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Cotswold Level 1 Strategic Flood Risk Assessment

Final Report

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Cotswold District Council	June 2026

COTSWOLD
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Contract

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This report describes work commissioned by Cotswolds District Council by an instruction dated 23 December 2025. The Client's representative for the contract was Joanne Corbett of Cotswold District council. Kira Khangura and Laura Thompson of JBA Consulting carried out this work.

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The methodology adopted and the sources of information used by JBA in providing its services are outlined in this Report. The work described in this Report was undertaken between December 2025 and June 2026 and is based on the conditions encountered and the information available during the said period. The scope of this Report and the services are accordingly factually limited by these circumstances.

The conclusions and recommendations contained in this Report are based upon information provided by others and upon the assumption that all relevant information has been provided by those parties from whom it has been requested and that such information is accurate. Information obtained by JBA has not been independently verified by JBA, unless otherwise stated in the Report.

Acknowledgements

We would like to acknowledge the assistance of the Environment Agency, Severn Trent Water, Thames Water, Wessex Water, South Oxfordshire District Council, South

Gloucestershire Council, Stroud District Council, Vale of White Horse District Council, Wiltshire District Council and Wychavon District Council.

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Abbreviations

ADEPT	Association of Directors of Environment, Economy, Planning & Transport
AEP	Annual Exceedance Probability
AIMS	Asset Information Management System
BNG	Biodiversity Net Gain
CaBA	Catchment Based Approach
CC	Climate Change
CDA	Critical Drainage Area
CIA	Cumulative Impact Assessment
CIL	Community Infrastructure Levy
CIRIA	Construction Industry Research and Information Association
DCG	Design and Construction Guidance
Defra	Department for Environment, Food and Rural Affairs
DWMP	Drainage and Wastewater Management Plan
EA	Environment Agency
FAA	Flood Alert Area
FCERM	Flood and Coastal Erosion Risk Management
FFL	Finished Floor Level
FMfP	Flood Map for Planning
FRA	Flood Risk Assessment
FWA	Flood Warning Area
FWMA	Flood and Water Management Act
FWS	Flood Warning System
GCC	Gloucestershire County Council
GI	Green Infrastructure
GSPZ	Groundwater Source Protection Zone
IDB	Internal Drainage Board
JBA	Jeremy Benn Associates
LFRMS	Local Flood Risk Management Strategy
LiDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
mAOD	metres Above Ordnance Datum
NFM	Natural Flood Management
NPPF	National Planning Policy Framework

NVZ	Nitrate Vulnerable Zone
PPG	Planning Practice Guidance
RMAs	Risk Management Authorities
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SHELAA	Strategic Housing and Economic Land Availability Assessment
SoP	Standard of Protection
SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan

Definitions

1D model: One-dimensional hydraulic model.

2D model: Two-dimensional hydraulic model.

Annual Exceedance Probability: The probability (expressed as a percentage) of a flood event occurring in any given year.

Brownfield: A previously developed parcel of land.

Climate change: Long term variations in global temperature and weather patterns caused by natural and human actions.

Design flood: A flood event of a given annual flood probability, which is generally taken as: fluvial (river) flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year), or surface water flooding likely to occur with a 1% annual probability (a 1 in 100 change each year), plus an appropriate allowance for climate change, against which the suitability of a proposed development is assessed and mitigation measures, if any, are designed.

Flood defence: Infrastructure used to protect an area against floods such as floodwalls and embankments; they are designed to a specific Standard of Protection (SoP) (design standard).

Green infrastructure: A network of multi-functional green and blue spaces and other natural features, urban and rural, which is capable of delivering a wide range of environmental, economic, health and wellbeing benefits for nature, climate, local and wider communities and prosperity.

Greenfield: An undeveloped parcel of land.

Lead Local Flood Authority: The unitary authority for the area or if there is no unitary authority, the County Council for the area.

Main river: A watercourse shown as such on the statutory main river map held by the Environment Agency (EA). They are usually the larger rivers and streams. The EA has permissive powers (not duties) to carry out maintenance and improvement works on main rivers).

Major development: Defined in the National Planning Policy Framework (NPPF) as a housing development where 10 or more homes will be provided, or the site has an area of 0.5 hectares or more, or as a non-residential development with additional floorspace of 1,000m² or more, or a site of 1 hectare or more, or as otherwise provided in the Town and Country Planning (Development Management Procedure) (England) Order 2015 (gov.uk).

Natural Flood Management (NFM): Techniques that work with nature to reduce the risk of flooding for communities.

Ordinary watercourse: Any river, stream, ditch, drain, cut, dyke, sluice, sewer (other than a public sewer) and passage through which water flows but which does not form part of a

main river. The local authority or Internal Drainage Board (IDB) has permissive powers (not duties) on ordinary watercourses.

Permissive powers: Authorities have the power to undertake flood risk management activities, but not a duty to do so. This will depend on priorities in flood risk management.

Return period: An estimate of the interval of time between events of a certain intensity or size, in this instance it refers to flood events. It is a statistical measurement denoting the average recurrence interval over an extended period of time.

Riparian owner: A riparian landowner, in a water context, owns land or property, next to a river, stream or ditch.

Risk Management Authority (RMA): The EA; a Lead Local Flood Authority; a District Council in an area where there is no unitary authority; an internal drainage board; a water company and a highway authority.

Risk: In flood risk management, risk is defined as a product of the probability or likelihood of a flood occurring, and the consequence of the flood.

Stakeholder: A person or organisation affected by the problem or solution or interested in the problem or solution. They can be individuals or organisations, includes the public and communities.

Sustainable Drainage Systems (SuDS): Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques, such as grates, gullies, and channels.

Windfall site: A site which becomes available for development unexpectedly and therefore not included as allocated land in a planning authority's Local Plan.

Executive Summary

This report provides a comprehensive and robust evidence base on flood risk issues to support the development of planning policies for the new Local Plan for Cotswold District. This report uses the best available information, including input from key stakeholders. The SFRA applies the latest national planning policy and guidance, including:

- National Planning Policy Framework (NPPF) (gov.uk), last updated in February 2025.
- Planning Practice Guidance (PPG): Flood risk and coastal change (gov.uk) updated in September 2025.
- The latest Environment Agency climate change guidance (gov.uk) (updated in July 2021 and May 2022).
- The Environment Agency 'How to prepare a strategic flood risk assessment' (gov.uk) guidance, last updated in August 2025.
- The Association of Directors of Environment, Economy, Planning & Transport (ADEPT) 'Strategic flood risk assessment good practice guidance' (adeptnet.org.uk).

Introduction

To support the development of the new Local Plan for Cotswold District Council (referred to hereafter as the Council), the key objectives of the assessment are:

- To collate and analyse the latest available information and data for current and future (i.e., climate change) flood risk from all sources, and how these risks may be mitigated against.
- To inform decisions in the new Local Plan, including informing the sustainability appraisal, the selection of development sites, and planning policies.
- To provide evidence to support the application of the Sequential Test for the allocation of new development sites, to support the Council in the preparation of the new Local Plan.
- To provide a comprehensive set of maps presenting flood risk from all sources that can be used as evidence base for use in the new local plan.
- To help decide when a Flood Risk Assessment (FRA) will be required for individual planning applications.
- To provide advice for applicants carrying out site-specific FRAs, including those at risk from sources other than river flooding, or at risk of flooding in the future due to climate change, and outline specific measures or objectives that are required to manage flood risk.
- To provide the basis for applying the Sequential Test on planning applications, including by identifying sources of flooding other than those in 'Flood Zones' and those at risk of flooding in the future.

- To identify opportunities to reduce the causes and impacts of flooding and gather information on the land that is likely to be required for flood risk management structures.

Summary of Cotswold and flood risk

Cotswold administrative area is situated in the south of England within the county of Gloucestershire. Over 90,800 people live in the Cotswold administrative area, according to the 2021 Census. The area covers approximately 1,165km^2 of land, it is rural and sparsely populated, with numerous villages and hamlets. The largest town is Cirencester and is home to approximately 22% of the population of the district.

Flood risk from all sources has been assessed in this SFRA. This study has shown that the most significant sources of flood risk across Cotswold are fluvial and surface water. The points below summarise the findings:

Fluvial: The majority of fluvial risk comes from the River Churn which flows through Cirencester and South Cerney. There is also fluvial flood risk along the River Thames and the River Coln along the southern border of the district. Fluvial flood risk is discussed in Section 4.4.1 and the flood extents are shown in the interactive GeoPDF mapping (Appendix B)

Surface Water: The Environment Agency's (EA) Risk of Flooding from Surface Water (RoFSW) highlights several communities in the district at risk from surface water flooding. Areas to the north of the district appear at highest risk of surface water flooding, including Chipping Campden, Moreton-in-Marsh, Evenlode and Bourton-on-the-Water. Other key areas of risk are present in the south of the district, most notably Cirencester, Down Ampney, South Cerney and Lechlade on Thames. Surface water flood risk is discussed in Section 4.5 and the flood extents are shown in the interactive GeoPDF mapping (Appendix B)

Climate Change: Areas at risk of flooding today are likely to be at increased risk in the future and the frequency of flooding will also increase in such areas, due to climate change. Flood extents will increase; in some locations this may be minimal, but flood depth, velocity and hazard may have more of an impact due to climate change. This SFRA provides an assessment of the impacts of climate change on fluvial and surface water flood risk. The approach to climate change is discussed in Section 5 and the flood extents are also shown in the interactive GeoPDF mapping in Appendix B.

Sewer: Thames Water, Wessex Water and Severn Trent Water provide water and sewerage services across the district and have provided details of historic sewer flooding Sewer flood risk is discussed in Section 4.6.

Groundwater: The risk of groundwater emergence within Cotswold is varied. There are several areas shown in the JBA Groundwater Emergence Map where groundwater levels are either at or very near the ground surface, as detailed in Section 4.7 and shown in the interactive GeoPDF mapping in Appendix B.

There is no national risk-based groundwater flood dataset of a suitable resolution to inform the areas at risk from groundwater flooding; however, emergence mapping when considered in conjunction with topography and surface water flow paths can indicate areas where groundwater is likely to emerge, and the flow paths it may take once above the ground.

Reservoirs: There are 10 reservoirs located outside Cotswold, which present a potential risk of flooding within the district. The level and standard of inspection and maintenance required under the Reservoirs Act means that the risk of flooding from reservoirs is relatively low. However, there is a residual risk of a reservoir breach, and this risk should be considered in any site-specific FRAs (where relevant) in accordance with the updated PPG: Flood risk and coastal change. Reservoir flood risk is discussed in Section 4.8.1 and flood extents are shown in the interactive GeoPDF mapping in Appendix B.

Defences

The EA Asset Information Management System (AIMS) dataset provides information on flood defence assets across Cotswold. The majority of flood defences within Cotswold District are present along the River Windrush, River Leach, River Coln and River Churn, as flood embankments and walls. Further information on defences across Cotswold is available in Section 6 and is shown in the interactive GeoPDF mapping in Appendix B.

How to use this report

The SFRA provides recommendations regarding all sources of flood risk across the district, which can be used to inform policy on flood risk within the new Local plan. This includes how the cumulative impact of development should be considered.

It provides the latest flood risk data and guidance to inform the Sequential Test, for both allocations and individual planning applications and provides guidance on how to apply the Exception Test.

This SFRA is a strategic assessment of flood risk and does not replace the need for site-specific FRAs, where required. The SFRA provides guidance for the development industry and development management officers to establish when an FRA is required and to assess whether site-specific FRAs meet the required quality standard (Section 7). This should be used alongside the EA's FRA Guidance (gov.uk). The SFRA can be used to help identify which locations and developments may require emergency planning provision.

The SFRA will also be helpful for developing community level flood risk policies in high flood risk areas. Similarly, all known available recorded historical flood events across the district are listed in Section 4.3. This can be used to supplement local knowledge regarding areas worst hit by flooding. Ongoing and proposed flood alleviation schemes planned within the district are outlined in Section 6.5 and Section 8 discusses mitigations, resistance and resilience measures which can be applied to alleviate flood risk to an area.

Table 1-1 sets out the contents of the SFRA and how users should use the information provided through the document and appendices.

Mapping

The SFRA mapping in Appendix B highlights on a strategic scale flood risk from fluvial, surface water and reservoirs sources, and where groundwater emergence may occur; as well as where the effects of climate change are most likely. The mapping also shows the location of raised flood defences, flood warning and alert areas and locations where there is the potential for NFM to be implemented. The maps are useful to provide a community level view of flood risk but may not identify if an individual property is at risk of flooding or depict small scale changes in flood risk. Local knowledge of flood mechanisms will need to be included to complement this mapping.

The mapping data should always be supplemented by direct consultation with the relevant wastewater company to ascertain if there is any site-specific risk from a public sewer. This is because sewer flood risk information is not publicly available and would need to be considered on a site-specific basis.

1 Introduction

1.1 Purpose of a Strategic Flood Risk Assessment (SFRA)

Cotswold District Council (referred to hereafter as the Council) acts as the Local Planning Authority (LPA). In its role as LPA, the Council is responsible for producing a Local Plan, determining planning applications, enforcement in response to breaches of planning control, and supporting neighbourhood planning.

As set out in the National Planning Policy Framework (NPPF), 2025 (Paragraph 171) "*Strategic policies should be informed by a strategic flood risk assessment and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards*."

This SFRA will form a key part of the evidence base for the Council's new Local Plan and will inform future planning decisions. It will be used to assist in the formulation of land allocations for development and specific policies in relation to water management and adapting to climate change.

1.2 Relevance of the SFRA

The 'How to prepare a Strategic Flood Risk Assessment guidance', 2025 (gov.uk) sets out the requirements that the LPA must address within their SFRA and has been used to undertake this Level 1 SFRA.

This Level 1 SFRA has been developed using the best available information, supplied at the time of preparation. Appendix G details the information supplied and included in the Level 1 SFRA. Over time, new and updated information will become available to inform planning decisions:

- The Environment Agency (EA) regularly reviews and updates its hydrology, hydraulic modelling, and flood risk mapping.
- The EA published the national flood risk assessment 2 mapping (NaFRA2) and national coastal erosion risk mapping (NCERM). Regular updates to flood risk information datasets are ongoing.
- Other datasets used to inform this SFRA may also be updated periodically and following the publication of this SFRA, new information on flood risk may be provided by other Risk Management Authorities (RMAs).

The SFRA should be a live document that is easily updateable to reflect the latest information. Links have been provided for relevant guidance documents and policies published by RMAs such as Gloucestershire County Council (GCC) in its role as the Lead Local Flood Authority (LLFA) and the EA. When considering this Level 1 SFRA to help prepare site specific flood risk assessments (FRA), it is important to check with the source organisation that the most up to date information is used.

As the data available for SFRAs and the relevant legislation is continually changing, the SFRA should be updated to reflect changes where applicable and reasonably practicable. Under any changes in guidance or legislation, the implications on the SFRA should be considered and a review undertaken where this is deemed necessary.

1.3 Levels of SFRA

The PPG: Flood risk and coastal change (gov.uk) identifies two levels of SFRA.

Level 1 SFRAs are high-level strategic documents and do not go into detail on an individual site-specific basis. Where potential site allocations are not at major flood risk and where development pressures are low, a Level 1 assessment may be sufficient, without the LPA needing to progress to a more detailed Level 2 assessment. The Level 1 assessment should be of sufficient detail to enable application of the Sequential Test, to inform the allocation of development to areas of lower flood risk.

A Level 2 assessment is required where land outside flood risk areas cannot appropriately accommodate all necessary development, creating the need to apply the NPPF's Exception Test if relevant, or if the LPA believe they may receive high numbers of applications in flood risk areas on sites not identified in the Local Plan. In these circumstances the assessment should consider the detailed nature of the flood characteristics from all sources, both now and in the future.

This report and associated appendices fulfil the requirements of a Level 1 SFRA.

1.4 Local Plan area

Cotswold District Council administrative area is situated in the south of England within the county of Gloucestershire. The south of the district is bordered by Wiltshire whilst the east borders the West Oxfordshire district. Stratford-upon-Avon and Wychavon districts border the north whilst Tewkesbury, Stroud and Cheltenham districts border the west. Over 90,800 people live in the Cotswold administrative area, according to the 2021 Census. Cotswold is a largely rural district covering 1,165 km^2. The largest town is Cirencester and is home to approximately 22% of the population of the district with numerous villages and hamlets located across the district.

The landscape is exceptionally distinctive. The Cotswolds National Landscape (CNL) (formerly known as the Cotswolds Area of Outstanding Natural Beauty (AONB)) is a national designation which affords the highest level of landscape protection and covers nearly three quarters of the district. In addition, there are locally designated Special Landscape Areas and the Cotswold Lakes (formerly known as the Cotswold Water Park), internationally important for its nature conservation. Coupled with this natural beauty the district has an abundance of built heritage and archaeology, creating a unique 'Cotswold Character'. The district has many listed buildings and a significant number of conservation areas. Several parks are listed on the English Heritage list of historic parklands. The district also has 238 scheduled ancient monuments.

The main river catchment is the Thames catchment which extends over an area of almost 13,000 km^2. The topography of the catchment is characterised by rural landscapes, rolling hills and wide, flat river floodplains with the east comprising a significantly more urban environment. The west of the district is comprised of hilly, upland areas. The nature of the topography indicates a faster, 'flashy' system in the uplands with water levels and flows responding to rainfall in a shorter time. In contrast, the flatter lower-lying parts of the lower catchment show slower responses.

The Thames is a 346-kilometre-long watercourse, rising in the west in Gloucestershire, flowing through the Cotswold district, Oxfordshire and Buckinghamshire. The River Thames has its source upstream of Kemble and continues as an ordinary watercourse in the Cotswold district at Thames Head (ST 9804 9947), very soon being classed as a main river less than 1km downstream. The river then flows through Greater London, with the channel becoming more artificially engineered and straightened, before reaching the Thames Estuary to the east. The Thames has a number of tributaries in its upstream phase that have the potential to be a source of risk for settlements within the Cotswolds, including the River Churn, River Coln, and Ampney Brook.

The River Churn flows through Cirencester, where it is the main source of flood risk to properties and roads in Cirencester, South Cerney and Siddington. Historical blockage of culverts on the River Churn in the Spitalgate Lane area may have contributed to fluvial flood risk in the past. The River Churn is also recorded to have flooded several residential properties at Watermoor, South Cerney and Cerney Wick.

The River Coln rises as several minor rivers in the hills north of Withington. It is classed as a main river from Chedworth Woods onwards. From here it winds its way south eastwards through Bibury, Coln St Aldwyns and Fairford and past the Cotswold Water Park before flowing into the River Thames. The main areas described as being at risk in Fairford are Milton Street and the A417.

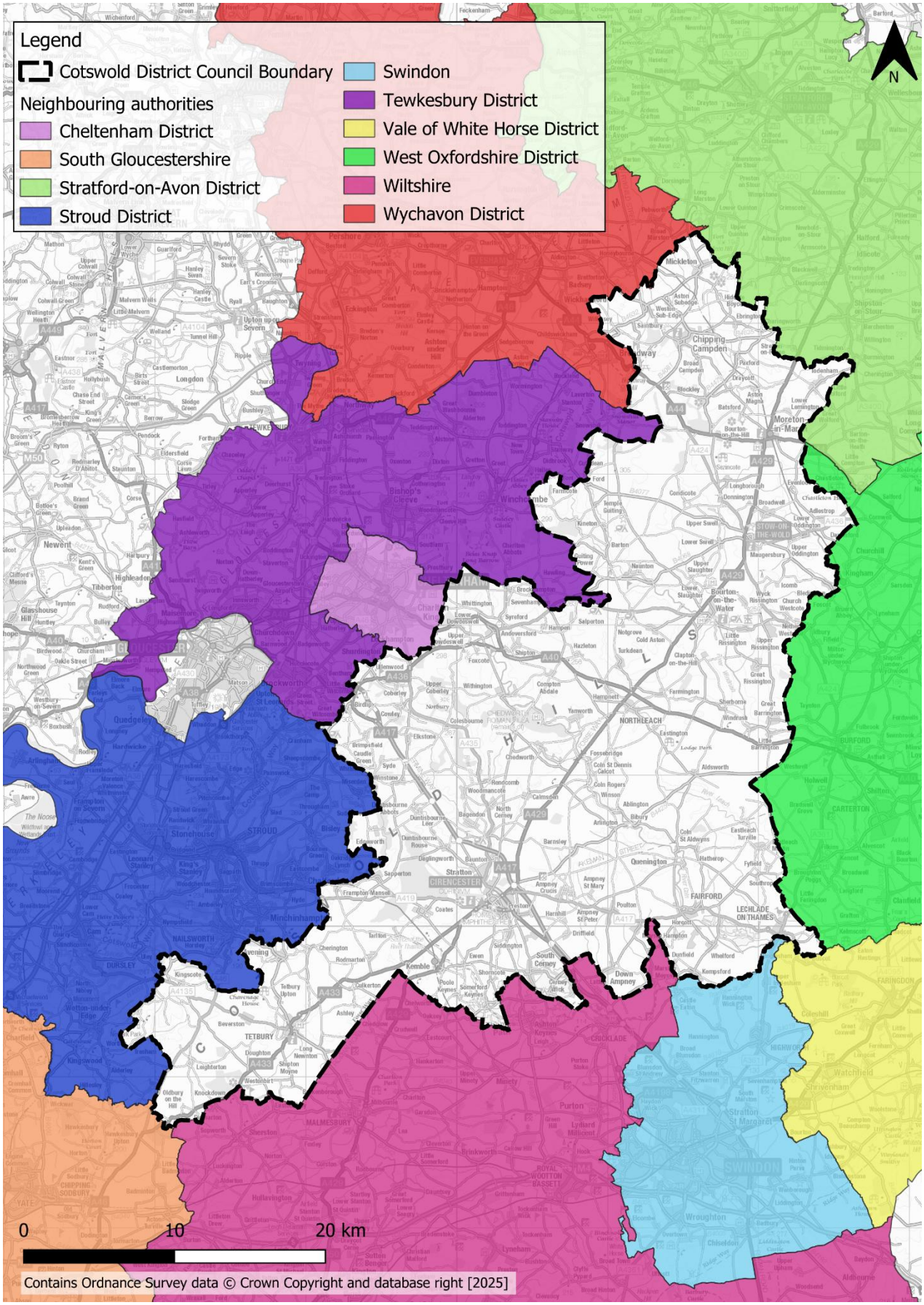


Figure 1-1: Cotswold District and its neighbouring authorities

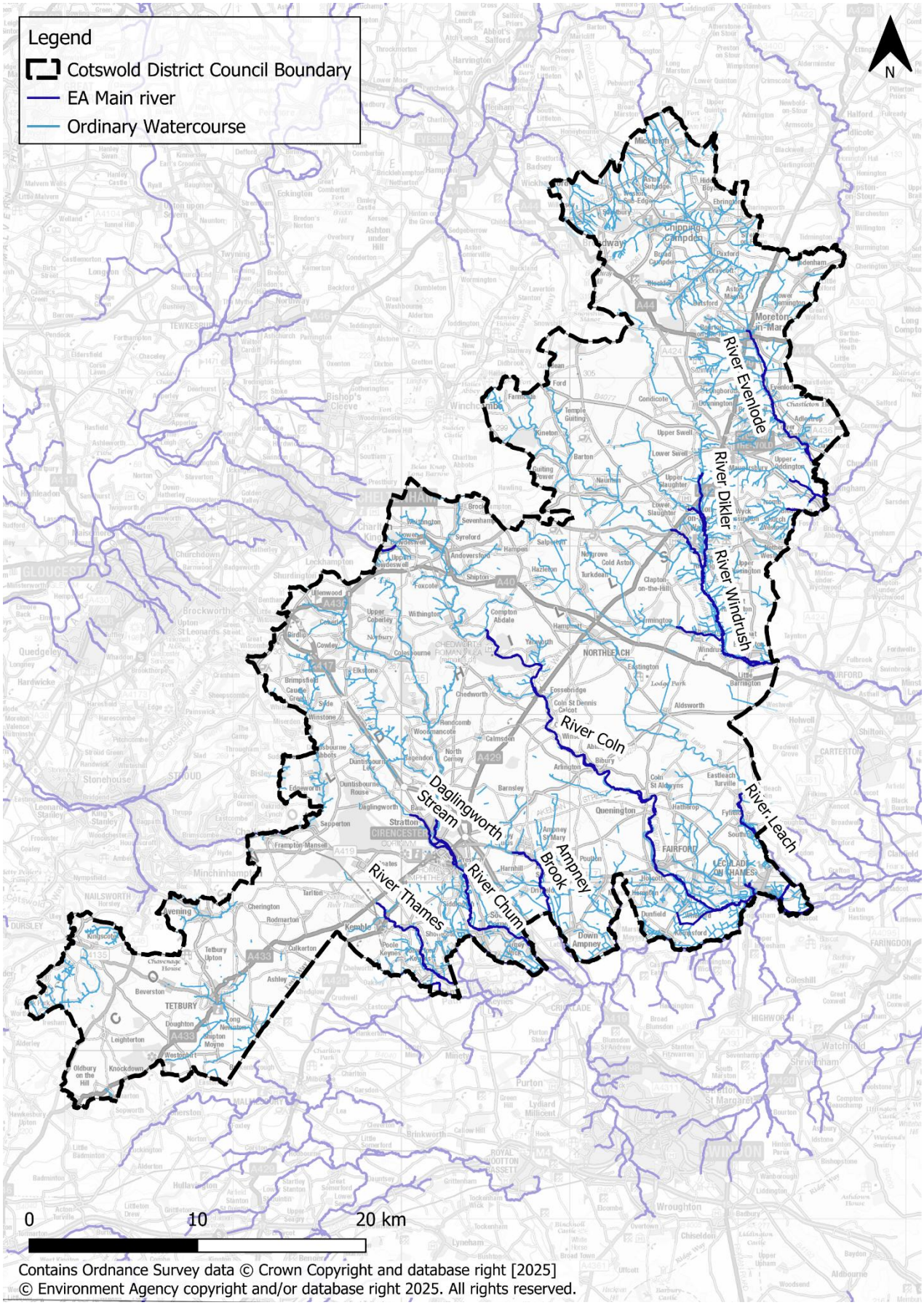


Figure 1-2: Main rivers and other watercourses across Cotswold

1.5 Consultation

SFRAs should be prepared in consultation with other Risk Management Authorities (RMAs). In addition to the LPA the following parties have been consulted during the preparation of the Level 1 SFRA through data requests and draft report reviews:

- Environment Agency
- Lead Local Flood Authority (Gloucestershire County Council)
- Severn Trent Water
- Thames Water
- Wessex Water
- Stratford-on-Avon District Council
- Wychavon District Council
- Tewkesbury Borough Council
- Cheltenham Borough Council
- Stroud District Council
- South Gloucestershire Council
- Wiltshire Council
- Swindon Borough Council
- Vale of White Horse District Council
- West Oxfordshire District Council

The 'How to prepare a Strategic Flood Risk Assessment guidance' (gov.uk) also recommends consultation with:

- Emergency planners
- Emergency services
- Reservoir owners or undertakers
- Highways authorities (National Highways and Gloucestershire County Council)
- Catchment partnerships (Section 12.1)
- Regional flood and coastal committees (Wessex Regional Flood and Coastal Committee)

1.6 Structure of this report

Table 1-1 sets out the contents of this Level 1 SFRA report and appendices, and how to use each section.

Table 1-1: Content of this Level 1 SFRA report

Section	Contents	How to use
Executive summary	This section focuses on how the SFRA can be used by planners, developers, and neighbourhood planners.	Users should refer to this section for a summary of the Level 1 findings and recommendations.
1. Introduction	This section provides a background and context to the study and the Local Plan Area. It also details the organisations involved in the SFRA.	Users should refer to this section for general information and context.
2. Policy and strategy for flood risk management	This section sets out the relevant legislation, policy, and strategy for flood risk management at a national, regional, and local level.	Users should refer to this section for any relevant policy which may underpin strategic or site-specific assessments.
3. Sequential and Exception Tests	This section provides an overview of national planning policy, application of the sequential approach, and the Sequential/Exception Test process. It provides guidance for the Council and developers on the application of the Sequential and Exception Test for both allocations and windfall sites, at allocation and planning application stages.	Users should use this section to understand and follow the steps required for the Sequential and Exception Tests.
4. Understanding flood risk	This section introduces the concept of flood risk and provides an overview of the local characteristics of flooding affecting Cotswold and key risks including historical flooding incidents and flood risk from all sources, as well as characteristics that influence flood risk including topography, geology and soils.	This section should be used to understand all sources of flood risk across Cotswold including where has flooded historically.

Section	Contents	How to use
5. Impact of climate change	This section outlines the latest climate change guidance published by the EA and how this was applied to the SFRA. It also sets out how developers should apply the guidance to inform site-specific FRAs.	This section should be used to understand the climate change allowances for a range of epochs and conditions, linked to the vulnerability of a development.
6. Flood risk infrastructure	This section provides a summary of current flood defences and asset management and future planned schemes.	This section should be used to understand if there are any defences or flood schemes in a particular area, for further detailed assessment at site specific stage.
7. Flood risk management requirements for developers	This section contains guidance for developers on FRAs, considering flood risk from all sources, and principles of managing flood risk in developments.	Developers should use this section to understand requirements for FRAs and what conditions/guidance documents should be followed, as well as mitigation options.
8. Principles for site design and master planning	This section contains guidance for developers on principles of managing flood risk in developments through site design and master planning.	Developers should use this section to understand what should be considered within the site design and master planning stages of a development.
9. Surface water management and SuDS	This section provides an overview of SuDS, including signposting to relevant guidance, as well as guidance for developers on surface water drainage strategies, considering any specific local standards and guidance for SuDS from the LLFA.	Developers should use this section to understand what national, regional, and local SuDS standards are applicable. Hyperlinks are provided.
10. Flood warning and emergency planning	This section provides an overview of the requirements for emergency plans, include any local emergency planning arrangements, and an overview of the available flood alerts and warnings.	Developers should use this section to understand requirements for emergency planning.

Section	Contents	How to use
11. Cumulative Impact Assessment	This section details the cumulative impact assessment, which identifies which catchments are most likely to be sensitive to increased flood risk as a result of future development.	Planners should use this section to help develop policy recommendations for the potential cumulative impacts of development.
12. Strategic flood risk solutions	This section sets out wider strategic solutions that may offer potential to reduce flood risk across Cotswold, including natural flood management. It also details current partnership working opportunities within Cotswold.	Planners should use this section to help develop policy recommendations for strategic flood risk solutions to reduce flood risk across Cotswold, with a particular emphasis on natural flood management and nature-based solutions. Developers should use this section to consider options for strategic solutions and natural flood management techniques and nature-based solutions.
13. Summary, recommendations and next steps	This section outlines planning policy recommendations. It also sets out the recommended next steps and potential future work.	Developers and planners should consider the recommendations made in this section. Developers should refer to the Level 1 SFRA recommendations when considering site specific assessments.
Appendix A	Provides a background to the flood risk policy documents that are relevant to the authority area.	Planners and developers should use this appendix, in conjunction with Section 2 of this report, to understand the relevant flood and water management policy and guidance for development.
Appendix B	Provides the flood risk mapping for the SFRA.	Planners and developers should use these maps to identify key areas of flood risk from different sources.
Appendix C	Technical note explaining the methodology behind the delineation of the functional floodplain (Flood Zone 3b)	Planners and developers should use this appendix to understand the datasets used to

Section	Contents	How to use
	and future functional floodplain for this Level 1 SFRA.	inform the functional floodplain extents.
Appendix D	Excel spreadsheet containing an assessment of flood risk to the potential development allocations based on all available sources of flood risk including for climate change where available. Each potential allocation is assigned a strategic recommendation based on risk and vulnerability.	Planners should use this appendix to understand the level of risk to each potential allocation and associated recommendations for development. Planners should use this appendix to assist in the application of the Sequential Test for Local Plan preparation.
Appendix E	Summarises the outcomes of the sites assessment process recorded in Appendix D.	Planners and developers should use this appendix to understand the level of risk to each potential allocation and associated recommendations for development. Planners should use this appendix to assist in the application of the Sequential Test for Local Plan preparation.
Appendix F	Details the methodology and results for the cumulative impact assessment.	Planners should use this appendix, in conjunction with Section 11 of this report, to help develop policy recommendations for the cumulative impacts of development.
Appendix G	Details the data used to inform the SFRA, including when the data was provided, any associated licensing, and where the data can be obtained from.	Planners and developers should use this appendix to understand what data has been used in the SFRA, whether it has since been updated, and where to access the latest data from.
Appendix H	Sets out the recommended methodology for carrying out the Sequential Test, including how each source of flood risk should be considered following consultation with the EA.	Planners and developers should consider this appendix to inform the application of the Sequential Test.

2 Policy and strategy for flood risk management

This section, along with Appendix A which contains greater detail, sets out the flood risk management roles and responsibilities for different organisations and relevant legislation, policy, and strategy.

2.1 Roles and responsibilities

There are different organisations in and around the district that have responsibilities for flood risk management, known as RMAs. These are listed in Table 2-1 with a summary of their responsibilities.

Further information on the roles and responsibilities of the RMAs is available in Annex A of the National Flood and Coastal Erosion Risk Management Strategy (FCERM) (gov.uk) for England. The Local Government Association (gov.uk) also provides further information on the roles and responsibilities for managing flood risk. The National flood risk standing advice for local planning authorities (gov.uk) provides advice on when to consult the EA.

Table 2-1: Roles and responsibilities for RMAs

Risk Management Authority	Strategic Level	Operational Level	Planning role
EA	Strategic overview for all sources of flooding, National Strategy, flood forecasts and warnings and general supervision	Main River (e.g., River Thames) and reservoirs (Flood Risk Activity Permits, enforcement, and works), flood warning	Statutory consultee for certain development in Flood Zones 2 and 3 and all works within 20 metres of a main river.
Gloucestershire County Council as LLFA	Coordination of Local Flood Risk Management and maintaining a Local Flood Risk Management Strategy (LFRMS)	Surface water, groundwater, and ordinary watercourses (consenting, enforcement, and works)	Statutory consultee for major developments
Severn Trent Water, Thames Water and Wessex Water	Asset Management Plans, supported by Periodic Reviews (business cases), develop drainage and wastewater management plans (DWMPs)	Public sewers and some reservoirs	Non-statutory consultee

Risk Management Authority	Strategic Level	Operational Level	Planning role
Highways Authorities - National Highways for motorways and trunk roads and Cotswold District Council for non-trunk roads	Highway drainage policy and planning	Highway drainage	Statutory consultee regarding highways design standards and adoptions

2.1.1 Riparian ownership

Land and property owners are responsible for the maintenance of watercourses either on or next to their properties, called riparian owners. Riparian owners are also responsible for the protection of their properties from flooding as well as other management activities, for example by maintaining riverbeds/banks, controlling invasive species, and allowing the flow of water to pass without obstruction. More information can be found on the government website in the EA publication 'Owning a watercourse' (gov.uk).

When it comes to undertaking works to reduce flood risk, the EA, and the Council do have permissive powers, but limited resources must be prioritised and targeted to where they can have the greatest effect. Permissive powers mean that RMAs are permitted to undertake works but are not obliged.

3 Sequential and Exception Tests

This section summarises national planning policy for development and flood risk and the application of the Sequential and Exceptions Tests for both planners and developers.

3.1 National Planning Policy Framework and Guidance

The NPPF (February 2025) (gov.uk) sets out government's planning policies for England. It must be considered in the preparation of local plans and is a material consideration in planning decisions. The NPPF advises on how flood risk should be considered to guide the location of future development and FRA requirements. The NPPF states that:

"*Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing of future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere*" (paragraph 170).

The Sequential and Exception Tests help to guide this process.

The Flood Risk and Coastal Change PPG, 2025 (gov.uk) sets out how the policy should be implemented. Diagram 1 in the PPG (Paragraph: 007 Reference ID: 7-007-20220825) sets out how flood risk should be considered in the preparation of local plans. The PPG states that:

"A strategic Flood Risk Assessment should be used to apply the Sequential Test and, where necessary, the Exception Test when determining land use allocations" (paragraph 009).

3.2 The Sequential Test

Firstly, land at the lowest risk of flooding from all sources should be considered for development. A test is applied called the 'Sequential Test' to do this. Figure 3-1 summarises the Sequential Test.

The LPA will apply the Sequential Test to strategic allocations for the potential inclusion in the local plan. For all other developments, evidence must be supplied to the LPA, with a planning application, that the development has passed the test if any proposed building, access and escape route, land-raising or other vulnerable element will be:

- In Flood Zone 2 or 3 of the Flood Map for Planning (FMfP), See Section 4.4.1 for information on the FMfP;
- In Flood Zone 3b and your development is not incompatible;
- Within 'Flood Zones plus climate change' of the FMfP, showing it is at increased risk of flooding from rivers in the future;
- In Flood Zone 1 and the FMfP shows it is at risk of flooding from surface water;
- In Flood Zone 1 and the SFRA shows it will be at increased risk of flooding during its lifetime; or

- Subject to sources of flooding other than from rivers

The requirements for developers are set out in the FRA Standing Advice (gov.uk).

The LPA should define a suitable search area for the consideration of alternative sites in the Sequential Test. Based on the latest updates to the PPG, sites can be considered 'reasonably available' if their location is suitable for the type of development proposed, they are able to meet the same development needs and they have a reasonable prospect of being developed at the same time as the proposal (Paragraph: 027a Reference ID: 7-027a-20220825).

The Sequential Test can be undertaken as part of a local plan sustainability appraisal. Alternatively, it can be demonstrated through a free-standing document, or as part of Strategic Housing Land/Employment Land Availability Assessments.

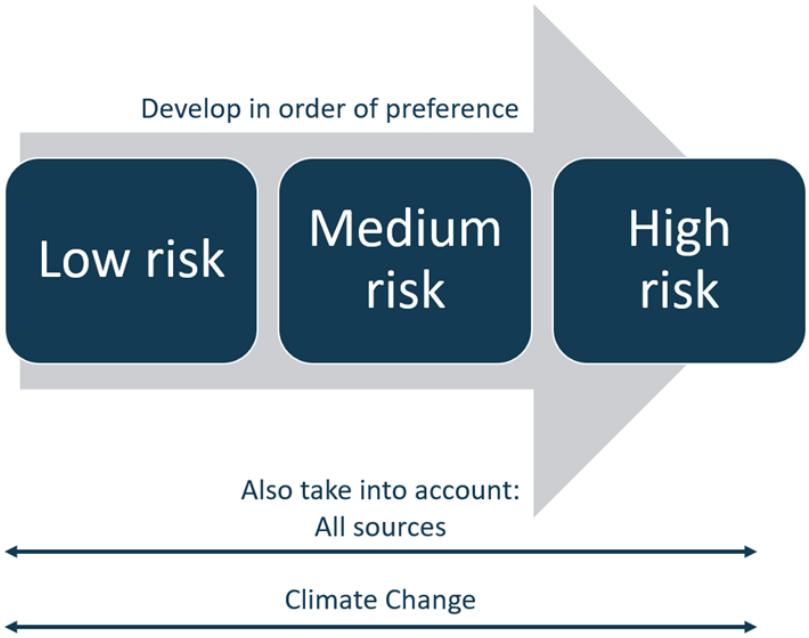


Figure 3-1: The Sequential Test

Whether any further work is needed to decide if the land is suitable for development will depend on both the vulnerability of the development and the Flood Zone it is proposed within. Table 2 of the PPG (gov.uk) (Paragraph: 079 Reference ID: 7-079-20220825) shows whether, having applied the Sequential Test first, the vulnerability of development is not compatible with a particular Flood Zone and where the Exception Test is required to determine the suitability of that vulnerability of development to the Flood Zone.

Figure 3-2 illustrates the Sequential Test as a process flow diagram using the information contained in this SFRA to assess potential development sites against areas of flood risk and development vulnerability compatibilities. This is a stepwise process, but a complex one, as several of the criteria used are qualitative and based on experienced judgement. The process must be documented, and evidence used to support decisions recorded.

In addition, the risk of flooding from other sources and the impact of climate change must be considered when considering which sites are suitable to allocate. Appendix H addresses the use of flood risk information in the performance of the Sequential Test.

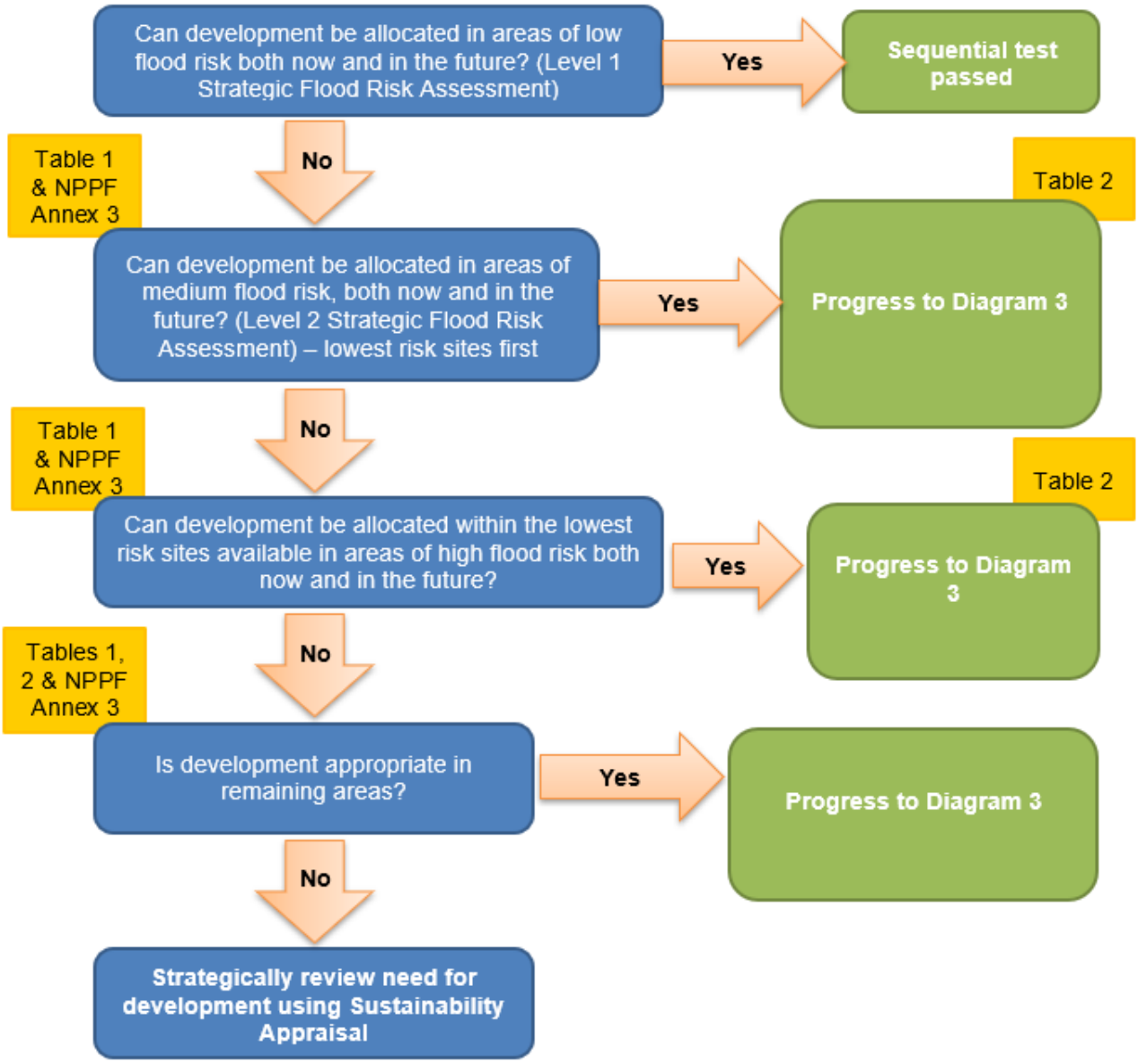


Diagram 2 of PPG: Flood Risk and Coastal Change (paragraph 026, Reference ID 7-026-20220825) Revised September 2025.

Figure 3-2: Application of the Sequential Test for plan preparation

3.2.1 The risk-based approach

The NPPF takes a risk-based approach to development in flood risk areas.

Since July 2021, the approach has adjusted the requirement for the Sequential Test (as defined in Paragraph 172 of the NPPF) so that all sources of flood risk are to be included in the consideration.

The PPG further states:

"*Other forms of flooding need to be treated consistently with river and tidal flooding in mapping probability and assessing vulnerability, so that the sequential approach can be applied across all areas of flood risk*" (paragraph 023).

The general implications of these approaches are summarised as follows:

- The Sequential Test must be based on mapping that enables decision making according to a prioritisation based on a risk-based sequence (for river flooding national mapping is available that describes low, medium and high-risk Flood Zones but comparable mapping of this specific type and quality is not available for other sources; for river flooding the risk zones are based on the assumption that no flood risk management features are present, with the exception of Flood Zone 3b (the functional floodplain)).
- The other sources of flood risk that can potentially be included in the Sequential Test are surface water, groundwater, sewer flooding and reservoir flooding (or other water impounding features such as canals).
- It follows that proposed new development placed in locations at high or medium risk from flooding from other sources now and in the future (note that the explicit requirement to include climate change in the test, as set out in the September 2025 PPG may require the preparation of additional modelling and mapping or use of proxies) should be accompanied by evidence that the site can remain safe for its lifetime and pass the Exception Test (if applicable) (through a Level 2 SFRA).

A basic requirement for the Sequential Test to be performed is that appropriate, competent mapping can be prepared to enable logical comparison of the flood risk from different sources at alternative locations, both now and in the future, as this is fundamental to establishing a logical “risk sequence”.

Appendix H describes the implications of including different sources of flooding both now and in the future in the Sequential Test. It also highlights matters to be considered and identifies a preferred approach. This suggested approach has been consulted on with the EA.

3.3 The Exception Test

It will not always be possible for all new development to be located on land that is not at risk from flooding. To further inform whether land should be allocated, or planning permission granted, a greater understanding of the scale and nature of the flood risks is required. In these instances, the Exception Test will be required. Diagram 3 of the PPG (gov.uk) (Paragraph: 033 Reference ID: 7-033-20220825) summarises the Exception Test (Figure 3-3).

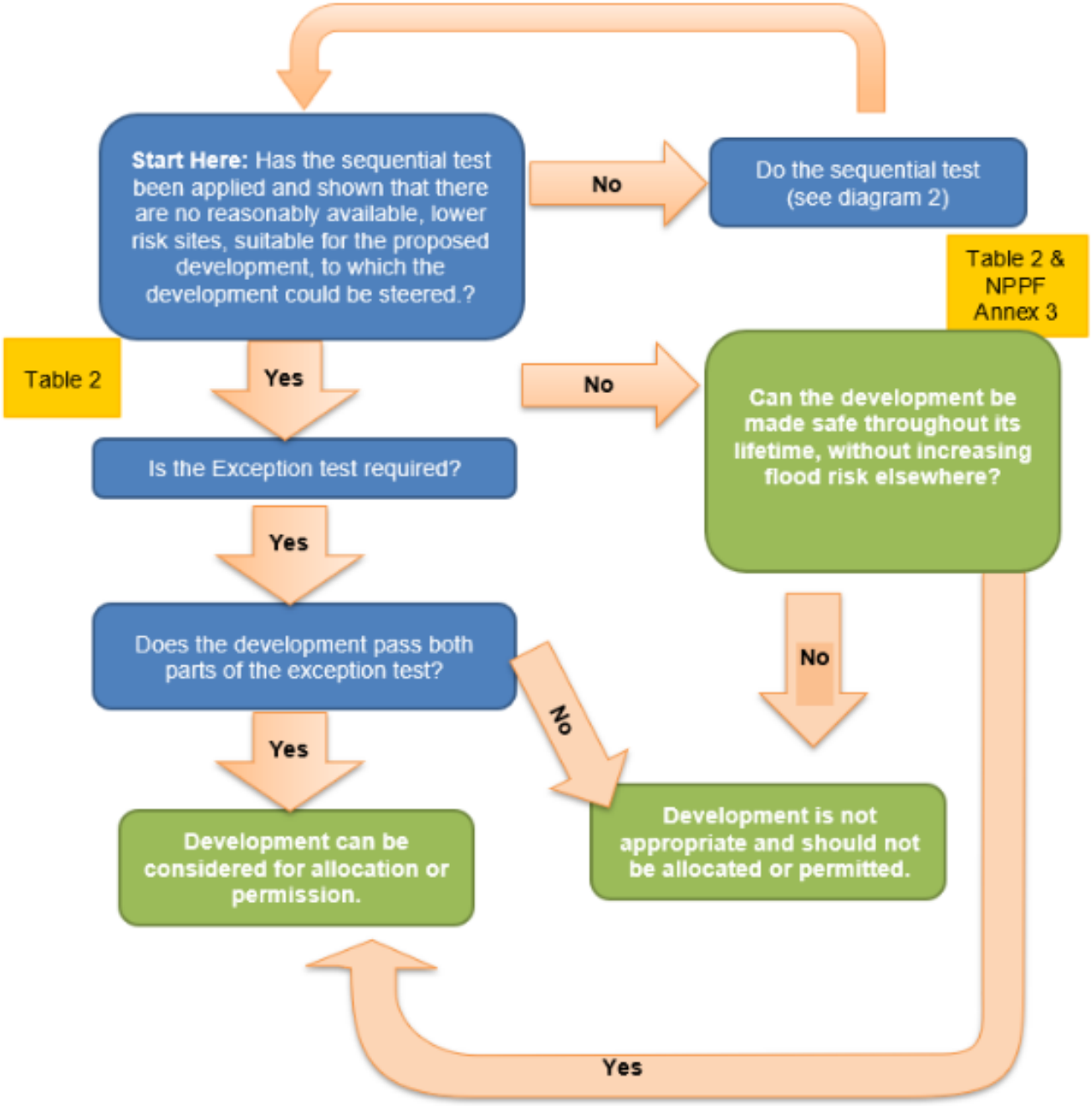
Table 2 of the PPG (gov.uk) sets out when the Exception Test is required but does not reflect the need to avoid flood risk from sources other than rivers and the sea. There is no

guidance on how to consider other sources of flood risk. The Exception Test should only be applied, following the application of the Sequential Test, in the following instances for:

- 'Essential infrastructure' in Flood Zone 3a or 3b.
- 'Highly vulnerable' development in Flood Zone 2 (this is NOT permitted in Flood Zone 3a or 3b).
- 'More vulnerable' development in Flood Zone 3a (this is NOT permitted in Flood Zone 3b).

While the Exception Test is not explicitly required for sites at risk from other sources of flooding, the LPA should follow a similar principle where sites are proposed that are at risk from other sources of flooding, carefully weighing up the wider benefits of development against the risk, ensuring that site users can be kept safe through the lifetime of the development and ensuring residual risk can be safely managed.

For sites proposed for allocation within the local plan that are at flood risk, the LPA should use information provided in a Level 2 SFRA to inform the Exception Test. At the planning application stage, the developer must design the site such that it is appropriately flood resistant and resilient in line with the recommendations in national and local planning policy and supporting guidance and those set out in the SFRA. This should demonstrate that the site will still pass the flood risk element of the Exception Test based on the detailed site level analysis.



† Diagram 3 of PPG: Flood Risk and Coastal Change (paragraph 033, Reference ID 7-033-20220825) Revised September 2025.

Figure 3-3: Application of the Exception Test to plan preparation

There are two parts to demonstrating whether a development passes the Exception Test that should be considered by the LPA when allocating development sites, and developers when required (see Section 3.4 for Exception Test requirements for individual planning applications).

Part A: Demonstrating that the development would provide wider sustainability benefits to the community that outweigh the flood risk.

The LPA will need to set out the criteria used to assess the Exception Test and provide clear advice to enable applicants to provide evidence to demonstrate that it has been passed. If the application fails to prove this, the LPA should consider whether the use of planning conditions and/or planning obligations could allow it to pass the Exception Test. If this is not possible, this part of the Exception Test has failed, and development should not be considered for allocation or granting planning permission.

Wider sustainability objectives should be considered, such as those set out in local plan sustainability appraisals. These generally consider matters such as the local economy, biodiversity, green infrastructure, housing, historic environment, climate change adaptation, flood risk, green energy, pollution, health, transport etc.

The sustainability issues the development will address and how far doing so will outweigh the flood risk concerns for the site should also be considered, e.g., by facilitating wider regeneration of an area, providing community facilities, infrastructure that benefits the wider area, etc.

Part B: Demonstrating that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

In circumstances where the potential effects of proposed development are material, a Level 2 SFRA is likely to be needed to inform the Exception Test for strategic allocations to provide evidence that the principle of development can be supported. At the planning application stage, a site-specific FRA will be needed. Both will need to consider the undefended and residual risk and how this will be managed over the lifetime of the development.

3.4 Applying the Sequential Test and Exception Test to individual planning applications

3.4.1 Applying the Sequential Test

The LPA are responsible for considering the extent to which Sequential Test considerations have been satisfied.

Developers should consult with the LPA in the first instance before commencing on a site-specific FRA to determine the Sequential Test requirements for their site, including search area. Developers are required to apply the Sequential Test to all development sites, unless the site is:

- A strategic allocation and the test has already been carried out by the LPA as part of preparing the local plan, or
- A change of use (except to a caravan, camping or chalet site, or to a mobile home or park home site), or

- A minor development (householder development, small non-residential extensions with a footprint of less than 250m²), or
- A development in Flood Zone 1 unless there are other flood risk issues in the area of the development (i.e. surface water, groundwater, reservoir, sewer flooding).

The September 2025 update to the PPG sets out that the Sequential Test is also not required where *"a site-specific flood risk assessment demonstrates clearly that the proposed layout, design, and mitigation measures would ensure that occupiers and users would remain safe from current and future surface water flood risk for the lifetime of the development […], without increasing flood risk elsewhere"* (PPG, Paragraph 027).

It should also be noted that residential sub-divisions are exempt from the definition of minor development and therefore, by default, should also be subject to the Sequential Test.

This SFRA contains information on all sources of flooding and considers the impact of climate change. This should be considered when a developer undertakes the Sequential Test, including the consideration of reasonably available sites at lower flood risk.

Local circumstances must be used to define geographical scope of the Sequential Test (within which it is appropriate to identify reasonably available alternatives). To determine the appropriate search area criteria, include the catchment area for the type of development being proposed. For some sites this may be clear, e.g. school catchments, urban extensions, in other cases it may be identified by other local plan policies. For some sites, e.g. regional distribution sites, it may be suitable to widen the search area beyond LPA administrative boundaries.

As stated in the September 2025 update to the PPG *"…where there are large areas in Flood Zones 2 and 3 (e.g. coastal towns and settlements on major rivers) and development is needed in those areas to sustain the existing community, sites outside them are unlikely to provide reasonable alternatives"* (PPG, Paragraph 027a).

The Sequential Test should be applied proportionately, with a focus on realistic alternatives in areas of lower flood risk that could satisfy the same development need.

The sources of information on reasonably available sites may include but is not restricted to:

- Site allocations in local plans.
- Sites with planning permission but not yet built out.
- Strategic Housing and Economic Land Availability Assessments (SHELAAs)/five-year land supply/annual monitoring reports.
- Locally listed sites for sale.

It may be that a number of smaller sites or part of a larger site at lower flood risk form a suitable alternative to a development site at high flood risk. Ownership or landowner agreement are not acceptable as reasons not to consider alternatives.

3.4.2 Applying the Exception Test

Where a development proposal is in accordance with an allocation made in a local plan following the application of the Sequential and Exception Tests, the Exception Test will only be required to be repeated if:

- Elements of the development that were key to it satisfying the Exception Test at the plan-making stage (such as wider sustainability benefits to the community or measures to reduce flood risk overall) have changed or are not included in the proposed development; or
- The understanding of current or future flood risk has changed significantly.

For developments that have not been allocated in the local plan or where the Sequential Test was not applied at the development plan stage and new information becomes available that identifies a flood risk, developers must undertake the sequential and Exception Tests and present this information to the LPA for approval. The Level 1 SFRA can be used to scope the flooding issues that a site-specific FRA should investigate in more detail to inform the Exception Test for windfall sites.

The applicant will need to provide information that the application can pass both parts of the Exception Test.

4 Understanding flood risk

This section explores what flood risk is, key sources of flooding in Cotswold, and the factors that affect flooding including topography, soils, and geology.

This is a strategic summary of the risk in the district to inform the application of the Sequential and Exceptions Tests if required. Developers should use this section of the SFRA with the flood risk data included in the interactive GeoPDF mapping (Appendix B) to scope out the flood risk issues they need to consider in greater detail in a site-specific FRA to support a planning application. Information in this section should not be used to inform flood risk at a property-level.

4.1 Defining flood risk

Section 3 (subsection 1) of the Flood and Water Management Act 2010 (FWMA) (gov.uk) defines the risk of a potentially harmful event (such as flooding) as "*a risk in respect of an occurrence is assessed and expressed (as for insurance and scientific purposes) as a combination of the probability of the occurrence with its potential consequences*."
Figure 4-1 sets out this definition of risk.

Figure 4-1: Conceptual model depicting how risk can be defined

4.1.1 Probability

The probability of flooding is expressed as a percentage based on the average frequency measured or extrapolated from records over many years. For example, a 1% AEP (annual exceedance probability) indicates the flood level that has a 1% chance of occurring in any one year, not that it will occur at least once every hundred years.

4.1.2 Consequences

The consequences of flooding include fatalities, property damage, disruption to lives and businesses, with severe implications for people (e.g., financial loss, emotional distress, health problems). Consequences of flooding depend on the hazards caused by flooding (depth of water, speed of flow, rate of onset, duration, wave-action effects, water quality), the receptors that are present and the vulnerability of these receptors (type of development, nature, e.g., age-structure, of the population, presence, and reliability of mitigation measures etc).

4.1.3 Source-Pathway-Receptor model

Flood risk can be assessed using the Source-Pathway-Receptor model (Figure 4-2) where:

- The source is the origin of the floodwater, principally rainfall.
- A pathway is a route or means by which a receptor can be affected by flooding, which includes rivers, drains, sewers, and overland flow.
- A receptor is something that can be adversely affected by flooding, which includes people, their property, and the environment.

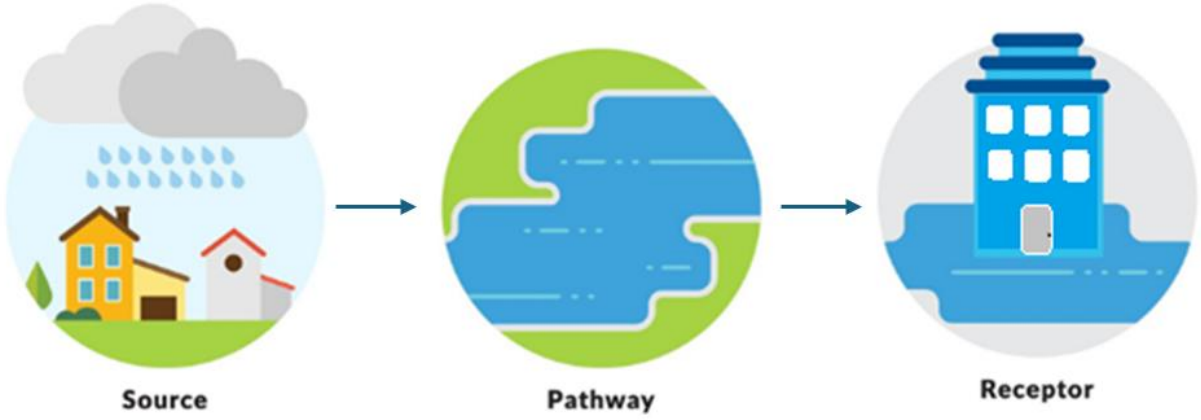


Figure 4-2: Source-Pathway-Receptor model

This is a standard environmental risk model common to many hazards and should be the starting point of any assessment of flood risk. All these elements must be present for flood risk to arise. Having applied the Source-Pathway-Receptor model it is possible to mitigate the flood risk by addressing the source (often very difficult), blocking, or altering the pathway, or removing the receptor, e.g., steer development away.

The planning process is primarily concerned with the location of receptors, taking appropriate account of potential sources and pathways that might put those receptors at risk. It is therefore important to define the components of flood risk to apply this guidance in a consistent manner.

4.2 Topography, geology, and soils

Topography, geology and soil are all important in influencing the way the catchment responds to a rainfall event. The degree to which a material allows water to percolate through it, the permeability, affects the extent of overland flow and therefore the amount of runoff reaching the watercourse. Steep slopes or clay rich (low permeability) soils will promote rapid surface runoff, whereas more permeable rock such as limestone and sandstone may result in a more subdued response due to greater infiltration.

4.2.1 Topography

The National LIDAR Programme (gov.uk) provides elevation data at 1m spatial resolution for all of England.

The topography of the district is influenced by the interbedded nature of the limestones and clays of the Inferior and Great Oolite Group. Towards the western extent of the district the landscape is characterised by a steep scarp face with incised valleys marking the edge of the Cotswold Hills. Here, elevations are in excess of 300 mAOD with the Inferior Oolite rocks forming the main upland area. To the east and south west of the escarpment, the topography of the district becomes rather more undulating, reflecting the regional dip of the Inferior and Great Oolite beds. Towards the south and south eastern extents of the district, valleys of those such as the Evenlode, Windrush and Coln are typically much broader and shallower cut into the underlying softer Lias mudstones. Here, elevations ranging from approximately 165 mAOD in the headwaters to 82 mAOD as the watercourses approach the flatter, wider floodplains of the River Thames. Figure 4-3 shows the topography of the district.

4.2.2 Geology

The geology of the district is complex and is dominated by limestones of the Jurassic age. The limestones within the Great Oolite Group and Inferior Oolite Group cover the majority of the district towards the north-western and central extents and have a significant influence on the topography, drainage and soils of the Cotswolds. Geology information can be viewed on the British Geological Society website here.

Much of the upland areas of the Cotswolds comprises of the Great Oolite Group and demonstrates a greater variety in formations than the Inferior Oolite Group. An area of Lias Group mudstones dominates to the northeast. Towards the south and east of the district in the Upper Thames Valley, the Jurassic limestones of the Great Oolite Group are succeeded by a succession of mudstones including the Oxford clay. These form the broad valleys around the main rivers and streams which flow eastwards.

Sand and gravel drift deposits are mainly associated with the tributaries of the River Thames including the Rivers Churn, Coln, Leach, Windrush and Evenlode and within the Cotswold Water Park towards the south. Here, superficial deposits are thick and extensive. Further drift deposits can be found towards the northeast of the district, overlying the Lias Group mudstones.

Away from the escarpment the drainage is almost entirely south eastwards via the tributaries of the Thames; namely the Rivers Churn, Coln, Leach, Windrush and Evenlode. Where they join the Thames, superficial deposits are thick and extensive. The valleys of the Churn, Coln, Leach and their tributaries tend to be narrow and meandering because they are incised into the limestones of the Inferior Oolite and Great Oolite. They contain narrow tracts of superficial deposits. In contrast, the Windrush and the Evenlode lie in broader shallow valleys cut into soft Lias mudstones and may be flanked by more substantial expanses of terrace deposits and alluvium. In addition, in the case of the Evenlode, which drains the Vale of Moreton, there are broad tracts of till and associated sand and gravel deposits left behind by an ice sheet during the last Ice Age.

A map detailing the extents of this bedrock and further superficial geology across Cotswold can be viewed online in the British Geology Society Geology Viewer (bgs.ac.uk).

The EA also provides mapping of different types of aquifers, the underground layers of water-bearing permeable rock from which groundwater can be extracted. Aquifers are designated as either principal or secondary aquifers. Principal aquifers are designated by the EA as strategically important rock units that have high permeability and water storage capacity.

The majority of the bedrock and superficial geology beneath the district are categorised as Principal aquifers. There are small areas in the south classified as Secondary A aquifers. A secondary aquifer is a permeable layer which can support local water supplies and provide a source of base flow to rivers.

4.2.3 Soils

Soils across the district are varied. Soilscapes are a classification of soils in England and Wales, conveying a summary of the regional differences in the soil landscapes.

Soils across the district are largely classified as Soilscape 3 (shallow lime-rich soils over chalk or limestone). Soil is freely draining and at particular risk to contamination from nitrate. Other soils are present across the authority in small amounts, including Soilscape 9 (lime-rich loamy and clayey soils with impeded drainage), drainage of soils to the stream network may be slightly impeded. Some soils in areas to the south of Stow-on-the-Wold are categorised by Soilscape 18 (slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils). This soil type is slowly permeable and seasonally wet. In the south east of the district, soils covering areas of Fairfield, Lechlade, Somerford Keynes and South Cerney are categorised as Soilscape 5 (Freely draining lime-rich loamy soils).

The British Geological Survey website (bgs.ac.uk) provides data on soils across the district.

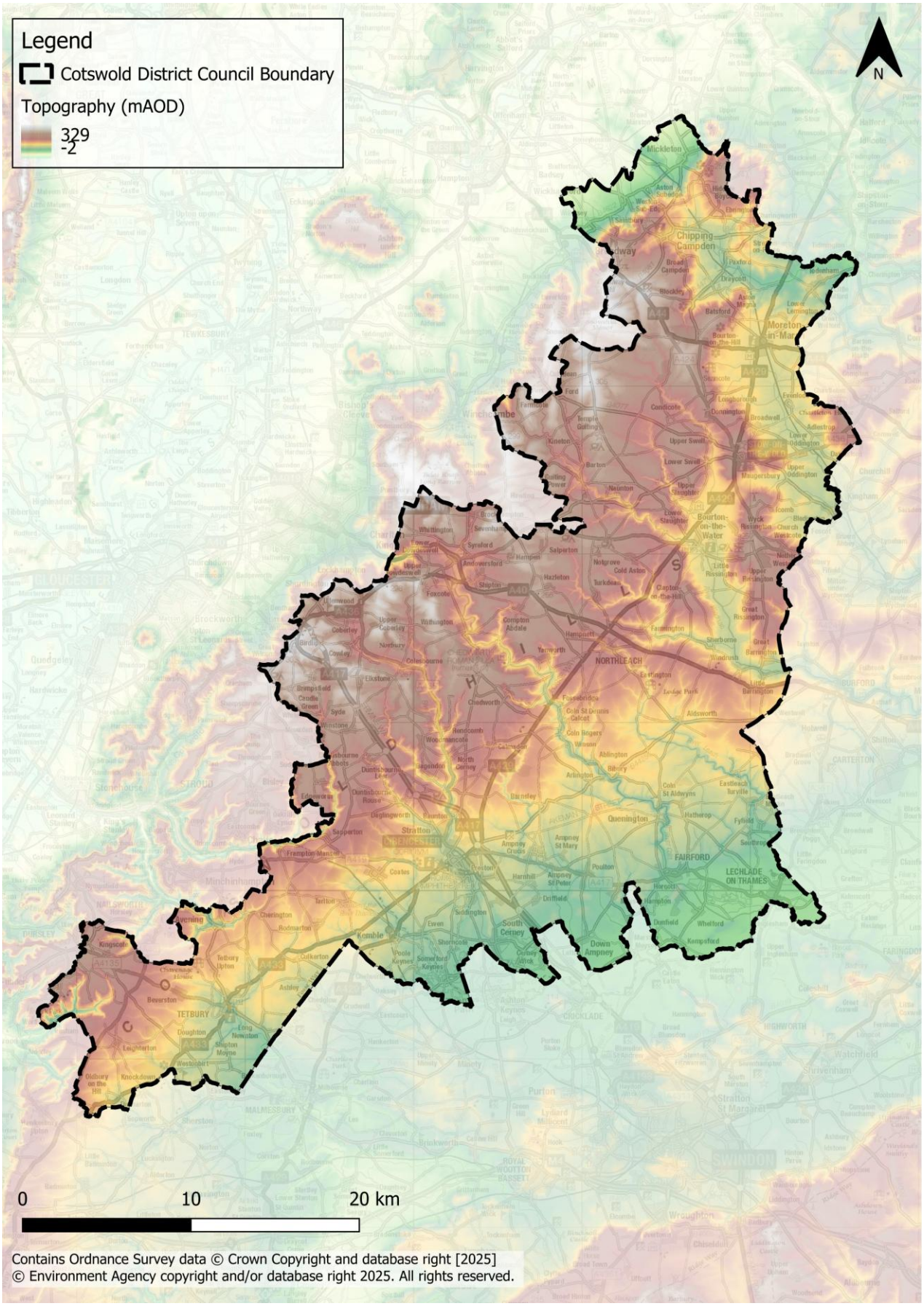


Figure 4-3: EA 1m LiDAR data showing the topography across Cotswold

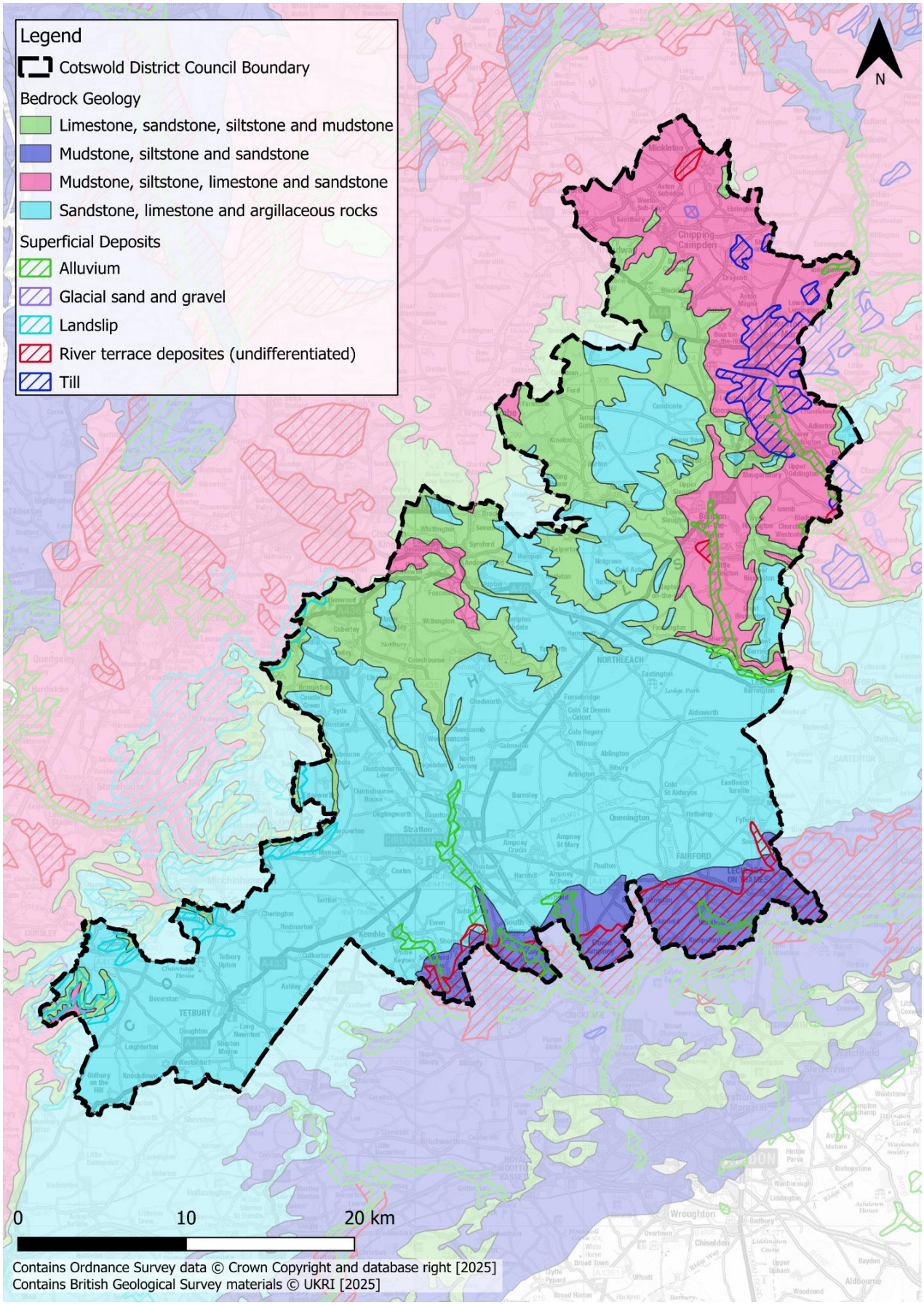


Figure 4-4: Bedrock geology across Cotswold

4.3 Historic flooding

Records of past flood events can help to build a picture of areas and locations that may be prone to flooding and to help confirm flood modelling outputs. Historic flood events can also help RMAs to target where flood risk management or resilience works may be required based on tangible evidence.

4.3.1 LLFA historic flood records

GCC as LLFA, is required, under the FWMA, to maintain and update its historic flood incidents database as and when any locally significant flood incidents occur. The LLFA has a statutory responsibility to investigate and report upon any 'significant' flood events. Figure 4-5 displays the number of LLFA recorded flood incidents, aggregated by ward. The highest number of historic flood events have been recorded in Fosseridge Ward, covering the area to the north and east of Stow-on-the-Wold.

The Gloucestershire Local Flood Risk Management Strategy (LFRMS) (2014) identified that the district has a long history with flooding, with flood events occurring throughout the last 80 years. Notable flood events occurred in the Summer of 2007 and the winter of 2012, due to heavy rainfall causing both surface water and fluvial flooding.

The LFRMS (2014) outlines nine major flood incidents in Cotswold District:

- March 1947
- July 1968
- August 1977
- September 1992
- October 1993
- April 1998
- December 2000
- Summer 2007
- January 2008

4.3.1.1 LLFA December 2020 flooding summary report

The LLFA flood summary report documents the flooding experienced across Gloucestershire on the 23 and 24 December 2020. The event was characterised by a period of intense rainfall, with rivers responding quickly and reaching their highest recorded peak levels. There were 94 reporting of flooding to property experienced across the district, 89 of these residential and five commercial properties. There were five parishes across Cotswold that experienced more than five reports of internal property flooding, namely Bledington, Cirencester, Lower Slaughter, Moreton-in-Marsh and Wyck Rissington.

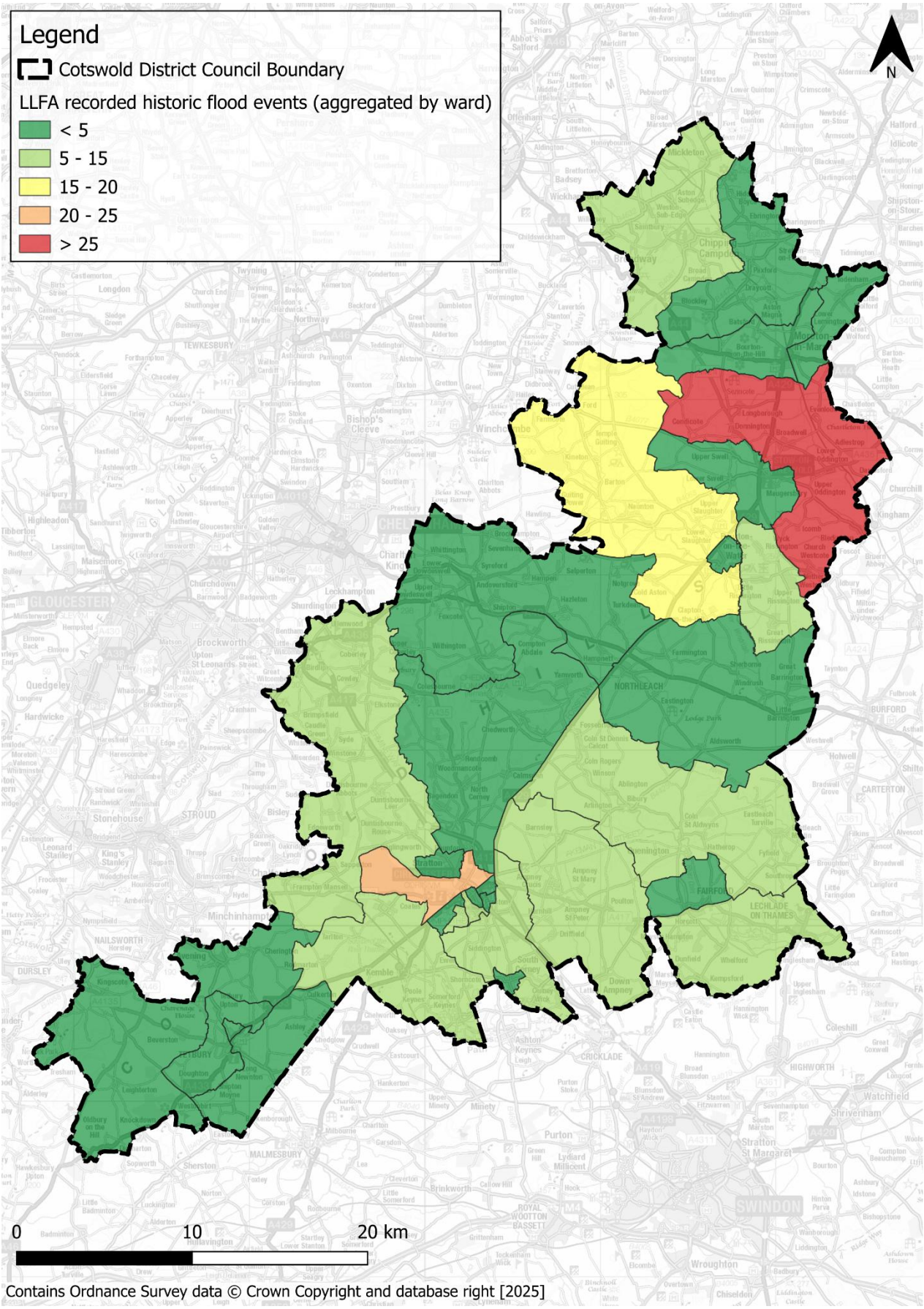


Figure 4-5: LLFA recorded historic flood events (aggregated by ward)

4.3.2 EA Historic Flood Map and Recorded Flood Outlines

The Historic Flood Map (HFM) is a spatial dataset showing the maximum extent of all recorded historic flood outlines from rivers, the sea and groundwater and shows areas of land that have previously been flooded across England. Records began in 1946 when predecessor bodies to the EA started collecting information about flooding incidents. The HFM accounts for the presence of defences, structures, and other infrastructure where such features existed at the time of flooding. It includes flood extents that may have been affected by residual flooding such as overtopping, breaches or blockages. It is also possible that historic flood extents may have changed and that some areas would not flood at present i.e., if a flood defence has been built.

The HFM does not contain any information regarding the specific flood source, return period or date of flooding, nor does the absence of the HFM in an area mean that an area has never flooded, only that records of historic flooding do not exist.

The Recorded Flood Outlines (RFO) dataset does include details of flood events. The difference between the two datasets is that the HFM only contains flood outlines that are ‘considered and accepted’ by the EA following adequate verification of the RFO dataset using certain criteria.

The EA's HFM dataset contains 29 records of flooding in Cotswold. The locations of these incidents are shown in Figure 4-6. Details of these incidents are provided in Table 4-1. Incidents have been recorded from 1947 to 2008. 22 incidents have been caused by the channel capacity being exceeded. Seven incidents have occurred due to surface water or local drainage issues.

Table 4-1: EA Historic Flood Map incidents in Cotswold

Start date	End date	Flood source	Flood cause
01/01/1925	31/01/1925	ordinary watercourse	channel capacity exceeded (no raised defences)
01/01/1947	12/12/1947	main river	channel capacity exceeded (no raised defences)
01/01/1968	12/12/1968	main river	channel capacity exceeded (no raised defences)
01/07/1968	01/07/1968	main river	channel capacity exceeded (no raised defences)
01/01/1977	12/12/1977	other	local drainage/surface water
01/01/1977	12/12/1977	main river	channel capacity exceeded (no raised defences)
06/03/1978	06/03/1978	drainage	local drainage/surface water
01/01/1979	12/12/1979	main river	channel capacity exceeded (no raised defences)
01/01/1985	01/01/1985	main river	channel capacity exceeded (no raised defences)
20/01/1985	24/01/1985	main river	channel capacity exceeded (no raised defences)
01/01/1992	12/12/1992	main river	channel capacity exceeded (no raised defences)
01/01/1993	12/12/1993	main river	channel capacity exceeded (no raised defences)
18/03/1996	18/03/1996	drainage	local drainage/surface water
01/04/1998	30/04/1998	main river	channel capacity exceeded (no raised defences)
01/01/2000	31/12/2000	main river	channel capacity exceeded (no raised defences)
23/12/2002	12/01/2003	other	channel capacity exceeded (no raised defences)
22/01/2006	22/01/2006	drainage	local drainage/surface water
19/07/2007	29/07/2007	drainage	local drainage/surface water
19/07/2007	29/07/2007	main river	channel capacity exceeded (no raised defences)
19/07/2007	29/07/2007	ordinary watercourse	channel capacity exceeded (no raised defences)
20/07/2007	23/07/2007	main river	channel capacity exceeded (no raised defences)
12/01/2008	20/01/2008	drainage	local drainage/surface water

Start date	End date	Flood source	Flood cause
12/01/2008	20/01/2008	main river	channel capacity exceeded (no raised defences)
13/12/2013	03/03/2014	main river	channel capacity exceeded (no raised defences)

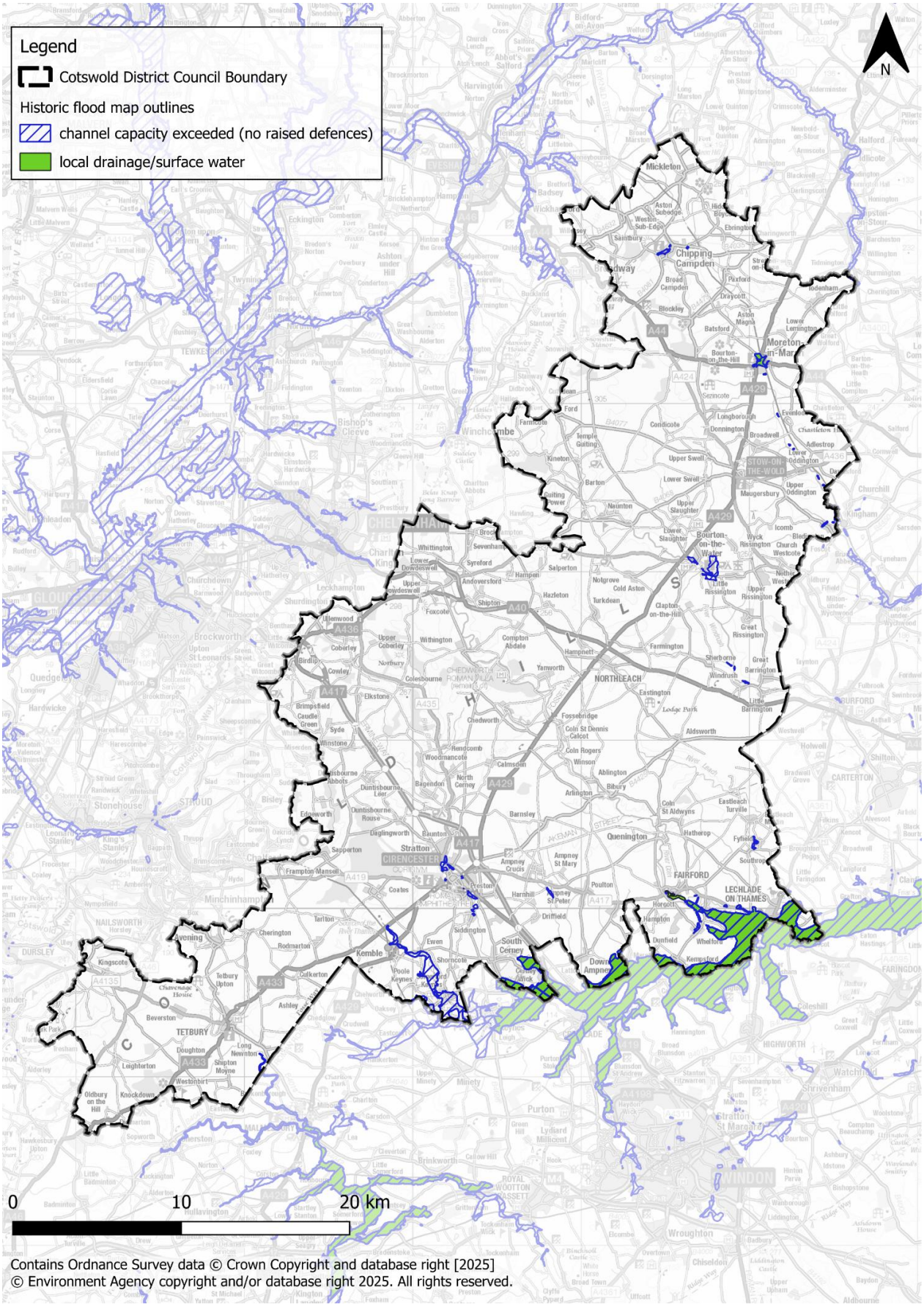


Figure 4-6: EA Historic Flood Map

4.3.3 Historic fluvial flooding

The LFRMS (2014) states that the unprecedented flooding in Gloucestershire in 2007 and also the less severe flooding in 2012 were largely caused by fluvial sources due to heavy rainfall causing high water levels in rivers and brooks. On the 20th of July the equivalent of two months' rain fell in 14 hours, leading to the flooding of approximately 5,000 residential properties and 500 non-residential properties.

4.3.3.1 July 2007

During the July 2007 event, Cotswold District Council received over 1,150 reports of flooded homes and businesses. Approximately 40% of these properties were located in Moreton-in- Marsh, Bourton-on-the-Water and Chipping Campden to the north of the district. In total, 79 towns and villages across the Cotswold District are known to have been affected by the floods in summer 2007.

Rivers were reported as a source of flooding in 42 of the 79 (53%) locations affected. The River Windrush flooded over 100 homes and businesses in Naunton and Bourtonon-the-Water, while the River Churn flooded parts of Cirencester. The River Thames at Lechlade reached record levels and there were over 100 reports of property flooding at the confluence of the Thames and River Leach. The northernmost part of the District is located within the Avon catchment. The River Cam, a sub catchment of the Avon, caused severe flooding to a number of residential properties and businesses in Chipping Campden.

Some of the areas worst-affected by surface water flooding included Moreton-In-Marsh, Fairford and Whelford. Additionally, Thames Water has identified nine areas where properties were flooded internally by sewers (Fairford, South Cerney, Ampney St Peter, Ampney St Mary, Upper and Lower Slaughter, Moreton-in-Marsh, Bourton-on-the-Water, Quenington). However, it recognises that there were many other areas where sewers caused flooding to gardens and open spaces. Further, groundwater was reported as a source of flooding in nine locations. Blewbury Rd East Hagbourne, report on flooding of 20th July 2007.

The flooding followed unprecedented rainfall; the wettest-ever May to July period since national records began in 1766. The Centre for Ecology and Hydrology3 states that May to July produced hydrological conditions with no close modern parallel for the summer period in England and Wales. Met Office records show that an average of 414mm of rain fell across England and Wales during a three month period - 228mm greater than the average May to July rainfall recorded.

4.3.3.2 Winter 2013/14

Flooding problems were experienced in known flood risk areas e.g. Cirencester and South Cerney. Sewer flooding problems were again at Lakeside, Lechlade. The flood events did test the defences at Moreton-in-Marsh and Fairford which were considered to have performed well.

4.3.3.3 December 2020

During the December 2020 flood event, significant flooding was observed in Bledington, Cirencester, Lower Slaughter and Moreton-in-Marsh. The event was characterised by a short period of intense rainfall that fell on saturated ground and elevated river levels, causing widespread flooding across the district. Peak river levels were exceeded by the River Evenlode at Moreton, the River Churn at Cerney Wick and the River Thames at Somerford Keynes.

4.3.3.4 Autumn 2024

Storm Bert caused prolonged periods of heavy rainfall across the Cotswolds in November 2024. This resulted in widespread flooding impacting roads, infrastructure and properties. Bledington was impacted significantly during this event, with at least four properties requiring evacuation, and a further 20 were flooded.

4.3.4 Historic surface water flooding

The LFRMS (2014) states that the Summer 2007 flood event was also partly caused by water overloading the drainage system leading to surface water flooding.

4.3.5 Historic sewer flooding

Severn Trent Water, Thames Water and Wessex Water have provided their sewer flood incident data. Many historic flooding incidents form sewers are at the individual property level and considered sensitive information. The incident locations have therefore been aggregated to ward boundaries, as shown in Figure 4-7. The highest number of recorded incidents have occurred around the areas of Chipping Campden in the north of the district, and around the areas of Shipton Moyne, Long Newnton and Tetbury in the south of the district. It should be noted that the absence of a recorded historic incident doesn't mean sewer flooding has not occurred in a location, only that it hasn't been recorded.

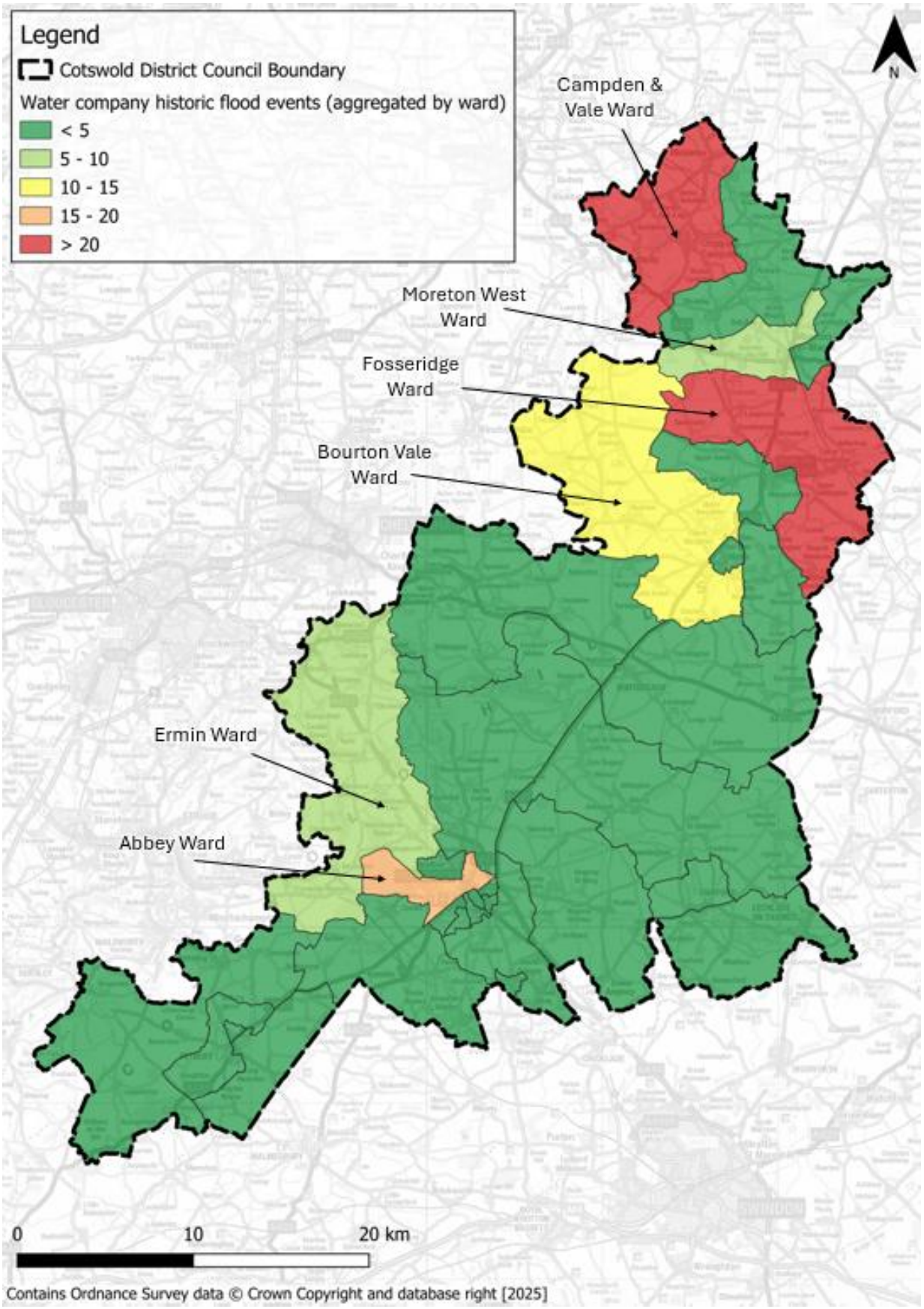


Figure 4-7: Severn Trent Water, Thames Water and Wessex Water historic flood incidents, aggregated by ward

4.3.6 Historic groundwater flooding

There are no records available of historic flooding from groundwater sources.

4.4 Fluvial flood risk

4.4.1 Flood Zones

Present day fluvial flood risk across the district is assessed based on Flood Zones. The definition of the Flood Zones is provided below. The Flood Zones do not consider defences, except when considering the functional floodplain. This is important for planning long term developments as long-term policy and funding for maintaining flood defences over the lifetime of a development may change over time.

The Flood Zones are:

- FMfP Flood Zone 1: Low risk: less than a 0.1% chance of river or sea flooding in any given year.
- FMfP Flood Zone 2: Medium risk: between a 1% and 0.1% chance of river or sea flooding in any given year.
- Flood Zone 3a (distinct from FMfP Flood Zone 3): High risk: between a 3.3% and 1% chance of river flooding in any given year or between a 3.3% and 2% change of flooding from the sea. This Flood Zone includes all areas in the FMfP Flood Zone 3 that are not in Flood Zone 3b.
- Flood Zone 3b: Functional Floodplain: land where water has to flow or be stored in times of flood. Only water compatible and essential infrastructure are permitted in this zone and should be designed to remain operational in times of flood, resulting in no loss of floodplain or blocking of water flow routes. Annex 3 of the NPPF (gov.uk) provides information on flood risk vulnerability. See Appendix C for details on the functional floodplain and how it has been delineated through this SFRA.

Important note on Flood Zone information in this SFRA

The FMfP Flood Zones for Cotswold are shown in Figure 4-8 and are included in the interactive GeoPDF mapping (Appendix B). These have been derived from the EA's Flood Map for Planning (FMfP) (gov.uk), accessed December 2025. Flood Zones 2 and 3a within this SFRA show the same extent as the online FMfP, at the time of publication of this SFRA. An updated Flood Zone 3b extent has been delineated through this SFRA.

The Flood Zones of the FMfP do not cover all catchments or ordinary watercourses with areas <3km². However, where the EA have suitable data for smaller catchments, this will be included in the Flood Zones of the FMfP. As a result, whilst the EA Flood Zones of the FMfP may show an area is in Flood Zone 1, there may be a flood risk from a smaller watercourse(s) not shown in the Flood Zones. Where detailed modelling or the FMfP is not available for a watercourse, the surface water flood extents can be used as a proxy for fluvial risk. At the planning application stage, a detailed model for small watercourses within the vicinity of a site may be required to robustly assess fluvial flood risk.

As stated in EA guidance, flood defences should be considered when delineating the functional floodplain. The methodology for functional floodplain delineation is described in Appendix C. Caution should also be applied where the Flood Zone 3b extent encompasses existing urban areas which would not otherwise be "designed to flood". Developers should consult the LPA on the derivation of the functional floodplain.

Potential development sites shown to be at high or medium risk from fluvial sources should be subject to further investigation through a Level 2 SFRA (Section 13.1).

4.4.2 Summary of fluvial flood risk across Cotswold

According to the EA's FMfP (as shown in Figure 4-8), the majority of fluvial risk is concentrated in the south of the district. An extensive area of Flood Zone 3 is located along the River Churn, which passes through Cirencester and South Cerney. There is also fluvial flood risk along the River Thames and the River Coln along the southern border of the district. Other key areas include the areas located adjacent to the River Dikler, the River Windrush and the River Evenlode.

Present day and future fluvial flood risk within the authority area is included in the interactive GeoPDF mapping (Appendix B). The impacts of climate change on fluvial flooding are discussed in Section 5.2.

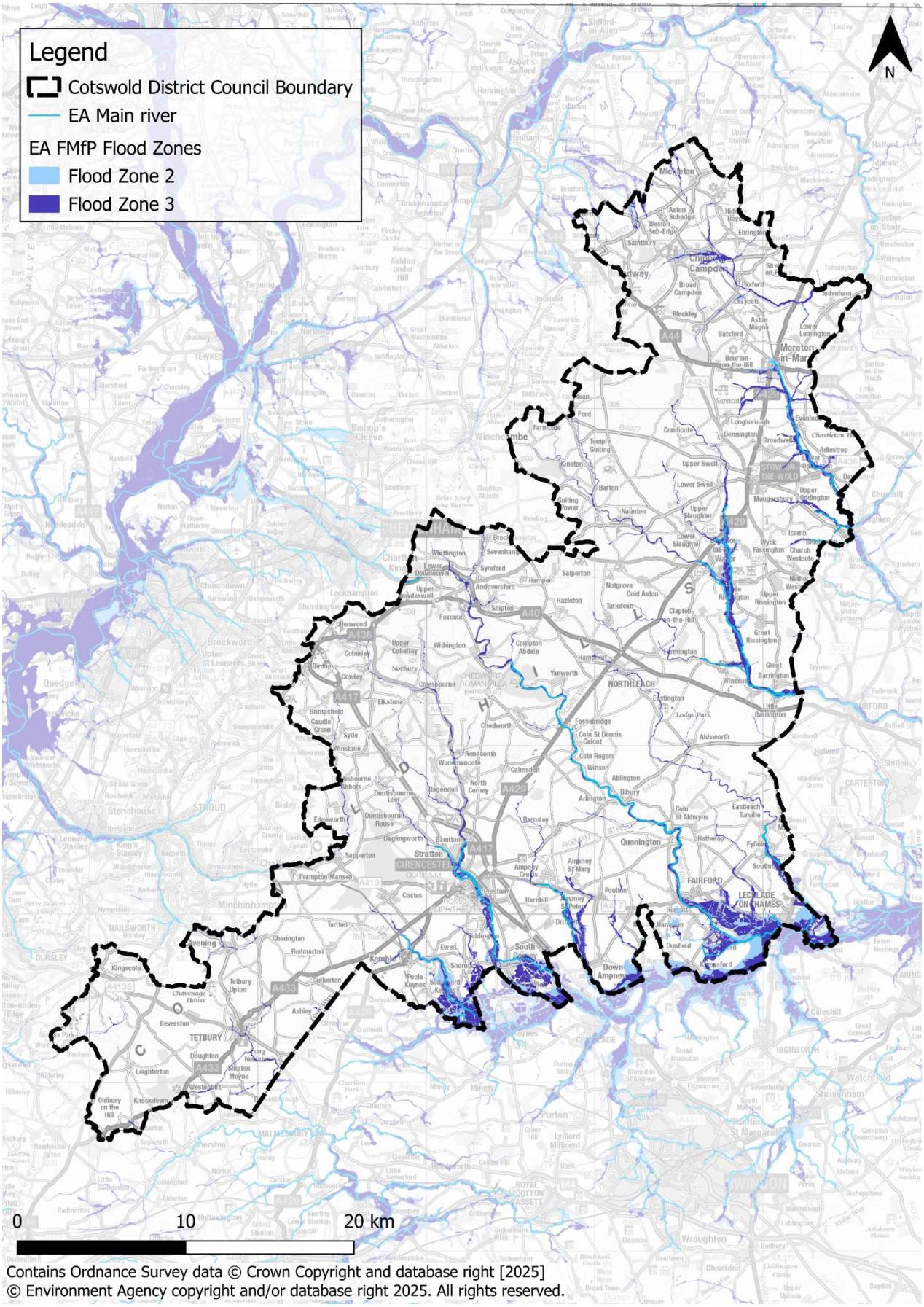


Figure 4-8: EA's Flood Map for Planning for Rivers and Sea - Flood Zones

4.5 Surface water flood risk

Surface water runoff is most likely to be caused by intense downpours e.g. thunderstorms. At times the amount of water falling can completely overwhelm the drainage network, which is not designed to cope with extreme storms. The flooding can also be complicated by blockages to drainage networks, sewers being at capacity and/or high-water levels in watercourses that cause local drainage networks to back up.

The EA's Risk of Flooding from Surface Water mapping (RoFSW) (gov.uk) received a significant update through NaFRA2 and was published January 2025. The RoFSW has been used to assess surface water risk within this SFRA. These maps are intended to provide a consistent standard of assessment for surface water flood risk across England and Wales in order to help LLFAs, the EA, and any potential developers to focus their management of surface water flood risk.

The RoFSW map is an assessment of where surface water flooding may occur when rainwater does not drain away through the normal drainage systems or soak into the ground buy lies on or flows over the ground instead. It is produced using national scale modelling and enhanced with compatible, locally produced modelling from LLFAs. Risk is displayed as one of three likelihood bandings:

- High - greater than or equal to 3.3% (1 in 30) chance in any given year.
- Medium - less than 3.3% (1 in 30) but greater than or equal to 1% (1 in 100) chance in any given year.
- Low - less than 1% (1 in 100) but greater than or equal to 0.1% (1 in 1000) chance in any given year.

The RoFSW map does not map flooding less than 0.075m (7.5cm) in depth. Therefore, where the map may show no flooding, there may be shallow flooding up to a depth of 0.075m. Therefore, the RoFSW should not be used to understand flood risk for individual properties but can be considered suitable for high level assessments such as this SFRA.

Potential development sites shown to be at high or medium risk from surface water should be subject to further investigation through a Level 2 SFRA (Section 13.1).

4.5.1 Summary of surface water flood risk across Cotswold

The EA RoFSW (as shown in Figure 4-9) highlights several communities in the district at risk from surface water flooding. Surface water flow paths generally follow the topography of existing watercourses. Areas to the north of the district appear at highest risk of surface water flooding, including Chipping Campden, Moreton-in-Marsh, Evenlode and Bourton-on-the-Water. Other key areas of risk are present in the south of the district, most notably Cirencester, Down Ampney, South Cerney and Lechlade on Thames.

Surface water flow paths generally follow areas of topographic low spots with areas of isolated ponding. Additionally, surface water flow routes are also established on roads in the more urban areas highlighting risk to transport networks while posing a risk to buildings which water can be routed to.

The RoFSW data for the district is included in the interactive GeoPDF mapping (Appendix B). The impacts of climate change on surface water flooding are discussed in Section 5.3.

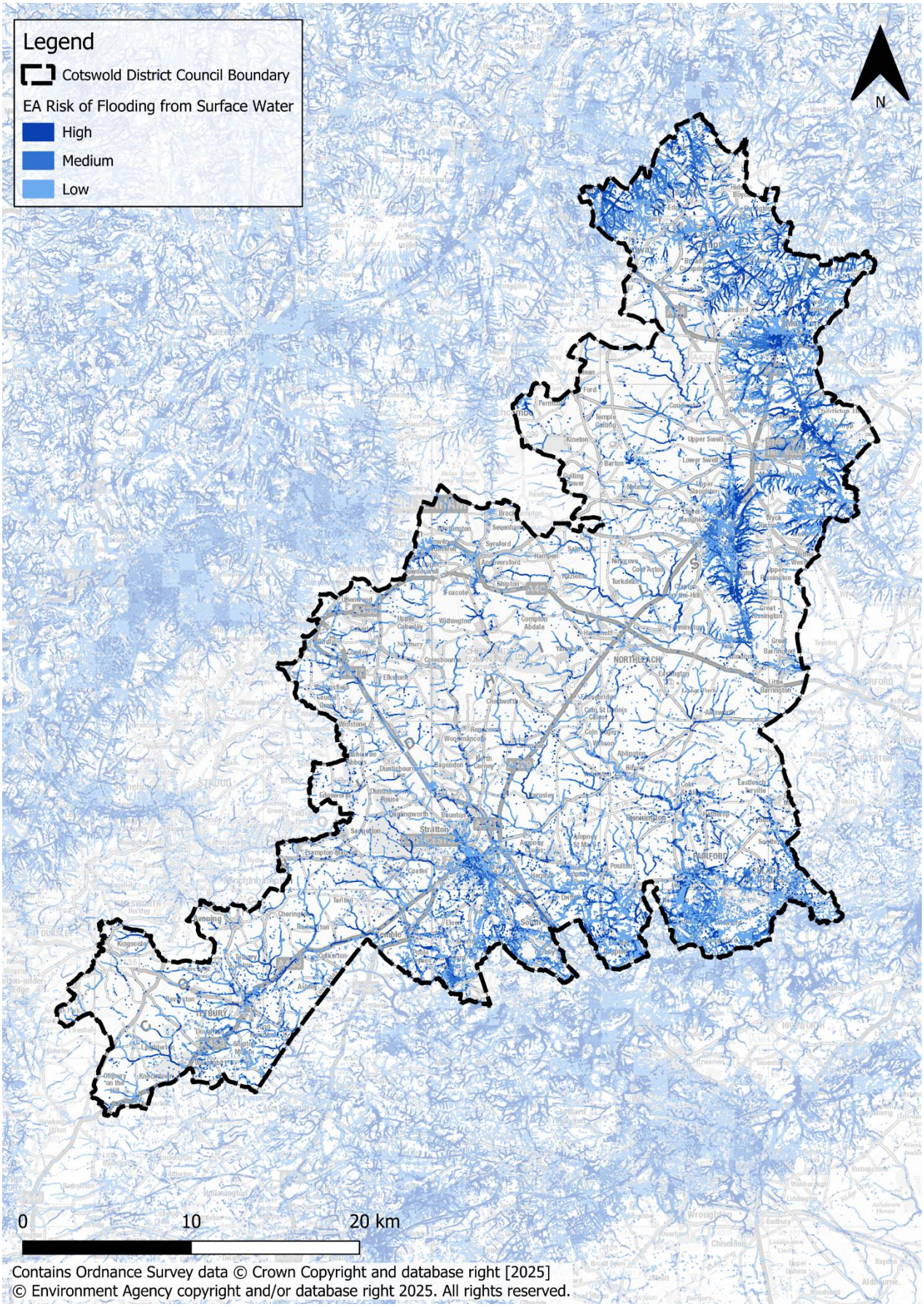


Figure 4-9: EA's Risk of Flooding from Surface Water mapping

4.6 Sewer flood risk

Sewer flooding occurs when intense rainfall/river flooding overloads sewer capacity (surface water, foul or combined), and/or when sewers cannot discharge to watercourses due to high water levels. Sewer flooding can also be caused by blockages, collapses, equipment failure or groundwater leaking into sewer pipes.

Since 1980, the Sewers for Adoption guidelines mean that new surface water sewers have been designed to have capacity for a 3.3% AEP rainfall event, although until recently this did not apply to smaller private systems. This means that sewers can be overwhelmed in larger rainfall and flood events.

New developments should not cause additional pressures on existing sewers due to the requirements to maintain greenfield runoff rates. However, increases in rainfall as a result of climate change can lead to existing sewers becoming overloaded, although this can be reduced through the use of well-designed SuDS to reduce surface water runoff. Water Cycle Studies can also assist LPAs and water companies in planning for new development and subsequent increased pressures on the sewerage and wastewater network.

Severn Trent Water, Wessex Water and Thames Water are the water companies responsible for the management of the sewerage networks across the district, as shown in Figure 4-10.

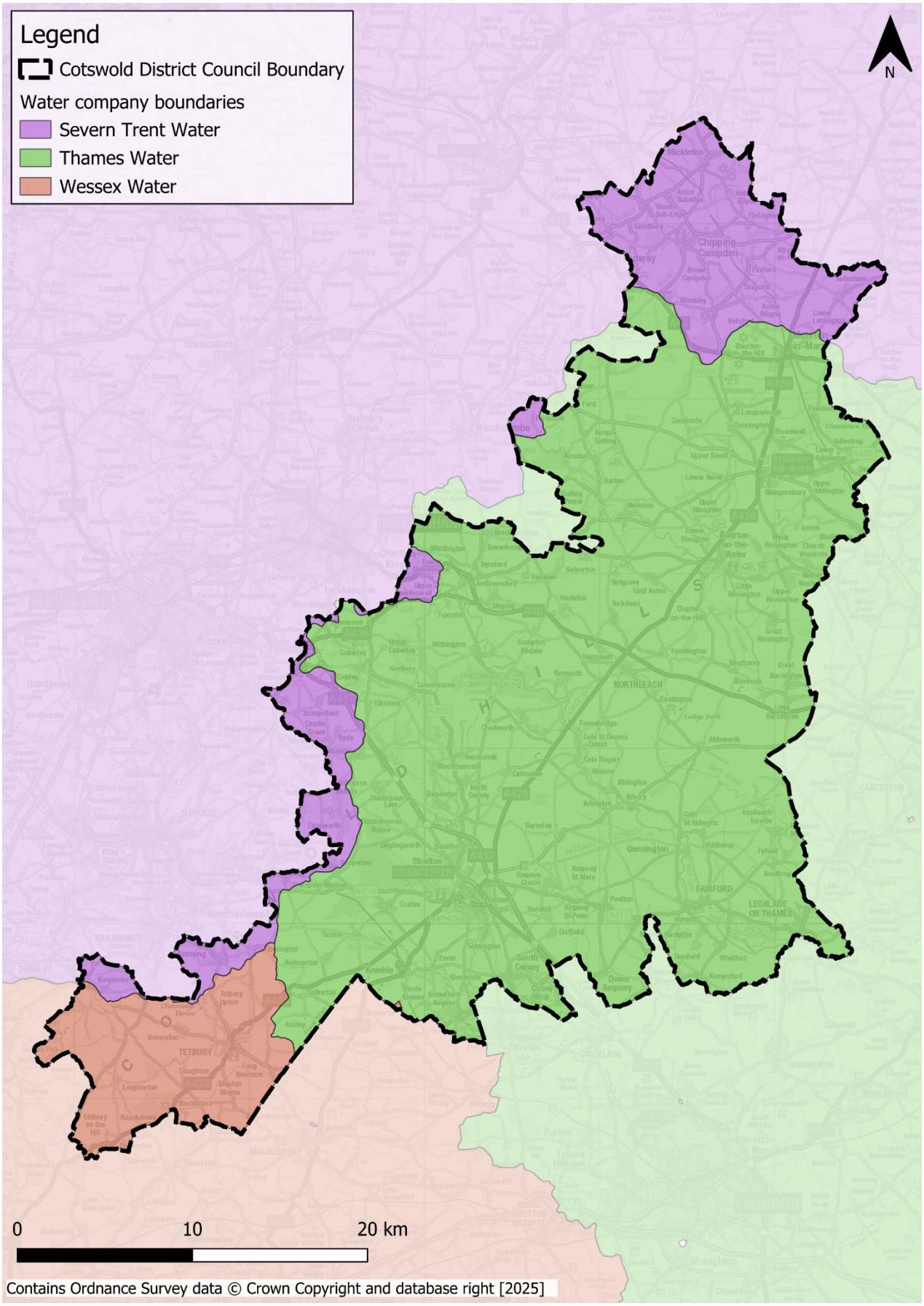


Figure 4-10: Water company boundaries covering Cotswold

4.6.1 Summary of sewer flood risk across Cotswold

Sewer flood risk is greatest in urban locations, particularly in areas where surface water and wastewater share the same combined sewer. Based on the water company historic flood incident data (Figure 4-7), the areas with the highest risk of sewer flooding are Chipping Campden, Tetbury, Long Newnton, Ashley and Shipton Moyne.

4.7 Groundwater flood risk

In general, less is known about groundwater flooding and availability of data is limited. Groundwater flooding can be caused by:

- High water tables, influenced by the type of bedrock and superficial geology.
- Seasonal flows in dry valleys, which are particularly common in areas of chalk geology.
- Rebounding groundwater levels, where these have been historically lowered for industrial or mining purposes.
- Where there are long culverts that prevent water easily getting into watercourses.
- Perched aquifers underlain by impermeable geology, particularly in low lying areas.

Groundwater flooding is different to other types of flooding. It can last for days, weeks, or even months and is much harder to predict and warn for. Monitoring does occur in certain areas, for example where there are major aquifers or in areas of historic mining.

The JBA Groundwater Emergence map shows the likelihood of groundwater emergence posing a risk to both surface and subsurface assets, based on predicted groundwater levels during a 1% AEP event. This divides groundwater emergence into five categories (Table 4-2).

Table 4-2: JBA Groundwater Emergence Map category descriptions

Category	Potential risk
0-0.025 - Groundwater levels are either at or very near (within 0.025m of) the ground surface.	Within this zone there is a risk of groundwater emergence to both surface and subsurface assets. Groundwater may emerge at significant rates and has the capacity to flow overland and/or pond within any topographic low spots.
0.025 - 0.5 - Groundwater levels are between 0.025m and 0.5m below the ground surface.	Within this zone there is a risk of groundwater emergence to both surface and subsurface assets. There is the possibility of groundwater emerging at the surface locally.
0.5 - 5 - Groundwater levels are between 0.5m and 5m below the ground surface.	There is a risk of emergence to subsurface assets, but surface manifestation of groundwater is unlikely.
>5 - Groundwater levels are at least 5m below the ground surface.	Groundwater emergence is not likely.

Category	Potential risk
N/A - no risk	This zone is deemed as having a negligible risk from groundwater flooding due to the nature of the local geological deposits.

It should be noted that this dataset only identifies areas likely to be at risk of groundwater emergence and does not allow for the prediction of the likelihood of groundwater flooding or quantification of the volumes of groundwater that might be expected to emerge in a given area.

Potential development sites shown to be at risk from groundwater emergence should be subject to further investigation through a site-specific FRA (Section 7.2).

4.7.1 Summary of groundwater emergence risk across Cotswold

The risk of groundwater emergence within Cotswold is varied. There are several areas shown in the JBA Groundwater Emergence Map where groundwater levels are either at or very near the ground surface. These areas include:

- Area around and to the south of Moreton-in-Marsh
- Areas of Ashton Keynes and Somerford Keynes
- South of Down Ampney
- Area to the east of Fairford and to the south near RAF Fairford
- Lechlade

A site-specific assessment for groundwater may be required to fully inform the likelihood of emergence to subsurface and surface areas. This may involve seasonal percolation testing and ground investigations. The JBA Groundwater Emergence Map is shown in Figure 4-11 and is included in the interactive GeoPDF mapping (Appendix B).

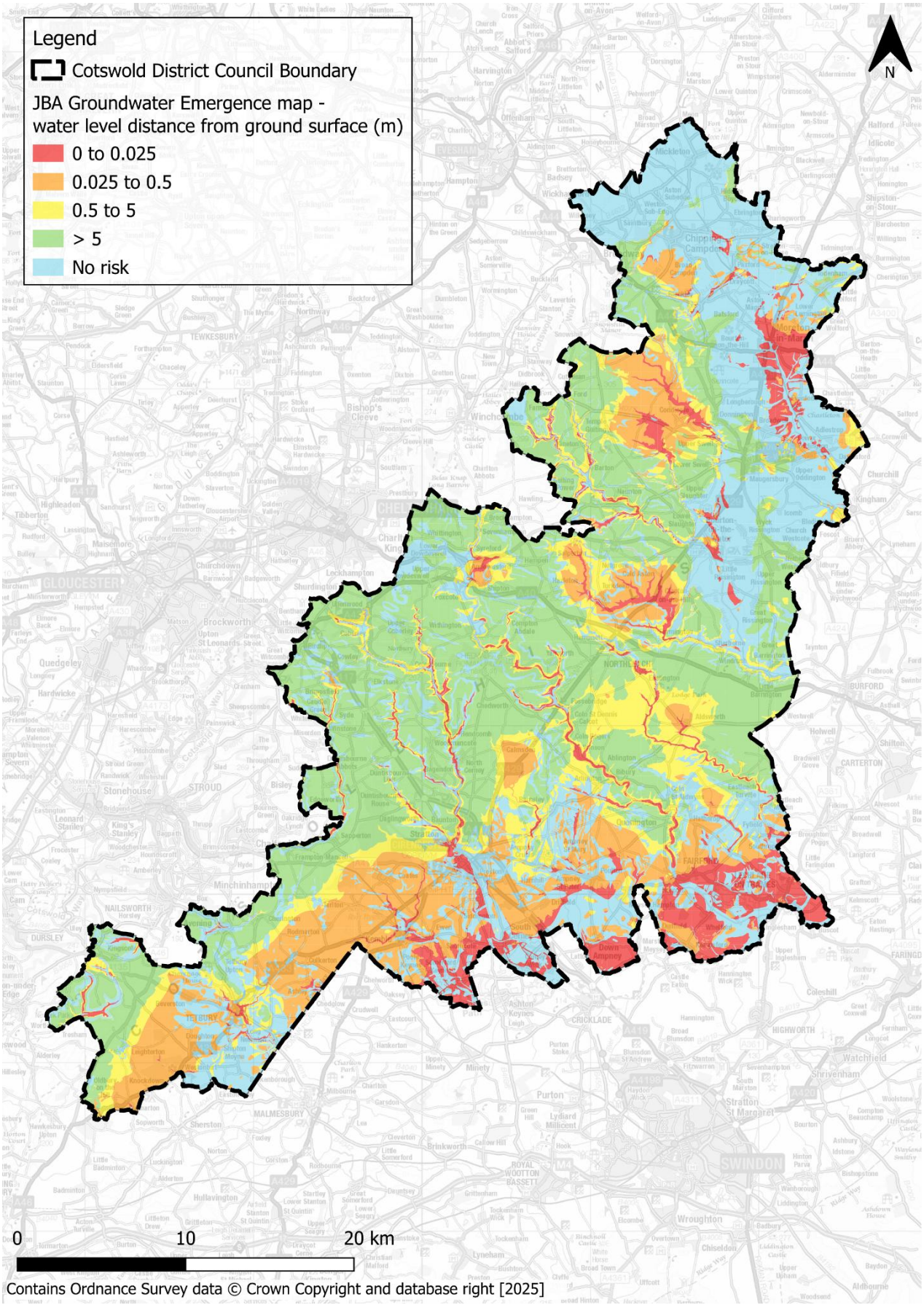


Figure 4-11: JBA Groundwater Emergence Map

4.8 Residual risk

Residual risk comes in two main forms (PPG: Flood Risk and Coastal Change Paragraph: 041):

- Residual risk from flood risk management infrastructure.
- Residual risk to a development once any site-specific flood mitigation measures are taken into account.

Examples of residual flood risk from flood risk management infrastructure include:

- A breach of a raised flood defence, blockage of a surface water conveyance system (culvert), or failure of a pumped drainage system;
- Failure of a reservoir / impounded waterbody; and
- A flood event that exceeds a flood management design standard, such as a flood that overtops a raised flood defence, or an intense rainfall event which the drainage system cannot accommodate.
- This SFRA does not assess the probability of infrastructure failure. However, in accordance with the NPPF, all sources of flooding need to be considered. If a defence breach or overtopping event were to occur, then the consequences to people and property could be significant. It is the responsibility of the developer to fully assess flood risk, propose measures to mitigate it and demonstrate that any residual risks can be safely managed.

Examples of residual flood risk to a single development to consider include:

- The depth of internal flooding predicted after any raising of land or finished floor levels;
- The flood hazard to which people would be exposed on access or escape routes after they have been raised; and
- A failure of flood forecasting or flood warning and the risks associated with people not receiving warnings or not acting upon them.

4.8.1 Reservoir flood risk

Reservoirs with an impounded volume greater than 25,000 cubic metres are governed by the Reservoirs Act 1975 (gov.uk) and are on a register held by the EA. The level and standard of inspection and maintenance required by a Supervising Panel of Engineers under the Act means that the risk of flooding from reservoirs is very low.

Reservoirs have a designated "risk category" set by the potential damage and loss of life in circumstances where there is a breach or an extreme flood event. Reservoirs designated as high risk are subject to increased inspection and maintenance requirements. However, this designation does not mean they are at a high risk of flooding. Allocation of new development downstream of an existing reservoir could potentially change the risk category of the reservoir and result in a legal requirement to improve the structural and hydraulic capacity of the dam. As the cost of implementing such works can be substantial, consideration should be given to whether it would be more appropriate to place development in alternative locations not associated with such risk.

Flooding from reservoirs occurs following partial or complete failure of the control structure designed to retain water in the artificial storage area. Reservoir flooding is very different from other forms of flooding; it may happen with little, or no warning and evacuation will need to happen immediately. The likelihood of such flooding is difficult to estimate but is extremely low compared to flooding from other sources. It may not be possible to seek refuge upstairs from floodwater as buildings could be unsafe or unstable due to the force of water from the reservoir breach or failure.

The EA's Reservoir Flood Map (RFM) shows the potential consequences of reservoir failure. Developers and planners should check the Long-Term Risk of Flooding (gov.uk) before using the reservoir data shown in this SFRA to make sure they are using the most up to date mapping. The EA provide two flooding scenarios for the RFM: a ‘dry-day’ and a ‘wet-day’. The ‘dry day’ scenario shows the predicted flooding which would occur if the dam or reservoir fails when rivers are at normal levels. The ‘wet day’ scenario shows the predicted worsening of the flooding which would be expected if a river is already experiencing an extreme natural flood. It should be noted that these datasets give no indication of the likelihood or probability of reservoir flooding. The EA maps represent a credible worst-case scenario. In these circumstances it is the time to inundation, the depth of inundation, the duration of flooding and the velocity of flood flows that will be most influential.

Potential development sites shown to be at risk from reservoir flooding should be subject to further investigation through a site-specific FRA (Section 7.2).

4.8.1.1 Summary of reservoir flood risk across Cotswold

The RFM shows that there are 10 reservoirs located outside the district which may pose a risk to Cotswold (detailed in Table 4-3). The EA's 'dry-day' and 'wet-day' reservoir flood extent maps are shown in Table 4-3 and are included in the interactive GeoPDF mapping (Appendix B).

Reservoir flood risk largely follows the channels of the River Churn in the south and the River Thames in the southeast of the authority area.

Table 4-3: Reservoirs with flood extents that may impact Cotswold

Reservoir	Easting and Northing	Reservoir owner	Risk Category	Local Authority	Does reservoir flooding impact the district in 'dry day' scenario?
Buscot Park Lake	424900, 196900	The National Trust	High-risk	Oxfordshire	Yes
Buscot Reservoir	423800, 196600	The National Trust	High-risk	Oxfordshire	Yes
Cirencester Park - The Mansion Lake	401700, 201700	Bathurst Estate Farming Limited	High-risk	Gloucestershire	Yes
Coate Water	417500, 182000	Swindon Borough Council	High-risk	Swindon	Yes
Dowdeswell	399000, 219700	Environment Agency	High-risk	Gloucestershire	Yes
Gatcombe Water	386900, 199245	Ede Holdings Limited	High-risk	Gloucestershire	Yes
Kennel Pond, Woodchester	382600, 201100	The National Trust	High-risk	Gloucestershire	No
Middle Pond, Woodchester	382100, 201300	The National Trust	High-risk	Gloucestershire	No
Parkmill Pond, Woodchester	383000, 200900	The National Trust	High-risk	Gloucestershire	No
Stanton Park Lake	417600, 190000	Swindon Borough Council	High-risk	Swindon	No

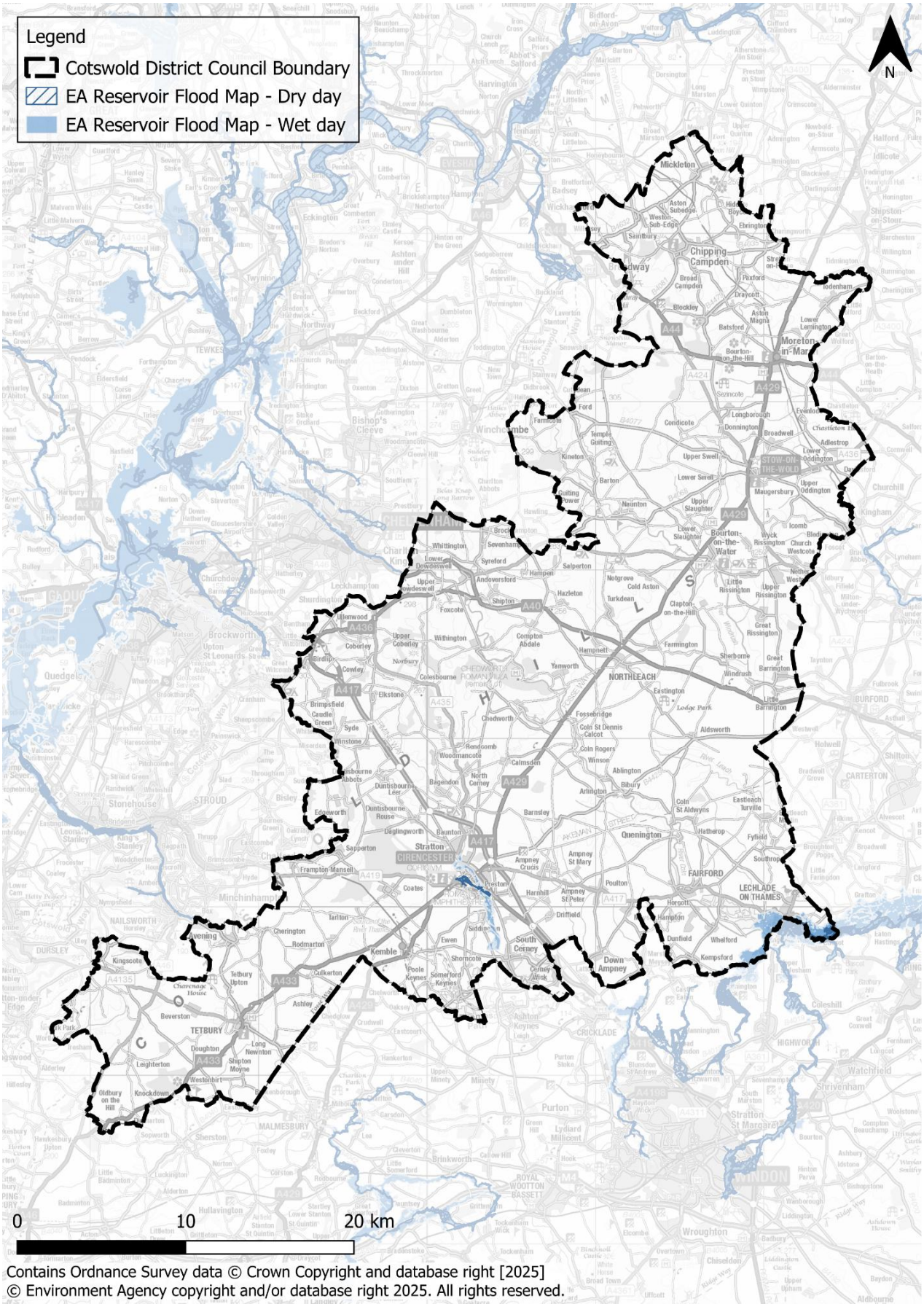


Figure 4-12: EA's Reservoir Flood Map in Cotswold

4.9 Combined sources of flood risk

In urban areas, surface water drainage networks and sewer systems are closely linked, with their interaction significantly influencing flood risk. Traditional urban drainage relies on impermeable surfaces directing rainwater into pipes and culverts, which often connect to combined sewers carrying both wastewater and stormwater. During heavy rainfall, these systems can become overwhelmed, leading to overflows that discharge untreated sewage into watercourses, exacerbating flooding and pollution.

4.10 Summary of flood risk in the district

The risk across the district is varied

- Fluvial flood risk predominantly originates from the River Churn, which flows through Cirencester and South Cerney. There is also fluvial flood risk along the River Thames and the River Coln along the southern border of the district. Historic fluvial flood events have significantly impacted the village of Bledington.
- Surface water risk is scattered across the study area. Notably this includes Chipping Campden, Moreton-in-Marsh, Evenlode and Bourton-on-the-Water in the north of the authority area and Cirencester, Down Ampney, South Cerney and Lechlade-on-Thames in the south.
- Groundwater emergence risk is varied across the district. Risk is greatest in areas around Moreton-in-Marsh and in the south of the district, covering areas including Down Ampney, Somerford Keynes, Fairford and Lechlade.
- Reservoir flood risk largely follows the channels of the River Churn in the south and the River Thames in the southeast.

5 Impact of climate change

The NPPF sets out that flood risk should be managed over the lifetime of a development, taking climate change into account. This section sets out how the impact of climate change on flood risk should be considered.

5.1 Climate change guidance

The Climate Change Act 2008 (legislation.gov.uk) creates a legal requirement for the UK to put in place measures to adapt to climate change and to reduce carbon emissions by at least 80% below 1990 levels by 2050. This was updated in June 2019 under the Climate Change Act 2008 (2050 Target Amendment) Order (legislation.gov.uk) to a 100% reduction (or net zero) by 2050.

In 2018, the Met Office published new UK Climate Projections (UKCP18) (gov.uk). The EA used these projections to update their guidance on climate change allowances for new developments for peak river flows (July 2021) and peak rainfall intensities (May 2022). This includes information on how these allowances should be included in both SFRAs and FRAs. The guidance adopts a risk-based approach considering the vulnerability of the development and considers risk allowances on a management catchment level, rather than a river basin level. The management catchments for Cotswold are shown in Figure 5-1.

Developers should check Flood risk assessments: climate change allowances (gov.uk) for the most recent guidance before undertaking a detailed FRA.

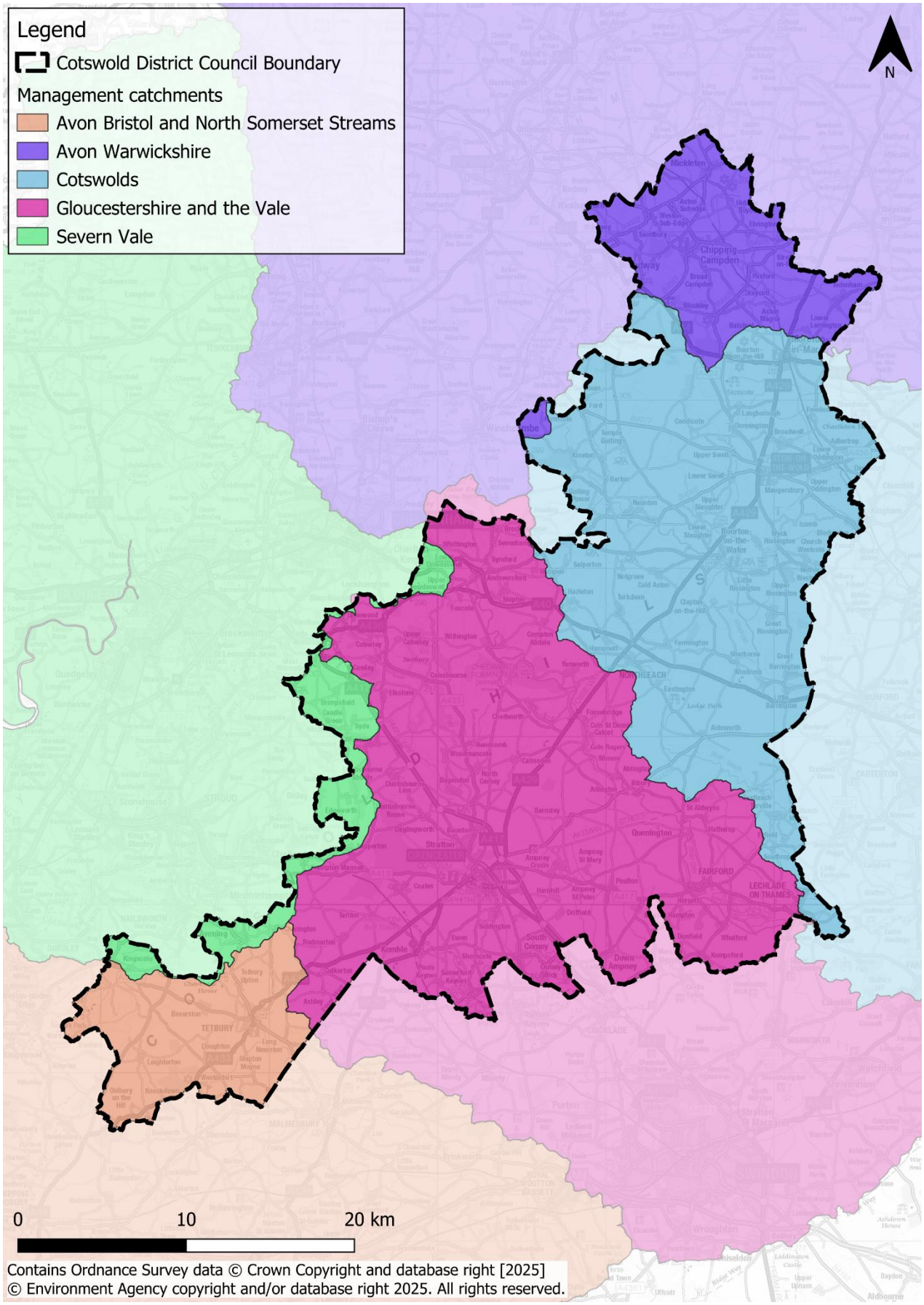


Figure 5-1: Management Catchments (assigned by the EA) across Cotswold

5.2 Peak river flows

Climate change is expected to increase the frequency, extent and impact of flooding, reflected in peak river flows. Wetter winters and more intense rainfall may increase fluvial flooding and surface water runoff and there may be increased storm intensity in summers. Rising river levels may also increase flood risk.

The peak river flow allowances (gov.uk) provided in the guidance shows the anticipated changes to peak flows for the management catchment within which the subject watercourse is located. The range of allowances are based on percentiles which describe the proportion of possible scenarios that fall below an allowance level:

- The central allowance is based on the 50th percentile (exceeded by 50% of the projections in the range).
- The higher central allowance is based on the 70th percentile (exceeded by 30% of the projections in the range).
- The upper end allowance is based on the 95th percentile (exceeded by 5% of the projections in the range).

These allowances (increases) are provided in the form of figures for the total potential change anticipated, for three climate change periods or epochs:

- The '2020s' (2015 to 2039).
- The '2050s' (2040 to 2069).
- The '2080s' (2070 to 2125).

The time period used in the assessment depends upon the expected lifetime of the proposed development. Residential development should be considered for a minimum of 100 years, whilst the lifetime of a non-residential development depends upon the characteristics of that development but a period of at least 75 years is likely to form a starting point for assessment. Further information on what is considered to be the lifetime of development is provided in the PPG (gov.uk).

5.2.1 Peak river flow allowances

The district is located within the Cotswolds, Gloucestershire and the Vale, Avon Warwickshire, Severn Vale and Avon Bristol and North Somerset Streams Management Catchment for peak river flow allowances. Table 5-3 displays the peak river flow allowances that apply to the district authority area.

Table 5-1: Peak river flow allowances for the management catchments covering Cotswold

Management Catchment	Allowance category	Total potential change (%) anticipated for '2020s' (2015 to 2039)	Total potential change (%) anticipated for '2050s' (2040 to 2069)	Total potential change (%) anticipated for '2080s' (2070 to 2125)
Cotswolds	Upper end	31	43	82
	Higher Central	17	21	43
	Central	11	13	30
Gloucestershire	Upper end	33	43	84
	Higher Central	17	19	41
	Central	11	11	26
Avon Warwickshire	Upper end	22	31	59
	Higher Central	12	14	32
	Central	7	8	21
Severn Vale	Upper end	34	52	94
	Higher Central	20	28	53
	Central	14	19	37
Avon Bristol and North Somerset Streams	Upper end	27	38	71
	Higher Central	15	19	39
	Central	10	12	26

5.2.2 Which peak river flow allowance to use?

The EA guidance states that both the central and higher central allowances should be assessed in SFRAs.

The Flood Zone and flood risk vulnerability classification (gov.uk) should be considered when deciding which allowances apply to the development or the plan. Specific guidance for which climate change allowance estimates should be applied can be found in the EA climate change guidance (gov.uk).

5.2.3 Representation of fluvial climate change within the Level 1 SFRA

The EA provided the latest available flood models for watercourses within Cotswold. The central allowance for the 2080s epoch has been assessed for risk of flooding from rivers, as per the EA's guidance on climate change. All seven of the available river models are up to date with the latest climate change allowances, having previously been updated in accordance with the EA peak river flow allowances to produce flood extents to support the

2023 Cotswold SFRA update. The available climate change allowances are stated in Table 5-2. These EA models are still the latest available and have been used to inform the future fluvial risk across Cotswold for this version of the Level 1 SFRA.

The FMfP also now includes the Flood Zones plus Climate Change dataset. This dataset represents how the combined extent of Flood Zones 2 and 3 could increase with climate change, ignoring the benefits of any existing flood defences. This dataset has been used to represent fluvial climate change in areas not subject to detailed modelling. No additional modelling has been completed as part of this Level 1 SFRA.

Table 5-2: EA detailed flood models covering Cotswold

Model	Year	Available 1% AEP event climate change allowances
Bledington Brook	2012	30%, 43%
Churn (Baunton to Siddington)	2011	30%, 43%
Daglingworth Stream FRA	2016	30%, 43%
Thames (MRL to St Johns)	2014	30%, 43%
Thames (St Johns to Shifford)	2011	15%, 25%, 35%, 70%
Windrush (Bourton-on-the-Water)	2014	30%, 43%
Windrush (Bourton-on-the-Water)	2018	10%, 11%, 13%, 15%, 17%, 21%, 25%, 30%, 31%, 35%, 43%, 70%, 82%

5.2.4 Implications of climate change for fluvial risk across the district

According to the available EA detailed model climate change outlines, as shown in Figure 5-2, there is an increase in fluvial flood risk when taking into account the impact of climate change. This is primarily evident along the River Thames and River Churn, in the areas of Cirencester, South Cerney and Fairford.

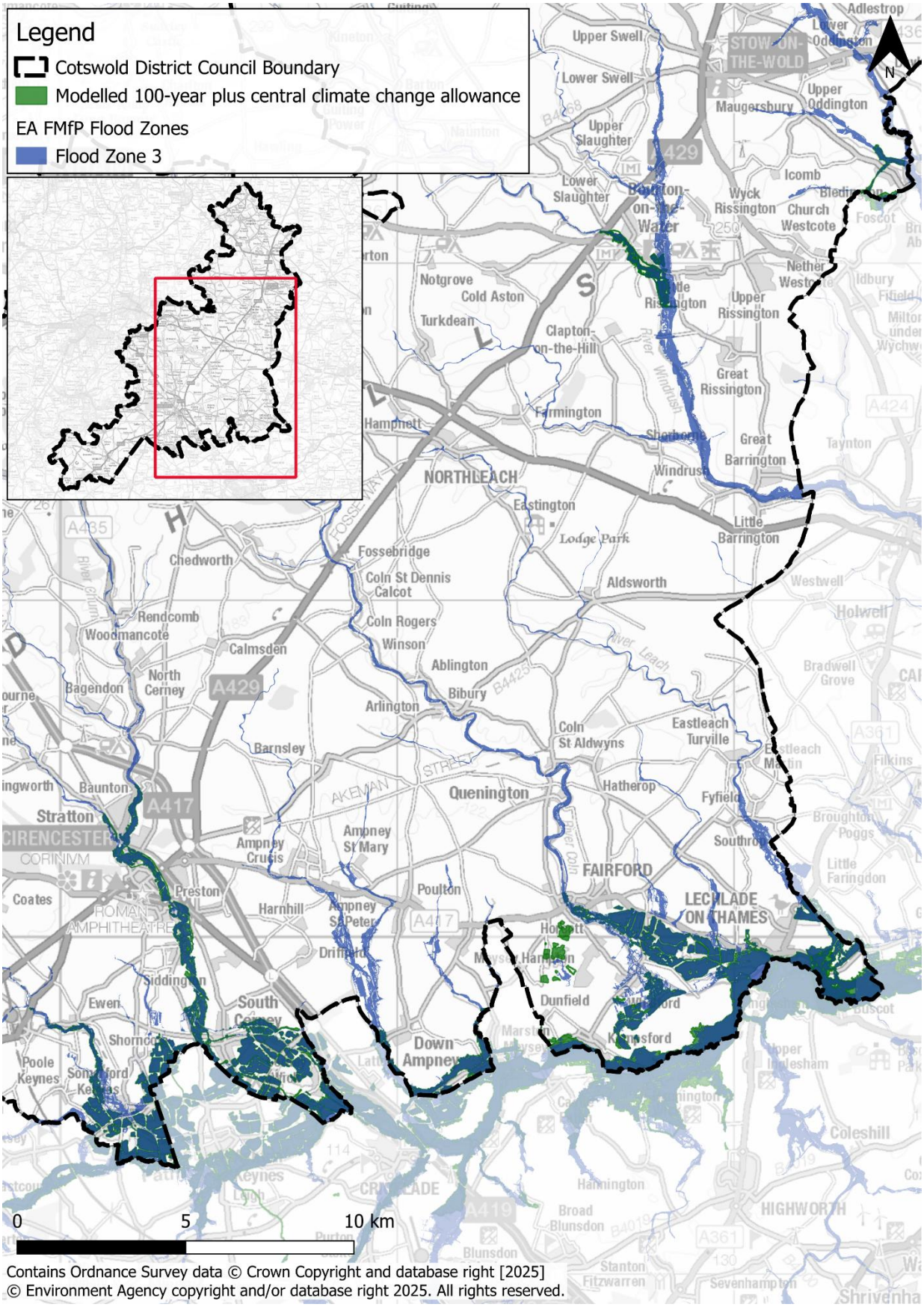


Figure 5-2: EA Detailed Flood Model Outlines - 100-year undefended plus central climate change allowance

5.3 Peak rainfall intensities

Climate change is predicted to result in wetter winters and increased summer storm intensities in the future. This increased rainfall intensity will likely negatively impact land and urban drainage systems, resulting in surface water flooding, due to the increased volume of water entering the systems. The EA have developed a peak rainfall allowances map (gov.uk) which shows anticipated changes in peak rainfall intensity which can be used for site-scale applications (like urban drainage design) and surface water flood mapping in small catchments (<5km^2).

The guidance suggests that direct rainfall modelling may not be suited to larger (>5km^2) catchments with rural land use. In these instances, the guidance states that the fluvial flood risk affected by climate change should be assessed using uplifts from peak river flow allowances (Section 5.2).

5.3.1 Peak rainfall intensity allowances for the district

The district is located within the Cotswolds, Gloucestershire and the Vale, Avon Warwickshire, Severn Vale and Avon Bristol and North Somerset Streams Management Catchment for peak rainfall allowances. Table 5-3 shows the peak rainfall allowances that apply to the district.

Table 5-3: Peak rainfall intensity allowances for small and urban catchments for Cotswold

Management Catchment	Allowance category	Total potential change (%) anticipated for '2050s' (2022 to 2060) 3.3% AEP	Total potential change (%) anticipated for '2050s' (2022 to 2060) 1% AEP	Total potential change (%) anticipated for '2070s' (2061 to 2125) 3.3% AEP	Total potential change (%) anticipated for '2070s' (2061 to 2125) 1% AEP
Cotswolds	Upper end	35	40	35	40
	Central	20	20	25	25
Gloucestershire	Upper end	35	40	35	40
	Central	20	20	25	25
Avon Warwickshire	Upper end	35	40	35	40
	Central	20	20	25	25
Severn Vale	Upper end	35	40	35	40
	Central	20	25	25	25
Avon Bristol and North Somerset Streams	Upper end	35	40	40	45
	Central	20	25	25	25

5.3.2 Which peak rainfall intensity allowance to use?

Rainfall intensity climate change uplifts should be applied to both the 3.3% and 1% AEP events. The recommended epoch and use of either the central or upper end allowances should be based on the design lifetime of the proposed development. Further details are provided within the EA climate change guidance (gov.uk). For FRAs and SFRAs the upper end allowance should be used. The EA guidance recommends that the upper end allowance is considered for both the 3.3% and 1% AEPs for the 2070's epoch (2061 to 2125), unless the allowance for the 2050's epoch (2022 to 2060) is higher, in which case this should be used. This is appropriate for development with a lifetime beyond 2100. For development with an expected shorter lifetime, the central allowance can be used.

5.3.3 Representation of surface water climate change within the Level 1 SFRA

The 2025 RoFSW includes for one modelled climate change scenario, the 2050s central allowance for the 3.3%, 1% and 0.1% AEP events. However, as stated above, the upper end allowance on peak rainfall for the 2070s should be assessed in SFRAs. Therefore, at the time of writing, the national surface water climate change mapping available, is unsuitable for consideration in development planning. For this Level 1 SFRA, the 0.1% AEP event is considered as a conservative, worst case proxy for the 1% AEP plus climate change extent, as consulted on with the EA. The proxy surface water climate change mapping is shown on the interactive GeoPDF mapping in Appendix B.

5.4 Groundwater

The effect of climate change on groundwater flooding, and those watercourses where groundwater has a large influence on winter flood flows, is uncertain. Milder wetter winters may increase the frequency of groundwater flooding incidents in areas that are already susceptible, but warmer drier summers may counteract this effect by drawing down groundwater levels to a greater extent during the summer months. The effect of climate change on groundwater levels for sites in areas where groundwater may be an issue, as informed at a strategic level by the JBA Groundwater Emergence map (Section 4.7), should be considered appropriately at the planning application stage. There is currently no available dataset that assesses the impacts of climate change on groundwater.

5.5 Adapting to climate change

PPG: Climate Change (gov.uk) Paragraph 003 (Reference ID: 6-003-20140612) contains information and guidance for how to identify suitable mitigation and adaptation measures in the planning process to address the impacts of climate change. Paragraph 005 (Reference ID: 6-005-20140306) also provides considerations for the LPA on dealing with the uncertainty of climate risks and accounting for climate change in a realistic way within developments.

The Gloucestershire climate change strategy (2023-2024) sets out how the County Council will reduce contributions to global warming and meet ambitious net-zero targets. It details the commitment of GCC to cut corporate emissions by 80% by 2030 and achieve a net-zero

county by 2045. Initiatives include the installation of EV charge points for residents, the improvement of cycling infrastructure, investment in decarbonisation and waste reduction.

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6 Flood risk infrastructure

This section provides a summary of existing flood alleviation schemes and assets in Cotswold. Planners should note the areas that are protected by defences where further work to understand the undefended and residual flood risk through a Level 2 SFRA may be beneficial. Developers should consider the benefit they provide over the lifetime of a development in a site-specific FRA.

6.1 Asset management

RMAs hold databases of flood risk management and drainage assets according to their jurisdiction as follows:

- The EA holds a national asset database that is updated by local teams known as the Asset Information Management System (AIMS).
- The LLFA should hold a register of significant local flood risk assets, required under Section 21 of the FWMA (2010).
- Highways authorities (National Highways for major roads in England, GCC for local, minor roads) hold databases of highways drainage assets, such as gullies and connecting pipes.
- Water companies hold records of public surface water, foul and combined sewers, the records may also include information on culverted watercourses.

The databases include the assets the RMAs directly maintain, and also third-party assets. The drainage network is extensive and will have been modified over time. It is unlikely that any RMA contains full information on the location, condition, and ownership of all the assets in their area. RMAs generally take a prioritised approach to collecting asset information, which will continue to refine the understanding of flood risk over time.

6.2 Standards of Protection

Flood defences are designed to give a specific Standard of Protection (SoP), reducing the risk of flooding to people and property in flood prone areas. For example, a flood defence with a 1% AEP SoP means that the flood risk in the defended area is reduced to at least a 1% chance of flooding in any given year.

Over time the actual SoP provided by the defence may decrease, for example due to deterioration in condition, lack of maintenance, or increases in flood risk due to climate change. The understanding of SoP may also change over time as RMAs undertake more detailed surveys and flood modelling studies.

It should be noted that the EA's ongoing hydraulic modelling programme may revise flood risk datasets and, therefore, the SoP offered by flood defences may also be revised. The AIMS dataset contains information on SoP.

6.3 Maintenance

Different authorities have responsibilities relating to maintenance of flood risk assets, set out in Table 6-1. It is important that the authorities work in partnership to maintain flood risk assets and manage flood risk across Cotswold.

Table 6-1: Flood risk asset maintenance responsibilities based on the FWMA (2010)

Authority	Asset maintenance responsibilities
EA	Permissive powers to maintain and improve main rivers, ultimate responsibility for maintaining watercourses rests with the landowner.
Local Authorities	Permissive powers to maintain and improve ordinary watercourses, ultimate responsibility for maintaining watercourses rests with the landowner.
LLFA	Permissive powers, limited resources are prioritised and targeted to where they can have the greatest effect
Highways Authorities	Duty to maintain public roads, making sure they are safe, passable, and the impacts of severe weather have been considered. Responsible for maintaining sections of watercourses where they are crossed by highways.
Water Companies	Duty to effectually drain their area. What this means in practise is that assets are maintained to common standards and improvements are prioritised for the parts of the network that do not meet this standard e.g., where there is frequent sewer flooding.
Riparian Owners	Responsible for the protection of their properties from flooding as well as other management activities, for example by maintaining riverbeds/banks, controlling invasive species, and allowing the flow of water to pass without obstruction.

There is potential for the risk of flooding to increase in areas where flood alleviation measures are not maintained regularly. Breaches in raised flood defences are most likely to occur where the condition of a flood defence has degraded over time. Drainage networks can frequently become blocked with debris which can lead to blockages of culverts and bridge openings.

Developers should not assume that any defence, asset, or watercourse is being or will continue to be maintained throughout the lifetime of a development. They should contact the relevant RMA about current and likely future maintenance arrangements and make future users of the development aware of their obligations to maintain watercourses.

Formal structural defences are given a rating based on a grading system for their condition. A summary of the grading system used by the EA for condition is provided in Table 6-2.

Table 6-2: Grading system used by the EA to assess flood defence condition

Grade	Rating	Description
1	Very good	Cosmetic defects that will have no effect on performance.
2	Good	Minor defects that will not reduce the overall performance of the asset.
3	Fair	Defects that could reduce the performance of the asset.
4	Poor	Defects that would significantly reduce the performance of the asset. Further investigation required.
5	Very poor	Severe defects resulting in complete performance failure.

Source: Condition Assessment Manual – EA 2006

6.4 Major flood risk management assets in Cotswolds

The EA's AIMS dataset includes raised flood defences. Table 6-3 details the locations in the district which benefit from formal flood defences within the AIMS dataset. The LPA, LLFA, and developers should refer to the AIMS Spatial Flood Defences dataset (gov.uk) for further information on specific flood defences in terms of planning development. It is clear from Table 6-3 that there are gaps in information regarding much of the defence network across the district whereby current conditions and SoPs are unknown. Survey of any defences that may provide protection to an area where new development is planned should be carried out. It should be noted that the AIMS dataset does not include all third-party flood defences, therefore there may be existing defences that are not included in Table 6-3.

The AIMS Spatial Flood Defences dataset is shown on the interactive GeoPDF Mapping (Appendix B).

Table 6-3: Locations shown in the EA 'AIMS' dataset

Watercourse	Location	Type	Design SoP (AEP)	Actual SoP (AEP)	Target Condition Rating (1-5)	Actual Condition Rating (1-5)	Asset Maintainer
Bledington Brook	Bledington	Embankment	2	Unknown	Uknown	Unknown	Unknown
River Windrush	Bourton-on-the-Water	Embankment	75	Unknown	Unknown	Unknown	Unknown
River Windrush	Bourton-on-the-Water	Embankment	75	Unknown	3	2	Environment Agency
River Windrush	Bourton-on-the-Water	Embankment	75	Unknown	Unknown	Unknown	Local Authority
River Windrush	Bourton-on-the-Water	Wall	75	Unknown	Unknown	Unknown	Unknown
River Leach	Lechlade-on-Thames	Embankment	5	Unknown	Unknown	Unknown	Private individual Company or charity
River Leach	Lechlade-on-Thames	Embankment	5	Unknown	Unknown	Unknown	Unknown
River Coln	Whelford	Embankment	5	Unknown	Unknown	Unknown	Private individual, company or charity

Watercourse	Location	Type	Design SoP (AEP)	Actual SoP (AEP)	Target Condition Rating (1-5)	Actual Condition Rating (1-5)	Asset Maintainer
River Coln	Fairford	Embankment (2)	Unknown (2)	Unknown (2)	Unknown (2)	Unknown (2)	Private individual, company or charity (2)
River Coln	Fairford	Wall (4)	Unknown (4)	Unknown (4)	Unknown (4)	Unknown (4)	Private individual, company or charity Local Authority (1)
River Churn	South Cerney	Embankment (3)	5 (3)	Unknown (3)	Unknown (3)	Unknown (3)	Private individual, company or charity (3)
River Churn	South Cerney	Wall (2)	5 (2)	Unknown (2)	Unknown (2)	Unknown (2)	Private individual, company or charity (2)

Watercourse	Location	Type	Design SoP (AEP)	Actual SoP (AEP)	Target Condition Rating (1-5)	Actual Condition Rating (1-5)	Asset Maintainer
Unnamed watercourse	Somerford Keynes	Embankment (2)	50 (2)	Unknown (2)	3 (2)	3 (2)	Environment Agency (2)
River Churn	Cirencester	Embankment	5	Unknown	Unknown	Unknown	Private individual, company or charity
River Churn	Cirencester	Embankment	Unknown	Unknown	3	3	Environment Agency
River Churn	Cirencester	Embankment (2)	Unknown (2)	Unknown (2)	Unknown (2)	Unknown (2)	Unknown (2)
River Churn	Cirencester	Wall	Unknown	Unknown	Unknown	Unknown	Private individual, company or charity
River Churn	Cirencester	Wall (2)	Unknown (2)	Unknown (2)	Unknown (2)	Unknown (2)	Unknown (2)
River Churn	Cirencester	Engineered High Ground	50	Unknown	Unknown	Unknown	Unknown

6.5 Existing and future flood alleviation schemes

The EA manages government investment to reduce flood risk and coastal erosion in England. The LLFA works with the EA and other RMAs to deliver Local Flood Risk Management Strategies, focusing on surface water, groundwater, and ordinary watercourse flooding, and to deliver specific local flood risk management projects outlined in the local strategy and action plan.

6.5.1 Completed schemes in Cotswold

6.5.1.1 Chipping Campden Flood Alleviation Scheme

The Chipping Campden flood alleviation scheme was developed in response to the July 2007 flooding where approximately 115 to 120 properties were affected. The scheme was completed in March 2013. According to the Chipping Campden flood alleviation report the following measures were implemented:

- Creation of clay core earth bund in the grounds of Westington Mill
- Installation of a filter drain on the boundary of Westington Mill and Campden House land
- Channel clearance downstream of blind lane culverts

6.5.1.2 Northleach Flood Alleviation Scheme

The Northleach flood alleviation scheme was developed in response to the July 2007 flooding where approximately 15 to 20 properties were affected. The scheme was completed in August 2013. According to the Northleach flood alleviation report the following measures were implemented:

- New surface water pipe laid along High street to alleviate surface water and highway flooding
- Creation of balancing pond

6.5.1.3 Weston-Sub-Edge flood alleviation scheme

The Weston-Sub-Edge flood alleviation scheme was developed in response to the July 2007 flooding where 16 properties were affected. The scheme was completed in Spring 2013. According to the Weston-Sub-Edge flood alleviation report the following measures were implemented:

- Saintbury brook bank protection
- Surface water diversion scheme, reprofiling driveways and junctions to divert surface water into a carrier pipeline discharge into Coombe brook
- Communal property level protection at Cider Mill Orchard

6.5.1.4 Bledington Village Flood Risk Management

An outline design summary report was completed in 2023 for the Bledington Village Flood Risk Management project. A previous options appraisal was completed which identified the need for raising the level of the existing village ditch bund, which had been overtopped in recent events, and also the creation of a new bund that will limit the ingress of water from the Westcote Brook to the village ditch. The report summarises the desk-based assessments completed to define the best approaches and next steps to move the project forward.

6.5.1.5 Wyck Rissington Pipe Capacity

Modelling has been undertaken to review the pipe capacity under the village green. The modelling will be used to inform the installation of two 250mm culverts beneath the main report through the village, as agreed with the Parish Council.

6.5.1.6 Other schemes

Other completed schemes within the area include:

- Bourton-on-the-Water - several permanent flood defences (Naight Meadow Flood Bund, Congiers Meadow Flood Bund, Rissington Road Flood Bund and Chestnut House Wall)
- Cirencester - offered protection from works associated with the Environment Agency's Churn Strategy to provide a 1 in 30-year SoP, including flood defences, flow control structures and localised management
- Fairford FAS - offered protection from the Fairford Flood Alleviation Scheme, consisting of a combination of walls and bunds in targeted locations throughout the town to provide a 1 in 100-year SoP
- Somerford Keynes - offered protection from the Somerford Keynes Flood Alleviation Scheme, consisting of embankments, channel realignment and a pumping station, providing a 1 in 50-year SoP

6.5.2 Future schemes

6.5.2.1 Queen Street, Chedworth

GCC, as LLFA, and highways have agreed that work is required to improve the condition of the existing drainage infrastructure on Queen Street to ensure maximum capacity for conveying flow. The completion of this work is subject to funding being sourced. The next phase of the work involves further investigations by the highways structures teams on the collapsed culvert beneath the highway at the bottom of Queen Street.

6.5.2.2 Lower Slaughter Weir Overflow Channel

Investigations are ongoing into the reshaping of an overflow channel past the weir on the River Eye. The benefits of the scheme are currently being identified to inform a funding application.

6.5.2.3 South Cerney Road, Siddington

The first design phase has been completed to help improve conveyance around Siddington to reduce flooding at The Common.

7 Flood risk management requirements for developers

This section provides guidance on site-specific FRAs and other principles for managing flood risk in new development.

7.1 Early consultation with statutory and non-statutory consultees

Developers should consult with the EA, the LLFA and the relevant sewerage undertaker at an early stage to discuss flood risk including requirements for site-specific FRAs, detailed hydraulic modelling and foul and surface water drainage assessment and design. It should be noted that some of these consultees may need to charge for data and/or advice requested by developers or landowners. However, developers should first consult the LPA when considering a site for development on whether the site has already been subject to the Sequential Test as part of the local plan making process.

7.2 Site-specific FRAs

7.2.1 What is a site-specific FRA?

A site-specific FRA is carried out by (or on behalf of) a developer to assess the flood risk to and from a development site and should accompany a planning application where required (see Section 7.2.2). It is recommended that the assessment is undertaken by a suitably qualified person or company. The assessment should demonstrate how flood risk will be managed now and over the development's lifetime, taking both climate change and the vulnerability of users into account. The developer should check with the LPA whether they are required to apply the Sequential Test prior to commencing with a site-specific FRA.

The objectives of a site-specific FRA are to establish:

- Whether a proposed development is likely to be affected by current or future flooding from any source.
- Whether a proposed development will increase flood risk elsewhere.
- Whether the measures proposed to deal with these effects and risks are adequate and appropriate.
- The nature of residual risk and whether this can be safely managed.
- The evidence, if necessary, to apply the Sequential Test.
- The evidence, if applicable, to show whether the development will be safe for its lifetime and pass the Exception Test.

7.2.2 When is an FRA required?

As set out in Flood risk assessments: applying for planning permission (gov.uk), a site-specific FRA is required for all development (including minor development and changes of use) proposed:

- In Flood Zones 2, 3, or 3b.
- Within Flood Zone 1 with a site area of 1 hectare or more.
- Within Flood Zone 1 and the FMfP shows it is though shown to be at risk of flooding from surface water.
- In areas with critical drainage problems (as identified by the EA or LLFA).
- Within Flood Zone 1 where the LPA's SFRA shows it will be at increased risk of flooding during its lifetime, as shown in the Environment Agency detailed climate change modelled and the 'Flood Zones plus Climate Change' extent shown on the EA FMfP.
- Where the vulnerability classification is increased and may be subject to sources of flooding other than rivers or sea.

7.2.3 What level of detail is needed in a site-specific FRA?

Site-specific FRAs should be proportionate to the degree of flood risk and the scale, nature, and location of the development. This SFRA can be used by developers as a starting point to identify the initial flood risk to a site however a pre-application consultation is key to define the scope of the FRA and identify data requirements, making sure that latest available datasets are used.

7.2.4 Guidance for FRAs

FRAs should follow the approach recommended by the NPPF (and associated planning practice guidance), and guidance provided by the EA and the LLFA. Guidance and advice for developers on the preparation of site-specific FRAs is available from the following websites with hyperlinks provided:

- Standing Advice on Flood Risk (gov.uk)
- Flood Risk Assessment for Planning Applications (gov.uk); and
- Site-specific Flood Risk Assessment: Checklist (gov.uk)

Guidance should be sought from the EA and the Council at the earliest possible stage, and opportunities should be taken to incorporate environmental enhancements and reduce flooding from all sources both to and from the site through development proposals. Developers should seek to go beyond managing the flood risk and support opportunities to reduce the causes and impacts of flooding, whilst enhancing and conserving the natural environment. PPG: Flood risk and coastal change (gov.uk) Paragraphs 062 - 067 provide further information. Potential strategic solutions to consider are detailed in Section 12 of this report.

7.3 Emergency planning

Safe access and escape routes should always be available from developments. The developer should seek to incorporate an emergency plan and ensure safe refuge points are available if the development site has been identified to be at risk of flooding. Emergency planners, emergency services, the local resilience forum, and all other flood incident responders should be consulted when designing an emergency plan. For further details on emergency planning, see Section 10.2 of this report.

8 Principles for site design and master planning

Flood risk should be considered at an early stage in deciding the layout and design of a site to provide an opportunity to reduce flood risk within the development. This section sets out the principles for site design through ground level modifications, consideration of the impact of defence infrastructure on planning, and property flood resilience.

The NPPF states that a sequential, risk-based approach should be applied to try to locate more vulnerable land uses away from high-risk areas to higher ground and lower flood risk areas, while more flood-compatible development (e.g., recreational spaces) can be located in higher risk areas. Higher risk areas can also be retained and enhanced as natural green space. Whether parking in floodplains is appropriate will be based on the likely flood depths and hazard, evacuation procedures and availability of flood warnings and alerts. The nature of risk to water quality also needs to be considered and mitigated to ensure that accumulated hydrocarbons and other vehicle related pollutants are not released to the aquatic environment.

Waterside areas, or areas along known flow routes, can be included in development layouts as blue green infrastructure, being used for recreation, amenity, and environmental purposes, allowing the preservation of flow routes and flood storage, whilst at the same time providing valuable social and environmental benefits contributing to other sustainability objectives. Appropriate landscaping should provide safe access to higher ground from these areas and avoid the creation of isolated 'dry islands' as water levels rise.

8.1 Modification of ground levels

Modifying ground levels to raise the land above the design flood level is an effective way of reducing flood risk to a particular site in circumstances where the land does not act as conveyance for floodwaters. However, care must be taken as raising land above the flood level could reduce conveyance or flood storage in the floodplain and could adversely impact flood risk downstream or on neighbouring land. Raising ground levels can also deflect flood flows, so analysis should be performed to demonstrate that there are no adverse effects on third party land or property.

If compensatory flood storage is required, following application of the sequential test and sequential approach to site layout, this should be provided on a level for level, volume for volume basis on land that does not currently flood but is adjacent to the floodplain (for it to fill and drain by gravity). This should be provided where development displaces water within the floodplain. It should be in the vicinity of the site and within the red line of the planning application boundary (unless the site is strategically allocated). Where it is not possible to provide onsite compensatory storage, it may be acceptable to provide it off-site if it is hydraulically and hydrologically linked. Stilts and voids are unlikely to be an acceptable method of compensating for losses in floodplain storage.
The PPG: Flood risk and coastal change (gov.uk) Paragraph 049, and Appendix A3 of the

CIRIA Publication C624 (ciria.org) provides guidance on how to address floodplain compensation.

Raising levels can also create areas where surface water might pond during significant rainfall events. Any proposals to raise ground levels should be modelled and fully tested to check that it would not cause increased ponding or build-up of surface runoff on third party land.

Any proposal for modification of ground levels within areas of flood risk will need to be discussed at an early stage with the EA and its impacts assessed as part of a detailed FRA.

8.2 Raised floor levels

If raised floor levels are proposed, these should be agreed with the LPA and the EA. The minimum Finished Floor Level (FFL) may change dependent upon the vulnerability and flood risk to the development.

Developers should refer to the Preparing a flood risk assessment: standing advice (gov.uk) for the latest guidance on FFLs but generally the EA advises the minimum finished floor levels should be set 600mm above the 1% AEP fluvial plus climate change peak flood level (considered to be the standard design event), where the appropriate climate change allowances have been used. An additional allowance may be required because of residual risks relating to blockages to the channel, culvert or bridge and should be considered as part of an FRA. Lowering existing FFLs below the existing levels within the 1% AEP plus climate change floodplain would not be acceptable and should be discouraged. New development offers opportunities to improve the resilience of buildings to flooding.

Building design and raised floor levels are the only way to fully reduce groundwater flood risk, through ensuring FFLs are raised above predicted groundwater levels considering known groundwater issues.

Allocating the ground floor of a building for less vulnerable, non-residential, or non-habitable residential use may be an effective way of raising living space above flood levels. However, it is important to consider the flood risk vulnerability for the whole development to ensure it is compatible with the flood zone. Single storey buildings such as ground floor flats or bungalows are especially vulnerable to rapid rise of water (such as that experienced during a breach of flood defences). This risk can be reduced by use of multiple storey construction and raised areas that provide a point of refuge. However, safe access and escape routes must still be available, particularly when flood duration covers many days.

Similarly, the use of basements should be avoided in areas of flood risk. Habitable uses of basements within Flood Zone 3 and areas at high or medium risk of surface water flooding should not be permitted, whilst basement dwellings (classed as 'highly vulnerable') in Flood Zone 2 will be required to pass the Exception Test.

Where the ground level of a site is below the ground level at the point where the drainage connects to the public sewer, care must be taken to ensure that the proposed development is not at an increased risk of sewer surcharge. It is good practice for the FFLs and manhole cover levels (including those that serve private drainage runs) to be higher than the

manhole cover level at the point of connection to the receiving sewer. Alternatively, mitigation measures may need to be incorporated into the proposals to protect against sewer surcharge.

8.3 Development and raised defences

8.3.1 Undefended and residual risk

Construction of localised raised floodwalls or embankments to protect new development is not a preferred option, as a residual risk of flooding will remain. New defence works would normally be into in place to protect existing development. Compensatory storage must be provided where raised defences remove storage from the floodplain. This is because raised defences prevent floodwater from spreading naturally across the floodplain, which can increase flood levels elsewhere.

Where development is located behind, or in an area that benefits from defences, both the undefended risk and the residual risk of flooding from defence breaching or overtopping must be considered by the developer and it must be demonstrated that they can be safely managed. The assessment of the risk should consider:

- Improvements required to the level of protection afforded by existing defences for future development.
- The future commitment and funding to maintain the current SoP of any existing defences.
- Any disparities between the proposed level of commitment to maintain the current standard of protection and the level of protection required to support future development.
- The effects of climate change on the future SoP afforded by the defences and the associated maintenance and upgrade commitments required.
- Any land required to be safeguarded for affordable future flood risk management measures.

8.3.2 Breach assessment

The assessment of the residual risk from a breach event should consider an assessment of the hazards that might occur from subsequent flood flows, considering depth and flow velocities, so that the safety of people and structural stability of properties and infrastructure can be appropriately considered.

Considerations should include the location of a breach, when it would occur and for how long, the depth of the breach (toe level), the loadings on the defence, and the potential for multiple breaches.

There are various ways of assessing breaches using hydraulic modelling. EA LIT56413 Breach of Defences Guidance (2021) provides some guidance for breach assessment from the EA. It is recommended that the EA is consulted if a development site is located near to a flood defence, to understand the level of assessment required and to agree the location(s) and approach for the breach assessment. Breach assessment can be modelled to inform site allocation through a Level 2 SFRA.

8.3.3 Overtopping assessment

The assessment of the residual risk from overtopping of defences should consider the potential flood hazard to people, based on factors such as the height of floodwaters above the crest of the defence, the proximity and elevation of receptors relative to the defence and the likely depth and velocity of floodwaters in the event of overtopping. The Defra and EA Flood Risks to People guidance document (gov.uk) provides standard flood hazard ratings based on the distance from the defence and the level of overtopping. Overtopping modelling or assessments should be undertaken for any sites located near to defences or perched ponds/reservoirs, accounting for climate change.

8.3.4 Developer contributions

In some cases, and following application of the Sequential Test, it may be appropriate for the developer to contribute to the improvement of flood defence provision that would benefit both the proposed new development and the existing local community. Developer contributions can also be made to maintenance and provision of flood risk management assets, flood warning and the reduction of surface water flooding (i.e. SuDS). LPAs can choose to impose a community infrastructure levy (CIL) on development in their area.

8.4 Buffer strips

The provision of a buffer strip alongside a watercourse allows additional capacity to accommodate climate change and means access to the watercourse, and any structures or defences, is retained for future maintenance purposes. It also helps to avoid the disturbing of riverbanks which may adversely impact local ecology, and the need to have to construct engineered riverbank protection and can also contribute to Biodiversity Net Gain (see Section 12.2). A buffer strip of 8m is recommended for any non-tidal main river. Where flood defences are present, these distances should be taken from the landward toe of the defence.

Building adjacent to riverbanks may cause issues with the structural integrity of the riverbanks and subsequently the building itself, making future maintenance of the river much more difficult. Flood Risk Activity Permits (gov.uk) from the EA are likely to be required for development in these areas alongside any planning permission. There should be no built development within these distances from main rivers/flood defences (where present).

8.5 Property Flood Resilience (PFR)

Property Flood Resilience (PFR) includes a range of measures that can be installed around the perimeter of a building to reduce the risk of internal flooding. PFR can also be used within a building, to minimise the damage done if internal flooding stills occurs. PFR aims to help households and businesses reduce the damage caused by flooding, helping to speed up recovery and reoccupation.

PFR encompasses two main elements:

- Resistance - Resistance measures are installed around the perimeter of a building. These measures aim to reduce or resist the amount of water entering the building, thus reducing the damage caused internally. Examples include flood doors/barriers, anti-flood airbricks, and non-return valves.
- Resilient adaptation (recoverability) - Adaptations made within a property, which aim to reduce the damage caused if internal flooding occurs.

The consideration of resistance measures and resilient adaptation should not be used to justify development in inappropriate locations. However, having applied planning policy there may be some instances where development is permitted in high or medium flood risk areas where application of resistance and resilience measures may be required.

There may also be opportunities for 'change of use' developments to be used to improve the flood resistance and resilience of existing development, which may not have been informed by a site-specific FRA when first constructed.

Further information and guidance on best practice can be found online in the following locations:

- Department for Communities and Local Government Improving the Flood Performance of New Buildings: Flood Resilient Construction (gov.uk)
- CIRIA Property Flood Resilience Code of Practice (ciria.org)
- EA Flood resilience construction of new buildings (gov.uk)

9 Surface water management and SuDS

This section provides an overview of SuDS, including signposting to relevant guidance, as well as guidance for developers on surface water drainage strategies.

9.1 Sustainable Drainage Systems (SuDS)

Sustainable Drainage Systems (SuDS) are management practices which enable surface water to be drained in a more sustainable manner and to mimic the local natural drainage. The inclusion of SuDS within developments is also an opportunity to enhance ecological and amenity value, and promote blue green infrastructure, incorporating above ground features into the development landscape strategy.

It is essential that developers consider sustainable drainage at an early stage of the development process – ideally at the pre-application or master planning stage. To further inform development proposals at the master planning stage, pre-application submissions are accepted by the Council. This assists with the delivery of well designed, appropriate, and effective SuDS. Applicants are also encouraged to engage with the relevant water company to discuss their surface water proposals, especially where adoption is proposed.

9.2 Sources of SuDS guidance

9.2.1 National standards for SuDS

Previously, SuDS guidance was developed to sit alongside the PPG and provide non-statutory standards as to the expected design and performance for SuDS

As of June 2025, the Defra National standards for sustainable drainage systems (SuDS) (gov.uk) were brought in to comply with principles laid out in Section 9.1. Whilst remaining as a non-statutory specification, these now form a material consideration for LPAs when assessing planning applications. These standards aim to reflect and reinforce good practice and use of SuDS as detailed in Section 9.4, reflecting the four pillars of SuDS design.

The national standards contain two sets of standards. The first type (Standard 1) is known as the hierarchy standard and gives criteria for the prioritisation of final runoff destinations. The other standards (Standards 2-7) detail the minimum requirements of design criteria that surface water drainage systems should satisfy alongside how they are to be appropriately built, maintained, and operated.

9.2.2 C753 CIRIA SuDS Manual (2015)

The C753 CIRIA SuDS Manual (2015) (ciria.sharefile.com) provides guidance on planning, design, construction, and maintenance of SuDS. The manual is divided into five sections ranging from a high-level overview of SuDS, progressing to more detailed guidance with progression through the document.

9.2.3 Design and Construction Guidance (DCG)

The Design and Construction Guidance (DCG) (water.org.uk) contains Codes for Adoption, covering the adoption of new water and wastewater infrastructure by water companies, and contains details on the water sector's approach to the adoption of SuDS.

9.2.4 Local SuDS guidance

GCC defer to the Defra National standards for SuDS as the guidance that should be used for development within Cotswold.

9.3 Roles of the LLFA and LPA

GCC as LLFA are a statutory planning consultee. They provide technical advice on surface water drainage strategies and designs put forward for major development[1] proposals, to confirm that onsite drainage systems are designed in accordance with the current legislation and guidance.

When considering planning applications, the LLFA drainage/flood risk engineering team will provide advice to the LPA on the management of surface water. The LPA should satisfy themselves that the development's proposed minimum standards of operation are appropriate and, using planning conditions or planning obligations, to ensure there are clear arrangements for ongoing maintenance over the lifetime of the development.

In their respective roles as LPA and LLFA, Cotswold District Council and GCC should:

- Promote the use of SuDS for the management of runoff;
- Ensure their policies and decisions on applications support and compliment the building regulations on sustainable rainwater drainage, giving priority to infiltration over discharges into watercourses, and then sewer conveyance;
- Incorporate favourable policies within development plans;
- Adopt policies for incorporating SuDS requirements into the Local Plan; and
- Encourage developers to utilise SuDS whenever practical, if necessary, through the use of appropriate planning conditions.

9.3.1 Schedule 3 of the Flood and Water Management Act (2010)

At the time of writing, the implementation of SuDS is driven through planning policy. Schedule 3 of the FWMA 2010 aims to provide a framework for the approval and adoption of drainage systems, to designate SuDS Approving Bodies (SAB) within unitary and county councils, and to ensure national standards on the design, construction, operation, and

1 The NPPF defines residential major development as development where 10 or more homes will be provided, or the site has an area of 0.5 hectares or more. For non-residential development it means additional floorspace of 1,000m^2 or more, or a site of 1 hectare or more, or as otherwise provided in the Town and Country Planning (Development Management Procedure) (England) Order 2015.

maintenance of SuDS for the lifetime of the development are followed. Timescales for the enactment of Schedule 3 by government are unknown.

9.4 Considerations for SuDS design

9.4.1 Four pillars of SuDS design

SuDS are designed to maximise the opportunities and benefits that can be secured from surface water management practices. SuDS design should consider the four pillars of SuDS (Figure 9-1): water quantity, water quality, amenity, and biodiversity.

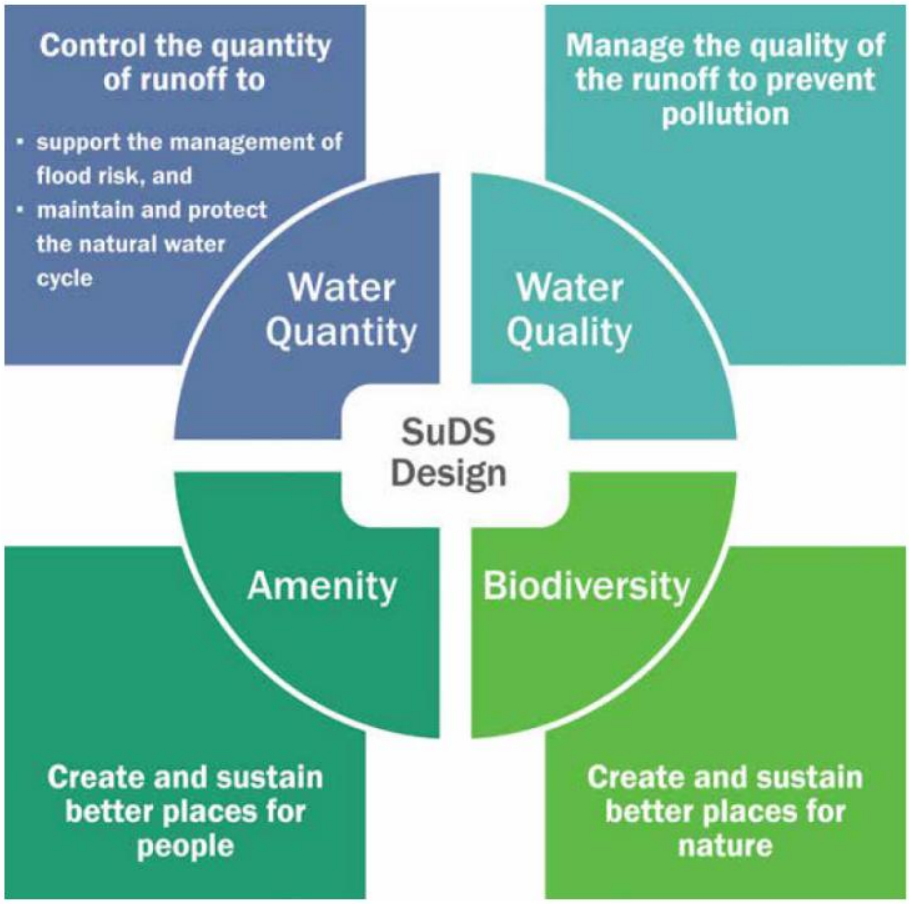

Figure 9-1: Four pillars of SuDS design (The SuDS Manual C753, 2015)

Given the flexible nature of SuDS, they can be used in most situations within new developments as well as being retrofitted into existing developments. SuDS can also be designed to fit into most spaces, for example, permeable paving could be used in parking spaces or rainwater gardens as part of traffic calming measures.

It is a requirement that *'applications which could affect drainage on or around the site should incorporate sustainable drainage systems to control flow rates and reduce volumes of runoff, and which are proportionate to the nature and scale of the proposal. These should provide multifunctional benefits wherever possible, through facilitating improvements in water quality and biodiversity, as well as benefits for amenity'* (NPPF Paragraph 182).

It is important that SuDS are maintained for the lifetime for the development so that features can continue to function as designed. Consideration should be given to enhancing SuDS to achieve Biodiversity Net Gain.

9.4.2 Types of SuDS System

There are many different SuDS techniques that can be implemented in attempts to mimic pre-development drainage conditions. Techniques can include soakaways, infiltration trenches, permeable pavements, grassed swales, green roofs, ponds, and wetlands. Many of which do not necessarily need to take up a lot of space. The suitability of the techniques will be dictated in part by the development proposal and site conditions. Advice on best practice is available from the EA and the Construction Industry Research and Information Association (CIRIA) e.g. the CIRIA SuDS Manual C753 (2015).

9.4.3 SuDS management train

SuDS should not be used individually but as a series of features in an interconnected system designed to capture water at source and convey it to a discharge location. Collectively this concept is described as a SuDS Management Train (see Figure 9-2).

The number of treatment stages required within the Management Train depends primarily on the source of the runoff and the sensitivity of the receiving waterbody or groundwater.

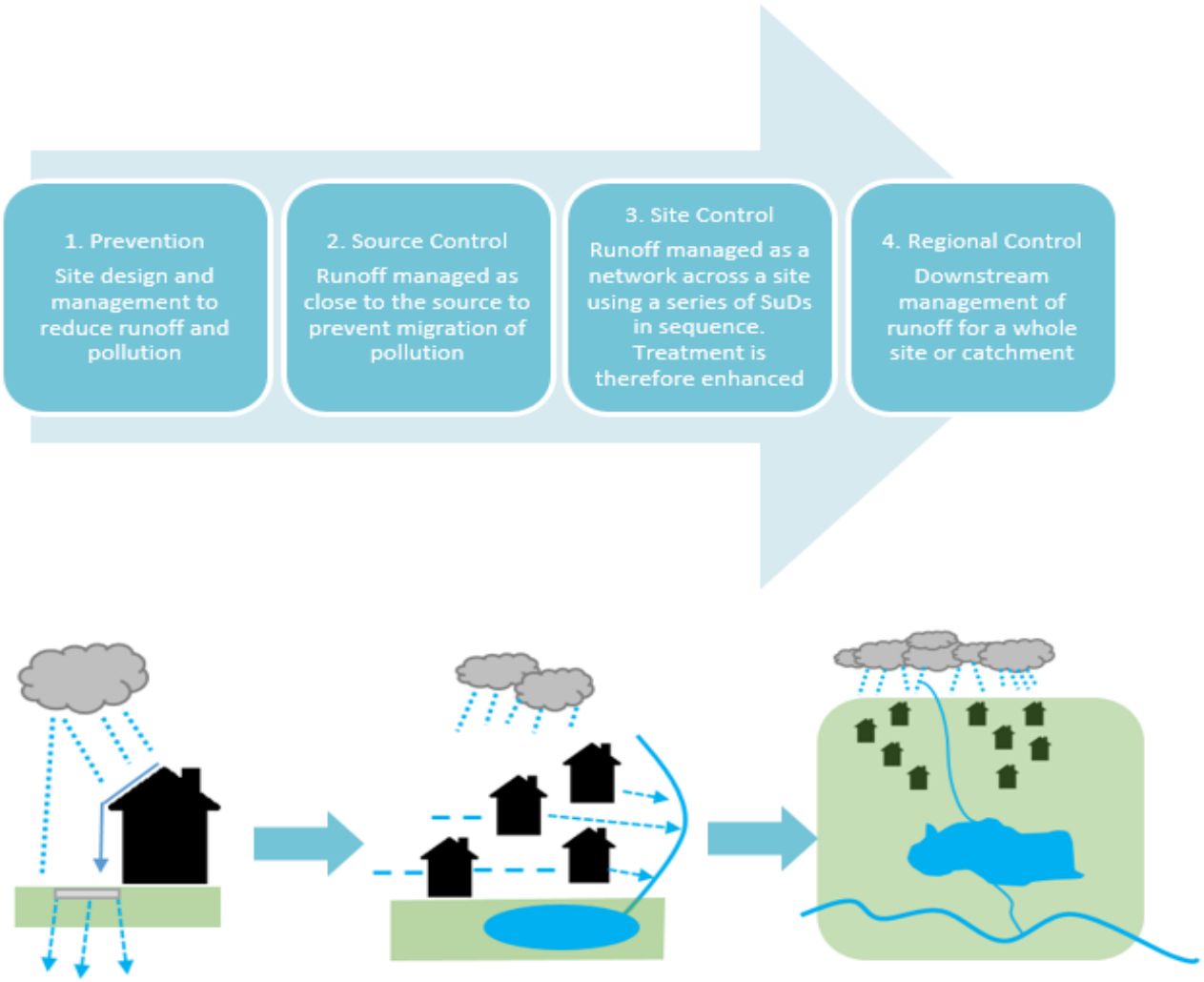

Figure 9-2: SuDS Management Train

9.4.4 SuDS considerations

The design of appropriate SuDS will be influenced by a number of physical and policy constraints. These should be taken into account and reflected upon during the conceptual, outline, and detailed stages of SuDS design. Table 9-1 details some possible constraints and how they may be overcome.

Drainage from new development sites or redeveloped sites should be designed in line with the drainage hierarchy (PPG: Flood Risk and Coastal Change Paragraph: 056) which initially promotes the use of infiltration prior to considering alternative drainage. For SuDS techniques that are designed to encourage infiltration, it is imperative that the water table is low enough to receive surface runoff waters. Most types of SuDS will be suitable in areas with permeable bedrock including features such as soakaways and infiltration basins. In areas with more impermeable geology, offsite discharge in accordance with the drainage hierarchy may be required to discharge surface water runoff from the site. In some cases, above-ground features such as attenuation ponds may be practical with a managed outlet or discharge point. Infiltration SuDS should be considered with caution within areas of possible subsidence or sinkholes.

Site-specific infiltration testing will need to be conducted early on as part of the design of the development in order to determine the impact of groundwater levels on the effectiveness of any drainage system. Groundwater monitoring is also encouraged and may be required in some locations.

Where sites lie within or close to Groundwater Vulnerability Zones (Section 9.5.1), Groundwater Source Protection Zones (GSPZs) (Section 9.5.2) or aquifers (Section 4.2.2), further restrictions may be applicable, and guidance should be sought from the LLFA and the EA.

Table 9-1: Example SuDS design constraints and possible solutions

Constraints	Solution
Land availability	SuDS can be designed to fit into small areas by utilising different systems. For example, features such as permeable paving and green roofs can be used in urban areas where space may be limited.
Contaminated soil or groundwater below site	SuDS can be placed and designed to overcome issues with contaminated groundwater or soil. Shallow surface SuDS can be used to minimise disturbance to the underlying soil. The use of infiltration should also be investigated as it may be possible in some locations within the site. If infiltration is not possible linings can be used with features to prevent infiltration.
High groundwater levels	Non-infiltrating features can be used. Features can be lined with an impermeable line or clay to prevent the egress of water into the feature. Additional, shallow features can be utilised which are above the groundwater table.

Constraints	Solution
Steep slopes	Check dams can be used to slow flows. Additionally, features can form a terraced system with additional SuDS components such as ponds used to slow flows.
Shallow slopes	Use of shallow surface features to allow a sufficient gradient. If the gradient is still too shallow pumped systems can be considered as a last resort.
Ground instability	Geotechnical site investigation should be done to determine the extent of unstable soil and dictate whether infiltration would be suitable or not.
Sites with deep backfill	Infiltration should be avoided unless the soil can be demonstrated to be sufficiently compacted. Some features such as swales are more adaptable to potential surface settlement.
Open space in floodplain zones	Design decisions should be done to take into consideration the likely high groundwater table and possible high flows and water levels. Features should also seek to not reduce the capacity of the floodplain and take into consideration the influence that a watercourse may have on a system. Facts such as siltation after a flood event should also be taken into account during the design phase.
Future adoption and maintenance	The LPA should ensure development proposals, through the use of planning conditions or planning obligations, have clear arrangements for on-going maintenance over the development's lifetime.

9.5 Other surface water considerations

9.5.1 Groundwater Vulnerability Zones

The 2015 EA published groundwater vulnerability maps provide a separate assessment of the vulnerability of groundwater in overlying superficial rocks and those that comprise of the underlying bedrock. The map shows the vulnerability of groundwater at a location based on the hydrological, hydro-ecological, and soil properties within a one-kilometre grid square.

The majority of Cotswold is classified as high groundwater vulnerability.

The groundwater vulnerability maps should be considered when designing SuDS. Depending on the height of the water table at the location of the proposed development site, restrictions may be placed on the types of SuDS appropriate to certain areas. Groundwater vulnerability maps can be found on Defra's interactive mapping (defra.gov.uk).

9.5.2 Groundwater Source Protection Zones (GSPZ)

The EA also defines GSPZs near groundwater abstraction points. These protect areas of groundwater used for drinking water. The GSPZ requires attenuated storage of runoff to prevent infiltration and contamination. GSPZs can be viewed on Defra's interactive mapping (defra.gov.uk). Three main zones are defined as follows:

- Inner protection zone (Zone 1) - areas from where pollution can travel to the groundwater source within 50 days or is at least a 50m radius.
- Outer protection zone (Zone 2) - areas from where pollution can travel to the groundwater source within 400 days or lies within the nearest 25% of the total catchment area (whichever is largest).
- Total catchment (Zone 3) - the total area needed to support removal/discharge of water from the groundwater source.

Online mapping shows there are currently 27 GSPZs which lie, fully or partially within Cotswold, located throughout the district.

Where a site is located in a GSPZ used for public water supply, applicants should engage with the Council to understand any concerns and any necessary mitigation measures to manage the risk of development to public water supply.

9.5.3 Nitrate Vulnerable Zones

Nitrate Vulnerable Zones (NVZs) are areas designated as being at risk from agricultural nitrate pollution. Nitrate levels in waterbodies are affected by surface water runoff from surrounding agricultural land entering receiving waterbodies. The level of nitrate contamination will potentially influence the choice of SuDS and should be assessed as part of the design process. 2025 - 2028 NVZs can be viewed on the EA's interactive mapping (data.gov.uk).

The majority of Cotswold District is designated as an NVS (2025 - 2028).If a site falls within a NVZ, these rules must be followed: Nitrate vulnerable zones (data.gov.uk). Landowners can appeal an NVZ designation once notified if their land (or part of it):

- Does not drain into water that has been identified as polluted
- Drains into water that should not be identified as polluted

9.5.4 Critical Drainage Areas

Local Authorities can choose to designate Critical Drainage Areas (CDAs) within their authority area; There are no CDAs currently designated within the district.

10 Flood warning and emergency planning

This section provides an overview of the requirements for emergency plans, including any local emergency planning arrangements, and an overview of the available flood alerts and warnings from the EA in Cotswold.

10.1 NPPF requirements

The NPPF Flood Risk Vulnerability and Flood Zone "incompatibility" table seeks to avoid inappropriate development in areas at risk from fluvial flooding. It is essential that any development which will be required to remain operational during a flood event is located in the lowest flood risk zones to ensure that, in an emergency, operations are not impacted upon by floodwater, or that such infrastructure is resistant to the effects of flooding such that it remains serviceable/operational during 'central' events for the majority of development types, and 'upper end' events for essential infrastructure, as defined in the Environment Agency's climate change allowances.

The outputs of this Level 1 SFRA should be compared and reviewed against any existing emergency plans and continuity arrangements. This includes any nominated rest and reception centres (and prospective ones), so that evacuees are outside of the high-risk Flood Zones and will be safe during a flood event. The EA's online FMfP should also be consulted to ensure the latest data is being considered.

10.2 Emergency planning

The Civil Contingencies Act 2004 lists local authorities, the EA and emergency services as Category 1 responders, responsible for reducing, controlling, and mitigating the effects of emergencies in both response and recovery phases.

The NPPF (Paragraph 181) requires site-level FRAs to demonstrate that "*any residual risk can be safely managed; and safe access and escape routes are included where appropriate, as part of an agreed emergency plan*."

In accordance with the NPPF, SFRAs and GCC's LFRMS (2014) can be used in the preparation and execution of a flood emergency plan as they can indicate areas that may be at risk of flooding. Emergency plans can be provided as part of a FRA or as a separate document. Decisions regarding whether an emergency plan is required sits with the LPA, with advice from the Council's emergency planning teams, the EA, and the LLFA.

According to the PPG, an emergency plan is needed wherever emergency flood response is an important component of making a development safe; this includes the free movement of people during a 'design flood' and potential evacuation during an extreme flood.

Emergency plans are essential for any site with transient occupancy in areas at risk of flooding, such as holiday accommodation, hotels, caravan, and camping sites (PPG: Flood risk and coastal change paragraph 043).

Emergency plans should consider:

- The type of flood risk present, and the extent to which advance warning can be given in a flood event.
- The number of people that would require evacuation from the area potentially at risk.
- The vulnerability of site occupants.
- The impact of the flooding on essential services e.g., electricity, gas, telecommunications, water supply and sewerage.
- Safe access and escape routes for users and emergency services (Section 10.2.1).

Further information is available from the following documents/websites with hyperlinks provided:

- The National Planning Policy Guidance (gov.uk)
- 2004 Civil Contingencies Act (legislation.gov.uk)
- Defra (2014) National Flood Emergency Framework for England (gov.uk)
- FloodRe (floodre.co.uk)
- The EA and Defra's Standing Advice for FRAs (gov.uk)
- EA's 'How to plan ahead for flooding' (gov.uk)
- Sign up for Flood Warnings with the EA (gov.uk)
- The National Flood Forum (nationalfloodforum.org.uk)
- 'Prepare for flooding' (gov.uk)
- ADEPT Flood Risk Plans for new development (adeptnet.org.uk)
- Environment Agency Community flood plan (2023)
- Environment Agency Personal flood plans (2023).

10.2.1 Safe access and escape routes

Safe access and escape routes need to be available during the design flood event with consideration of climate change. Access requirements are set out in the PPG: Flood Risk and Coastal Change (gov.uk) Paragraph: 047.

As part of an FRA, the developer should review the acceptability of the proposed access in consultation with the LLFA, the EA, and emergency planners. Site and plot specific velocity and depth of flood flows should be assessed against standard flood hazard criteria to ensure safe access and escape routes can be achieved during a flood.

10.3 Local arrangements for managing flood risk

The Gloucestershire Local Resilience Forum works to prepare for, respond to and recover from emergency incidents, including flooding. The LRF is a multi-agency partnership that brings together representatives from the emergency services, local authorities, the NHS, the Environment Agency and others. The LRF provide advice on flooding in their Community Risk Register and on the County Council website.

10.4 Flood alerts and flood warnings

The EA is the lead organisation for providing warnings of river flooding. Flood Warnings are supplied via the Flood Warning System (FWS) service, to homes and business within Flood Zones 2 and 3. The EA Sign up for Flood Warnings (gov.uk) page provides information on how to sign up for these warnings.

There are currently 18 Flood Alert Areas (FAA) and 19 Flood Warning Areas (FWAs) covering the district.

Flood alerts are issued when there is water out of bank for the first time anywhere in the catchment, signalling that 'flooding is possible', and therefore FAAs usually cover the majority of main river reaches.

Flood warnings are issued to designated FWAs (i.e., properties within the extreme flood extent which are at risk of flooding), when the river level hits a certain threshold; this is correlated between the FWA and the gauge, with a lead time to warn that 'flooding is expected'.

The FAAs and FWAs are included on the interactive GeoPDF mapping in Appendix B.

11 Cumulative Impact Assessment

This section details the cumulative impact assessment, which identifies which river catchments are most likely to be sensitive to increased flood risk as a result of future development.

11.1 Introduction

The cumulative impact of development should be considered at both the local plan making stage and the planning application and development design stages.

When allocating land for development, consideration should be given to the potential cumulative impact of the loss of floodplain storage volume from any source, as well as the impact of increased flows on flood risk downstream. Whilst the loss of storage for individual developments may only have a minimal impact on flood risk, the cumulative effect of multiple developments may be more severe. Similarly, the effect of the loss of surface water flow paths/exceedance paths from sewers, surface water ponding and infiltration can also give rise to cumulative effects and potentially exacerbate flood risk. There are also risks of development causing modified flow regimes from sites creating an alignment in peak flows in downstream watercourses and resulting in greater flood risk as a result of the development.

All developments are required to comply with the NPPF and demonstrate they will not increase flood risk elsewhere. Therefore, providing developments comply with the latest guidance and legislation relating to flood risk and sustainable drainage, and appropriate consideration is given to flow paths and storage proposals should normally not increase flood risk downstream.

Local planning policies can also be used to identify areas where the potential for development to increase flood risk is highest and identify opportunities for such new development to positively contribute to decreases in flood risk downstream.

There is currently no national guidance available for assessing the cumulative impacts of development. The cumulative impact assessment (CIA) in this SFRA provides a relative assessment of the catchments within Cotswold and are not comparable across other boroughs/districts. The full methodology for the CIA is set out in Appendix F.

11.2 Results

The CIA has identified the following catchments as high risk:

- Bretforton Bk - source to conf Broadway-Badsey Bk
- Broadway-Badsey Bk - source to conf R Avon
- Churn (Baunton to Cricklade)
- Coln (from Coln Rogers) and Thames (Coln to Leach)
- Evenlode (Source to Four Shires S) and Longborough Stream
- Knee Bk - source to conf Blockley Bk

- Swilgate - source to conf R Avon
- Swill Brook (source to Ashton Keynes)
- Tetbury Avon - unnamed trib to conf Sherston Avon
- Thames (Churn to Coln)
- Thames (Kemble to Waterhay Bridge)
- Thames (Leach to Evenlode)
- Thornhill Ditch and tributaries at Cotswolds Water Park
- Windrush (Slade Barn Stream to Dikler)

Specific recommendations for catchments identified as high risk, alongside broadscale recommendations applicable across the whole District, are set out in Appendix F.

12 Strategic flood risk solutions

This section sets out wider strategic solutions that may offer potential to reduce flood risk across Cotswold, including natural flood management. It also details notable partnership working opportunities within Cotswold.

Section 11 of this report and Appendix F consider the cumulative impacts of development across Cotswold and the catchments which are most sensitive to these impacts, and as such where strategic flood risk solutions may be most beneficial.

Where possible, developments should seek to help reduce flood risk in the wider area. The following sections outline different options which could be considered for strategic flood risk solutions. Any strategic solutions should ensure they are consistent with wider catchment policy and the local policies.

It is important that the ability to deliver strategic solutions in the future is not compromised by the location of proposed development. When assessing the extent and location of proposed development, consideration should be given to the requirement to secure land for flood risk management measures that provide wider benefits.

12.1 Partnership working

Flood risk to an area or development can often be attributed to multiple different sources, including fluvial, surface water and/or groundwater, which can become intertwined. Where complex flood risk issues are highlighted, it is important that all stakeholders are actively encouraged to work together to identify issues and provide suitable solutions.

12.1.1 Catchment Based Approach

The Catchment Based Approach (CaBA) (catchmentbasedapproach.org) was introduced by government to establish catchment partnerships throughout England to jointly deliver improved water quality and reduce flood risk, directly supporting achievement of many of the targets set out within government's 25-year Environment Plan. CaBA partnerships are actively working in all 100+ river catchments across England and cross-border with Wales.

The CaBA partnerships working within Cotswold include:

- Evenlode Catchment Partnership
- Windrush Catchment Partnership
- Upper Thames Catchment Partnership
- Bristol Avon Catchment Partnership
- Severn Vale Catchment Partnership

12.2 Biodiversity Net Gain

Biodiversity Net Gain (BNG) is a strategy to develop land and contribute to the recovery of nature. It is making sure the habitat for wildlife is in a better state than it was before development. BNG has been applicable since November 2023 for developments in the Town and Country Planning Act 1990, unless exempt, and has been applicable to small sites since April 2024. Exempt developments include existing planning applications, below threshold development and small home extensions. Further information is available on the Government BNG webpage (gov.uk). Strategic flood risk solutions can help developments achieve BNG requirements.

12.3 Natural Flood Management

12.3.1 Introduction to NFM

Development can provide opportunities to work with natural processes to help reduce flood and erosion risk, benefit the natural environment and reduce costs of schemes. This is known as Natural Flood Management (NFM) or nature-based solutions, a process whereby action is taken to mitigate flood risk by protecting, restoring and emulating natural processes. This approach aims to reduce flow volumes and delay the arrival of peak flood flow downstream.

Techniques and measures, which could be applied within in Cotswold include:

- Creation of offline storage areas.
- Re-meandering streams (creation of new meandering courses or reconnecting cut-off meanders to slow the flow of the river).
- Targeted woodland planting.
- Reconnection and restoration of functional floodplains (Section 12.4).
- Restoration of rivers and removal of redundant structures, i.e. weirs and sluices no longer used or needed (Section 12.5).
- Installation or retainment of large woody material in river channels.
- Improvements in management of soil and land use.
- Creation of rural and urban SuDS.

To maximise the benefits of NFM, it is important that land which is likely to be needed for NFM is protected by safeguarding land for future flood risk management infrastructure through local plan policy. This is particularly important for infrastructure that reduces the risk of flooding to large areas of existing development, or where options for managing risk in other ways are limited to achieve multiple benefits for flood risk and the environment.

It is important to recognise the value of maintenance or restoration of natural riparian zones, such as grasslands, which protect the soils from erosion and ‘natural’ meadows which can tolerate flood inundation. The use of blue green infrastructure throughout river corridors can also play a vital role in enhancing the river environment as well as safeguarding land from future development, protecting people and buildings from flooding and reducing flood risk downstream.

The Rivers Trust NFM National Map (theriverstrust.hub.arcgis.com) provides further information about completed and ongoing NFM schemes and community works.

12.3.2 Working with natural processes

The EA published their updated evidence base in February 2025 for Working with Natural Processes to reduce flood risk 2024 (gov.uk) to support the implementation of NFM, with 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.

12.3.3 Gloucestershire NFM Partnership

The Gloucestershire NFM Partnership was established in 2023, which brings together 18 local partners, including GCC, the EA and Natural England. The partnership aims to expand the scale, scope and impact of NFM measures in Gloucestershire. This will be done by creating a pipeline of NFM projects, sourcing funding and creating relationships with local communities and landowners.

12.3.4 Ongoing NFM schemes

12.3.4.1 Churn Waterways and Environment Partnership

The Churn Waterways and Environment Partnership aims to provide benefits to Cirencester's waterways whilst also protecting against drought and flooding through the implementation of nature-based solutions. The partnership is a collection of organisations including the Department for Environment, Food and Rural Affairs, the EA, Thames Water, Severn Trent and the National Trust.

12.3.4.2 Bledington

A collaboration is underway between the EA and GCC and Bledington Flood Group. Funding is provided by the EA through the Water Environment Improvement Fund to support NFM work on the Gawcombe and Idbury tributaries of the Westcote Brook Catchment, delivered by the Evenlode Catchment Partnership.

Further funding has also been obtained for NFM work on the Westcote Brook.

12.3.4.3 Batsford Estate, Moreton-in-Marsh

There are proposed NFM measures to be installed across the Batsford Estate, Moreton-in-Marsh. Phase 1 has been completed, which involved the installation of eight leaky barriers. The next phase involves the potential creation of wetlands with flood storage capacity.

12.3.4.4 Thames Source NFM

There are a number of schemes proposed within Cotswold under the Thames Source NFM project:

- Marsden - floodplain reconnection, in-channel deflectors, leaky dams and wetland creation
- Moor Wood - pond and wetland creation, ditch blocking and reconnecting small watercourses
- Hartleys Farm - leaky dams along two sections of the upper Churn and its tributaries
- Stratton Meadows - partial restoration of the Stratton Water meadow floodplain north of Cirencester

12.3.5 Completed NFM schemes

12.3.5.1 Windrush Floodplain Meadow Restoration

The first stage of this project aimed to restore floodplain meadows along the River Windrush. The initial tasks involved engagement with local landowners and a review of the land management plans developed as part of the Windrush Floodplain Meadow Strategy. In total, 16.75 hectares of land was sown with floodplain meadow seeds and plug planting to maximise establishment success. The second of this project designed NFM measures at three sites, particularly promoting wetland habitat creation, leaky dams and field bunds.

12.4 Catchment and floodplain restoration

Floodplain restoration represents the most sustainable form of strategic flood risk solution, by allowing watercourses to return to a more naturalised state, and by creating space for naturally functioning floodplains working with natural processes.

Although the restoration of floodplain is difficult in previously developed areas where development cannot be rolled back, the following measures should be adopted:

- Promoting existing and future brownfield sites that are adjacent to watercourses to naturalise banks as much as possible. Buffering areas around watercourses to provide an opportunity to restore parts of the floodplain through blue green corridors and helping to deliver BNG.
- Removing redundant structures to reconnect the river and the floodplain.
- Applying the sequential approach to avoid new development within the floodplain.

12.5 Structure removal and/or modification (e.g. weirs)

Structures, both within watercourses and adjacent to them can have significant impacts upon a river's regime, including alterations to the geomorphology and hydraulics of the channel through water impoundment and altering the sediment transfer regime, which over time can significantly impact the channel profile including bed and bank levels, alterations to flow regime and interruption of biological connectivity, including the passage of fish and invertebrates.

Many artificial in-channel structures (such as weirs and culverts) can sometimes be redundant and/or serve little purpose. Opportunities for the removal of such structures

should be investigated where feasible. The need to do this is heightened by climate change, for which restoring natural river processes, habitats and connectivity are vital adaptation measures. However, it also must be recognised that some artificial structures may have important functions or historical/cultural associations, which need to be considered carefully when planning and designing restoration work.

In the case of weirs, whilst weir removal should be investigated in the first instance, in some cases it may be necessary to modify a weir rather than remove it. For example, by lowering the weir crest level or adding a fish pass. This will allow more natural water level variations upstream of the weir and remove a barrier to fish migration.

Developers should investigate the 'opening up' or 'daylighting' of existing culverts where possible and should not construct new culverts on site except for short lengths to allow essential infrastructure crossings for access.

12.6 Riverbank stabilisation

Any practice that may cause riverbank erosion should be avoided. Landowners should be encouraged to avoid using machinery and vehicles close to or within the watercourse unless in the circumstances where machinery and vehicles are required for watercourse maintenance such as desilting, grass cutting, or removal of vegetation. Care should be taken not to destabilise the banks.

There are several techniques that can be employed to restrict the erosion of riverbanks. In an area where bankside erosion is particularly bad and/or vegetation is unable to properly establish, ecologically sensitive bank stabilisation techniques, such as willow spiling, can be particularly effective. Live willow stakes thrive in the moist environment and protect the soils from further erosion allowing other vegetation to establish and protect the soils. Other approaches include the planting of brash or small trees, large wood, large trees and root wads.

12.7 Green infrastructure

Green infrastructure (GI) is a planned and managed network of natural environmental components and green spaces that intersperse and connect the urban centres, suburbs and rural fringe and consist of:

- Open spaces – parks, woodland, nature reserves, lakes.
- Linkages – blue green river corridors and canals, and pathways, cycle routes and greenways.
- Networks of “urban green” – private gardens, street trees, verges and green roofs.

The identification and planning of GI are critical to achieving sustainable growth. It merits forward planning and investment as much as other socio-economic priorities such as health, transport, education and economic development. GI is also central to climate change action and is a recurring theme in planning policy. With regards to flood risk, green spaces can be used to manage storm flows and free up water storage capacity in existing

infrastructure to reduce risk of damage to urban property, particularly in urban centres and vulnerable urban regeneration areas. GI can also improve accessibility to waterways, improve water quality, support regeneration, and improve opportunities for leisure, economic activity, and biodiversity through delivery of BNG.

13 Recommendations and next steps

13.1 Requirements for a Level 2 SFRA

Following the application of the Sequential Test using Appendix D and E of this Level 1 SFRA, where sites cannot be appropriately accommodated in low-risk areas, the Council may need to show that sites proposed for allocation can be safe for their lifetime. Some sites may also require application of the Exception Test. In these circumstances, a Level 2 SFRA is required, to assess in more detail the nature and implications of the flood characteristics in order for the LPA to allocate such sites in the new local plan. However, a Level 2 SFRA does not negate the need for a site-specific FRA at the planning application stage.

As part of this Level 1 SFRA, an initial site screening exercise using the Council's potential development site boundaries and the latest flood risk data has been undertaken to help inform the application of the Sequential Test and the subsequent potential requirement for a Level 2 SFRA.

Appendix E provides a strategic assessment of the suitability, relative to flood risk both now and in the future, of the sites to be considered for allocation in the Council's new Local plan, summarising the outcomes of the sites screening assessment spreadsheet in Appendix D.

SFRA Strategic Recommendation B applies to sites where a Level 2 SFRA may be required in order to allocate. Of the 170 potential development sites screened, Strategic Recommendation B applies to 124 sites. A Level 2 SFRA may not be required for all of these sites, depending on the proportion and spatial variation of risk across each site. The sites where Strategic Recommendation B applies should be reviewed by the Council to identify those where further assessment would be required in order to allocate.

13.2 Recommendations from SFRA findings

The following overarching SFRA recommendations have been developed to guide future development and inform planning decisions across Cotswold in relation to flood risk. These recommendations should be read alongside national and local policies and are intended to support the allocation of sites and planning applications, ensuring that flood risk is appropriately considered at all stages of the planning process.

- New development should be directed to areas with the lowest probability of flooding (Flood Zone 1). Development within Flood Zones 2 and 3 should only be considered if no reasonably alternative sites exist. Development should also be directed away from the climate change flood risk zones.
- There should be no residential development within Flood Zone 3a, the modelled climate change flood outlines, and the Flood Zones plus Climate Change flood risk area. More vulnerable development is required to be subject to and to pass the Exception Test if it is proposed within Flood Zone 3a.

- Where development is proposed within Flood Zone 2, and whilst accounting for climate change, consideration should be given to locating dwellings above ground floor level. Ground floor areas should be limited to less vulnerable uses, such as retail, restaurants, office space, or car parking, where compatible with local policy.
- There should be no development within Flood Zone 3b (functional floodplain). Areas of functional floodplain would ideally remain as or be converted to open greenspace, providing multifunctional ecology, social and amenity benefits, as well as for flood attenuation and storage.
- Consideration should be given to areas that may be needed for future flood risk management features and structures. Areas at high risk from fluvial flooding could be considered as appropriate areas to safeguard for flood storage.
- A site-specific flood risk assessment should accompany planning applications where development is proposed within Flood Zones 2 and 3a, at risk from climate change, at risk from any other flood source, or within Flood Zone 1 and the site area is 1 hectare or greater.
- Built development within 8m of the bank top of a main river, culvert or flood defence should be discouraged. Focus should be for the preservation of the watercourse corridor, wildlife habitat, flood flow conveyance and future watercourse maintenance or improvement, with a focus on achieving BNG.
- For all new development situated within flood risk areas, planning applications should be accompanied by an emergency plan that is proportionate to the risk. This should set out clear procedures for safe evacuation, identify safe access and escape routes and account for the vulnerability of site users during a flood event.
- Space should be provided for the inclusion of SuDS on all allocated sites, outline proposals and full planning applications. SuDS design should demonstrate how constraints have been considered and how the design provides multiple benefits e.g. landscape enhancement, biodiversity, recreation, amenity, leisure, and the enhancement of historical features.
- Where development is located behind a flood defence or within a defended area, consideration should be given to the potential safety of the development, FFLs and for safe access and escape routes in the event of rapid inundation of water due to a defence breach with little warning.
- The cumulative impact assessment recommendations, outlined in Appendix F, should be considered for all development within the district.

13.3 Recommendations for further work

The SFRA process has developed into more than just a planning tool. Sitting alongside the Sustainability Appraisal and Local Flood Risk Management Strategy, it can be used to provide a much broader and inclusive vehicle for integrated, strategic and local flood risk management and delivery.

There are several studies listed in Table 13-1 that may be of benefit to the LPA, in developing the flood risk evidence base to support the delivery of the new Local Plan, or to the LLFA to help fill critical gaps in flood risk information that have become apparent through the preparation of this Level 1 SFRA.

Table 13-1: Potential further works and assessments

Type	Study	Reason
Understanding of local flood risk	Level 1 SFRA update	When there are changes to: the predicted impacts of climate change on flood risk; national flood modelling; detailed flood modelling - such as from the EA or LLFA; the local plan, spatial development strategy or relevant local development documents; local flood management schemes; flood risk management plans; local flood risk management strategies; national planning policy or guidance (2025 reforms of the PPG); or after a significant flood event.
	Level 2 SFRA	Reviewing of EA flood zones in those areas not covered by existing detailed hydraulic models (i.e., the FMfP does not cover every watercourse such as those <3km^2 in catchment area or ordinary watercourses). If a watercourse or drain is present on OS mapping but is not covered by the FMfP, this does not mean there is no potential flood risk. A model or further investigation may therefore be required to ascertain the flood risk, if any, to any nearby sites.
	Level 2 SFRA	Further, more detailed assessment of flood risk to high and medium risk sites both now and in the future as notified by this Level 1 SFRA, following application of the Sequential Test.
	SWMP/ detailed surface water modelling	The LLFA may wish to produce a SWMP for Cotswold based on the most up to date surface water flood risk information and climate change allowances or consider targeted areas of high surface water flood risk.
Residual risk	Level 2 SFRA	Residual risk from flooding as a result of defence breaches and asset blockages should continue be mitigated through sequential testing to steer development to lower risk areas and identifying opportunities for property flood resilience measures for properties at residual risk.
Flood storage and attenuation	Working with Natural Processes	Further assessment of WwNP options in upper catchments to gauge possible areas for Natural Flood Management. Promote creation of floodplain and riparian woodland, floodplain reconnection and runoff attenuation features where the research indicates that it would be beneficial to the authority area.
Water	Water Cycle	To ensure sufficient provision of infrastructure for water supply and wastewater for new development.

Type	Study	Reason
resources	Study	Particularly relevant to intensification of urban development or the development of large strategic sites.
Data collection	Flood incident data	The Council should record flood events including such information as date, location, weather, flood source (if apparent without an investigation), impacts (properties flooded or number of people affected) and response by any RMA. This should be made available in GIS format.
	FRM Asset Register	The LLFA should continue to update and maintain its asset register as per FWMA requirements.
Risk assessment	Asset inspection	The LLFA should carry out condition inspections of critical flood risk management assets (see Section 6.4).
Capacity	SuDS review / guidance	The LLFA and LPA should clearly identify requirements of developers for inclusion of SuDS in new developments. Internal capacity, within the Council should be in place to deal with SuDS applications, set local specifications and set policy for adoption and future maintenance of SuDS.
Partnership	Water companies	The Council should continue to collaborate with water companies on sewer and surface water projects to ensure their assets can remain operational and resilient at all times across the district and that capacity for new development is appropriate.
	EA	The Council should continue to work with the EA on fluvial flood risk management projects. Potential opportunities for joint schemes to tackle flooding from all sources should be identified.
	Community	Continued involvement with the community through existing flood risk partnerships.

Appendices

A Planning Policy Framework and Flood Risk Policy

B Interactive GeoPDF Mapping

C Functional Floodplain Delineation

D Site Screening Assessment

E Site Assessment Summary

F Cumulative Impact Assessment

G Data Sources

H Sequential Test Guidance

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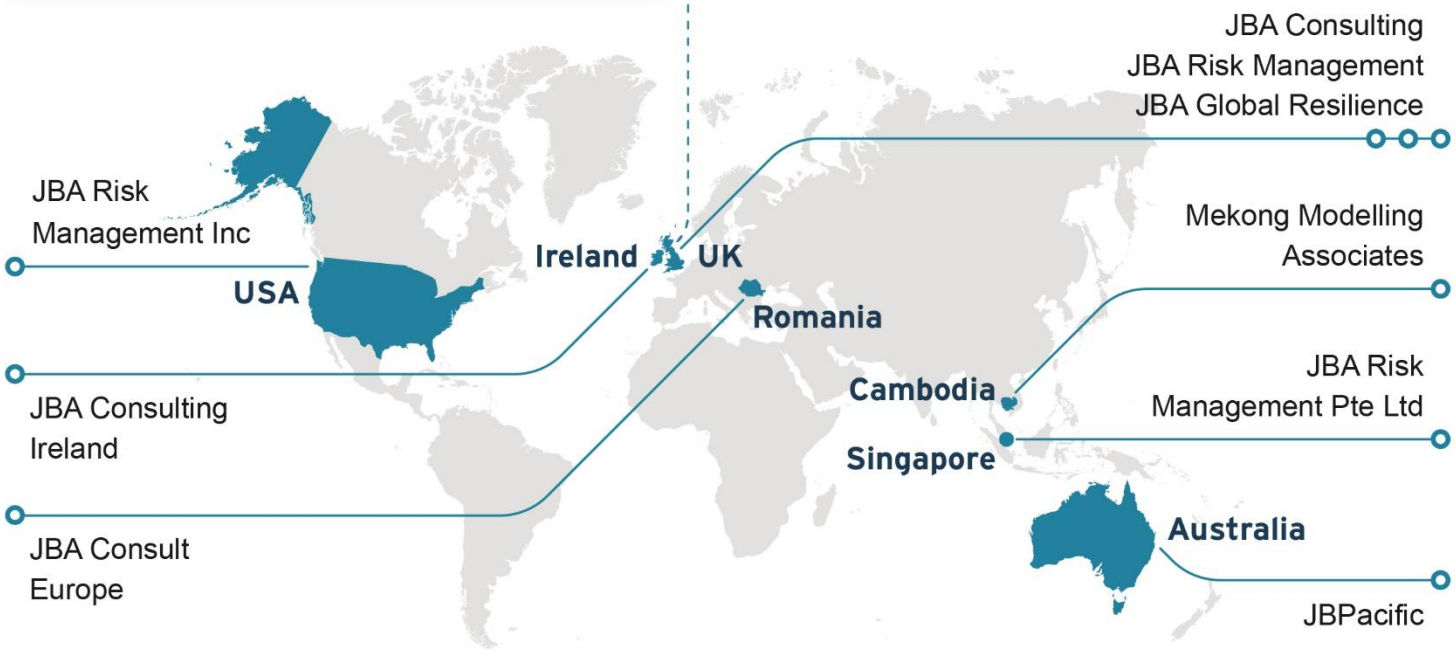

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