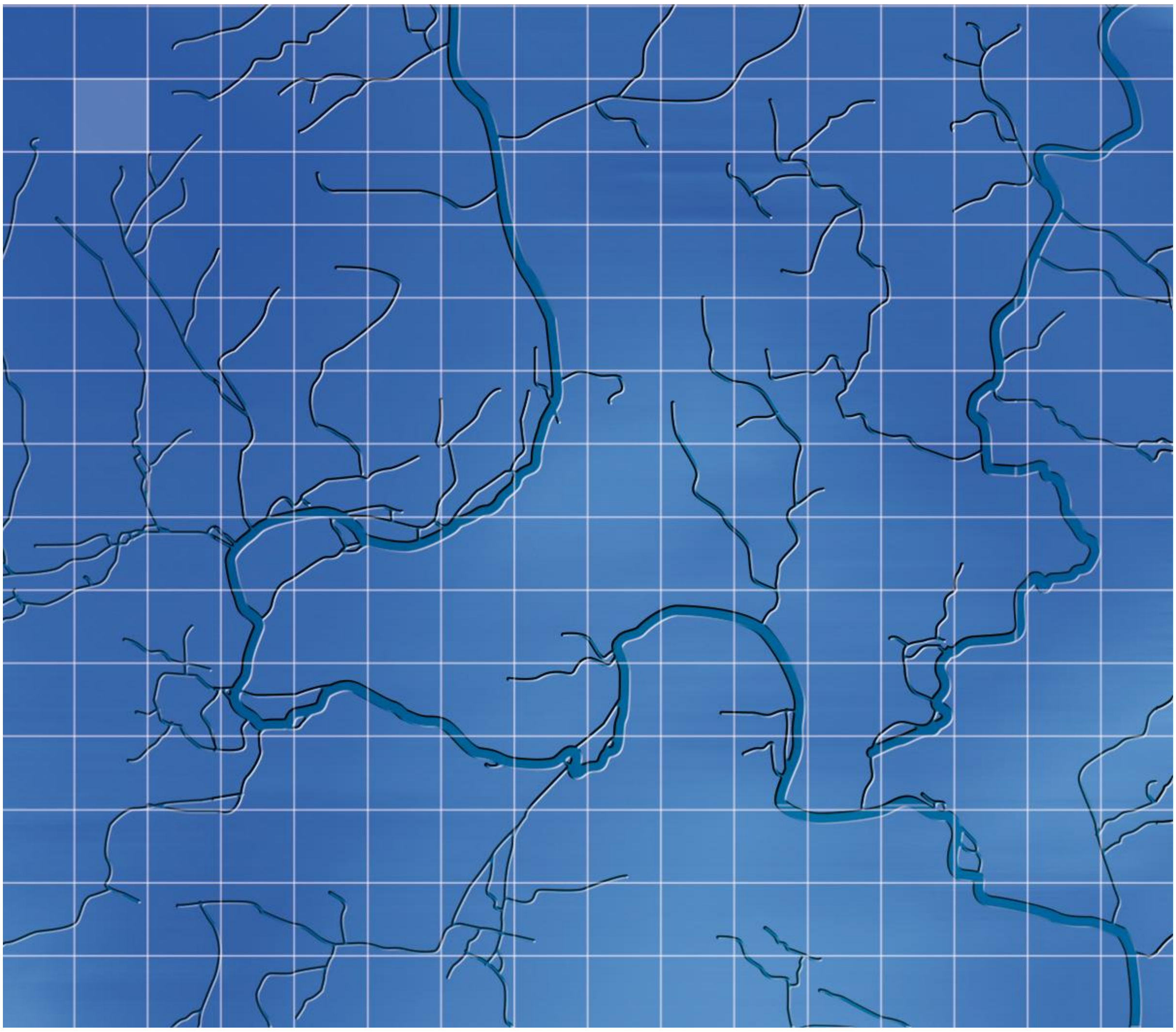
West Oxfordshire District Council

July 2025

West Oxfordshire Level 1 Strategic Flood Risk Assessment



West Oxfordshire District Council

West Oxfordshire Level 1 Strategic Flood Risk Assessment

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Contents

1 Introduction

1.1 Scope of Assessment

Wallingford HydroSolutions (WHS) has been commissioned by West Oxfordshire District Council (WODC) to undertake a Strategic Flood Risk Assessment (SFRA) to identify the extent of flood risk and to inform policies and site selection processes for WODC's Local Plan Review covering the period up to 2041.

The study will identify key flood risk constraints within the development plan area to enable WODC to assess the suitability of future development and inform land use policy with regards to flood risk.

1.2 SFRA Objectives

SFRAs are overarching technical studies that are used to guide development and inform the selection of sites in relation to flood risk.

A major part of this study will be to assess flood risk from all sources which will first involve the collation of available model data, historical information on flooding and details on flood risk management infrastructure. Flood risk will be assessed for the baseline and the future scenario, which will consider the latest climate change guidance.

In this context, we will i) identify and map flood risk from all sources, ii) assess existing and future flood management infrastructure, and iii) outline measures to reduce the causes and impacts of flooding.

This information will enable WODC to make informed decisions on allocating sites for development in the local plan and identify sites where a further level 2 SFRA assessment is required.

Figure 1 shows the main watercourses within the WODC administrative boundary.

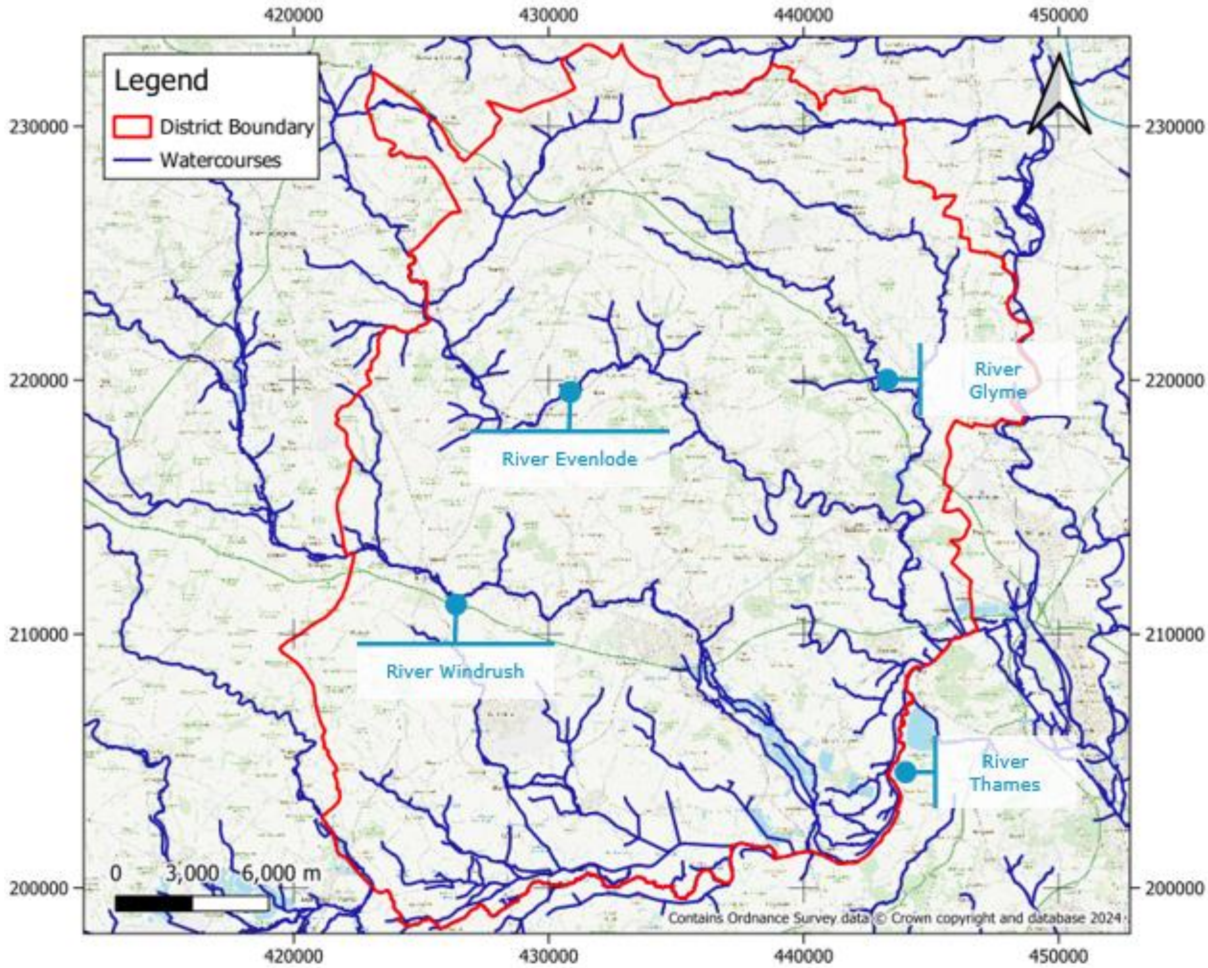

Figure 1- Overview of Study Area

1.3 Overview of National Planning Policy

1.3.1 National Planning Policy Framework (NPPF)

The National Planning Policy Framework (NPPF)[1] sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally prepared plans for housing and other development can be produced. The latest NPPF was revised in December 2024 and replaces the previous NPPF published in December 2023.

In terms of flood risk, NPPF states that a sequential risk-based approach (the sequential test) should be taken for development to ensure that it is directed away from areas at highest risk. Where development is necessary in such areas, an exception test should be applied ensuring development is i) made safe for its lifetime without increasing flood risk elsewhere, and ii) provides wider sustainability benefits to the community (see section 3.2 for more details).

To inform strategic development policies in the context of flood risk, NPPF specifies the requirement for an SFRA that considers flood risk from all sources, the potential impacts of climate change and

[1] Ministry of Housing, Communities & Local Government (2024) *National Planning Policy Framework*, https://assets.publishing.service.gov.uk/media/67aafe8f3b41f783cca46251/NPPF_December_2024.pdf

the effects of development on flood risk. The SFRA should take account of flood risk management policies and provides the basis for application of the sequential test.

1.3.2 NPPF Flood Zones

Flood risk is a function of the probability of a flood occurrence and the direct consequences to the community or a receptor. The NPPF categorises areas within the fluvial floodplain into zones of low, medium and high probability, as shown in Table 1.

Table 1- Flood Zones

Flood Zone	Definition
Flood Zone 1 (Low Probability)	Land having a less than 0.1% annual probability of river or sea flooding.
Flood Zone 2 (Medium Probability)	Land having between a 1% and 0.1% annual probability of river flooding; or land having between a 0.5% and 0.1% annual probability of sea flooding.
Flood Zone 3a (High Probability)	Land having a 1% or greater annual probability of river flooding; or Land having a 0.5% or greater annual probability of sea flooding.
Flood Zone 3b (Functional Floodplain)	This zone comprises land where water from rivers or the sea has to flow or be stored in times of flood. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. Functional floodplain will normally comprise: • land having a 3.3% or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or • land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding).

1.3.3 Planning Practice Guidance- Flood Risk and coastal change

The Planning Practice Guidance (PPG)[2] supports the NPPF. The PPG on flood risk and coastal change was last updated in August 2022 and advises how to take account of and address the risks associated with flooding and coastal change in the planning process. It supports and aligns with the principles espoused by the NPPF but sets out more specific guidance for developers and planners. The main areas covered by the PPG include:

- Taking flood risk into account in preparing plans
- Site-specific flood risk assessments
- The sequential approach & exception test
- The role of the Environment Agency (EA) and Lead Local Flood Authorities (LLFA)
- Addressing residual flood risk
- The flood risk issues raised by minor developments & changes of use

[2] Ministry of Housing, Communities & Local Government (2022) *Flood risk and coastal change*, https://www.gov.uk/guidance/flood-risk-and-coastal-change

- Permitted development rights and flood risk
- Proximity to watercourses and the need for a flood risk activity permit
- Sustainable drainage systems (SuDS)
- Flood resistance and flood resilience
- Planning and development in areas of coastal change
- Flood Zone and flood risk tables

In terms of taking flood risk into account in preparing plans, the document outlines how local planning authorities (LPAs) should use SFRAs to:

- Inform the sustainability appraisal of the Local Plan, so that flood risk is fully taken into account when considering allocation options and in the preparation of plan policies;
- Apply the sequential test and, where necessary, the exception test when determining land use allocations;
- Inform the allocation of land to safeguard it for flood risk management infrastructure;
- Inform policies for change of use and reducing the causes and impacts of flooding;
- Identify the requirements for site-specific flood risk assessments in particular locations, including those at risk from sources other than river and sea flooding;
- Determine the acceptability of flood risk in relation to emergency planning capability;
- Help demonstrate how the adaptation to climate change could be met.

1.3.4 Climate Change

The EA release guidance[3] on how local planning authorities, developers and their agents should use climate change allowances in flood risk assessments. Making allowances for climate change minimises vulnerability and provides resilience to flooding and coastal change.

The climate change allowances are predictions of anticipated change and are provided for:

- Peak river flow
- Peak rainfall intensity
- Sea level rise
- Offshore wind speed and extreme wave height

There are allowances for different climate scenarios over different epochs, or periods of time, over the coming century. For West Oxfordshire the peak river flow and peak rainfall intensity allowances are relevant and are covered in more detail below.

Peak river flow

Peak river flow allowances show the anticipated changes to peak flow by management catchment. Management catchments are sub-catchments of river basin districts. The range of allowances is based on percentiles, as follows.

- Central allowance is based on the 50th percentile
- Higher Central allowance is based on the 70th percentile
- Upper End allowance is based on the 95th percentile

[3] EA (2022), *Flood risk assessments: climate change allowances*, https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

The West Oxfordshire District Council administrative boundary crosses three management catchments in total. As, the Cotswolds catchment applies to the majority of the district, for consistency it has been applied when determining potential climate change impacts for the Level 1 SFRA. For site specific FRA at sites falling within the other management catchments, the allowances for the other districts will need to be considered. The peak river flow allowances for the three management catchments are summarised in Table 2.

Table 2- Peak river flow allowances for West Oxfordshire Management Catchments

Allowance	Total Potential Change (2020s)	Total Potential Change (2050s)	Total Potential Change (2080s)
Cherwell and Ray			
Central	6%	4%	15%
Higher	11%	10%	25%
Upper	24%	27%	49%
Gloucestershire and the Vale			
Central	11%	11%	26%
Higher	17%	19%	41%
Upper	33%	43%	84%
Cotswolds			
Central	11%	13%	30%
Higher	17%	21%	43%
Upper	31%	43%	82%

The guidance states that both the central and higher central allowances should be assessed as part of an SFRA. When applied at a site specific level for the purposes of a flood risk assessment (FRA), the flood risk vulnerability classification as defined in the NPPF should first be used to classify the vulnerability of your development. Subsequently the location of the development with respect to different flood zones should be determined. Following this exercise, the recommended allowances are summarised below:

In flood zones 2 or 3a for:

- essential infrastructure – use the higher central allowance
- highly vulnerable – use central allowance (development should not be permitted in Flood Zone 3a)
- more vulnerable, less vulnerable & water compatible – use the central allowance

In Flood Zone 3b for:

- essential infrastructure – use the higher central allowance
- highly vulnerable, more vulnerable & less vulnerable – development should not be permitted
- water compatible – use the central allowance

The peak river flow allowances should also be applied to development that is currently located in Flood Zone 1 but might be in Flood Zone 2 or 3 in the future.

Peak rainfall

Increased rainfall affects surface water flood risk and the design of drainage systems. Peak rainfall allowances are provided for the central and upper percentile and across two epochs. Once more the allowances are specified for each management catchment. The three management catchments spanning the district have the same central and upper end allowances. These are summarised in Table 3.

Table 3- Peak rainfall allowances applicable to West Oxfordshire

Allowance	Total Potential Change (2050s)	Total Potential Change (2070s)
3.3% Annual Exceedance Probability (AEP)		
Central	20%	25%
Upper	35%	35%
1.0% Annual Exceedance Probability (AEP)		
Central	20%	25%
Upper	40%	40%

In terms of what allowances to apply the guidance is based on the proposed lifetime of the development. For developments with a lifetime beyond 2100, FRAs should assess the upper end allowances. You must do this for both the 1% and 3.3% annual exceedance probability (AEP) events for the 2070s epoch (2061 to 2125).

For development with a lifetime between 2061 and 2100 take the same approach but use the central allowance for the 2070s epoch (2061 to 2125).

For development with a lifetime up to 2060, take the same approach but use the central allowance for the 2050s epoch (2022 to 2060).

1.3.5 Flood and Water Management Act 2010

The Flood and Water Management Act (FWMA) (2010)[4], sets out legislation on the management of risks in connection with flooding and coastal erosion for the United Kingdom. It highlights the need for an effective flood risk strategy, which must be developed, maintained, applied, and monitored regularly to adequately manage flood risk.

It gives a new responsibility to the EA for developing a National Flood and Coastal Risk Management Strategy, and gives a new responsibility to local authorities (LAs), as LLFAs, to co-ordinate flood risk management in their area.

Duties for the LLFA include being the statutory consultee for ordinary watercourses, investigating significant flooding incidents (typically defined as five or more properties), maintaining a register of designated flood assets and provision of information.

1.3.6 National Flood and Coastal Erosion Risk Management Strategy for England

The Flood and Water Management Act 2010 sets out how the EA must develop, maintain and apply a National Strategy for Flood and Coastal Erosion Risk Management (FCERM) in England.

The most recent strategy was published in July 2020[5]. The strategy sets out how the EA will manage the risks from flooding and coastal erosion across England. It clarifies roles and responsibilities before

[4] UK Parliament (2010) *Flood and Water Management Act*, https://www.legislation.gov.uk/ukpga/2010/29/contents

[5] EA (2020) *National Strategy for Flood and Coastal Erosion Risk Management*, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/920944/023_15482_Environment_agency_digitalAW_Strategy.pdf

setting out the policies and direction for all England's Flood Risk Management Authorities to follow, with measures to explain how targets will be achieved. The strategy highlights the importance of climate resilience in the development of future infrastructure.

1.3.7 Non-statutory guidance for SuDS

The non-statutory guidance[6] for SuDS published by DeFRA (2015), sets out the technical Standards for SuDS systems in England. For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year and 1 in 100-year rainfall event should never exceed the peak greenfield runoff rate for the same event. For developments which were previously developed, the peak runoff rate from the development must be as close as reasonably practicable to the equivalent greenfield runoff rate over the same area; never exceeding the rate of discharge from the development prior to redevelopment for any event.

1.3.8 Overview of Local Guidance and Past Studies

A wide range of local planning documents developed by Oxfordshire County Council exist related to flood risk and surface water management.

As the LLFA, Oxfordshire County Council is responsible for flooding from surface water, groundwater and ordinary watercourses, as well as developing a Local Flood Risk Management Strategy[7]. The strategy sets a long-term programme for the reduction of flood risk, establishes how to identify areas where flood risk management will achieve multiple benefits and seeks to facilitate greater engagement with the community. The strategy is due for review and an update in the near future.

The LLFA also sets out local standards and guidance[8] on SuDS and drainage requirements within the county which makes reference to the FWMA. Major developments within Oxfordshire should meet these standards.

Existing planning policy in West Oxfordshire includes the Local Plan 2011-2031[9], which is to be superseded by the West Oxfordshire Local plan 2041. The Local plan 2011-2031 has provided a framework for the development of new homes, jobs, community facilities and infrastructure within the district up to 2031. It was supported by a Level 1 SFRA completed in 2016. The plan sets out a specific policy for the management of flood risk.

Policy EH7: Flood risk will be managed using the sequential, risk-based approach, set out in the National Planning Policy Framework, of avoiding flood risk to people and property where possible and managing any residual risk (taking account of the impacts of climate change).

[6] Department for Environmental, Food and Rural Affairs (2015) *Sustainable Drainage Systems Non-statutory technical standards for sustainable drainage systems*, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/415773/sustainable-drainage-technical-standards.pdf
[7] Local Flood Risk Management Strategy. OCC. 2015 Available from: https://www.oxfordshirefloodtoolkit.com/wp-content/uploads/2016/04/OxfordshireFloodRiskManagementStrategy.pdf
[8] Local Standards and Guidance for Surface Water Drainage on Major Development in Oxfordshire, OCC. 2021. Available from: https://www.oxfordshirefloodtoolkit.com/wp-content/uploads/2022/01/LOCAL-STANDARDS-AND-GUIDANCE-FOR-SURFACE-WATER-DRAINAGE-ON-MAJOR-DEVELOPMENT-IN-OXFORDSHIRE-Jan-22-2.pdf
[9] West Oxfordshire District Council (2018) *West Oxfordshire Local Plan 2031.* Available from: https://www.westoxon.gov.uk/media/feyjmpen/local-plan.pdf

West Oxfordshire also falls within the Thames catchment so is subject to the Thames Catchment Flood Management Plan[10] (CFMPs) developed by the EA in 2009. The CFMP seeks to establish the scale and extent of flooding now and in the future and sets policies for managing flood risk within the catchment. It should be used to inform planning and decision making by LAs.

1.4 Data Sources

To inform the assessment of flood risk, existing information and model data have been identified and collated for different sources of flooding. Any recent and relevant studies on flood risk within the study area have also been incorporated into the SFRA, along with details on flood defences and flood management schemes. This information and the available model data have been used to assess flood risk across the study area as well as at each of the preferred sites. Detailed flood maps utilising the latest GIS software have also been created. The main sources of data to inform this SFRA include:

- EA Fluvial Flood Maps[11] [12] [13]– to quantify fluvial flood risk where detailed model data are not available. This includes the existing fluvial flood maps and the NAFRA2 outputs to be released formally in March 2025.
- EA Surface Water Flood Maps[14] [15] – to quantify the pluvial flood risk and flood risk from ordinary watercourses where appropriate. This includes the existing surface water flood maps and the NAFRA2 outputs to be released formally in March 2025.
- EA Reservoir Flood Mapping[16] – to quantify the risk of reservoir flooding
- EA Historical Flood Map[17] and Recorded Flood Outlines[18] – to review historical flood events
- Hydraulic modelling data from the Chil Brook (2014) model[19]
- Hydraulic modelling data from the Clanfield Brook (2007) model[20]
- Hydraulic modelling data from the Evenlode Wychwoods (2013) model[21]
- Hydraulic modelling data from the Hailey Road Drain (Witney) (2014) model[22]
- Hydraulic modelling data from the Thames (MRL to St Johns) (2014) model[23]
- Hydraulic modelling data from the Thames (Shifford to Eynsham & Windrush A40 to Thames Confluence) (2011) model[24]

[10] EA (2009) *Thames Catchment Flood Management Plan* https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/293903/Thames_Catchment_Flood_Management_Plan.pdf
[11] EA (2023) *Flood Map for Planning (Rivers and Sea) – Flood Zone 2* https://www.data.gov.uk/dataset/cf494c44-05cd-4060-a029-35937970c9c6/flood-map-for-planning-rivers-and-sea-flood-zone-2
[12] EA (2023) *Flood Map for Planning (Rivers and Sea) – Flood Zone 3* https://www.data.gov.uk/dataset/cf494c44-05cd-4060-a029-35937970c9c6/flood-map-for-planning-rivers-and-sea-flood-zone-3
[13] EA (2025) *Risk of Flooding from Rivers and Sea https://environment.data.gov.uk/dataset/96ab4342-82c1-4095-87f1-0082e8d84ef1*
[14] EA (2023) *Risk of surface water flooding* https://environment.data.gov.uk/DefraDataDownload/?Mode=rofsw
[15] EA (2025) *Risk of Flooding from Surface Water https://environment.data.gov.uk/dataset/b5aaa28d-6eb9-460e-8d6f-43caa71fbe0e*
[16] EA (2025) *Risk of Flooding from Reservoirs - Maximum Flood Extent* https://www.data.gov.uk/dataset/44b9df6e-c1d4-40e9-98eb-bb3698ecb076/risk-of-flooding-from-reservoirs-maximum-flood-extent-web-mapping-service
[17] EA (2025) *Recorded Flood Outlines,* https://www.data.gov.uk/dataset/16e32c53-35a6-4d54-a111-ca09031eaaaf/recorded-flood-outlines
[18] EA (2025) *Historic Flood Map,* https://www.data.gov.uk/dataset/76292bec-7d8b-43e8-9c98-02734fd89c81/historic-flood-map
[19] EA (2014) *Chil Brook Products 5-7*
[20] EA (2007) *Clanfield Brook Products 5-7*
[21] EA (2013) *Evenlode Wychwoods Products 5-7*
[22] EA (2014) *Hailey Road Drain (Witney) Products 5-7*
[23] EA (2014) *Thames (MRL to St Johns) Products 5-7*
[24] EA (2011) *Thames (Shifford to Eynsham & Windrush A40 to Thames Confluence) Products 5-7*

- Hydraulic modelling data from the Thames (St Johns to Shifford) (2011) model[25]
- Hydraulic modelling data from the Windrush (Worsham to A40) (2014) model[26]
- Flooding incident data provided by LLFA – to provide information on local and historical flooding from surface water flooding across the study area
- EA flood defence structures[27] – to assess existing formal and informal flood defences present
- British Geological Survey (BGS) geoviewer[28] – To determine local bedrock and its expected permeability informing assessment of groundwater flood risk
- Soilscapes map[29] – To determine local soil and its expected permeability informing assessment of groundwater flood risk
- Thames Water sewer flooding data[30] – to determine risk of sewer flooding based on incidences of sewer flooding
- Previous flood risk studies previously completed by WODC and the LLFA (see section 1.3.8)

1.5 Limitations & Assumptions

1.5.1 Age and Extent of Modelling Data

The EA regularly review and update the Flood Map, with any amendments to the Flood Zone mapping being informed by more detailed information as and when it becomes available. This can either be because of more detailed hydraulic modelling carried out by the EA and/or external parties; or recorded flood extents following a flood event. Furthermore, real-world upgrades to flood defence infrastructure will also alter the degree of flood risk in a particular area. In this regard, the SFRA is a snapshot of flood risk based on data available at the time of publication, with the conclusions on flood risk presented subject to change in accordance with any updates to the EA Flood Map and existing flood defence infrastructure.

Detailed modelling data is available for the River Thames throughout West Oxfordshire, and the rivers Evenlode and Windrush where they flow through urban areas in the district.

However, there are many watercourses which are not included in the detailed hydraulic models available. The flood extents for these watercourses are likely to be based on JFLOW mapping. JFLOW is appropriate for a strategic assessment of flood risk, however it is generally not advised for site-specific purposes. It should be noted that the EA is currently updating its national generalised modelling (NAFRA2), which will effectively replace JFLOW in areas where detailed modelling is not available. The outputs of this modelling are available and have been used in this study in combination with the existing flood map data. The NAFRA2 data is due to be formally released in late March 2025.

1.5.2 Assessing the impacts of Climate Change

As part of SFRAs, LPAs should assess and map the effects of climate change on flood risk to identify areas where flood risk will increase and ensure that future development is sustainable.

The modelling results predate the latest climate change allowances for the Cotswolds management catchment. The Thames and Windrush models apply the old allowances for the Thames River Basin

[25] EA (2011) *Thames (St Johns to Shifford) Products 5-7*
[26] EA (2014) *Windrush (Worsham to A40) Products 5-7*
[27] EA (2025) AIMS Spatial Flood Defences (inc. standardised attributes) https://www.data.gov.uk/dataset/cc76738e-fc17-49f9-a216-977c61858dda/aims-spatial-flood-defences-inc-standardised-attributes
[28] BGS (2025) *BGS Geology Viewer*, https://geologyviewer.bgs.ac.uk/
[29] Cranfield Soil and Agrifood Institute (2025) *Soilscapes map*, http://www.landis.org.uk/soilscapes/
[30] Thames Water (2023) Sewer flooding data for Oxfordshire *Oxfordshire CC SFHD data_Mar23.xlxs*

of 15%, 25%, 35% and 70% for the 1.0% AEP event. The Chil Brook, Clanfield Brook, Evenlode Wychwoods, and Hailey Road Drain models use a blanket allowance of 20%.

All modelled reaches within West Oxfordshire are either mostly or entirely within the Cotswolds management catchment. The central and higher allowances are 30% and 43% respectively.

For the Thames and Windrush models, the 35% allowance has been used as a proxy for the 30% central allowance, and the 70% allowance has been used as a conservative proxy for the higher central 43% allowance.

For the River Evenlode, Chil Brook, and Clanfield Brook, the blanket 20% allowance has been used as a proxy for the 30% central allowance. As there are no higher climate change allowance runs available for these models, the 0.1% AEP scenario has been used as a proxy for the higher central 43% allowance.

Where detailed modelling data is unavailable, the Flood Zone 2 extent shown in the EA's fluvial flood map is used to assess the impact of climate change in general.

The approach outlined above is suitable for the purposes of a level 1 SFRA. However, where detailed modelled outcomes for new climate change scenarios are unavailable for sites at risk of fluvial flooding, further detailed modelling will need to be undertaken to refine the assessment of the latest allowances. This should be carried out as part of a site-specific FRA.

2 Summary of Flood Risk in West Oxfordshire

2.1 Review of Flooding Sources

The following sections provide a detailed summary of baseline flood risk from all relevant sources across the West Oxfordshire District. They identify where flood risk is most significant and is likely to pose a risk to people or property. Where data is available, the future scenario considering the impacts of climate change is also considered. A series of supporting GIS maps offer a visual representation of the risks outlined and are provided in Appendix 1-8 of this report.

The assessment of flood risk has been based on the collation of available model data, historical information on flooding and details on flood risk management infrastructure.

2.1.1 Fluvial Flood Risk

The risk of fluvial flooding has been assessed using the mapped flood extents throughout West Oxfordshire, as shown by existing hydraulic modelling data and the EA's Fluvial Flood Map. Flood risk from the main rivers running across the district is summarised below. Larger watercourses are usually designated as main rivers. The EA carries out maintenance, improvement or construction work on main rivers to manage flood risk.

River Thames

The predicted EA Flood Zone 2 and 3 extents for the River Thames within West Oxfordshire appear to be largely informed by the Thames (Shifford to Eynsham & Windrush A40 to Thames Confluence) 2011 and the Thames (St Johns to Shifford) 2011 model. The Chil Brook and Clanfield Brook tributaries also have associated models (Chil Brook 2014 and Clanfield Brook 2007) that inform the EA flood zones in their respective areas.

The River Thames flows eastwards following the southern boundary of West Oxfordshire, flowing into the district near the village of Kelmscott before flowing out southeast of Cassington. The River Thames is adjoined by many tributaries that confluence with the main channel. The most notable of these are the rivers Windrush and Evenlode which confluence with the Thames south of Standlake and Cassington respectively.

The flood zones associated with the River Thames in West Oxfordshire covers up to 2 km of land north of the river channel in some places. Therefore, some small settlements are located mostly or entirely within Flood Zones 2 and 3. Notably these include the villages and hamlets of Kelmscott, Radcot, Chimney, Moreton, and Northmoor.

Kelmscott is the first settlement along the River Thames within West Oxfordshire. All properties south of the main road running west to east in the village (unnamed road) are within Flood Zone 2. Some properties close to drainage channels are also within Flood Zone 3.

All properties within the hamlets of Radcot, Chimney, and Moreton are within Flood Zone 2. However, only Moreton and Radcot are covered by areas of Flood Zone 3, with more properties affected in Radcot.

The village of Northmoor is close to the confluence of the Rivers Windrush and Thames. Due to this, Flood Zone 2 has a maximum width of over 2.5 km on the left bank of the Thames close to the village. Despite this, the centre of the village along Church Rd is not located within either Flood Zone 2 or 3.

River Windrush

The predicted EA Flood Zone 2 and 3 extents for the River Windush downstream of Worsham appear to be largely informed by the Thames (Shifford to Eynsham & Windrush A40 to Thames Confluence) 2011 and Windrush (Worsham to A40) 2014 models. An additional model, Hailey Road Drain (Witney) 2013, also contributes to the flood zone extents along and adjacent to Hailey Rd, Witney.

The River Windrush flows south eastwards through West Oxfordshire, flowing into the district west of Burford and joining the River Thames at their confluence south of Standlake. Between Witney and Standlake, the River Windrush bifurcates into two channels. Between and around these channels are a number of brooks and manmade lakes.

The small town of Burford is the most upstream place along the River Windrush within the West Oxfordshire District. A small number of properties in the north of the town are within fluvial Flood Zone 2 and 3. However, the buildings within Flood Zone 3 are those directly adjacent to the watercourse.

Witney is the largest town along the reach of the River Windrush within West Oxfordshire. The river flows through the centre of the town from north to south. The buildings located within Flood Zone 3 due to the River Windrush are mostly located along or adjacent to Bridge Street. Additionally, some properties on Church Ln and Eastfield Rd are within Flood Zone 3 due to Madley Brook and Hailey Rd Drain respectively. Other properties at risk and located within Flood Zone 2 are on or close to Mill St, High St, Welch Way, and Cogges Hill Rd.

Standlake is located just upstream of the rejoining of the River Windrush channels. The majority of the town is outside of both Flood Zone 2 and 3, however properties along Rack End are within Flood Zone 2 due to their close proximity to the river channel.

River Evenlode

Only one detailed model is available along the River Evenlode. The Evenlode Wychwoods 2013 model covers the stretch of the River Evenlode and its tributaries that affects the towns of Milton-under-Wychwood, Shipton-under-Wychwood, and Ascott-under-Wychwood.

The River Evenlode flows eastwards through West Oxfordshire, flowing into the district southeast of Bledington and joining the River Thames at their confluence south of Cassington. Between the villages of Hanborough and Bladon, the River Glyme joins the River Evenlode.

Approximately 10-20 properties within Shipton-under-Wychwood are within either Flood Zone 2 or 3, with most of these on or close to Station Rd. A greater number of properties within Ascott-under-Wychwood are within the Flood Zone 2 flood risk extent. These properties are mostly south of the rail line along Shipton Rd, London Ln, The Green, and High St.

River Glyme

The flood zones associated with the River Glyme are relatively small and its route does not flow through many urban areas. As such, very few properties are located within the River Glyme flood zones. Approximately 5 or fewer properties within the village of Cleveley are located within the Flood Zone 3 extent of the River Glyme. These properties are adjacent to the river channel.

River Dorn

Similarly to the River Glyme, the flood zones of the River Dorn are relatively small. However, the river does run through the south of Middle Barton, though only approximately 3 properties are located within either Flood Zone 2 or 3.

Clanfield Brook

The predicted fluvial Flood Zone 2 and 3 flood extents associated with Clanfield Brook appear to be largely informed by the Clanfield Brook (2007) model. Clanfield Brook flows from north to south through the centre of the village of Clanfield. Within the village, approximately five properties are at least partially located within Flood Zone 3, all located along Main St/Bourton Rd. Additional properties located on The Green and Main St are within Flood Zone 2.

Chil Brook

The fluvial flood zones associated with Chil Brook appear to be largely informed by the Chil Brook (2014) model.

Chil Brook flows from northwest to southeast through the hamlet of Barnard Gate. Approximately 5-10 properties in the hamlet are located within both Flood Zone 2 and 3.

The modelled extent also show approximately 5-10 properties south of Eynsham to be located within Flood Zone 2 with three properties also partially within Flood Zone 3.

2.1.2 Climate change

This section provides a summary of potential impacts of climate change on fluvial flood risk based on the modelling data available.

River Thames

When considering the central allowance for the 1.0% AEP event (35% proxy in absence of a 30% design run), the flood risk extent increases to cover most properties within the village of Kelmscott. Other significant increases in flood extent generally occur on agricultural land northwest of Chimney, south of Brighthampton, northwest of Northmoor, north of Sutton, and east of Eynsham.

For the higher central allowance (here the much greater 70% is used as a proxy in absence of a 43% design run), increases in flood extents generally followed where there were increases during the 35% scenario. However, a large increase in the extent of the flood risk area associated with the Thames confluences between Standlake and Stanton Harcourt occurs north of Northmoor. This extent generally covers agricultural land but also impact some properties in Northmoor along Church Rd.

River Windrush

When considering the central allowance for the 1.0% AEP event (35% proxy in absence of a 30% design run), a significant increase in the predicted flood extent is seen in Witney. A new extent is predicted along Welch Way, High St, Queen Emma's Dyke, and Gordon Way, connecting the River Windrush to the small watercourse Emma's Dyke. This extent covers many residential and commercial properties as well as Witney Community Hospital. Additional flood extent increases are also predicted to effect properties on and around Bridge St and Witain Way. Furthermore, the most western properties in the Witney suburb of Cogges are predicted to be within the increased flood risk extent. South of the A40, large increases in flood risk extent are also observed, however this mainly affects agricultural land. In Standlake, some additional properties and businesses are within the increased extent, notably along Rack End, and within Lincoln Farm Park (Holiday Centre) and The Mulberry Bush School.

For the higher central allowance (here the much greater 70% is used as a proxy in absence of a 43% design run), much smaller increases in Witney are predicted. However, south of Witney, larger increases in extent are predicted across agricultural land east of Ducklington and Standlake.

River Evenlode

When considering the central allowance for the 1.0% AEP event (20% proxy in absence of a 30% design run), a significant increase in extent is predicted to occur south of the rail line in Ascott-under-Wychwood. This extent affects a number of properties on Shipton Rd and London Ln as well as a large area of agricultural land north of High St.

For the higher central allowance (0.1% scenario used as a proxy in absence of a 43% design run), the size of the flood extent south of the rail line increases to cover additional properties on Shipton Rd, Church View, The Green, London Ln, and High St. Increases in flood extent are also estimated across the rest of the modelled reach of the River Evenlode and Littlestock Brook, impacting properties on Littlebrook Meadow and Station Rd in Shipton-under-Wychwood, and Church Meadow in Milton-under-Wychwood.

Clanfield Brook

Clanfield Brook flows alongside Main St within the village of Clanfield. When considering climate change effects for the Clanfield Brook 2017 model undefended scenario, the 0.1% AEP extent was used as a proxy for climate change uplift on the 1% AEP extent. This is because the 1% AEP + CC scenario extents were unavailable.

The extent of flood risk associated with Clanfield Brook predominantly increased in the north and south of the village. South of Calcroft Ln and west of Bourton Rd, the flood risk extent increased but did not include any additional properties.

In the south of the village, the flood risk extent increased to cover the properties along Main St between Tidworth Row and High House Close. Further properties are included in the extent to the east of Main Street along The Green. This extent continues south to cover a large area of agricultural land east of Main St.

Chil Brook

Chil Brook flows eastwards south of Eynsham, adjoining Limb Brook and eventually the River Thames north of Swinford. When considering the central allowance for the 1.0% AEP event (20% proxy in absence of a 30% design run), there are generally only minor increases to flood extent. Most areas of increases occur after confluences between Chil Brook and other small watercourses, across areas of agricultural land southeast of Eynsham.

For the higher central allowance (0.1% scenario used as a proxy in absence of a 43% design run), an additional area north of Oxford Rd is included within the flood extent. This flood risk affects the playing field adjacent to this road, as well as Hazeldine Close north of this field. The predicted extent shows the potential for one to two properties along Hazeldine Close to be at flood risk during this scenario.

Maps showing the extent of the flood outlines for the fluvial flood maps in West Oxfordshire are provided in Appendix 1.

2.1.3 Surface Water Flooding

Surface water flooding is often the result of high peak rainfall intensities, and/or insufficient capacity in the sewer network. Surface water flooding is a significant flood risk in urban areas due to the high proportion of impermeable surfaces, which cause a significant increase in runoff rates and consequently the volume of water that flows into the sewer network.

Although managing the risk of flooding from surface water is the responsibility of LLFAs, the EA have produced the updated Flood Map for Surface Water (uFMfSW) under their strategic role in England.

This combines the EA's nationally produced surface water flood mapping and appropriate locally produced maps from LLFAs. The EA have recently published the Risk of Flooding from Surface Water map that includes outputs from NaFRA2[15]. This map is intended to be the best single source of information on surface water flooding, incorporating the latest EA modelling techniques and local data. It is used herein to describe surface water flooding across the district. Mapped outputs are provided for both the uFMfSW and NaFRA2.

The NaFRA2 surface water flood map show areas of High Risk, which relates to land estimated to flood in a 3.3% AEP or greater pluvial event, Medium Risk, which relates to land estimated to flood in a 3.3% - 1.0% AEP pluvial event, and Low Risk, which relates to land estimated to flood in a less than 1% AEP pluvial event.

The maps are currently based on a number of assumptions and only indicate where surface water flooding would occur as a result of local rainfall. Caution should be exercised when reviewing the maps as it may show an over or under-estimation of the surface water flood risk in certain areas. Furthermore, due to the modelling techniques used, the mapping picks out depressions in the ground surface and simulates some flow along natural drainage channels and smaller rivers (a drainage sump in the latest NAFRA2 mapping removes this for main rivers). Where this is the case, the dominant flooding mechanism is considered to be fluvial, and these areas are therefore ignored in the assessment of surface water flooding throughout West Oxfordshire.

Based on the assumptions and limitations listed above the maps should only be used at the strategic planning level. To further assess surface water flood risk Oxfordshire County Council's flood incident dataset has also been used to identify any recent (since 2007) recorded incidents of flooding from events which were pluvial in origin. In this regard, the analysis has sought to combine both data sources to identify areas at significant risk of surface water flooding; particularly where historical incidents corroborate flooding shown by the mapping. The at-risk areas are summarised below:

- **Witney** - There is a high risk of surface water flooding along several roads in Witney including Welch Way, Moorland Rd, High St, Woodford Way, Queen Emmas Dyke, Thorney Leys, Hailey Rd, and Eastfield Rd. Two recent surface water incidents have been recorded in Witney off Woodford Way and Eastfield Rd, both in 2020.
- **Chipping Norton** - There is a high risk of surface water flooding along several roads in Chipping Norton including London Rd, Banbury Rd, and Station Rd. There have been no recent recorded surface water incidents in Chipping Norton.
- **Kingham** - There is a high risk of surface water flooding along several roads in Kingham including Church St, Cozens Lane, Station Rd, and West St. There have been no recent recorded surface water incidents in Kingham.
- **Milton-under-Wychwood** - There is a high risk of surface water flooding along several roads in Milton-under-Wychwood including Frog Ln, High St, Ansell Way, and Green Ln. There have been no recent recorded surface water incidents in Milton-under-Wychwood.
- **Shipton-under-Wychwood** – There is a high risk of surface water flooding along several roads in Shipton-under-Wychwood including Station Rd, and Mawles Ln. There have been no recent recorded surface water incidents in Shipton-under-Wychwood.
- **Eynsham** - There is a high risk of surface water flooding along several roads in Eynsham including Oxford Rd, Queen St, Newland St, Beech Rd, Mill St, Acre End St, Swan St, and Merton Court. There have been no recent recorded surface water incidents in Eynsham.

- **Middle Barton** – There is a high risk of surface water flooding along two roads in Middle Baton, Kiddington Rd, and Holliers Cresent. Two recent surface water incidents have been recorded in Middle Barton off Kiddington Rd and Church Ln, both in 2020.
- **Carterton** - There is a high risk of surface water flooding along several roads in Carterton including Brize Norton Rd, Halton Rd, Wycombe Way, Norton Way and Upavon Way. There have been no recent recorded surface water incidents in Carterton.
- **Tackley** - There is a high risk of surface water flooding along several roads in Tackley including Nerthercote Rd, Medcroft Rd, St Johns Rd, Harbourne Rd, and Rousham Rd. There have been no recent recorded surface water incidents in Tackley.

Maps showing the extent of the flood outlines for the surface water flood maps in West Oxfordshire are provided in Appendix 2.

2.1.4 Ordinary Watercourses

Ordinary watercourses include every river, stream, ditch, drain, cut, dyke, surface water sewer (other than public sewers) and passage through which water flows, above ground or culverted, which is not designated as a main river.

To assess flood risk from these watercourses, the updated EA NaFRA2 Risk of Flooding from Rivers and Sea[13], and Risk of Flooding from Surface Water maps were used. The main ordinary watercourses and the flood risk associated with each are summarised below. Maps showing the main rivers and ordinary watercourses across West Oxfordshire are provided in Appendix 3.

- **Littlestock Brook:** Multiple streams rise west of Milton-under-Wychwood and join with Littlestock Brook. The largest of these is The Liffs which confluences with Littlestock Brook at NGR: 427434, 218444. Littlestock Brook joins the River Evenlode at NGR: 428097, 218480. The most recent Risk of Flooding from Rivers and Sea map shows multiple properties in the north of Milton-under-Wychwood to be at high (≥ 3.3% AEP) and medium risk (1% - 3.3% AEP) from Littlestock Brook. The Risk of Flooding from Surface Water map shows negligible risk to property for the upper sections/tributaries of the brook.
- **Madley Brook:** Madley Brook rises northeast of Witney and joins with the River Windrush at NGR: 436056, 209716. The most recent Risk of Flooding from Rivers and Sea map shows multiple properties in the northeast of Witney to be at medium risk (1% - 3.3% AEP) of fluvial flooding from Madley Brook. The Risk of Flooding from Surface Water map shows negligible risk to property for the upper sections/tributaries of the brook.
- **Colwell Brook:** Colwell Brook rises in the west of Witney and joins Emma's Dyke at NGR: 435482, 208595. The most recent Risk of Flooding from Rivers and Sea map shows a small number of properties in the west of Witney to be at high (≥ 3.3% AEP) risk of fluvial flooding from Colwell Brook.
- **Trot's Brook:** Trot's Brook rises south of Shipton-under-Wychwood and joins with the River Evenlode at NGR: 428069, 218002. The most recent Risk of Flooding from Surface Water map shows a small number of properties in the southeast of Shipton-under-Wychwood to be at high risk (1% - 3.3% AEP) of flooding from Trot's Brook.

2.1.5 Groundwater Flooding

Groundwater flooding is defined as the emergence of groundwater at ground level. There are limited local data with respect to groundwater flooding. However, for a strategic level assessment of the potential for groundwater flooding, the BGS UK Geoviewer has been used to determine the bedrock across the study area, with the Landis Soilscapes map used to determine the soils present.

BGS mapping shows the district is underlain by a variety of sedimentary bedrock types. The south of the district is generally underlain by mudstones in the form of the Oxford Clay and West Walton formations. The centre and east of the district are generally underlain by limestone in the form of the Forest Marble Limestone, White Limestone, and Cornbrash Limestone formations. The north of the district is underlain by a mixture of sedimentary rocks with the White Limestone, Charmouth Mudstone, and Chipping Norton Limestone formations present. These bedrocks range in permeability with mudstone being relatively impermeable and limestone being relatively permeable. More permeable bedrock increases the risk of groundwater flooding as it allows the water table to be more mobile.

Based on soilscapes mapping, the area of the district within the floodplains of the Thames and Windrush, have generally loamy and clayey floodplain soils with naturally high groundwater.. A wider area around the River Thames also has loamy soils with naturally high groundwater. Where this is the case groundwater flood risk is considered to be high.

In southern areas of the district outside of the floodplain including the villages of Eynsham, Standlake, Aston, Bampton, Clanfield and Langford, soils are freely draining and lime rich. The northeast of the district is also overlain by freely draining lime-rich loamy soils. This includes the villages of Tackley, Wooton, Glympton, and Middle Barton. In these locations groundwater flood risk is likely to be moderate given the mobile water table in such soils.

The soils overlying much of the centre and west of the district are shallow lime-rich soils. This is again expected to be freely draining allowing for a mobile water table which again poses a moderate groundwater flood risk. This soil type occurs at least partially in the towns of Carterton, Witney, Burford, Charlbury, Woodstock, and Chipping Norton.

In the northwest of the district, soils tend to be slowly permeable loamy and clayey soils. Here drainage is likely to be more impeded, so groundwater flooding is likely less of a risk.

Maps showing the bedrock and soils across West Oxfordshire are provided in Appendix 4.

2.1.6 Sewer Flooding

Sewer flooding often occurs because of an existing drainage system having insufficient capacity to drain rainfall, consequently causing the release of water at manholes. Sewer flooding can also occur should there be a fault/failure at an existing drainage system.

The responsible authority for sewer flooding across the majority of the study area is Thames Water (TW). TW was contacted to gather available data on sewer flooding. A total of 184 historic records of sewer flooding have been recorded by TW within the district since records began. It should be noted that Severn Trent Water is the wastewater sewerage undertaker for a very small area in the north of the district, however this area still falls within TW water supply area.

The historic records are somewhat dependent on reporting and are given for a point location. In this regard, caution should be exercised when ascribing a sewer flood risk to a particular area.

A summary of the spatial distribution of incidents of sewer flooding by post code area is summarised in Table 4. This shows the area around Carterton, Burford, and Bampton to have the most incidents. Please note, that some of the post code areas cross the district boundary so may include events in neighbouring authorities.

Table 4 - Sewer Flooding Incidents by Post code area

Post Code	Settlements	External Flooding	Internal Flooding	Total
OX15	Hook Norton, Bloxham, Deddington, and Winderton	1	0	1
OX18	Carterton, Bampton, Aston, Clanfield, Bradwell, Burford, Windrush, Taynton, Swinbrook, and Westwell	80	6	86
OX20	Woodstock, Wootton, Woodleys, and Over Kiddlington	1	1	2
OX28	Witney	14	5	19
OX29	Minster Lovell, Ducklington, Leafield, North Leigh, Long Hanborough, Freeland, Stonesfield, Cassington, Eynsham, Stanton Harcourt, Brighthampton, Standlake, and Northmoor	34	17	51
OX7	Ascott-under-Wychwood, Finstock, Charlbury, Chipping Norton, Middle Barton, Enstone, Chadlington, Shipton-under-Wychwood, Milton-under-Wychwood, and Lyneham	20	5	25
Total		**150**	**34**	**184**

* Please note, that post code area crosses the district boundary so may include events in neighbouring authorities.

2.1.7 Reservoir Flooding

In 2021 the EA published updated maps showing the flood risk associated with reservoirs. Dam breach and flood modelling techniques were used to produce a new national set of reservoir flood maps for England. The maps show two flooding scenarios, including a 'dry-day' and a 'wet-day'. The 'dry-day' scenario predicts the flooding that would occur if the dam or reservoir failed when rivers are at normal levels. The 'wet day' scenario predicts how much worse the flooding might be if a river is already experiencing an extreme natural flood.

The main reservoirs which could impact West Oxfordshire include the following:

- Farmoor No.1 (grid reference: SP4450006800) Owner: Thames Water Limited
- Farmoor No.2 (grid reference: SP4450006000) Owner: Thames Water Limited
- Buscot Reservoir (grid reference: SU2380096600) Owner: The National Trust
- Buscot Park Lake (grid reference: SU2490096900) Owner: The National Trust
- Coate Water (grid reference: SU1750082000) Owner: Swindon Borough Council
- Faringdon House (grid reference: SU2830096100) Owner: Mr Charlie Crossley Cooke
- Sarsden Lake (grid reference: SP2900022700) Owner: JJ Gallagher Ltd
- Blenheim Lake (grid reference: SP4376816003) Owner: Blenheim Visitors Ltd
- Scott's House Lake (grid reference: SP3990012100) Owner: Mr David Mason

The modelled extents tend to lie along the River Thames and River Evenlode. The two Farmoor reservoirs, Buscot Reservoir, Buscot Park Lake, Coate Water, and Faringdon House impact the River Thames whilst Sarsden Lake and Blenheim Lake impact the River Evenlode. Scott's House Lake discharges into Chil Brook.

Areas affected within the Thames floodplain include Kelmscott, Radcot, Northmoor, and parts of Eynsham and Cassington. Areas affected within the Evenlode floodplain include Ascott-under-

Wychwood, Shipton-under-Wychwood, and Bruern Abbey. The village of Bladon is also impacted by Blenheim Lake along the River Glyme just upstream of its confluence with the River Evenlode.

Whilst these areas are shown to be at risk, it should be noted that reservoir failure is a rare event with a very low probability of occurrence. Current reservoir regulation, which has been further enhanced by the FWMA, aims to make sure that all reservoirs are properly maintained and monitored to detect and repair any problem. Maps showing the reservoir flood extents in West Oxfordshire are provided in Appendix 5.

2.2 Review of Historic Flood Events

Historical flood events are recorded by the EA and subsequently documented in the form of reports, photographs and maps. This information is used to update the recorded flood outlines map, which shows the extent of all individual recorded flood outlines. Information provided by WODC as part of the previous SFRA has also been used to identify any events not shown in the EA records.

In West Oxfordshire twenty-two flood events have been identified dating back to Winter 1877, thirteen of which are shown in the EA recorded flood outlines mapping. Those not included in the mapping date from 1877–1960, plus an additional event in 1990. Table 5 shows a list of the notable flood events identified.

Most instances of historic flood events within West Oxfordshire are associated with the floodplains of the River Thames, Windrush, and Evenlode. The main towns and villages effected by these events include Northmoor, Standlake, Witney, Burford, Shipton-under-Wychwood, Aston-under-Wychwood, Kelmscott, and Radcot. Appendix 6 shows the EA's recorded flood outlines for West Oxfordshire.

Table 5- Summary of Historic Flood Events within West Oxfordshire

Date
Winter 1877
1894
Winter 1907
Winter 1909
Summer 1910
Spring 1947
Summer 1947
1959
Winter 1960
1977
1979
Winter 1990
1992
1993
Winter 1998
2000
Winter 2002
Winter 2006
Summer 2007
Winter 2008
Winter 2013
Winter 2020

2.3 Review of Flood Defences

The EA national flood defence layer have been used to identify significant flood defence infrastructure across the district.

The EA Asset Information Management System (AIMS) contains details of flood defence assets associated with Main Rivers. This dataset shows that the majority of the watercourses in the district are not formally defended but may be informally protected by natural high ground on either side of the watercourse. Where formal protection exists, this is generally in the form of embankments.

Table 6 provides a summary of the flood defences including where available their condition, extent and standard of protection. Maps showing the location of flood defences in West Oxfordshire are provided in Appendix 7.

Table 6- Flood Defences in West Oxfordshire

Location	Defence Type	Length (m)	Condition	Design SOP
Colwell Brook, SW Witney (NGR: 433678, 209206)	Embankment (Local Authority)	434.13	Not Provided	Not Provided
Madley Brook, NE Witney (NGR: 437014, 210478)	Embankment (Local Authority)	107.21	Not Provided	5
Madley Brook, NE Witney (NGR: 437093, 210555)	Embankment (Local Authority)	97.67	Not Provided	5
River Evenlode, east of Shipton-under-Wychwood (NGR: 428179, 218178)	Embankment (Privately Owned)	47.07	Not Provided	5
River Evenlode, SW Ascott-under-Wychwood (NGR: 429636, 218389)	Embankment (Privately Owned)	32.91	Not Provided	25
River Evenlode, W of Ascott-under-Wychwood (NGR: 429688, 218587)	Embankment (Environment Agency)	21.66	Poor	25
River Windrush, NE Standlake (NGR: 440043, 203345)	Embankment (Privately Owned)	216.9	Not Provided	100
Tributary of Littlestock Brook, NW of Milton-under-Wychwood (NGR: 425746, 218705)	Embankment (Privately Owned)	321.45	Not Provided	40
Chil Brook, S Eynsham (NGR: 442999, 208928)	Embankment (Local Authority)	112.1	Not Provided	20
Colwell Brook, SW Witney (NGR: 433587, 209329)	Spillway (Local Authority)	5.0	Not Provided	Not Provided
Tributary of Highmoor Brook, S of Brize Norton (NGR: 430295, 206810)	Spillway (Local Authority)	5.0	Not Provided	Not Provided

2.4 Review of Flood Warning

The EA is responsible for issuing flood warnings in West Oxfordshire. In regularly monitoring the river network they aim to give the public notice of any local main river overtopping its bank (flood alert) or flooding properties (flood warning).

Water levels are monitored at a number of locations, and this information is used to inform flood warnings at the four flood warning areas within the study area. Flood warning areas are geographical areas where the EA expect flooding to occur and where the EA provide a flood warning service. A flood warning is issued when there is a risk of property flooding. The flood warning areas in the study area are listed below:

- River Windrush at Witney and Ducklington
- Shill Brook at Carterton and Bampton
- River Thames and tributaries at Wolvercote in Oxford
- River Thames from Buscot Wick down to Shifford
- River Cherwell from Lower Heyford down to Cherwell Bridge

- River Windrush at Asthall, Minster Lovell and Crawley
- River Windrush at Rack End and Standlake including Northmoor and Newbridge
- River Thames between Newbridge and Kings Lock above Oxford
- River Evenlode at Milton under Wychwood, Shipton under Wychwood and Ascott under Wychwood
- River Glyme at Woodstock
- River Leach from just below Southrop to Mill Lane near Lechlade
- River Evenlode at Eynsham Mill down to and including Cassington Mill near Cassington
- Clanfield Brook for Clanfield Village
- River Thames from Calcutt to Lechlade including Hannington Wick

Gauges along watercourses are also used to issue flood alerts across wider flood alert areas. Flood alert areas are geographical areas where it is possible for flooding to occur. A flood alert is issued to warn people of the possibility of flooding. The flood alert areas in the study area are listed below:

- River Leach from Northleach to Mill Lane near Lechlade
- River Thames and its small tributaries from Calcutt to Lechlad
- Clanfield Brook for Clanfield Village and the Shill Brook for Bampton
- River Evenlode from Moreton in Marsh to Cassington and also the River Glyme at Wootton and Woodstock
- River Thames and tributaries from Buscot Wick down to Kings Lock
- River Stour in South Warwickshire
- River Thames and tributaries in the Oxford area
- River Windrush from Bourton to Newbridge
- River Cherwell from Lower Heyford down to and including Oxford
- River Cherwell from Charwelton to just above Upper Heyford

Maps showing the location of the flood warning and alert areas are available in Appendix 8.

The timings of flood alerts and warnings are typically determined by trigger levels at the gauges which relate to the following:

- **FAL – Flood Alert**
  The level where flood waters first come out of bank if there were no defences.
- **FW – Flood Warning**
  The level where flood waters flood 1 property.
- **SFW – Severe Flood Warning**
  The level where flood waters flood 50 properties.

Flood alerts and warnings are available from the EA by a preferred contact method e.g. by phone or email. It is recommended that landowners/property owners in flood risk areas sign up to this service.

In terms of the response times associated with the main rivers in the district, before its confluence with the River Windrush and River Evenlode, the catchment of the River Thames is predominantly underlain by relatively impermeable Oxford Clay and mudstones in the south and more permeable limestones in the north. It is therefore expected to have a mixed response to rainfall. The River Evenlode is also underlain by both limestones and mudstones. In comparison, the River Windrush is underlain by predominantly limestones. Therefore, the River Windrush is likely to be slower to respond to a rainfall event than the River Thames and Evenlode overall due to the higher proportion of permeable bedrock. In general, none of the rivers are expected to be fast responding, however there will be more time for flood warnings to be delivered.

3 Flood Risk at Site Allocations

3.1 Sequential Test

This SFRA provides information to support application of the sequential test to the preferred sites identified by WODC.

The sequential test ensures that a sequential, risk-based approach is followed to steer new development to areas with the lowest risk of flooding, taking all sources of flood risk and climate change into account. Where it is not possible to locate development in low-risk areas (Flood Zone 1), the sequential Test should go on to compare reasonably available sites:

- Within medium risk areas (Flood Zone 2); and
- Within high-risk areas (Flood Zone 3), only where there are no reasonably available sites in low and medium risk areas

The sequential test should then consider the spatial variation of risk within medium and then high flood risk areas to identify the lowest risk sites in these areas.

Site specific FRAs should apply the sequential test at a site level locating the most vulnerable infrastructure in lower risk areas. To support such an assessment information on flood depth, velocity, hazard and speed-of-onset should be considered, along with the role of flood management infrastructure and the potential impacts of climate change.

3.2 Exception Test

In situations where sites at lower risk of flooding are not available following application of the sequential test, potential development may be located in medium to high-risk areas. In these cases, it may be necessary to apply the exception test.

The exception test requires two additional elements to be satisfied before allowing development to be allocated or permitted. It should be demonstrated that:

- development will provide wider sustainability benefits to the community that outweigh flood risk; and
- 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.

Table 7 sets out the circumstances when the exception test will be required. More guidance on application of the sequential and exception test is provided in the NPPF and flood risk and coastal change PPG.

Table 7- Flood risk vulnerability and flood zone 'incompatibility'

Flood Zones	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a	Exception Test required	x	Exception Test required	✓	✓
Zone 3b	Exception Test required	x	x	x	✓

3.3 Cumulative Impacts of Development and Land Use Change

The cumulative flood risk impacts of the development proposed in the Local Plan and additional windfall development needs to be considered as part of the planning process. Land use and land management influences the characteristics of how rainwater runs off land into local water networks such as drains, streams and rivers. Localised changes in land use can alter the pre-existing baseline behaviour of an individual area, and when this occurs collectively over multiple areas within a catchment, it can cause a change in flooding characteristics for the area. As such, this may incur detrimental impacts downstream on a catchment-wide scale.

Instances in which this can occur can be seen in the development of previously rural land which increases the amount of impermeable surface. If insufficient measures are taken to mitigate this, surface runoff following rainfall can increase in volume and velocity. When instances of this happen repeatedly across a catchment, this can result in a catchment experiencing shorter amounts of time between rainfall events and peak flood levels resulting in greater magnitude floods and making effective flood response more difficult.

In addition, the development of pre-existing open land may result in loss of floodplain area, causing reduced floodplain storage capacity which could have a detrimental impact on flood risk on immediately neighbouring land as well as downstream. Instances of practices that may cause this include changes in a buildings footprint which could reduce flood storage area, whilst the raising of land levels above the existing floodplain may interfere with storage and floodwater conveyance.

The strategic policies of WODC's local plan will be informed by this SFRA, with a sequential approach taken in the allocation of land to steer new development to the areas with the lowest flood risk based on an understanding of flood risk from all sources.

For allocated and non-allocated sites, developers must follow advice provided by the EA and LLFA to mitigate against detriment to downstream areas in the instance of a flooding event. FRAs supporting developments should incorporate evidence that the cumulative effects of development in the area – both in terms of past and present developments – have been considered and shown to be sufficiently mitigated.

Additionally, developers should have a suitable surface water drainage strategy and SuDS plan that demonstrate there is no increase in surface water flood risk as a result of any new impermeable surfaces that may be present within a development. This should follow the guidance provided in Local Standards and Guidance for Surface Water Drainage on Major Development in Oxfordshire. A further cumulative impact of development that should be considered is the impact on sewer capacity, Thames water should be consulted in this regard.

More detail is provided in section 4 on the requirements for site specific FRAs and how development impacts can be mitigated.

4 Flood Risk Management

SFRAs should include information on i). opportunities to reduce the causes and impacts of flooding and ii). recommendations on how to address flood risk in development. This section focuses on these two areas and details the specific requirements for site-specific FRAs.

Both these areas are closely tied into the requirements of the exception test in ensuring development is safe and provides wider sustainability benefits that outweigh the flood risk incurred by it. This includes benefits that could reduce flood risk to the wider community.

As outlined in PPG[31], developers should refer to the SFRAs and site-specific FRAs to identify opportunities to reduce flood risk overall and to demonstrate that the measures go beyond just managing the flood risk resulting from the development.

4.1 Opportunities to Reduce Flood Risk

This section identifies at a strategic level how a proposed development has the potential to improve the water environment via the use of SuDS and Natural Flood Management (NFM), in addition to remedial work on structures (i.e. culverts and bridges) and the provision of green spaces. Some of the potential measures and key benefits are outlined below:

- Runoff control using SuDS - SuDS slow the rate of surface water run-off and where viable use infiltration to mimic natural drainage in both rural and urban areas. This reduces the risk of "flash-flooding" which occurs when rainwater rapidly flows into the public sewerage and drainage systems. Runoff is controlled at or near source and typically, greenfield rates are maintained or there is a betterment on brownfield rates at existing development sites. This minimises excess runoff to third party land, thereby managing and reducing flood risk where possible. Provided SuDS is correctly implemented it should safeguard against the cumulative impact of development causing an increase of flood risk within West Oxfordshire.

- Promoting the use of rainwater re-use – In accordance with the drainage hierarchy contained in Approved Document H of the Building Regulations, PPG[32] and the need to mitigate against water scarcity surface water runoff should consider rainwater re-use (e.g. rainwater harvesting, greywater recycling) before discharge to the ground, a watercourse or a sewer. This approach recognises water as a valuable resource with rainwater collected (harvested) for non-potable use where practicable. This not only reduces potable water demand, but it can also reduce the volume of surface water runoff requiring disposal.

- Promoting the use of infiltration SuDS – Water re-use can be used for small rainfall events but for larger order events typically water will need to be discharged elsewhere. The PPG sets out the hierarchy of drainage to promote the use of SuDS, by aligning modern drainage systems with natural water processes. The most sustainable option is considered to be infiltration of surface water run-off into the ground as it aligns closely with natural processes. This generally requires i) soils and/or bedrock to be permeable ii) groundwater levels to be a significant distance below the surface reducing the risk of groundwater emergence, iii) minimal land stability issues and iv) sites to be flat or gently sloping. Where infiltration is proposed, infiltration rates should be

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[31] Ministry of Housing, Communities & Local Government (2022) Paragraph: 037 Flood risk and coastal change, https://www.gov.uk/guidance/flood-risk-and-coastal-change

[32] HM Government (2010) *Approved Document H- Drainage and waste disposal* https://www.gov.uk/government/publications/drainage-and-waste-disposal-approved-document-h

confirmed through BRE Digest 365 Soakaway Tests. Additional groundwater monitoring may also be required where there is a risk of groundwater emergence.

- Increasing flood storage and attenuation using natural flood management (NFM) - NFM involves techniques that aim to work with natural hydromorphological processes, features and characteristics to manage the sources and pathways of flood waters. Examples include the introduction of storage/conveyance features such as water meadows along with incorporation of riverside vegetation or leaky barriers to help slow overland flows and increase interception. This in turn prevents a flashy catchment response and serves to attenuate peak flows; mainly for lower order rainfall events and in smaller catchments.
- Land management using NFM - Incorporating good practice into the management of land for the purpose of increasing infiltration of water and sediments into soils and reducing surface runoff. Woodland creation is also encouraged in some cases. The former relates to encouraging the use of infiltration SuDS where feasible at new development sites, but also improving management on existing land.
- River and floodplain restoration using NFM - The stabilisation of excessively eroding riverbanks in order to reduce deposition of sediment downstream and works that restore an altered river to a more appropriate shape and in turn reconnect the river with its floodplain. These options could be considered at the catchment scale and at the site scale. For example, where future development is located in the vicinity of an eroding riverbank or altered river, restoration could be considered as part of the scheme to bring wider benefits.
- Maintaining and removing existing structures/channels - developments can serve to adapt problem structures within a watercourse/floodplain, which can improve conveyance and reduce impact of flooding. Diverting and daylighting of culverted watercourses can also provide more effective flow routing through an area as well as environmental benefits.
- Managing water quality using SuDS - incorporation of SuDS features which provide filtration and capture of pollutants. These can include features such as permeable pavements and swales within the surface water system, which can settle and filter contaminants to provide treatment of surface water before being discharged. The level of treatment provided can be set relative to the risk index of the site. Particular attention should be applied to sites in groundwater source protection zones (SPZs) where additional measures may be necessary to protect the water environment. In sites where waterbodies are proximal, the EA and LLFA should be consulted to determine local sensitivities and any specific requirements.
- Enhancing biodiversity & amenity - developments can improve the quality of existing habitats and help create new habitats through landscape change. Sites offer an opportunity to establish green corridors and create coherent ecological networks. Development sites can also provide amenity benefits in the form of publicly accessible green spaces and improved access networks. SuDS and NFM often create new water features which can, if correctly implemented, bring multiple benefits as part of the green infrastructure network, in addition to associated educational benefits. For the allocated sites and for future development in general, biodiversity and amenity should always be factored into site design and the provision of SuDS/NFM.

4.2 SuDS

This section provides more detail on SuDS design considerations and requirements at a site-level. The NPPF states that any development should give priority to their use, and local authorities assess planning proposals based on their ability to mitigate the impacts that development has on surface water runoff rates and volumes.

In West Oxfordshire, all developments must incorporate SuDS as appropriate and in line with the Government's Standards[33]. They must also follow the Local Standards and Guidance for Surface Water Drainage on Major Development in Oxfordshire. Smaller schemes are encouraged to incorporate SuDS, where possible. All new developments in areas of flood risk should give priority to SuDS.

There are many types of SuDS component, which means that sustainable drainage can be tailored to a range of sites. They are generally split into two categories; infiltration systems and attenuation systems which can be defined as follows:

- Infiltration Systems - Infiltration components facilitate the infiltration of water into the ground. These often consist of temporary storage zones which allow for the slow release of water into the soil. They include permeable surfaces such as gravel, grassed areas, swales and permeable paving, and sub-surface components such as filter drains, geocellular systems and soakaways.
- Attenuation Systems – Attenuation SuDS capture runoff and control its subsequent discharge off-site. They are divided into conveyance systems which convey flows to downstream storage systems, and storage systems, which control the flows being discharged from a site by storing water and slowly releasing it. Examples of attenuation SuDS include detention basins, wetlands, ponds and swales.

The use of both systems is determined by the permeability of the soil, and a site's topography. Relatively flat or gently sloping sites are often necessary for infiltration SuDS, and geotechnical investigations required to determine whether infiltration rates are sufficient. If ground conditions cannot support infiltration systems, surface water may need to be attenuated using measures to capture surface water. Attenuation systems do not offer the same range of sustainability benefits as infiltration systems and therefore infiltration SuDS are always preferred where viable.

At a number of sites SuDS designs often include a combination of infiltration and attenuation systems. A central design component for SuDS is the SuDS management train. SuDS should not be thought of as individual components, but as an interconnected system designed to manage, treat and make best use of surface water. The use of a sequence of components that collectively provide the necessary processes to control runoff and water quality is therefore often encouraged.

In developing an interconnected system, the layout and function of drainage systems should be considered at the start of the design process for a new development. This will help ensure better integration with road networks and other infrastructure which can maximise the availability of developable land. This in turn can lead to the provision of multi-functional benefits and reduced land-take. Maintenance requirements and adoption arrangements should also be incorporated into the

[33] Department for Environmental, Food and Rural Affairs (2015) *Sustainable Drainage Systems Non-statutory technical standards for sustainable drainage systems*, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/415773/sustainable-drainage-technical-standards.pdf

planning process for any SuDS systems proposed. These should consider and encompass the lifetime of the development.

In terms of guidance for SuDS design, the SuDS Manual published in 2007 and updated in 2015 incorporates research, industry practice and construction methods for a range of SuDS components. In delivering SuDS there is also a requirement to meet the framework set out by the Government's 'non statutory technical standards' and the SuDS Manual complements these.

When determining SuDS design it is necessary to estimate runoff rates and volumes for a development site. These can be derived using the FEH methods specifically the rainfall runoff method implemented in ReFH 2. This is the current recommended method outlined in the CIRIA SuDS Manual[34]. Existing run-off rates are estimated by extracting point or catchment data. This data includes variables which describe rainfall and runoff characteristics in a particular area. For a development site the runoff characteristics derived can be linearly scaled based on the site area, yielding runoff rates and volumes for that area.

Note, when considering Brownfield sites specifically, these often coincide with critical drainage areas (CDAs), and the incorporation of SuDS is seen as key opportunity that may benefit existing hardstanding areas at flood risk.

In addition to runoff control, developers are encouraged to utilise SuDS to provide water quality inputs. Schemes should ensure that the movement of water through vertical infiltration as well as horizontal run-off does not worsen contamination effects. Wherever possible, SuDS provision should maximise ecological benefits, link into the existing green network, incorporate tree planting and landscaping and avoid damage to existing significant trees, including through changes to the site hydrology. Again, this should be conducted in adherence to the CIRIA SUDS Manual, and align with criteria set out in the Local Standards and Guidance for Surface Water Drainage on Major Development in Oxfordshire

At the time of writing Schedule 3 of the Flood and Water Management Act 2010 is expected to be implemented in England following the January 2023 review[35] of its proposed implementation. However, its implementation date is yet to be confirmed. Schedule 3 will make SuDS mandatory on all developments exceeding 100m^2 and provides a framework for the approval and adoption of drainage systems. A sustainable drainage system approving body (SAB) will be formed within unitary and county councils, and national standards on the design, construction, operation, and maintenance of sustainable drainage systems for the lifetime of the development should be published.

4.3 Flood Resilience

Property Flood Resilience (PFR) is another flood risk management option available for new and existing development. It is an approach to building design which aims to reduce flood damage and speed up recovery and reoccupation following a flood. It uses a combination of flood resistance and recovery measures.

It is described in the industry-developed CIRIA Property Flood Resilience Code of Practice[36], which provides advice for both new-build and retrofit. PFR is also now a key consideration in the NPPF

[34] CIRIA (2015) *The SuDS Manual (C753)*
[35] DeFRA (2023) The review for implementation of Schedule 3 to The Flood and Water Management Act 2010 *https://assets.publishing.service.gov.uk/media/63bc504dd3bf7f263846325c/The_review_for_implementation_of_Schedule_3_to_The_Flood_and_Water_Management_Act_2010.pdf*
[36] CIRIA (2021) *Code of practice for property flood resilience (C790)* https://www.ciria.org/CIRIA/Resources/Free_publications/CoP_for_PFR_resource.aspx

(paragraph 173b) for new developments in flood risk areas. This states that all new development in areas at risk of flooding should be appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment. The associated PPG for Flood Risk and Coastal Change also identifies flood resilience in new developments as a way of ensuring that developers can adapt to the challenges of a changing climate. The latest EA national strategy on flood risk and coastal change, also identifies flood resilience measures as a key means to adapt to the threats from flooding and coastal change, enabling growth in a sustainable and climate resilient way.

The NPPF is supported by the PPG for Flood Risk and Coastal Change, this states that the first preference is to apply the avoidance measures set out in the sequential approach to planning. Where this is not possible, flood resistance and flood resilience measures may need to be incorporated into the design of buildings and other infrastructure, including behind flood defence systems.

Resistance and resilience measures are unlikely to be suitable as the only mitigation measure to manage flood risk, but they may be suitable in some circumstances, such as:

- Water-compatible and less vulnerable uses where temporary disruption is acceptable, and the development remains safe;
- Where the use of an existing building is to be changed and it can be demonstrated that the avoidance measures set are not practicable, and the development remains safe;
- As a measure to manage residual flood risk from flood risk management infrastructure when avoidance measures have been exhausted.

In these cases, and where existing development is already in flood risk areas, flood resilience measures could be considered. These are typically defined as sustainable measures that can be incorporated into the building fabric, fixtures and fittings to reduce the impact of floodwater on property. They allow for easier drying and cleaning, ensure that the structural integrity of the building is not compromised and reduce the amount of time until the building can be re-occupied. Flood repairability should also be considered which involves the design and construction of building elements, to ensure the ease of replacement and repair, should they suffer flood damage.

As part of being resilient, buildings should be structurally sound and remain in situ during the worst case flooding effects (depth and velocity). Any measures in place to ensure structural soundness during a flood should not cause a hazard to people.

Some of the main measures to ensure structural safety and resilience are outlined below:

- Flood doors and windows - These can prevent water from entering a property by creating a watertight seal during a flood.
- Flood barriers - These can be fitted to external doorways, windows, across driveways, garage doors and gardens. It is recommended that they are not fitted higher than 600mm in order to prevent structural damage to walls.
- Flooring - Concreate floors with damp proof membranes can be used in properties which are at particular risk of groundwater flooding as they prevent water rising up through the floors.
- Walls - Pointing which is in poor condition should be repaired with a water-resistant mortar and any cracks or holes in brickwork can be repaired with a waterproof silicone sealant.
- Drains and pipes - Fitting non-return valves to pipes will prevent backflow from toilets, sinks, drains and manholes when drains and sewers become overwhelmed with flood water.

- Airbricks and vents - There are a number of products available, examples include automatic (self-closing) air bricks which allow ventilation but prevent flood water coming in when needed. Alternatively, air brick covers can be placed over airbricks.
- Adaption measures - Where flooding does occur waterproof plaster, solid concrete floors and tiled floor coverings, can reduce flood damage and greatly shorten the recovery time after a flood. Other steps include raising electric sockets to preserve electricity supply and moving paperwork and valuables to higher levels to minimise potential damage.

Planning and building standards have a complementary role in flood management and the use of flood damage resistant and mitigation measures could be considered at the proposed preferred sites where appropriate. These may be required as part of ensuring that consequences of flooding are acceptable.

It should be noted that mitigation and flood resilience measures are not sufficient justification to permit a development if the tolerable conditions are exceeded during an extreme flood event. High velocities and/or depths of floodwater pose a potential risk to life, may cause structural damage to buildings and could impact on human health and wellbeing.

4.4 Site Specific FRA Considerations

An FRA is required for the following development scenarios:

- In Flood Zone 2 or 3 including minor development and change of use.
- More than 1 hectare (ha) in Flood Zone 1.
- Less than 1 ha in Flood Zone 1, including a change of use in development type to a more vulnerable class (for example from commercial to residential), where they could be affected by sources of flooding other than rivers and the sea (for example surface water drains, reservoirs).
- In an area within Flood Zone 1 which has critical drainage problems as notified by the EA.

In general, FRAs should address the points below, full advice is available within the EA's FRA guidance[37]:

- The proposed site's address.
- Description of the proposed development.
- An assessment of the flood risk from all sources of flooding for the proposed development, including consideration for an allowance for climate change.
- The estimated flood level for the proposed development which takes into account the impacts of climate change over the proposed development's lifetime.
    - The estimated flood level is the depth of flooding predicted on a proposed development site in either a) a 1 in 100-year river flood plus an allowance for climate change b) a 1 in 200-year tidal flood event plus an allowance for climate change.
    - It should also be noted that if a proposed development is in an area with flood defences present, that the estimated flood level should account for residual flood risk if they breached or were overtopped.
    - Flood levels may be available from the EA or Local Planning Authority but if not, these can be calculated by specialist flood risk consultants if required.

[37] DeFRA & EA (2017) *Flood risk assessments if you're applying for planning permission* https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications

- Details of the finished floor levels; these should be a minimum elevation of the design flood level plus a freeboard.
- Details of flood resistance and resilience plans.
- All supporting plans and drawings.
- All other information for example planning correspondence.

As indicated, liaison should be sought when making a planning application and it is also recommended that the LLFA and local authority be contacted for area specific advice on flood risk requirements. The following sections provide more detail on some of the areas mentioned above.

4.5 Residual Risk

Residual risk should be minimised at each stage of the planning process. Residual risks include those that result from the failure or overtopping of flood defences, the blockage of drainage systems, failures in flood forecasting or flood warning issue, receipt or response, and failure of active measures such as demountable flood barriers. It can be minimised by taking a sequential approach to development. For example, in locating the buildings in areas at lowest risk, raising floor levels, managing site levels (where appropriate), raising vulnerable uses to upper floors and ensuring that appropriate passive flood resistant/resilient and recovery measures have been incorporated.

Where an assessment shows that flood risk and residual risks are a consideration for a plan or development proposal, the Avoid, Control, Mitigate, Manage residual risk process should be followed. More detail is provided in paragraph 4 of the Flood Risk and Coastal PPG.

To determine the level of risk and safety implications for development proposed in a site allocation or planning application, the following should be considered:

- the characteristics of a possible flood event,
- the safety of people within a building if it floods,
- the safety of people around a building and in adjacent areas,
- the structural safety of buildings; and,
- the impact of a flood on the essential services provided to or from a development.

More detail is provided in paragraph 5 of the Flood Risk and Coastal PPG.

4.6 Emergency Planning

Another consideration to ensure that development is safe is whether adequate flood warnings would be available to people using the development. An emergency plan will be needed wherever emergency flood response is an important component of making development safe. Emergency plans will need to take account of the impacts of climate change on escape routes. Residual risk mitigation measures may also include the provision of a safe refuge above the extreme (0.1% with climate change AEP) residual risk flood levels with a freeboard. Emergency flood plans should follow the ADEPT and EA guidance[38]. More detail is provided on managing residual risk and emergency planning in paragraph 42-48 of the Flood risk and Coastal PPG.

[38] Adept and EA (2019) Flood risk emergency plans for new development https://www.adeptnet.org.uk/system/files/documents/ADEPT%20%26%20EA%20Flood%20risk%20emergency%20plans%20for%20new%20development%20September%202019....pdf

Across the District as a whole, the Civil Contingencies Act 2004[39] is one of the most relevant pieces of legislation to emergency planning for flooding. It lists local authorities, the EA and emergency services as 'Category 1' responders to emergencies. It places duties on these organisations to:

- Undertake risk assessments
- Manage business continuity
- Carry out emergency planning
- Warn and advise the public during times of emergency.

The EA has a key role in relation to flooding. It is the lead agency for warning those at risk and maintaining and improving flood defences.

Local resilience forums (LRFs) – of which the EA is a member in all regions – have developed multi-agency flood plans (MAFPs). These cover various elements associated with a flood. The LRF applicable to West Oxfordshire is the Thames Valley Resilience Forum[40]. All the organisations that make up the Thames Valley Resilience Forum work together to ensure that preparations and plans are in place for major emergencies and incidents affecting the county. These are regularly reviewed, tested and updated so that agencies can respond immediately and effectively to any threat or incident.

4.7 Finished Floor Levels

As mentioned in section 4.4, details of the finished floor levels should be included within an FRA. These need to consider design flood levels and climate change in view of the nature and lifetime of the development. More detail on the design event and climate change allowances applicable to different development types is provided in the PPG on climate change allowances[41]. Development should be set at a floor level to provide an appropriate freeboard above the design flood level which should be calculated with climate change considered. A freeboard is defined as an additional amount of height above the design flood level which is used as a factor of safety to account for any uncertainty. Typically, it is set to 300 or 600mm above the design flood level. The freeboard allowance should be agreed with the EA, LLFA and/or local authority depending on the scale of the development and flood risks present. More detail is provided in the PPG for preparation of an FRA.

4.8 Third Party Impacts

Development or the cumulative impacts of development may result in an increase in flood risk elsewhere as a result of impacts such as the loss of floodplain storage, the deflection or constriction of flood flow routes or through inadequate management of surface water. Floodplain storage can also be lost where finished floor levels are raised above the design flood level.

Where this is the case, a site-specific FRA should include an assessment of 3rd party impacts. If 3rd party impacts are found, mitigation may be required including the provision of compensatory storage. Compensatory storage refers to a practice of offsetting the effects of a development that encroaches into floodplain storage by providing a hydraulically equivalent, excavated floodplain storage capacity onsite or elsewhere. The EA and LLFA should be contacted to confirm the requirements for assessing 3rd party impacts (e.g. hydraulic modelling), mitigation and compensatory storage.

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[39] UK Parliament (2004) Civil Contingencies Act https://www.legislation.gov.uk/ukpga/2004/36/section/1/enacted

[40] Thames Valley Local Resilience Forum (2024) https://www.thamesvalleylrf.org.uk/

[41] EA (2022), *Flood risk assessments: climate change allowances*, https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

4.9 Flood Risk Activity Permits

Applicants may need an environmental permit for flood risk activities if they want to do work in, under, over or within 8 metres from a fluvial main river and from any flood defence structure or culvert or 16m from a tidal main river and from any flood defence structure or culvert. If works are required close to an ordinary watercourse, ordinary watercourse consent may be required.

Further information regarding flood risk permits can found in the EA guidance for permits[42]. Oxfordshire County Council should be contacted regarding any requirements for ordinary watercourse.

[42] EA (2024) *Flood risk activities: environmental permits* https://www.gov.uk/guidance/flood-risk-activities-environmental-permits

5 Conclusions and Recommendations

5.1 Conclusions

5.1.1 A collation of potential sources of flood risk has been carried out in accordance with NPPF and associated legislation and guidance. The SFRA has been developed in consultation with WODC, the LLFA, the EA and TW.

5.1.2 The dominant flooding mechanism in West Oxfordshire tends to be fluvial in origin associated with flooding from the River Thames, River Windrush, and River Evenlode, and their associated tributaries.

5.1.3 In general, a number of properties lie within the Thames fluvial flood extents. This includes properties in Kelmscott, Radcot, Chimney, Moreton, and Northmoor.

5.1.4 Parts of Witney, Standlake, and Burford are shown to be at risk from the River Windrush. The River Evenlode poses a risk to both Shipton-under-Wychwood and Ascott-under-Wychwood.

5.1.5 Smaller ordinary watercourses also pose a risk of fluvial flooding. Littlestock Brook poses a risk to Milton-under-Wychwood, whilst Trot's Brook poses a risk to the southeastern area of Shipton-under-Wychwood. An area in northeastern Witney is at risk from Madley Brook, whilst an area in the west is at risk from Colwell Brook.

5.1.6 Flood risk also arises from surface water flooding, particularly in Witney, Chipping Norton, Charlbury, Kingham, Milton-under-Wychwood, Shipton-under-Wychwood, Eynsham, Middle Barton, Carterton, and Tackley.

5.1.7 In terms of groundwater flood risk, many areas are likely to be at moderate to high risk, both in areas where the water table is high and in areas where it is likely to be mobile. The only exception is the northwest of the district, where drainage is likely to be more impeded so groundwater emergence less likely.

5.1.8 Sewer flooding incidents have been recorded across West Oxfordshire. The southwest of the district has the highest risk with 86 of the 184 recorded incidents (47%) occurring in this area.

5.1.9 Reservoir flooding has been assessed using EA's reservoir flood maps. Areas within the floodplains of the River Thames and River Evenlode are shown to be at risk of reservoir flooding, however such an event is rare with very low probability of occurrence.

5.1.10 Embankment flood defences are present alongside the River Windrush, River Evenlode, Colwell Brook, Madley Brook, Littlestock Brook, and Chil Brook. These embankments have a range of SOPs and four of the nine defences are owned privately. Two spillways are also present in the district on a tributary of Highmoor Brook and on Colwell Brook. These are both owned by the local authority.

5.1.11 There are a total of 14 flood warning areas and ten flood alert areas within West Oxfordshire. The catchments of the River Thames, Windrush and Evenlode are all at least partially underlain by permeable bedrock so there is generally long lead in times from rainfall falling on the catchment in which to implement flood warning measures.

5.2 Recommendations

5.2.1 In general, development should be located in Flood Zone 1 wherever possible. In cases where this is not possible, a sequential approach should be taken with highly or more vulnerable development prioritised for areas where flood risk is lowest and less vulnerable development located in areas at higher risk if necessary.

5.2.2 Where flood risk is significant and access may be compromised in extreme events, a comprehensive Emergency Flood Plan can help manage any residual risk.

5.2.3 Sustainable drainage principles should be followed at every site to safeguard against increasing flood risk both onsite and to third party land downstream.

5.2.4 For greenfield development sites runoff rates should be controlled to be no greater than the existing greenfield rate of runoff from the site.

5.2.5 For developments on previously developed brownfield sites the rate of runoff should not exceed the runoff of the site in its previously developed condition, and may seek a betterment on pre-existing rates, especially in locations where drainage is poor.

5.2.6 Many parts of the district offer good potential for infiltration SuDS given their geology and topography. The use of infiltration SuDS should be encouraged where possible.

5.2.7 Where possible, opportunities to reduce flood risk at sites and downstream should be identified, for example through the creation of wetland features, encouraging vegetation growth and use of NFM practices. As West Oxfordshire is a predominantly rural district there may be opportunities to implement NFM in many areas, which could deliver multiple benefits as part of the green infrastructure network.

5.2.8 This SFRA does not replace the need for site specific FRAs. A greater level of detail should be provided by such assessments. FRAs should factor in the latest climate change guidance where sites are at risk.

5.2.9 Site specific FRAs are required for all sites over 1 hectare in size and for all sites located within Flood Zones 2 and 3. FRAs for sites within Flood Zone 1 may be required to assess surface water and non-fluvial forms of flood risk.

Appendix 1 – Fluvial Flood Maps

Appendix 2 – Surface Water Flood Maps

Appendix 3 – Mapping of Watercourses

Appendix 4 – Geological and Soils Mapping

Appendix 5 – Reservoir Flood Maps

Appendix 6 – Recorded Flood Extents

Appendix 7 – Flood Defences

Appendix 8 – Flood Warning and Alert Areas