERTON STW CARTERTON STW	U_IMP5 - The WwTW FFT must be increased to 3PG + IMAX + 3E U_MON3 - EDM U_INV2 - FFT monitoring U_MON3 - EDM U_INV2 - FFT monitoring	31/03/2025 31/03/2021 31/03/2022 31/03/2021 31/03/2022
Thames (Leach to Evenlode)	FLO01267 THM00183 THM00364 THM00663 THM00676 CHM00275	7TW300175 7TW200345 7TW200526 7TW200824 7TW200837 7TW300027	FARINGDON SEWAGE TREATMENT WORKS (Last in Line Overflow off site) FARINGDON SEWAGE TREATMENT WORKS (Last in Line Overflow off site) FARINGDON SEWAGE	U_IMP6 - The WwTW storm tank capacity must be increased to 68 litres/head or to 2 hours at max flow through the tanks. U_MON3 - EDM U_MON4 - FFT monitoring WFD_ND WFD_NDLS_Chem1 WFD_INV_CHEM13	31/03/2024 31/03/2023 31/03/2021 22/12/2024 22/12/2022 30/09/2021

Waterbody Name	WINEP ID	Unique ID	Scheme Name(s)	Type of scheme/notes	Completion date
			TREATMENT WORKS (Last in Line Overflow off site) Faringdon STW (CIP1) Faringdon STW (CIP1) Farringdon		
Windrush and tributaries (Little Rissington to Thames)	THM00138 THM00319 THM00258 THM00439 FLO01303 THM00285 THM00466	7TW200420 7TW200601 7TW300198 7TW200447 7TW200628	STANDLAKE STW STANDLAKE STW WITNEY SEWAGE TREATMENT WORKS WITNEY SEWAGE TREATMENT WORKS WITNEY SEWAGE TREATMENT WORKS	U_MON3 - EDM U_INV2 - FFT monitoring U_IMP5 - The WwTW FFT must be increased to 3PG + IMAX + 3E U_MON3 - EDM U_MON4 - FFT monitoring	31/03/2021 31/03/2022 31/03/2025 31/03/2025 31/03/2021
Dikler (Source to Wyck Rissington)	THM00018	7TW110006	River Coln and Dikler (No deterioration)	WFD_NDINV_WRFlow	31/03/2022
Cole (Acorn Bridge to Bower Bridge)	FLO01241	7TW300156	BOURTON-ON-THE-WATER STW (Last in Line Overflow off site)	U_IMP5 - The WwTW FFT must be increased to 3PG + IMAX + 3E	31/03/2023
Little Compton Brook and tributaries (Source to Evenlode)	FLO01278 THM00221 THM00402	7TW300180 7TW200383 7TW200564	LITTLE COMPTON STW LITTLE COMPTON STW LITTLE COMPTON STW	U_IMP6 - The WwTW storm tank capacity must be increased to 68 litres/head or to 2 hours at max flow through the tanks. U_MON3 - EDM	31/03/2024 31/03/2024 31/03/2024

Waterbody Name	WINEP ID	Unique ID	Scheme Name(s)	Type of scheme/notes	Completion date
				U_MON4 - FFT monitoring	
Cornwell Brook and tributaries (Source to Evenlode)	THM00154 THM00335	7TW200316 7TW200497	CHIPPING NORTON STW	U_MON3 - EDM U_MON4 - FFT monitoring	31/03/2022 31/03/2021
Evenlode (Compton Bk to Bledington Bk) and 4 Shires	THM00136 THM00317 FLO01284 THM00232 THM00413	7TW200298 7TW200479 7TW300185 7TW200394 7TW200575	BROADWELL STW BROADWELL STW MORETON IN MARSH STW (Last in Line Overflow off site) MORETON IN MARSH STW (Last in Line Overflow off site) MORETON IN MARSH STW (Last in Line Overflow off site)	U_MON3 - EDM U_MON4 - FFT monitoring U_IMP6 - The WwTW storm tank capacity must be increased to 68 litres/head or to 2 hours at max flow through the tanks. U_MON3 - EDM U_INV2 - FFT monitoring	31/03/2022 31/03/2022 31/03/2025 31/03/2021 31/03/2022
Thames (Churn to Coln)	FLO01256 FLO01257 THM00166 THM00347	7TW200899 7TW300166 7TW200328 7TW200509	CRICKLADE STW CRICKLADE STW CRICKLADE STW CRICKLADE STW	U_IMP5 - The WwTW FFT must be increased to 3PG + IMAX + 3E U_IMP6 - The WwTW storm tank capacity must be increased to 68 litres/head or to 2 hours at max flow through the tanks. U_MON3 - EDM U_MON4 - FFT monitoring	31/03/2024 31/03/2024 31/03/2023 31/03/2022
Dudgrove Brook	THM00214 THM00395	7TW200376 7TW200557	KEMPSFORD STW KEMPSFORD STW	U_MON3 - EDM U_INV2 - FFT monitoring	31/03/2021 31/03/2022
Churn (Baunton to Cricklade)	THM00007	7TW110001	Ampney Brook and Lower Churn	WFD_NDINV_WRFlow	31/03/2022

Waterbody Name	WINEP ID	Unique ID	Scheme Name(s)	Type of scheme/notes	Completion date
Swill Brook (source to Ashton Keynes)	THM00761	7TW110001	Ampney Brook and Lower Churn (No deterioration)	WFD_NDINV_WRFlow	31/03/2022
Littlestock Stream to tributary of Evenlode at Shipton	FLO01283 THM00231 THM00412	7TW200908 7TW200393 7TW200574	MILTON UNDER WYCHWOOD STW MILTON UNDER WYCHWOOD STW MILTON UNDER WYCHWOOD STW	U_IMP5 - The WwTW FFT must be increased to 3PG + IMAX + 3E U_MON3 - EDM U_INV2 - FFT monitoring	31/03/2025 31/03/2021 31/03/2022
Evenlode (Bledington to Glyme confluence)	THM00128 THM00309 THM00145 THM00326 THM00148 THM00329 THM00162 THM00343 FLO01268 THM00186 THM00367 THM00664	7TW200290 7TW200471 7TW200307 7TW200488 7TW200310 7TW200491 7TW200324 7TW200505 7TW200903 7TW200348 7TW200529 7TW200825	BLEDINGTON STW BLEDINGTON STW CHADLINGTON STW CHADLINGTON STW CHARLBURY STW CHARLBURY STW COMBE STW COMBE STW FINSTOCK STW FINSTOCK STW FINSTOCK STW FINSTOCK STW	U_MON3 - EDM U_INV2 - FFT monitoring U_MON3 - EDM U_INV2 - FFT monitoring U_MON3 - EDM U_INV2 - FFT monitoring U_MON3 - EDM U_INV2 - FFT monitoring U_IMP6 - The WwTW storm tank capacity must be increased to 68 litres/head or to 2 hours at max flow through the tanks. U_MON3 - EDM U_INV2 - FFT monitoring WFD_ND - Upper tier 46 mg/l	31/03/2021 31/03/2022 31/03/2021 31/03/2022 31/03/2021 31/03/2022 31/03/2021 31/03/2022 31/03/2024 31/03/2021 31/03/2022 31/03/2025
Coln (Source to Coln Rogers)	THM00114 THM00295 THM00017	7TW200276 7TW200457 7TW110006	ANDOVERSFORD STW ANDOVERSFORD STW River Coln and Dikler (No deterioration)	U_MON3 - EDM U_INV2 - FFT monitoring WFD_NDINV_WRFlow	31/03/2021 31/03/2022 31/03/2022

Waterbody Name	WINEP ID	Unique ID	Scheme Name(s)	Type of scheme/notes	Completion date
Coln (from Coln Rogers) and Thames (Coln to Leach)	THM00095 THM00182 THM00363	7TW200257 7TW200344 7TW200525	FAIRFORD STW FAIRFORD STW FAIRFORD STW	U_IMP5 - The WwTW FFT must be increased to 3PG + IMAX + 3E U_MON3 - EDM U_INV2 - FFT monitoring	31/03/2025 31/03/2021 31/03/2022
Leach (Source to Thames)	THM00219 THM00400 THM00236 THM00417	7TW200381 7TW200562 7TW200398 7TW200579	LECHLADE STW LECHLADE STW NORTHLEACH STW NORTHLEACH STW	U_MON3 - EDM U_MON4 - FFT monitoring U_MON3 - EDM U_MON4 - FFT monitoring	31/03/2024 31/03/2021 31/03/2024 31/03/2024
Thames (Kemble to Waterhay Bridge)	THM00762	7TW110001	Ampney Brook and Lower Churn (No deterioration)	WFD_NDINV_WRFlow	31/03/2022
Cerney Wick Brook (source to Thames)	FLO01254 THM00093 THM00159 THM00340	7TW300164 7TW200255 7TW200321 7TW200502	CIRENCESTER STW CIRENCESTER STW CIRENCESTER STW CIRENCESTER STW	U_IMP6 - The WwTW storm tank capacity must be increased to 68 litres/head or to 2 hours at max flow through the tanks. U_IMP5 - The WwTW FFT must be increased to 3PG + IMAX + 3E U_MON3 - EDM U_INV2 - FFT monitoring	31/03/2023 31/03/2024 31/03/2021 31/03/2022
Swilgate - source to conf R Avon	WMD00621 WMD00879 WMD00790 WMD01048	7ST201007 7ST201265 7ST201176 7ST201434	BROCKHAMPTON (STW) BROCKHAMPTON (STW) STOKE ORCHARD (STW) STOKE ORCHARD (STW)	U_MON4 - FFT monitoring U_MON3 - EDM U_MON4 - FFT monitoring U_MON3 - EDM	31/03/2021 31/03/2022 31/03/2025 31/03/2022

Waterbody Name	WINEP ID	Unique ID	Scheme Name(s)	Type of scheme/notes	Completion date
Tetbury Avon - source to conf unnamed trib	EDM00685 CHM00378 WSX01022 WSX01023	7WW300166 7WW300025 7WW200894 7WW200895	TETBURY - SPRINGFIELDS TETBURY STW TETBURY STW TETBURY STW	U_MON1 - Installation of EDM WFD_INV_CHEM11 U_MON4 - MCERTS monitor for FFT U_MON3 - EDM on overflow to & from storm tank	31/03/2025 30/09/2021 31/03/2024 31/03/2022
Nailsworth Stream - source to conf R Frome	WMD00592 WMD00850	7ST200978 7ST201236	AVENING (STW) AVENING (STW)	U_INV2 - FFT monitoring U_MON3 - EDM	31/03/2022 31/03/2021
The Cam R source to conf Glos and Sharpness Canal	WMD00644 WMD00902	7ST201030 7ST201288	COALEY (STW) COALEY (STW)	U_INV2 - FFT monitoring U_MON3 - EDM	31/03/2022 31/03/2021
Nethercote Bk - source to conf R Stour	WMD01364 WMD01383	7ST100260 7ST100261	LONG COMPTON (STW) NETHERCOTE (STW)	WFD_IMPg WFD_IMPg	22/12/2021 22/12/2021
Blockley Brook - source to confluence Knee Brook	WMD00609 WMD00867 WMD01121	7ST200995 7ST201253 7ST201507	BLOCKLEY (STW)	U_INV2 - FFT monitoring U_MON3 - EDM U_IMP5 - The WwTW FFT must be increased to 3PG+IMAX+3E	31/03/2022 31/03/2021 31/03/2023
Knee Brook - confluence Blockley Brook to confluence to River Stour	WMD00632 WMD00890 WMD00794 WMD01052	7ST201018 7ST201276 7ST201180 7ST201438	CHIPPING CAMPDEN (STW) STRETTON-ON-FOSSE (STW)	U_INV2 - FFT monitoring U_MON3 - EDM U_MON4 - FFT monitoring U_MON3 - EDM	31/03/2022 31/03/2021 31/03/2021 31/03/2022
Ozleworth Bk -	WSX00208	7WW200183	CHARFIELD STW	U_INV2 - MCERTS monitor for FFT	31/03/2021

Waterbody Name	WINEP ID	Unique ID	Scheme Name(s)	Type of scheme/notes	Completion date
source to conf Little Avon R	WSX00209 WSX00210 WSX01174	7WW200184 7WW200185 7WW201032	CHARFIELD STW CHARFIELD STW WOTTON UNDER EDGE STW	WFD_IMPg U_MON3 - EDM on overflow to & from storm tank WFD_IMPg	22/12/2024 31/03/2025 22/12/2024
Stour - conf Nethercote Bk to conf Back Bk	WMD00704 WMD00962 FLO00574 FLO00575	7ST201090 7ST201348 7ST300321 7ST300322	ILMINGTON (STW) ILMINGTON (STW) Shipston on Stour - Caudle Well TPS Shipston on Stour - Caudle Well TPS	U_INV2 - FFT monitoring U_MON3 - EDM U_MON4 U_MON3	31/03/2022 31/03/2021 31/03/2025 31/03/2022
Bretforton Bk - source to conf Broadway -Badsey Bk	WMD00699 WMD00957 WMD01342 WMD01343 WMD01538	7ST201085 7ST201343 7ST201722 7ST201723 7ST300205	HONEYBOURNE (STW) HONEYBOURNE (STW) HONEYBOURNE (STW) HONEYBOURNE (STW) HONEYBOURNE (STW)	U_MON4 - FFT monitoring U_MON3 - EDM WFD_IMPg WFD_ND WFD_ND	31/03/2025 31/03/2022 22/12/2024 31/03/2025 31/03/2025
Broadway -Badsey Bk - source to conf R Avon	WMD00496 WMD00533 WMD00607 WMD00865 WMD01282 WMD00620 WMD00878 WMD01286 WMD01287	7ST200882 7ST200919 7ST200993 7ST201251 7ST201665 7ST201006 7ST201264 7ST201669 7ST201670	BADSEY - HIGH STREET (CSO) BLACKMINSTER (STW) BLACKMINSTER (STW) BLACKMINSTER (STW) BLACKMINSTER (STW) BROADWAY (STW) BROADWAY (STW) BROADWAY (STW) BROADWAY (STW)	U_INV U_IMP6 - The WwTW storm tank capacity must be increased to 68 litres/head or 2 hours at max flow through the tanks U_INV2 - FFT monitoring U_MON3 WFD_IMPg - EDM U_MON4 U_MON3 - FFT monitoring WFD_IMPg - EDM WFD_ND	31/03/2022 22/12/2024 31/03/2022 31/03/2021 22/12/2024 31/03/2021 31/03/2022 22/12/2024 31/03/2025

Waterbody Name	WINEP ID	Unique ID	Scheme Name(s)	Type of scheme/notes	Completion date
Marchfont Bk - source to conf R Avon	WMD00552 WMD00722 WMD00980	7ST200938 7ST201108 7ST201366	LONG MARSTON (STW) LONG MARSTON (STW) LONG MARSTON (STW)	U_IMP6 - The WwTW storm tank capacity must be increased to 68 litres/head or 2 hours at max flow through the tanks U_INV2 - FFT monitoring U_MON3 - EDM	31/03/2023 31/03/2022 31/03/2021
Isbourne - source to conf R Avon	WMD00497 WMD00695 WMD00953 WMD00713 WMD00971 WMD00780 WMD01038 WMD00800 WMD01058 WMD00821 WMD01079	7ST200883 7ST201081 7ST201339 7ST201099 7ST201357 7ST201166 7ST201424 7ST201186 7ST201444 7ST201207 7ST201465	EVESHAM - PERSHORE RD (CSO) HINTON-ON-THE-GREEN (STW) HINTON-ON-THE-GREEN (STW) LAVERTON (STW) LAVERTON (STW) SEDGEBERROW (STW) SEDGEBERROW (STW) TODDINGTON (STW) TODDINGTON (STW) WINCHCOMBE (STW) WINCHCOMBE (STW)	U_INV U_INV2 - FFT monitoring U_MON3 - EDM U_INV2 - FFT monitoring U_MON3 - EDM U_INV2 - FFT monitoring U_MON3 - EDM U_INV2 - FFT monitoring U_MON3 - EDM U_MON4 - FFT monitoring U_MON3 - EDM	31/03/2022 31/03/2022 31/03/2021 31/03/2022 31/03/2021 31/03/2022 31/03/2021 31/03/2022 31/03/2021 31/03/2021 31/03/2022
Sherston Avon	WSX00325 WSX00326	7WW200282 7WW200283	DIDMARTON STW DIDMARTON STW	U_INV2 - MCERTS monitor for FFT U_MON3 - EDM on overflow to & from storm tank	31/03/2022 31/03/2024
Frome - source to Ebley Mill	CHM00098	7ST300006	Birdlip	WFD_INV_CHEM1	30/09/2021

Legend:

U_MON2 – Urban pollution monitoring

U_IMP5 - Flow to full treatment (FFT) = 3PG + Imax + 3E (Where: P = catchment population (number), G = per capita domestic flow (l/head/day), and E = trade effluent flow (l/d))FFT monitoring – Monitoring of Flow to Full Treatment – the volume of wastewater that is treated

EDM – Event Duration Monitoring – monitoring of the operation of storm overflows

WFD_IMP - Measures to reduce ammonia, BOD and Phosphorous at STWs in order to meet WFD standards in rivers. (h) measures to meet High status, (g) measures to meet Good status, (m) measures to meet Moderate status, (p) measures to meet Poor status.

DrWPA_ND - Catchment scheme actions and measures in Drinking Water Protected Areas (DrWPA) recommended by either previous investigations; or, actions for water companies identified in safeguard zone action plans to prevent WQ deterioration to avoid the need for additional treatment (WFD 'must do'): subject to cost effectiveness, sustainability and measurement of effectiveness.

HD_INV - Investigation and/or options appraisal to determine impacts of Water Company activities, or permits or licence standards on the Natura 2000 or RAMSAR site or to determine the costs and technical feasibility of new targets.

U_IMP1 - Schemes to improve discharges that, through population growth, have crossed the population thresholds in the Urban Waste Water Treatment Regulations (UWWTR) and therefore must achieve more stringent UWWTR requirements. This includes newly qualifying discharges (from agglomerations >10,000pe) within existing sensitive areas.

B Groundwater and surface waterbodies WFD catchments

Table 12-1Groundwater and Surface waterbodies that fall within the Cotswold Boundary

Catchment type	RBD name	Operational Catchment	Waterbody name	Waterbody ID
Groundwater	Severn	Avon Warwickshire - Jurassic Limestones Cotswold Edge North	Warwickshire Avon - Jurassic Limestones Cotswold Edge North	GB40901G304400
Groundwater	Severn	Severn Vale - Jurassic Limestone Cotswold Edge South	Severn Vale - Jurassic Limestone Cotswold Edge South	GB40901G305700
Groundwater	Severn	Inferior Oolite and Bridport Sands	Inferior Oolite and Bridport Sands	GB40901G305800
Groundwater	Severn	Bath Oolite	Bath Oolite	GB40901G805500
Groundwater	Severn	Severn Vale - Secondary Combined	Severn Vale - Secondary Combined	GB40902G204900
Groundwater	Severn	Avon Warwickshire - Secondary Mudrocks	Warwickshire Avon - Secondary Mudrocks	GB40902G990900
Groundwater	Thames	Burford Jurassic	Burford Jurassic	GB40601G600400
Groundwater	Thames	Chipping Norton Jurassic	Chipping Norton Jurassic	GB40602G600300
Groundwater	Thames	Kemble Forest Marble	Kemble Forest Marble	GB40602G600500
Groundwater	Thames	Thames Upper Gravels	Upper Thames Gravels	GB40603G000200
Surface water	Severn	Avon Bristol Rural	Sherston Avon	GB109053027690

Catchment type	RBD name	Operational Catchment	Waterbody name	Waterbody ID
Surface water	Severn	Avon Bristol Rural	Tetbury Avon - unnamed trib to conf Sherston Avon	GB109053027780
Surface water	Severn	Avon Bristol Rural	Shire bourne	GB109053027790
Surface water	Severn	Avon Bristol Rural	Tetbury Avon - source to conf unnamed trib	GB109053027800
Surface water	Severn	Frome and Cam	Horsley Str - source to conf Nailsworth Str	GB109054026510
Surface water	Severn	Frome and Cam	Nailsworth Stream - source to conf R Frome	GB109054026531
Surface water	Severn	Severn Lower Vale	Ozleworth Bk - source to conf Little Avon R	GB109054026610
Surface water	Severn	Frome and Cam	R Frome - source to conf Slad Bk	GB109054032470
Surface water	Severn	Chelt Hatherley and Normans Brook	Chelt - source to M5	GB109054032820
Surface water	Severn	Avon - Midlands West	Bretforton Bk - source to conf Broadway-Badsey Bk	GB109054039341
Surface water	Severn	Avon - Midlands West	Badsey Bk - source to conf Bretforton Bk	GB109054039350
Surface water	Severn	Avon Rural Rivers and Lakes	Nethercote Bk - source to conf R Stour	GB109054039820
Surface water	Severn	Avon Rural Rivers and Lakes	Blockley Bk - source to conf Knee Bk	GB109054039830

Catchment type	RBD name	Operational Catchment	Waterbody name	Waterbody ID
Surface water	Severn	Avon Rural Rivers and Lakes	Knee Bk conf Blockley Bk to conf St Giles's Chapel	GB109054039840
Surface water	Severn	Avon Rural Rivers and Lakes	Knee Bk - source to conf Blockley Bk	GB109054039870
Surface water	Severn	Avon Rural Rivers and Lakes	Stour - conf Nethercote Bk to conf Back Bk	GB109054039922
Surface water	Thames	Thames Upper	Thames (Waterhaybridge to Cricklade) and Chelworth Brook	GB106039022960
Surface water	Thames	Thames Upper	Thames (Churn to Coln)	GB106039022990
Surface water	Thames	Thames Upper	Dudgrove Brook	GB106039023110
Surface water	Thames	Thames Upper	Swill Brook (source to Ashton Keynes)	GB106039023700
Surface water	Thames	Thames Upper	Thames (Kemble to Waterhay Bridge)	GB106039023760
Surface water	Thames	Thames Upper	Cerney Wick Brook (source to Thames)	GB106039023800
Surface water	Thames	Thames Upper	Kemble Ditch at Kemble	GB106039023810
Surface water	Thames	Thames Upper	Marston Meysey Brook	GB106039023860
Surface water	Thames	Thames Upper	Churn (Baunton to Cricklade)	GB106039029750
Surface water	Thames	Thames Upper	Thornhill Ditch and tributaries at Cotswolds Water Park	GB106039029760
Surface water	Thames	Thames Upper	Daglingworth Stream (Source to Churn)	GB106039029770

Catchment type	RBD name	Operational Catchment	Waterbody name	Waterbody ID
Surface water	Thames	Thames Upper	Elkstone Brook	GB106039029790
Surface water	Thames	Thames Upper	Churn (source to Perrots Brook)	GB106039029810
Surface water	Thames	Evenlode	Westcote Brook (source to Evenlode at Bledington)	GB106039029950
Surface water	Thames	Evenlode	Evenlode (Bledington to Glyme confluence)	GB106039029960
Surface water	Thames	Thames Upper	Coln (Source to Coln Rogers)	GB106039029991
Surface water	Thames	Thames Upper	Coln (from Coln Rogers) and Thames (Coln to Leach)	GB106039029992
Surface water	Thames	Evenlode	Bledington Brook (Source to Evenlode)	GB106039030000
Surface water	Thames	Windrush	Leach (Source to Thames)	GB106039030040
Surface water	Thames	Windrush	Radcot Cut	GB106039030231
Surface water	Thames	Thames Upper	Ampney and Poulton Brooks (Source to Thames)	GB106039030300
Surface water	Thames	Windrush	Thames (Leach to Evenlode)	GB106039030333
Surface water	Thames	Windrush	Windrush and tributaries (Little Rissington to Thames)	GB106039030440
Surface water	Thames	Windrush	Hazelford and Coombe Brook	GB106039030450
Surface water	Thames	Windrush	Sherbourne Brook	GB106039030460

Catchment type	RBD name	Operational Catchment	Waterbody name	Waterbody ID
Surface water	Thames	Windrush	Dikler (Wyck Rissington to Windrush) and Lower Eye	GB106039030470
Surface water	Thames	Windrush	Windrush (Slade Barn Stream to Dikler)	GB106039030480
Surface water	Thames	Evenlode	Little Compton Brook and tributaries (Source to Evenlode)	GB106039037390
Surface water	Thames	Evenlode	Cornwell Brook and tributaries (Source to Evenlode)	GB106039037400
Surface water	Thames	Evenlode	Evenlode (Compton Bk to Bledington Bk) & 4 Shires	GB106039037410
Surface water	Thames	Evenlode	Evenlode (Source to Four Shires S) and Longborough Stream	GB106039037420
Surface water	Thames	Windrush	Slade Barn Stream (Source to Windrush)	GB106039037440
Surface water	Thames	Windrush	Eye (Source to Dikler)	GB106039037450
Surface water	Thames	Windrush	Windrush (Source to Slade Barn Stream)	GB106039037460
Surface water	Thames	Windrush	Dikler (Source to Wyck Rissington)	GB106039037470

C RQP results

C.1 Ammonia

C.1.1 Input Baseline results

MASS BALANCE (MONTE CARLO) Version 6.0
Calculations: 26 August 2025 at 11:24

Name of discharge	Moreton in Marsh
Name of river	Evenlode (Compton Bk to Bledington Bk) and 4 Shires Water Body
Determinand	Amm

Mean u/s river flow	.04
95% exceedence flow	.01
Mean discharge flow	.03
Standard deviation	.01

RIVER QUALITY TARGET 0.00

RIVER u/s OF DISCHARGE		lower	upper
Mean u/s river quality	.03	0.00	.07
Standard deviation	.08	.04	.10
Number of samples	9		
90-percentile	.06	.02	.34

RIVER d/s OF CURRENT DISCHARGE		lower	upper
Mean river quality	.06	.03	.08
Standard deviation	.03	.02	.05
Number of samples	9		
90-percentile	.08	.05	.17

CURRENT DISCHARGE QUALITY		lower	upper
Mean	.09	.08	.10
Standard deviation	.01	.01	.01
Number of samples	9		
95-percentile	.11	.10	.13
99-percentile	.12	.11	.14
99.5-percentile	.12	.11	.15

CORRELATION	
River and discharge flow	.54
River flow and quality	-0.30
Discharge flow and quality	-0.20

C.1.2 Input future results

MASS BALANCE (MONTE CARLO) Version 6.0

Calculations: 26 August 2025 at 11:36

Name of discharge	Moreton in Marsh
Name of river	Evenlode (Compton Bk to Bledington Bk) and 4 Shires Water Body
Determinand	Amm

Mean u/s river flow	.04		
95% exceedence flow	.01		
Mean discharge flow	.04		
Standard deviation	.01		

RIVER QUALITY TARGET

0.00

RIVER u/s OF DISCHARGE		lower	upper
Mean u/s river quality	.03	0.00	.08
Standard deviation	.08	.04	.11
Number of samples	9		
90-percentile	.06	.03	.36

RIVER d/s OF CURRENT DISCHARGE		lower	upper
Mean river quality	.06	.04	.08
Standard deviation	.03	.02	.04
Number of samples	9		
90-percentile	.08	.06	.16

CURRENT DISCHARGE QUALITY		lower	upper
Mean	.09	.08	.10
Standard deviation	.01	.01	.01
Number of samples	9		
95-percentile	.11	.10	.13
99-percentile	.12	.11	.14
99.5-percentile	.12	.11	.15

CORRELATION	
River and discharge flow	.54
River flow and quality	-0.30
Discharge flow and quality	-0.20

USE OF NON_PARAMETRIC DATA	
River flow	none

C.1.3 Input future TAL results

MASS BALANCE (MONTE CARLO) Version 6.0

Calculations: 26 August 2025 at 11:41

Name of discharge	Moreton in Marsh
Name of river	Evenlode (Compton Bk to Bledington Bk) and 4 Shires Water Body
Determinand	Amm

Mean u/s river flow	.04
95% exceedence flow	.01
Mean discharge flow	.04
Standard deviation	.01

RIVER QUALITY TARGET 0.00

RIVER u/s OF DISCHARGE		lower	upper
Mean u/s river quality	.03	0.00	.08
Standard deviation	.08	.04	.10
Number of samples	8		
90-percentile	.06	.02	.41

RIVER d/s OF CURRENT DISCHARGE		lower	upper
Mean river quality	.27	.11	.44
Standard deviation	.26	.16	.37
Number of samples	9		
90-percentile	.57	.35	1.46

CURRENT DISCHARGE QUALITY		lower	upper
Mean	.49	.19	.79
Standard deviation	.49	.29	.69
Number of samples	9		
95-percentile	1.36	.79	4.32
99-percentile	2.40	1.24	10.91
99.5-percentile	2.96	1.45	15.38

CORRELATION	
River and discharge flow	.54
River flow and quality	-0.30
Discharge flow and quality	-0.20

C.2 BOD

C.2.1 Input Baseline results

MASS BALANCE (MONTE CARLO) Version 6.0
Calculations: 27 August 2025 at 05:00

Name of discharge	Moreton in Marsh
Name of river	Evenlode (Compton Bk to Bledington Bk) and 4 Shires Water Body
Determinand	BOD

Mean u/s river flow	.04
95% exceedence flow	.01
Mean discharge flow	.03
Standard deviation	.01

RIVER QUALITY TARGET 0.00

RIVER u/s OF DISCHARGE		lower	upper
Mean u/s river quality	4.24	2.79	5.69
Standard deviation	2.16	1.24	3.13
Number of samples	8		
90-percentile	6.89	5.07	12.96

RIVER d/s OF CURRENT DISCHARGE		lower	upper
Mean river quality	3.83	3.06	4.59
Standard deviation	1.18	.68	1.69
Number of samples	8		
90-percentile	5.36	4.45	7.80

CURRENT DISCHARGE QUALITY		lower	upper
Mean	3.60	2.90	4.30
Standard deviation	1.13	.67	1.59
Number of samples	9		
95-percentile	5.69	4.65	8.70
99-percentile	7.01	5.49	12.23
99.5-percentile	7.57	5.82	13.88

CORRELATION	
River and discharge flow	.54
River flow and quality	-0.30
Discharge flow and quality	-0.20

C.2.2 Input future results

MASS BALANCE (MONTE CARLO) Version 6.0

Calculations: 27 August 2025 at 05:21

Name of discharge	Moreton in Marsh
Name of river	Evenlode (Compton Bk to Bledington Bk) and 4 Shires Water Body
Determinand	BOD

Mean u/s river flow	.04
95% exceedence flow	.01
Mean discharge flow	.04
Standard deviation	.01

RIVER QUALITY TARGET 0.00

RIVER u/s OF DISCHARGE		lower	upper
Mean u/s river quality	4.24	2.79	5.69
Standard deviation	2.16	1.24	3.13
Number of samples	8		
90-percentile	6.89	5.07	12.96

RIVER d/s OF CURRENT DISCHARGE		lower	upper
Mean river quality	3.78	3.07	4.49
Standard deviation	1.10	.63	1.57
Number of samples	9		
90-percentile	5.21	4.37	7.40

CURRENT DISCHARGE QUALITY		lower	upper
Mean	3.60	2.90	4.30
Standard deviation	1.13	.67	1.59
Number of samples	9		
95-percentile	5.69	4.65	8.70
99-percentile	7.01	5.49	12.23
99.5-percentile	7.57	5.82	13.88

CORRELATION	
River and discharge flow	.54
River flow and quality	-0.30
Discharge flow and quality	-0.20

C.2.3 Input future results

MASS BALANCE (MONTE CARLO) Version 6.0

Calculations: 29 August 2025 at 09:04

Name of discharge	Moreton in Marsh
Name of river	Evenlode (Compton Bk to Bledington Bk) and 4 Shires Water Body
Determinand	BOD

Mean u/s river flow	.04
95% exceedence flow	.01
Mean discharge flow	.04
Standard deviation	.01

RIVER QUALITY TARGET

90-percentile	5.00

RIVER u/s OF DISCHARGE		lower	upper
Mean u/s river quality	4.24	2.79	5.69
Standard deviation	2.16	1.24	3.13
Number of samples	8		
90-percentile	6.89	5.07	12.96

RIVER d/s OF CURRENT DISCHARGE		lower	upper
Mean river quality	3.37	2.53	4.21
Standard deviation	1.30	.75	1.85
Number of samples	8		
90-percentile	5.06	4.03	8.02

CURRENT DISCHARGE QUALITY		lower	upper
Mean	2.86	1.79	3.93
Standard deviation	1.72	1.01	2.43
Number of samples	9		
95-percentile	6.11	4.25	13.21
99-percentile	8.93	5.74	24.49
99.5-percentile	10.25	6.38	30.81

CORRELATION	
River and discharge flow	.54
River flow and quality	-0.30
Discharge flow and quality	-0.20

C.3 Phosphate

C.3.1 Input Baseline results

MASS BALANCE (MONTE CARLO) Version 6.0
Calculations: 29 August 2025 at 09:36

Name of discharge Moreton in Marsh
Name of river Evenlode (Compton Bk to Bledington Bk) and 4 Shires Water Body
Determinand Pho

Mean u/s river flow	.04
95% exceedence flow	.01
Mean discharge flow	.03
Standard deviation	.01

RIVER QUALITY TARGET 0.00

RIVER u/s OF DISCHARGE		lower	upper
Mean u/s river quality	.11	.08	.14
Standard deviation	.04	.03	.06
Number of samples	9		
0-percentile	0.00	0.00	.01

RIVER d/s OF CURRENT DISCHARGE		lower	upper
Mean river quality	1.10	.71	1.49
Standard deviation	.63	.37	.89
Number of samples	9		
Mean			

CURRENT DISCHARGE QUALITY		lower	upper
Mean	2.20	1.46	2.94
Standard deviation	1.20	.71	1.69
Number of samples	9		
95-percentile	4.47	3.20	9.07
99-percentile	6.33	4.22	16.00
99.5-percentile	7.19	4.65	19.75

CORRELATION	
River and discharge flow	.54
River flow and quality	-0.30
Discharge flow and quality	-0.20

C.3.2 Input future results

MASS BALANCE (MONTE CARLO) Version 6.0
Calculations: 29 August 2025 at 09:44

Name of discharge	Moreton in Marsh
Name of river	Evenlode (Compton Bk to Bledington Bk) and 4 Shires Water Body
Determinand	BOD

Mean u/s river flow	.04
95% exceedence flow	.01
Mean discharge flow	.04
Standard deviation	.01

RIVER QUALITY TARGET 0.00

RIVER u/s OF DISCHARGE		lower	upper
Mean u/s river quality	.11	.09	.13
Standard deviation	.04	.02	.06
Number of samples	9		
0-percentile	0.00	0.00	.01

RIVER d/s OF CURRENT DISCHARGE		lower	upper
Mean river quality	1.24	.81	1.68
Standard deviation	.70	.41	.99
Number of samples	9		
Mean			

CURRENT DISCHARGE QUALITY		lower	upper
Mean	2.20	1.46	2.94
Standard deviation	1.20	.71	1.69
Number of samples	9		
95-percentile	4.47	3.20	9.07
99-percentile	6.33	4.22	16.00
99.5-percentile	7.19	4.65	19.75

CORRELATION	
River and discharge flow	.54
River flow and quality	-0.30
Discharge flow and quality	-0.20

C.3.3 Input future TAL results

MASS BALANCE (MONTE CARLO) Version 6.0

Calculations: 13 October 2025 at 01:50

Name of discharge	Moreton in Marsh
Name of river	Evenlode (Compton Bk to Bledington Bk) and 4 Shires Water Body
Determinand	BOD

Mean u/s river flow	.04		
95% exceedence flow	.01		
Mean discharge flow	.04		
Standard deviation	.01		

RIVER QUALITY TARGET 0.00

RIVER u/s OF DISCHARGE		lower	upper
Mean u/s river quality	.11	.09	.13
Standard deviation	.04	.02	.06
Number of samples	9		
90-percentile	.16	.13	.24

RIVER d/s OF CURRENT DISCHARGE		lower	upper
Mean river quality	.18	.11	.25
Standard deviation	.11	.07	.16
Number of samples	9		
90-percentile	.32	.23	.61

CURRENT DISCHARGE QUALITY		lower	upper
Mean	.25	.13	.37
Standard deviation	.20	.12	.28
Number of samples	9		
95-percentile	.62	.39	1.65
99-percentile	1.00	.57	3.60
99.5-percentile	1.19	.66	4.81

CORRELATION	
River and discharge flow	.54
River flow and quality	-0.30
Discharge flow and quality	-0.20

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