



JBA
consulting

Strategic Flood Risk Assessment

Final Report

July 2013



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Contract

This report describes work commissioned by Vale of White Horse and South Oxfordshire District Councils, by an email dated 30 January 2013. The Councils' representative for the contract was Katherine Macdonald.

Purpose

This document has been prepared as a Strategic Flood Risk Assessment for Vale of White Horse and South Oxfordshire District Councils. JBA Consulting accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared.

JBA Consulting has no liability regarding the use of this report except to Vale of White Horse and South Oxfordshire District Councils.

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Executive Summary

In 2009 JBA Consulting completed an SFRA for South Oxfordshire District Council (SODC) and Vale of White Horse District Council (VOWH). A separate SFRA was completed for Didcot by HR Wallingford in 2007. Since preparation of the existing SFRAs there have been significant changes in legislation and flood risk policy, progression of the Local Plans for both Councils, along with some important updates to the flood risk mapping in the Districts. Consequently in March 2013, JBA Consulting was appointed to comprehensively review, update and combine the existing SFRAs with reference to the changes, specifically in flood policy and the best available flood risk information.

The report and accompanying maps are designed to furnish the two District Councils with enough information to carry out the Sequential Test as their Local Planning Frameworks progress and site allocations are made, enabling them to continue to fulfil their aim to locate development in areas of lowest flood risk. Available national flood risk mapping and other sources of evidence (historical records, detailed flood risk studies etc) are described. All sources of flood risk within the Districts are considered: fluvial, surface water, groundwater, sewer flooding, reservoir and other artificial sources. The impacts of climate change and adaptation measures are discussed.

Taking into account all the available information, flood risk for strategic sites and key settlements (main towns and larger villages) is discussed in further detail, along with the planning implications for each site/settlement.

General guidance is given for planners and developers to cover all types of development, including:

- Permitted development within the Flood Zones and requirements for Flood Risk Assessments (FRAs) and applying the Sequential and Exception Tests
- Taking into account other sources of flooding
- Surface water runoff and drainage
- Making development safe
- River restoration and enhancement
- Existing watercourses, defences and assets
- Developer contributions to flood risk improvements
- The WFD and water quality

The available flood risk data is being constantly updated and planners and developers should be aware that they should always use the latest information to inform their decision making, including the Sequential Test and Flood Risk Assessments, as the Local Plans continue to progress.

New legislation offers opportunities for a more integrated approach to flood risk management and development. As they are both in the relatively early stages of the site allocation process, the Councils have a real chance to make sure development provides improvements to flood risk overall and enhancements to the river environment.

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Abbreviations and Definitions

Actual Risk		The risk posed to development situated within a defended area (i.e. behind defences), expressed in terms of the probability that the defence will be overtopped, and/or the probability that the defence will suffer a structural failure, and the consequence should a failure occur
Annual Event Probability	AEP	Expresses the probability of a flood event of a specific magnitude occurring in any one year. For example, the 1 in 100 year flood event is expressed as the 1% AEP; there is a 1% chance of it occurring within any given year.
Area Action Plan	AAP	Planning document to guide development in a specific area. Forms part of the Local Plan.
Area Benefiting from Defence	ABD	Those areas which benefit from formal flood defences in the event of flooding from rivers with a 1% chance in any given year or from the sea with a 0.5% chance in any given year. If the defences were not there, these areas would be flooded.
Asset Information Management System	AIMS	Environment Agency's asset database
Areas Susceptible to Groundwater Flooding	AStGWF	National map produced by the Environment Agency showing areas susceptible to groundwater emergence.
Brownfield		Brownfield (sites or land) is a term in common usage that may be defined as 'development sites or land that has previously been developed'.
Combined sewer overflow	CSO	In combined sewerage systems, foul drainage and surface water are conveyed in the same piped system. During rainfall, when flows in the combined sewer are high, excess flow is diverted to watercourses or ground in order to reduce the risk of combined sewer flooding. CSOs can be a significant source of pollution to watercourses.
Core Strategy	CS	Term no longer used to describe a Development Plan Document setting out the long-term spatial vision, strategic objectives and policies relating to future development of an area. Where they remain, the Core Strategy forms part of the Local Plan.
Defended Area		An area offered a degree of protection against flooding through the presence of a flood defence structure
Development Plan Documents	DPDs	Documents that make up the Local Plan and form part of the statutory development plan for the areas. DPDs must include the Local Plan and adopted Policies Map. All DPDs are subject to public consultation and independent examination.
Flood Alleviation Scheme	FAS	Works designed to provide protection from flooding.
Flood Risk Management		The introduction of mitigation measures (or options) to reduce the risk posed to property and life as a result of flooding. It is not just the application of physical flood defence measures
Flood and coastal erosion risk management Grant in Aid	FCRMGiA	Central government funding to flood risk management authorities to pay for a range of activities including schemes that help reduce the risk of flooding and coastal erosion.
Flood Estimation Handbook	FEH	Provides current methodologies for estimation of flood flows for the UK
Flood Map for Surface Water	FMfSW	National map produced by the Environment Agency showing flood risk from surface water at the 30 year and 200 year return periods.
Floodplain		Any area of land over which water flows or is stored during a flood event or would flow but for the presence of defences
Flood Risk Assessment	FRA	A detailed site-based investigation that is undertaken by the developer at planning application stage
Flood Storage Area	FSA	Area designed to store water in a flood and release it later when flood waters have subsided.
Flood Zone		Areas of land at risk from tidal or fluvial flooding as delineated by the Environment Agency. Zone 1: Flooding predicted to occur less than once every thousand years (<0.1% Annual Event Probability) Zone 2: Flooding predicted to occur at least once every thousand years (0.1% Annual Event Probability) Zone 3: Flooding predicted to occur at least once every hundred years (1% Annual Event Probability)
Fluvial Flooding		Flooding caused by high flows in rivers or streams exceeding the capacity of the normal river channel.
Formal Defence		A flood risk asset which is maintained by any party to fulfil a flood defence function in agreement with the Environment Agency.

Freeboard		A 'safety margin' to account for residual uncertainties in water level prediction and/or structural performance, expressed in mm
Functional Floodplain		An area of land where water has to flow or be stored in times of flood.
Greenfield		Greenfield (sites or land) is a term in common usage that may be defined as 'development sites or land that has not previously been developed'.
Historic Flood Map	HFM	National map produced by the Environment Agency showing historical flood extents.
Informal Defence		An asset which was not designed for flood defence and is not maintained for this purpose, but forms some flood defence function.
ISIS		One-dimensional river modelling software developed by Halcrow. Capable of steady and unsteady state simulation.
Lead Local Flood Authority	LLFA	Body responsible for managing flood risk from localised sources across the County and a developing a strategy for local flood risk management that encompasses all sources of flooding (Oxfordshire County Council)
LIDAR		Light Detection and Ranging. An airborne laser mapping technique producing precise elevation data.
Local Development Framework	LDF	This term has been replaced by the term 'Local Plan'. It was used to describe a portfolio of Local Development Documents that provide a framework for delivering the spatial planning strategy for the area.
Local Plan	LP	The plan for the future development of the local area, drawn up by the local planning authority in consultation with the community. In law this is described as the development plan documents adopted under the Planning and Compulsory Purchase Act 2004. Current core strategies or other planning policies, which under the regulations would be considered to be development plan documents, form part of the Local Plan. The term includes old policies which have been saved under the 2004 Act.
Local Planning Authority	LPA	
Main River		Larger streams and watercourses, for which the Environment Agency is the designated body responsible for flood risk management.
Measure		A deliverable solution that will assist in the effective management (reduction) of risk to property and life as a result of flooding, e.g. flood storage, raised defence, effective development control and preparedness, and flood warning
Mitigation		The management (reduction) of flood risk
National Flood and Coastal Defence Database	NFCDD	A database, maintained by the Environment Agency, of fluvial and coastal assets. Flood defence assets are included, as are other assets with other functions such as footbridges on towpaths.
National Planning Policy Framework	NPPF	The NPPF sets out the Government's planning policies for England and how these are expected to be applied at a local level.
OfWAT		The Water Services Regulation Authority. The economic regulator of the Water Industry in England and Wales.
Oxfordshire County Council	OCC	Lead Local Flood Authority covering both Districts.
Ordinary Watercourses		All watercourses other than Main Rivers. The Lead Local Flood Authority is the designated body responsible for flood risk management.
Probability	1%	A measure of the chance that an event will occur. The probability of an event is typically defined as the relative frequency of occurrence of that event, out of all possible events. Probability can be expressed as a fraction, % or a decimal. For example, the probability of obtaining a six with a shake of a fair dice is 1/6, 16% or 0.166. Probability is often expressed with reference to a time period, for example, annual exceedance probability
Property Level Protection	PLP	Schemes that protect property from flooding at the property scale, for example installing flood barriers on doors, air brick covers etc.
Rapid Inundation Zone		An area immediately behind defences which, should they fail, will generate a combination of high velocities and flood depths that would cause a risk to life.
Residual Risk		The risk that inherently remains after implementation of a mitigation measure (option)
Return Period		The expected (mean) time (usually in years) between the exceedance of a particular extreme threshold. Return period is traditionally used to express the frequency of occurrence of an event, although it is often misunderstood as being a probability of occurrence.
Risk		The threat to property and life as a result of flooding, expressed as a function of probability (that an event will occur) and consequence (as a result of the event occurring)

Sewer		A pipeline, usually underground, designed to carry foul sewage and/or surface water from buildings and paved areas associated with buildings in more than one curtilage (plot of land).
Site Specific Allocations	SSAs	Allocation of sites for specific or mixed-use development.
South Oxfordshire District Council	SODC	
Standard of Protection	SoP	The return period to which properties are protected against flooding
Strategic Flood Risk Assessment	SFRA	The assessment of flood risk on a catchment-wide basis for proposed development in a District
Sewage Treatment Works	STW	
Supplementary Planning Documents	SPD	Supplementary Planning Documents or SPD support DPDs in that they may cover a range of issues, both thematic and site specific. Examples of SPD may be design guidance or development briefs. SPD may expand policy or provide further detail to policies in a DPD. They will not be subject to independent examination.
Surface Water Management Plan	SWMP	Projects to investigate local flooding issues such as flooding from sewers, drains, groundwater, and runoff from land, small watercourses and ditches that occurs as a result of heavy rainfall. Carried out through a partnership of all relevant stakeholders including local authorities, internal drainage boards, sewerage undertakers and the Environment Agency.
Sustainability Appraisal	SA	A Sustainability Appraisal is a systematic process to predict and assess the economic, environmental and social effects likely to arise from DPDs and SPDs, enabling each document to be tested and refined, ensuring that it contributes towards sustainable development.
Sustainable (Urban) Drainage System	SuDS	Current 'best practice' for new urban development that seeks to minimise the impact upon the localised drainage regime, e.g. through the use of pervious areas within a development to reduce the quantity of runoff from the site
Upper Thames Major Resource Development	UTMRD	Thames Water proposal for a large new storage reservoir to the west of Abingdon.
Uncertainty		A reflection of the (lack of) accuracy or confidence that is considered attributable to a predicted water level or flood extent
Vale of White Horse District Council	VOWH	
Water Framework Directive	WFD	European Union directive designed to improve and integrate the way water bodies are managed throughout Europe

1 Introduction

1.1 Background

In September 2007 JBA Consulting was commissioned jointly by South Oxfordshire District Council (SODC) and Vale of White Horse District Council (VOWH) to undertake a Strategic Flood Risk Assessment (SFRA). This consisted of a Scoping Study (Level 1) with some more detailed assessment in key settlements. The SFRA was completed in June 2009. A separate SFRA was completed for Didcot by HR Wallingford in 2007.

Since preparation of the existing SFRAs there have been significant changes in legislation and flood risk policy, progression of the Local Plans for both Councils, along with some important updates to the flood risk mapping in the Districts. Consequently in March 2013, JBA Consulting was appointed to comprehensively review, update and combine the existing SFRAs with reference to the changes, specifically in flood policy and the best available flood risk information.

1.2 Objectives

The SFRA is a planning tool that will assist the councils in their selection and development of sustainable site allocations away from vulnerable flood risk areas. The assessment focuses on the existing site allocations, but also sets out the procedure to be followed when assessing additional sites for development in the future. The SFRA will assist the council to make the spatial planning decisions required to inform the forthcoming Local Plans.

The National Planning Policy Framework (NPPF) reinforces the responsibility of Local Planning Authorities (LPAs) to ensure that flood risk is managed effectively and sustainably as an integral part of the planning process, balancing socio-economic needs, existing framework of landscape and infrastructure, and flood risk. To this end, the key objectives of the SFRA are:

- To investigate and identify the extent and severity of flood risk from all sources to the area at present and in the future.
- To present data on flood risk for planned new developments, as an evidence base for use in the Local Plan.
- To provide a planning tool with a straightforward 'risk-based' approach to development control within the LPAs, providing clarity to both planners and developers.
- To take an interactive approach with stakeholders to provide the necessary interpretation of detailed technical input.

1.3 Study area

The study area comprises the whole of the administrative areas of South Oxfordshire District Council and Vale of White Horse District Council. The study area is illustrated in Map 1.

The River Thames is the main watercourse within the two Districts, forming part of the boundary with West Oxfordshire and the City of Oxford, and the boundary between the two Districts to the north of Didcot. To the south it forms much of the boundary between SODC and West Berkshire, Reading and Wokingham. Significant tributaries joining the Thames within or on the borders of the Districts include the Dickler, Evenlode, Cherwell (within City of Oxford), Ock and Thame. The catchment area and channel size thus increase significantly. The upstream catchment area of the Thames entering VOWH near Lechlade is 776km², on re-entering VOWH/SODC at Kennington it is 3053km², and on exiting the study area at Henley it is 6613km².

2 The planning framework and flood risk policy

2.1 Introduction

The overarching aim of planning policy on development and flood risk is to ensure that flood risk is taken into account at all stages of the planning process. The purpose of this section of the report is to highlight the main changes to the planning framework and flood risk responsibilities since the previous SFRA was published in 2009.

Figure 2-2 gives an overview of the key strategic planning links for flood risk and associated documents. It shows how the Flood Risk Regulations and Flood and Water Management Act, in conjunction with the Localism Act’s “duty to cooperate”, introduce a wider requirement for the exchange of information and the preparation of strategies and management plans.

SFRAs contain information that should be referred to in responding to the Flood Risk Regulations and the formulation of local flood risk management strategies and plans. SFRAs are also linked to the preparation of catchment flood management plans (CFMPs), shoreline management plans (SMPs), surface water management plans (SWMPs) and water cycle strategies.

2.2 National legislation

2.2.1 Flood Risk Regulations (2009) and Flood and Water Management Act (2010) Background

The Flood Risk Regulations transpose the EC Floods Directive into UK law and place responsibility upon all Lead Local Flood Authorities (LLFAs) to manage local flood risk. The Flood and Water Management Act (FWMA) received Royal Assent in April 2010. The FWMA aims to create a simpler and more effective means of managing the risk of flood and coastal erosion and implements Sir Michael Pitt’s recommendations following his review of the 2007 floods.

Figure 2-1 sets out the requirements and timescales for implementing the requirements of the Directive.

Figure 2-1: Flood Risk Regulation Requirements

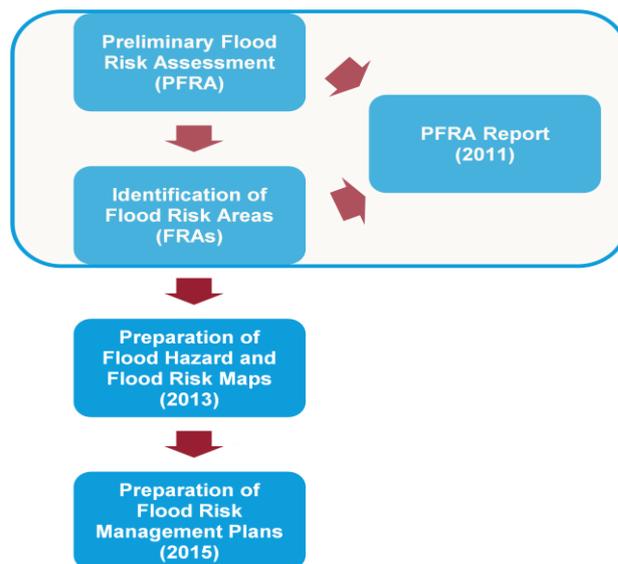
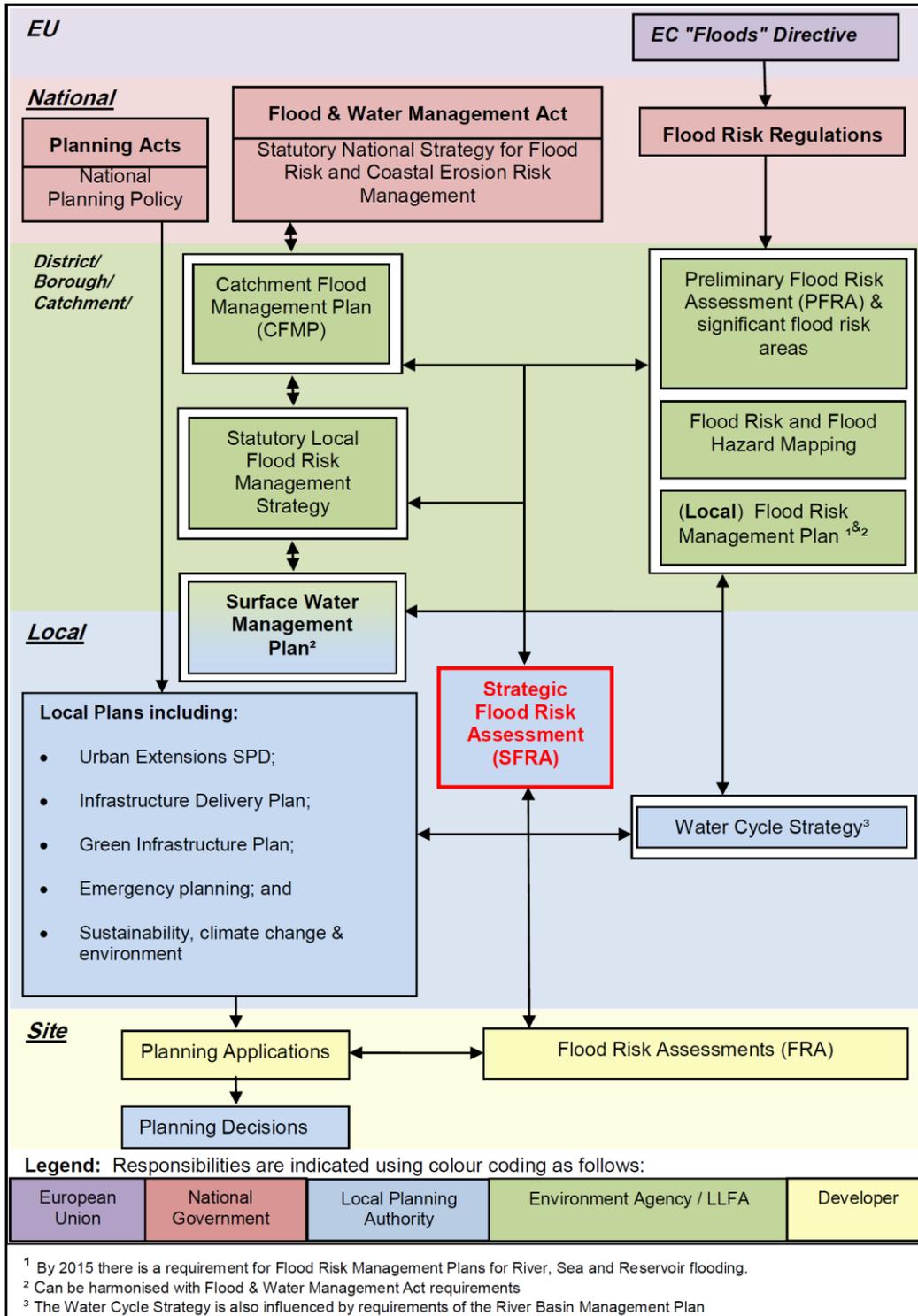


Figure 2-2: Strategic planning links and key documents for flood risk



The FWMA also calls for the establishment of a SuDS Approving Body (SAB) to be set up in county, county borough or unitary local authorities. The SAB will be responsible for approving, adopting and maintaining drainage plans and SuDS schemes that meet new national standards for design, construction, operation and maintenance. SAB approval of drainage systems for new and redeveloped sites will be required before construction can commence. A clear timetable for implementation of the new responsibilities for SABs and national standards is still pending. The responsibilities of the SAB are likely to rest with the LLFA (in this case, Oxfordshire County Council), although there is flexibility in the FWMA if it considered more effective for another body to take on the role.

The new and emerging responsibilities in Oxfordshire under the Flood and Water Management Act and the Flood Risk Regulations are summarised in Table 2-1.

Table 2-1: Roles and Responsibilities in Oxfordshire

Risk Management Authority (RMA)	Strategic Level	Operational Level
Environment Agency	National Statutory Strategy Reporting and supervision (overview role)	Main rivers, reservoirs Preliminary Flood Risk Assessment (per River Basin District) Identify Significant Flood Risk Area Flood Risk and Hazard Maps Flood Risk Management Plan
Lead Local Flood Authority (Oxfordshire County Council)	Input to national strategy. Formulate and implement local flood risk management strategy.	Surface water, groundwater, other sources of flooding Prepare and publish a PFRA Identify Flood Risk Areas Prepare Flood Hazard and Flood Risk Maps Prepare Flood Risk Management Plans SuDS Approval Body (future)
District Borough and City Councils	Input to National and Local Authority Plans and Strategy (e.g. Local Plan documents) Vale of White Horse Local Plan and South Oxfordshire Core Strategy	Ordinary watercourse Delegated powers from LLFA for flood investigation, consents and enforcement.

2.2.2 Localism Act

The purpose of this Act, which was given Royal Assent on 15 November 2011, is to shift power from central government back to the councils, communities and individuals. This Act allows councils to establish their own development plans to take account of local employment, housing and other land used in the plan making process.

In order for councils to achieve sustainable development practices, [Provision 110 of the Act](#)¹ was introduced to encourage cooperation during the planning process. This duty to cooperate requires Local Authorities to "engage constructively, actively and on an ongoing basis in any process by means of which development plan documents are prepared so far as relating to a strategic matter".

There are several Neighbourhood Plans in place in the Districts (see Section 2.3.5).

2.2.3 National Planning Policy Framework (NPPF)

The [NPPF](#)² was introduced in 2012 with its stated aim to simplify the planning system and to make it more accessible. It superseded Planning Policy Statement 25: Development and Flood Risk (PPS25). The NPPF also promotes the need for sustainable growth and protection of the environment and provides guidance to help local planning authorities prepare local plans. These local plans require strategic flood risk assessments that will help to develop policies on flood risk management with advice from the Environment Agency and other relevant bodies such as the LLFAs. [Technical guidance to the NPPF](#)³ has been produced as an interim measure, which works alongside the NPPF and sets out how the policy should be implemented.

The NPPF states that "inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere. For these purposes:

¹ Localism Act (2011) Section 110: Duty to cooperate in relation to planning of sustainable development. <http://www.legislation.gov.uk/ukpga/2011/20/section/110>

² Department of Communities and Local Government (2012) National Planning Policy Framework https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf

³ Department of Communities and Local Government (2012) Technical Guidance to the National Planning Policy Framework https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6000/2115548.pdf

- “areas at risk of flooding” means land within Flood Zones 2 and 3; or land within Flood Zone 1 which has critical drainage problems and which has been notified to the local planning authority by the Environment Agency;
- “flood risk” means risk from all sources of flooding - including from rivers and the sea, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources."

The **Sequential Test** has been carried forward from PPS25. Details of the test are described in NPPF and the accompanying NPPF Technical Guide. This test must be performed when considering the placement of future development and for planning application proposals. The NPPF Technical Guide gives detailed instructions on how to perform the test. These instructions on how to perform the test should be used with the following information from the SFRA:

- Identify the geographical area to be assessed, including a justification;
- Assess the sites chosen (including alternatives) on the Flood Zone maps that are provided with this assessment;
- Establish the risk of flooding from other sources using the maps in this SFRA; and
- Follow the instructions given in the NPPF Technical Guide.

The Environment Agency has published a technical note⁴ which provides guidance on how to apply the Sequential Test as per the NPPF and in relation to the allocation of land, individual planning applications, windfall sites, renewable energy projects, redevelopment of an existing single property and change of use.

The Sequential Test is used to direct all new development (through the site allocation process) to locations at the least risk of flooding, giving highest priority to Flood Zone 1. An increased scope SFRA provides further flood risk evidence which the Councils can use to assess whether it is necessary to revisit/update the Sequential Test. The Environment Agency recommends that the following approach is used by local planning authorities to apply the Sequential Test to planning applications located in Flood Zones 2 or 3. There are three stages to the test, these have been summarised in Figure 2-3.

2.2.4 Association of British Insurers (ABI): Guidelines on Planning and Insurance in Flood Risk Areas for Local Authorities in England⁵

The National Flood Forum and the ABI have published guidance which aims to help local authorities in England when producing local plans and helps them deal with the planning application process in flood risk areas. The main guidelines are:

- Ensure strong relationships with technical experts on flood risk
- Consider flooding from all sources, taking account of climate change impacts
- Take potential impacts on drainage infrastructure seriously
- Ensure that flood risk is mitigated to acceptable levels for proposed developments
- Make sure local plans take account of all relevant costs and are regularly reviewed

2.2.5 Water Framework Directive

The Water Framework Directive (WFD) is designed to improve and integrate the way water bodies are managed throughout Europe. In the UK, much of the implementation work will be undertaken by competent authorities. It came into force on 22 December 2000, and was put into UK law (transposed) in 2003.

Under this Directive, many of the parties listed in Table 2-1 have a specific statutory duty to protect and address water quality issues within the area, and in many cases this will be

⁴ Environment Agency (2012) Demonstrating the flood risk Sequential Test for Planning Applications version 3.1
http://www.environment-agency.gov.uk/static/documents/Business/SequentialTestProcess_v3.1.pdf

⁵ Association of British Insurers and National Flood Forum (April 2012) Guidance on Insurance and Planning in Flood Risk Areas for Local Planning Authorities in England
<http://www.planningofficers.org.uk/downloads/pdf/ABI%20%20NFF%20Guidance%20on%20Insurance%20and%20Planning%20for%20Local%20Planning%20Authorities.pdf>

considered as part of flood risk management or development proposals. For example, removing culverts, creating riparian zones or creating open space for water.

2.3 County, District and catchment level policy

2.3.1 Oxfordshire County Council Local Flood Risk Management (FRM) Strategy⁶

In fulfilling the role of LLFA, Oxfordshire County Council (OCC) has new roles and responsibilities, duties and powers to enable it to manage flood risk from localised sources across the County and a duty to develop, maintain, apply and monitor a strategy for local flood risk management that encompasses all sources of flooding.

In general terms the Flood and Water Management Act (2010) requires Risk Management Authorities to act consistently with the Local FRM Strategy when undertaking flood risk management functions, except for water companies who will need to have regard to it.

The strategy is ongoing at present and will include the following:

- Information on local flood risk in Oxfordshire, highlighting where problems have already occurred, or where areas fall in risk categories
- Clarification of which authority is responsible for what in relation to the prevention and management of flooding
- Detail on the measures that will be undertaken to manage flood risk
- Clarification on how work is prioritised
- Measures that communities can undertake to improve flood resilience, as it is not possible to stop all flooding

2.3.2 Oxfordshire Preliminary Flood Risk Assessment

The regulations required Oxfordshire County Council (as the LLFA) to prepare and publish a Preliminary Flood Risk Assessment (PFRA) on past and future flood risk from local sources of flooding. The Regulations also require the LLFA to identify significant Flood Risk Areas. The PFRA reports on significant past and future flooding from all sources except Main River and Reservoir (covered by Environment Agency).

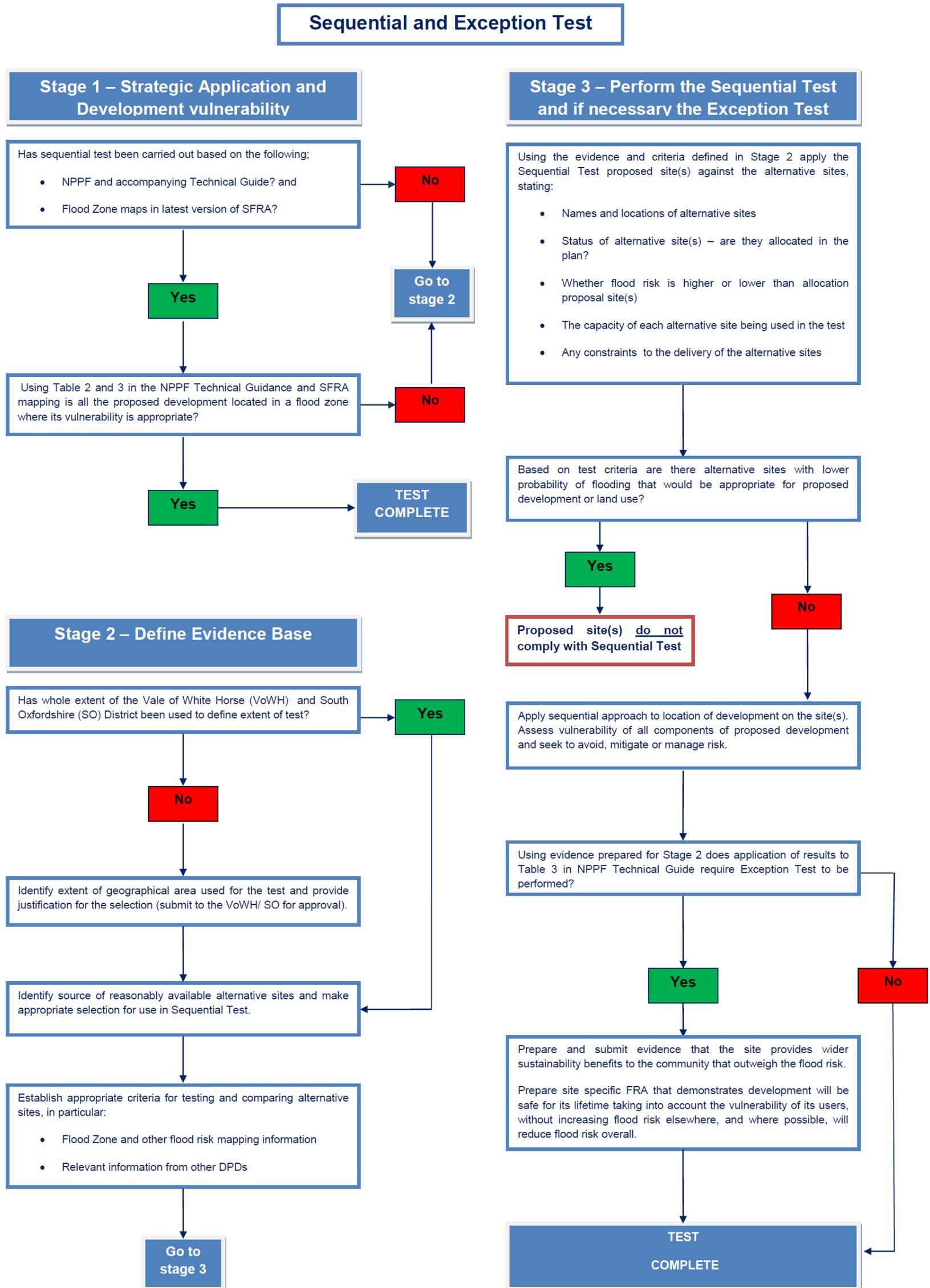
Key outputs of the Oxfordshire PFRA include⁷:

- The PFRA was a broad-scale assessment of flood risk from local sources (surface runoff, groundwater and ordinary watercourses) across the county. Existing available data was gathered from a variety of sources. Incidents of past flooding from local sources were investigated.
- The analysis of available data predicting future flood risk suggests that the level of risk in Oxfordshire is not significant enough to propose a new indicative Flood Risk Area. However, the evidence collected demonstrates that there are flooding issues that must be addressed in the Local Flood Risk Management Strategy.

⁶ Oxfordshire County Council Local Flood Risk Management Strategy
<http://www.oxfordshire.gov.uk/cms/content/oxfordshire-local-flood-risk-management-strategy>

⁷ Oxfordshire County Council (June 2011) Preliminary Flood Risk Assessment
<http://www.oxfordshire.gov.uk/cms/sites/default/files/folders/documents/environmentandplanning/flooding/pfra/PFRAPreliminaryreport.pdf>

Figure 2-3: Sequential and Exception Test



2.3.3 The Vale of White Horse Local Plan 2029⁸

The Vale of White Horse Local Plan 2029, once adopted, will provide a framework for future development across the Vale of White Horse District. It will replace the strategic elements of the Local Plan 2011. Up-to-date information on planning in VOWH and the Local Plan 2029 Part 1 can be found at <http://www.whitehorsedc.gov.uk/planning-policy>.

The Local Plan together with any Development Planning Documents (DPDs), and any neighbourhood plans prepared by the community, will make up the 'development plan' for the District. All planning applications will be determined in accordance with the development plan, taken as a whole, unless material considerations indicate otherwise. The following policies and references relate to the management of flood risk within the District.

Key challenges and opportunities

'Protecting the environment and responding to climate change' is identified as a key challenge and opportunity under the Local Plan. It identifies ways to build greater resilience to the unavoidable effects of climate change, including the issues of flooding and an increased incidence of extreme weather. Under this umbrella are set out policies on:

- Responding to climate change
- Sustainable design and construction (Draft Core Policy 30)
- Flood risk (Draft Core Policy 32)
- Water quality and meeting the needs of the WFD.
- Green infrastructure (Draft Core Policy 35)
- Conservation and improvement of biodiversity (Draft Core Policy 36).

At the time of writing, all policies are currently at draft stage and are subject to amendment following public consultation. Of most relevance is:

Draft Core Policy 32: Flood Risk

Draft Core Policy 32 deals with flood risk from all sources and is very much in-line with the NPPF. It states that "With regard to flood risk, the sequential approach will be strictly applied across the District, in accordance with national guidance. Development within areas of flood risk from any source of flooding, including areas with a history of groundwater or surface water flooding, will only be accepted if it is demonstrated that it is appropriate at that location, and that there are no suitable and available alternative sites at a lower flood risk. Planning permission will not be granted for any development in the functional floodplain (Flood Zone 3b) except water-compatible uses and essential infrastructure.

For all developments over 1 hectare and/or development in any area of flood risk from rivers (Flood Zone 2 or above) or other sources, developers must carry out a full Flood Risk Assessment (FRA) demonstrating that the proposed development will not increase flood risk.

Unless it is shown not to be feasible, all developments will be expected to incorporate sustainable drainage systems or techniques to limit surface water runoff from new development, and reduce the existing rate of run-off."

Appendix A of the Local Plan Strategic Site Development Templates

This appendix refers to the following strategic sites:

- Harwell Oxford Campus, Harwell
- Crab Hill, Wantage
- Monks Farm, Grove
- Land South of Park Road, Faringdon
- Valley Park, Harwell Parish, West of Didcot

⁸ Vale of White Horse District Council (2013) Local Plan 2029 http://www.whitehorsedc.gov.uk/sites/default/files/2013-03-14_FinalLocalPlanPartOneReduced.pdf PLEASE NOTE: At the time of writing this report, the Local Plan was in public consultation.

2.3.4 South Oxfordshire Core Strategy (Part of the Local Plan)⁹

This adopted document describes the framework for development for South Oxfordshire for 2027. The strategy is a key document within the South Oxfordshire Local Plan. The strategy sets out what physical, social and green infrastructure is needed and how and by what means it will be delivered. The following sections specifically relate to flood risk management and related matters within the District. Up-to-date information on planning in SODC and the Core Strategy can be found at <http://www.southoxon.gov.uk/services-and-advice/planning-and-building/planning-policy>.

Objective 3: Environment and Design

Objective 3: Environment and Design recognises that any new builds take into account climate change, including minimising the risks and effects of flooding.

The Environment

This chapter covers the Council's vision and objectives with regard to:

- Water quality - paragraph 14.11 describes the response to the needs of the WFD.
- Flood Risk Management - although there is no dedicated policy on flood risk, paragraphs 14.12 and 14.13 describe the approach to flood risk management, referring to the SFRA, and stating that "The Strategic Housing Land Availability Assessment shows that there is enough zone 1 land available in the District to meet our future greenfield allocation needs in our towns and villages. We will not therefore need to look at zone 2 or 3 land for the built element of greenfield allocations or carry out any exception testing."

Quality development

This chapter covers the Council's vision and objectives with regard to:

- Sustainable design and construction (Policy CSQ2)
- Climate change adaption - this section sets out the need to adapt to climate change in design and paragraph 15.24 recommends the use of SuDS to help cope with intense rainfall events.
- Design - this section mentions that new development in South Oxfordshire District should link to or provide green infrastructure where available (Policy CSQ3)

Green infrastructure and biodiversity

- Green infrastructure - Policy CSG1 refers directly to Green infrastructure indicating that the core strategy is aiming to increase the use of green infrastructure within South Oxfordshire and improve existing assets including Conservation Target Areas in accordance with the standards set out in the South Oxfordshire Green Infrastructure Strategy and Didcot Natural Greenspaces Study.
- Biodiversity - Policy CSB1 sets of an aim to increase the net biodiversity in the District.

2.3.5 Thames Catchment Flood Management Plan (CFMP)

The **Thames CFMP**¹⁰ is a high level policy document produced by the Environment Agency covering the whole of the River Thames catchment (fluvial only). It aims to set policies for sustainable flood risk management for the whole catchment covering the next 50 to 100 years. The CFMP was adopted in 2008. The CFMP messages are split into various policy units. Four of these policy units apply to the Districts, and the selected policies and management approaches are detailed in Table 2-2.

Table 2-2: Thames CFMP Key Messages by Policy Unit

CFMP policy unit	SFRA key settlements	Selected policy and flood risk management approach
Abingdon	Abingdon	P5 – reduce the risk – lower the probability of exposure to flooding and/or the magnitude of the consequences of a flood and hence the risk

⁹ South Oxfordshire District Council (December 2012) Core Strategy <http://www.southoxon.gov.uk/services-and-advice/planning-and-building/planning-policy/core-strategy/adopted-core-strategy>

¹⁰ Environment Agency (2008) Thames Catchment Flood Management Plan <http://a0768b4a8a31e106d8b0-50dc802554eb38a24458b98ff72d550b.r19.cf3.rackcdn.com/geth1209bqyl-e-e.pdf>

Ock	Faringdon, Grove & Wantage, Kingston Bagpuize & Southmoor, Shrivenham, Stanford in the Vale, Watchfield	P6 - take action to increase the frequency of flooding to deliver benefits locally and/or reduce the risk elsewhere
Sandford to Cookham	Benson, Cholsey, Crowmarsh Gifford, Goring, Henley on Thames, Kennington, Milton, Radley, Steventon, Sutton Courtenay, Wallingford, Woodcote.	P4 – accept the risk – but in the longer term take action to ensure that risk does not increase from current level
Swindon	Shrivenham, Watchfield.	P4 – accept the risk – but in the longer term take action to ensure that risk does not increase from current level
Thame	Berinsfield, Chalgrove, Chinnor, Horspath, Thame, Watlington, Wheatley	P3 - accept the risk – our current scale of actions is sufficient to manage the current risk and future increases will be acceptable
Upper Thames	Botley, Kingston Bagpuize & Southmoor.	P6 – take action to increase the frequency of flooding to deliver benefits locally and/or reduce the risk elsewhere

2.3.6 Critical drainage areas and surface water management

Defra's Surface Water Management Plan Technical Guidance¹¹ indicates that the Lead Local Flood Authority (Oxfordshire County Council) have the leadership role in Surface Water Management Plans (SWMPs), although they can delegate it to lower tier councils where appropriate. SWMPs can be carried out at a variety of levels, from the District-wide strategic level to settlements or specific areas. The triggers for requiring a SWMP are:

- There is evidence of historic surface water flooding.
- Significant development or redevelopment poses a risk to existing drainage networks, or an opportunity to resolve known problems.
- Surface water flood risk mapping identifies significant risks.
- Known drainage issues cannot be resolved by a single organisation (for example the Local Authority, Environment Agency or Water Company). A joint strategy needs to be developed in a partnership.

No critical drainage areas have so far been identified by the LLFA, or the lower tier Councils, and as such no SWMPs are currently planned for the two Districts.

2.4 Local level

2.4.1 Neighbourhood Plans

Another requirement of the FWMA is for councils to provide technical advice and support on neighbourhood's development proposals. The Act enables local people to decide on the location of new housing and business developments through the use of neighbourhood plans.

Vale of White Horse Neighbourhood Plans

The following list describes the neighbourhood plans for the Vale of White Horse and their status at the time of producing the SFRA:

- Faringdon Neighbourhood Plan - undergoing informal consultation with the community, which closed in 9 May 2013.

¹¹ Defra (March 2010) Surface Water Management Plan Technical Guidance <http://www.defra.gov.uk/publications/files/pb13546-swmp-guidance-100319.pdf>
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- Drayton Neighbourhood Plan - the neighbourhood area was approved in February 2013. The Parish Council are preparing the plan and undertaking community consultation events.
- Longworth Neighbourhood Plan - The Parish Council has submitted an application to designate the neighbourhood area. The consultation closes on 22 July 2013.
- Great Coxwell Neighbourhood Plan - the Parish Council has submitted an application to designate the neighbourhood area. The consultation closes on 22 July 2013.

Up-to-date information on Neighbourhood Plans in the district can be found at www.whitehorsedc.gov.uk/neighbourhoodplans.

South Oxfordshire Neighbourhood Plans

The following list describes the neighbourhood plans for the South Oxfordshire and their status at the time of producing the SFRA:

- Thame Neighbourhood Plan - waiting to be made by the Council
- Woodcote Neighbourhood Plan - out for pre-submission consultation
- Benson Neighbourhood Plan - Plan area designated
- Chalgrove Neighbourhood Plan - Plan area designated
- Dorchester on Thames Neighbourhood Plan - Plan area awaiting designation
- Henley-Harpsden Neighbourhood Plan - Plan area awaiting designation
- Sonning Common Neighbourhood Plan - Plan area under review

Up-to-date information on Neighbourhood Plans in the district can be found at <http://www.southoxon.gov.uk/services-and-advice/planning-and-building/planning-policy/neighbourhood-plans>.

3 Mapping and the risk based approach

3.1 How flood risk is assessed

3.1.1 Definitions

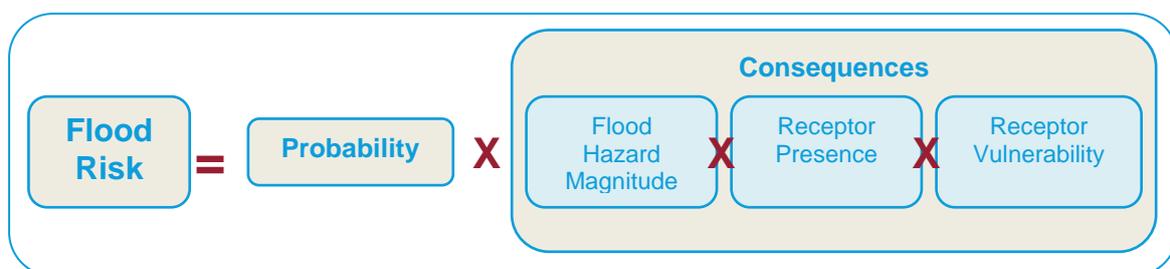
A flood is formally defined in the Flood and Water Management Act¹² as

"including cases where land not normally covered by water becomes covered by water and can be the result of water emanating from a number of sources".

Flood risk can be described as the combination of the statistical probability of a flood occurring and the scale of its potential consequences, whether inland or on the coast, and includes consideration of development located outside of the river and tidal flood risk areas. Thus it is possible to define flood risk as:

$$\text{Flood risk} = (\text{probability of a flood}) \times (\text{scale of the consequences})$$

On that basis it is useful to express the definition as follows:



The **probability** of flooding can be expressed as a return period in years (the average time between years with at least one larger flood), or as an annual exceedance probability (%) (the probability that a certain magnitude of flood will be exceeded in any one year).

¹² Flood and Water Management Act (2010) <http://www.legislation.gov.uk/ukpga/2010/29/contents>
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Increasing the probability or chance of a flood being experienced increases the flood risk. In situations where the probability of a flood being experienced increases gradually over time, for example due to the effects of climate change, then the magnitude of the flood risk will increase.

The severity of the consequences can increase the flood risk:

- **Flood hazard magnitude:** If the direct hazard posed by the depth of flooding, velocity of flow, the speed of onset, rate of rise in flood water or duration of inundation is increased (for example due to the effects of climate change), then the consequences of flooding, and therefore risk, is increased. New development can potentially increase the hazard if it causes an increase in surface runoff flows.
- **Receptor presence:** The consequences of a flood will be increased if there are more receptors affected. Additionally, if there is new development that increases the probability of flooding or increased density of infrastructure then consequences will also be increased.
- **Receptor vulnerability:** If the vulnerability of the people, property or infrastructure is increased then the consequences are increased. For example, old people or children are more vulnerable if they are caught up in a flood event.

3.1.2 Using SFRA risk information

The SFRA contains information that should be used for planning in advance of flooding. It also provides information on the effects of flood events (due to failure or overtopping of defences). The SFRA flood risk data should be updated following flood events.

The NPPF sets out a sequential approach to steer new development to areas with the lowest probability of flooding. This is initially based on the Flood Zones, but should be refined by the SFRA to take into account the probability of flooding, other sources of flooding and the impact of climate change.

The following sections describe the evidence base provided by available national flood risk mapping and other locally available flood risk information, to support the application of the Sequential approach using the SFRA.

3.2 Flood risk mapping

A number of national mapping products were provided by the Environment Agency through their Datashare website, including:

- Flood Map
- Flood Map for Surface Water (30 year, 200 year)
- Areas Susceptible to Surface Water Flooding
- Areas Susceptible to Ground Water Flooding
- Historic Flood Map
- Detailed River Network v3
- Defences
- Areas Benefiting from Defences
- Flood Storage Areas

The data was downloaded in February and March 2013.

3.2.1 Flood Map

The Flood Map is made up of a suite of GIS layers, including Flood Zone 2 and 3, Defences, Areas Benefiting from Defences and Flood Storage Areas.

The Flood Zones describe the land that would flood from rivers if there were no defences present (Map 2). They are based on broad scale modelling that has been refined with detailed hydraulic models in areas of higher risk. Areas Benefiting from Defences can be identified using the accompanying layers.

A concept diagram showing the classification of Flood Zones graphically is included in Figure 3-1 below. Table 3-1 includes a description and discussion of appropriate development. A

fuller discussion of Flood Zones and their relation to planning policy can be found in the NPPF and the technical guidance.

Figure 3-1: Definition of Flood Zones

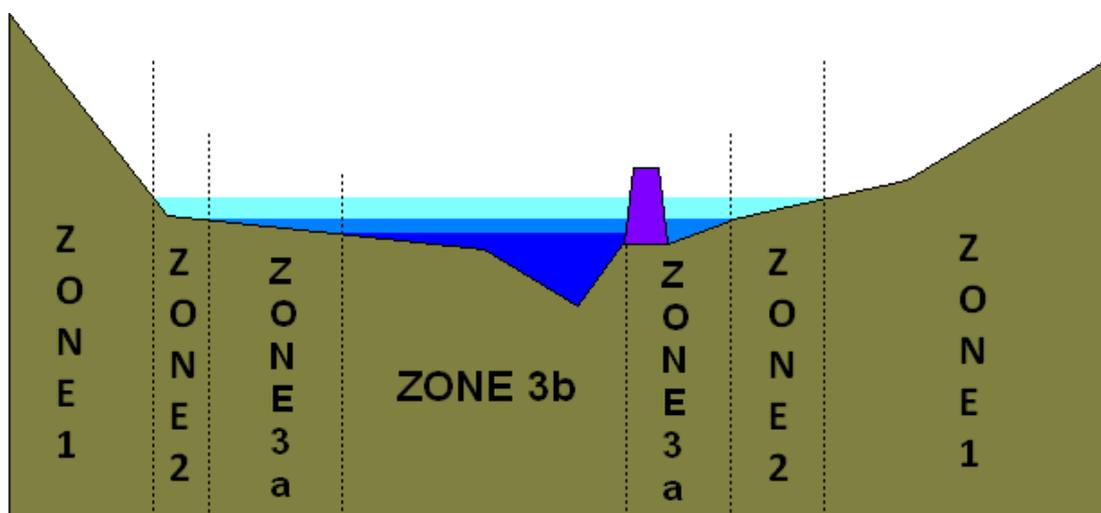


Table 3-1: Flood Zone descriptions

	Probability	Description	Suitable Development*
Zone 1	Low	This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).	All uses of land
Zone 2	Medium	This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (0.1% - 1%) or between 1 in 200 and 1 in 1000 annual probability of sea flooding (0.1% – 0.5%) in any year.	Water compatible, less vulnerable and more vulnerable uses of land and essential infrastructure are appropriate. The highly vulnerable uses are only appropriate if the Exception Test is passed.
Zone 3a	High	This zone comprises land assessed as having a greater than 1 in 100 annual probability of river flooding (>1.0%) or a greater than 1 in 200 annual probability of flooding from the sea (>0.5%) in any year.	Water compatible and less vulnerable uses of land are appropriate. More vulnerable and essential infrastructure should only be permitted if the Exception test is passed. Highly vulnerable uses should not be permitted.
Zone 3b	Function Floodplain	This zone comprises land where water has to flow or be stored in times of flood. SFRA should identify this Flood Zone (land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the LPA and the Environment Agency, including water conveyance routes.	Water compatible and essential infrastructure that has to be there is permitted. Essential infrastructure should pass the Exception Test and be designed and constructed to meet a number of flood risk related targets. Less vulnerable, more vulnerable and highly vulnerable uses should not be permitted.

New development should, whenever possible, be placed in Flood Zone 1. The Flood Zones are indicative of the potential undefended floodplain. Allocating sites in Flood Zone 1 means that future development is not reliant on fluvial or coastal flood defences. This negates the requirement of committing future generations to costly long term expenditure, which becomes unsustainable in light of the effects of climate change.

However, developers should be aware that the runoff from development on Flood Zone 1 land can potentially cause an increase in the probability of flooding. Information in the SFRA should be used to address this issue.

The most up to date version of the Flood Map should always be used, and can be viewed at <http://www.environment-agency.gov.uk/homeandleisure/37837.aspx>.

If it has not been possible for all future development to be situated in Flood Zone 1, or away from areas at flood risk from other sources, then a more detailed assessment is needed to understand the implications of locating proposed development in Flood Zones 2 or 3. It may be necessary to apply the Exception Test (see Table 3-1), in which case the scope of the SFRA must be expanded to take into account the 'actual' and 'residual' risk considering the presence of flood risk management infrastructure and its effect on the frequency, impact, speed of onset, depth and velocity of flooding.

3.2.2 Functional floodplain

The 'functional floodplain' is defined as an area of land where water has to flow or be stored in times of flood. This forms Flood Zone 3b in terms of the NPPF. Following discussion between the Districts and Environment Agency, the following definition of the functional floodplain was agreed:

- Use the 1 in 20 year modelled flood extent wherever hydraulic models are available, with the exception of the Oxford area (Thames Wolvercote to Kennington 2006) where the 1 in 25 year modelled flood extent should be used.
- Elsewhere, take a precautionary approach and assume that Flood Zone 3a represents the functional floodplain

The combined extent is shown in Map 3.

Flood Zones 3a and 3b are collectively referred to as Flood Zone 3.

3.2.3 Climate change

The Flood Map supplied by the Environment Agency does not include a layer for climate change impact. Some sensitivity testing was undertaken in 2007 to determine the impact of a 20% increase in flows to represent climate change (as recommended by the NPPF Technical Guidance on the Flood Zones), and it was found that on most watercourses the impact was relatively minor.

It was agreed between the Districts and Environment Agency that the SFRA should:

- Use the 1 in 100 year plus 20% climate change modelled flood extent wherever hydraulic models are available.
- Elsewhere, take a precautionary approach and assume that the Flood Zone 2 outline represents Flood Zone 3 with climate change.

The combined extent is shown in Map 4.

3.2.4 Surface water mapping

As part of the PFRA, the Lead Local Flood Authority has stated that the Environment Agency's **Flood Map for Surface Water (FMfSW)** should be used for assessing surface water risk in Oxfordshire (termed 'locally agreed' surface water information). The SFRA will therefore use this same information, in line with the PFRA.

The FMfSW is a national level broad-scale map indicating areas that are likely to be at risk from surface water flooding. It is not suitable for identifying individual properties at risk. According to the accompanying information, the type of flooding shown by the FMfSW fits with the definition in the Flood and Water Management Act (2010) and shows:

The flooding that takes place from the 'surface runoff' generated by rainwater (including snow and other precipitation) which:

- (a) is on the surface of the ground (whether or not it is moving), and
- (b) has not yet entered a watercourse, drainage system or public sewer.

The FMfSW will pick out natural drainage channels, rivers, low areas in floodplains, and flow paths between buildings. But it will only indicate flooding caused by local rainfall. It does not show flooding that occurs from overflowing watercourses, drainage systems or public sewers caused by catchment-wide rainfall events or river flow.

Two rainfall events, one with a 1 in 30 and the other with a 1 in 200 chance of occurring in any year, are modelled and mapped.

The FMfSW is provided to Councils for use in SFRA but is not publicly available. The 200 year FMfSW is shown in Map 5. The 30 year layer has not been shown for clarity.

It should be noted that the FMfSW is currently undergoing an update. New mapping has been produced (the Updated Flood Map for Surface Water) and is currently under review by the Environment Agency and the LLFA, but is not yet available for use in the SFRA or to the public. It should be available publicly on the Environment Agency website by the end of 2013.

3.2.5 Groundwater mapping

Areas Susceptible to Groundwater Flooding (AStGWF) is a strategic scale map showing groundwater flooding susceptibility on a 1km square grid. It was developed specifically by the Environment Agency for use by Lead Local Flood Authorities (LLFAs) for use in Preliminary Flood Risk Assessment (PFRA) as required under the Flood Risk Regulations. It is not available publicly.

This data has used the top two susceptibility bands of the British Geological Society (BGS) 1:50,000 Groundwater Flood Susceptibility Map and thus covers consolidated aquifers and superficial deposits. It does not take account of the chance of flooding from groundwater rebound. It shows the proportion of each 1km grid square where geological and hydrogeological conditions show that groundwater might emerge. The susceptible areas are represented by one of four area categories showing the proportion of each 1km square that is susceptible to groundwater emergence. It does not show the likelihood of groundwater flooding occurring.

In common with the majority of datasets showing areas which may experience groundwater emergence, this dataset covers a large area of land, and only isolated locations within the overall susceptible area are actually likely to suffer the consequences of groundwater flooding.

The data should not be interpreted as identifying areas where groundwater is actually likely to flow or pond, thus causing flooding, but may be of use to in identifying where, for example, further studies may be useful.

The Areas Susceptible to Groundwater Flooding data for the Districts is shown in Map 6.

3.2.6 Sewer flood risk mapping

The sewer flooding register provided by Thames Water, is a register held by water companies on the location of properties at risk of foul and/or surface water sewer related flooding problems showing the number of properties flooded by 'overloaded sewers' within the Districts over the past ten years by postcode area is shown in Map 7. 'Overloaded sewers' is the Ofwat definition of flooding due to excessive flows in sewers. Thames Water do not make publicly available figures for other causes of flooding including blockages, collapses and equipment failure, presumably because such problems should be rectified in a relatively short time and so should be unlikely to recur.

The incidents recorded will relate to incidents of flooding due to a wide range of storm return periods, and may include repeated incidents at a single property. Where improvements have been made by Thames Water to rectify a known flooding problem, the affected properties are taken off the register.

Given that only ten years of incidents have been provided, it is reasonable to assume that there are significantly more properties at risk of sewer flooding, but which haven't experienced the rainfall or other conditions to cause flooding during this period. Thames Water do not make available data with any more detailed location information, citing data protection reasons. Comparison of the sewer flooding register data with locally reported sewer flooding issues suggests that it does not tell the whole story.

Therefore in the case of sewer flooding, more reliance should be placed on locally gathered knowledge and information on sewer flooding incidents when assessing flood risk for development. The analysis of surface water flooding can also help to indicate likely locations at risk of sewer flooding, since in extreme floods the importance of above ground flow routes is arguably as or more significant than underground piped drainage systems.

3.2.7 Historic Flood Map

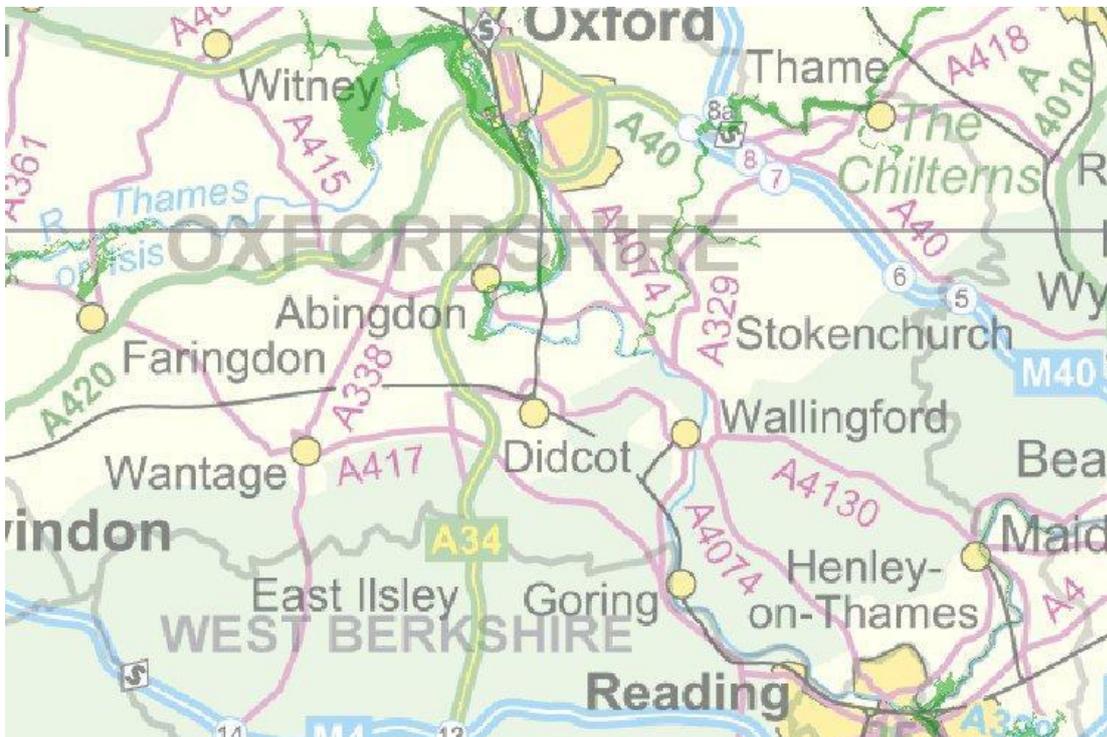
The Environment Agency maintains and updates a **Historic Flood Map (HFM)**, which shows the combined extents of known flooding from rivers, the sea, and groundwater. Events are only included where there is enough information to map them. The layer contains no attributes about the date of the event, or the mechanism of flooding. The HFM is shown in Map 8a.

It is worth noting that HFM outlines are used to define Flood Zone 2, where they are more extensive than the modelled Flood Zone 2 and where there is an appropriate level in confidence in the source and extents of the historic event.

3.2.8 Risk of flooding from reservoirs

The risk of inundation as a result of reservoir breach or failure of a number of reservoirs within the area was assessed as part of the National Inundation Reservoir Maps (NRIM) study. All reservoirs with an above ground storage capacity of 25,000 m³ were meant to be included within this study.

This dataset was not available to the SFRA but it can be viewed on the Environment Agency website under [Risk of Flooding from Reservoirs](#)¹³, and is shown in Figure 3-2.



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Figure 3-2: Risk of flooding from reservoirs (extracted from Environment Agency website)

3.3 Other flood risk evidence

3.3.1 Hydraulic modelling

The Environment Agency has carried out various detailed flood risk mapping studies, which include hydrological assessments and hydraulic models of specific reaches of river. The following studies were available at the time of writing:

- River Thames (Poole Keynes to St Johns), 2000
- River Thames (St Johns to Shifford), 2011

¹³ Environment Agency, Risk of flooding from Reservoirs map http://maps.environment-agency.gov.uk/wiyby/wiybyController?x=357683.0&y=355134.0&scale=1&layerGroups=default&ep=map&textonly=off&lang=_e&topic=reservoir