West Berkshire Level 2 SFRA

Final Report

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West Berkshire Council

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Revision History

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Contract

This report describes work commissioned by West Berkshire Council in an appointment letter dated 14 May 2020. Emily Jones and Fiona Hartland of JBA Consulting carried out this work.

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Purpose

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Executive summary

Level 2 SFRA objectives

The objectives of this Level 2 SFRA update are to:

- Using available data, provide information and maps presenting flood risk from all sources for potential allocation sites in the West Berkshire Local Plan Review to 2036 (LPR).
- Inform the Sequential Test (whereby new development is steered towards areas at lowest risk of flooding).
- Serve as guidance for developers to complete the Exception Test if applicable (i.e. if development has to take place in Flood Zone 2 (medium risk) or Zone 3 (high risk).
- Provide an assessment of residual flood risk and climate change.
- Where flood risk information is unavailable or limited, conduct appropriate hydraulic modelling where possible to determine the flood risks to potential site allocations.
- Take into account the most recent national and local policy and guidance documents, update information on the requirements for site-specific FRAs, considerations for suitable surface water management methods and opportunities to reduce flood risk to existing communities through new development.

The Level Two assessment includes detailed assessments of the potential site allocations. These sites will be subject to further site assessment as part of the LPR or neighbourhood planning process to determine which will ultimately be selected as allocations.

These include:

- An assessment of the highest risk flooding mechanism (or way in which flooding occurs) and most likely flooding source (or type of flooding) for each site.
- An assessment of all sources of flooding including fluvial flooding, surface water flooding, groundwater flooding, reservoir flooding, mapping of the functional floodplain and the potential increase in fluvial and surface water flood risk due to climate change.
- An assessment of existing flood warnings at the sites, including whether there is safe access and egress during an extreme event.
- Advice and recommendations on the likely suitability of Sustainable Drainage Systems (SuDS) for managing surface water runoff.

As part of the Level 2 SFRA, detailed site summary tables have been produced for the potential allocation sites in West Berkshire. To accompany each site summary table, there are a series of maps, containing all of the mapped flood risk outputs.

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Abbreviations and Definitions

Term	Definition
AEP	Annual Exceedance Probability. Chance of occurrence in any one year, expressed as a percentage. For example, a 1% annual probability event has a 1 in 100 chance of occurring in any given year
Attenuation	The storing of water to reduce peak discharge of water
Brownfield land	Previously developed land
CC	Climate change - Long term variations in global temperature and weather patterns caused by natural and human actions.
CIRIA	Construction Industry Research and Information Association
Climate change	Long term variations in global temperature and weather patterns
Conveyance feature	A term used to describe a feature of a sustainable drainage system which is designed to convey (move) water through the system (e.g. a swale or rill)
Culvert/culverted	A channel or pipe that carries water below the level of the ground
Defra	Department for Environment, Food and Rural Affairs
EA	Environment Agency
Exception Test	A method to help ensure that flood risk to people and property will be managed satisfactorily, while allowing necessary development to go ahead in situations where suitable sites at lower risk of flooding are not available. The two parts to the Test require proposed development to show that it will provide wider sustainability benefits to the community that outweigh flood risk, and that it will be safe for its lifetime, without increasing flood risk elsewhere and where possible reduce flood risk overall

Term	Definition
Flood defence	Infrastructure used to protect an area against floods as floodwalls and embankments; they are designed to a specific standard of protection (design standard).
Flood mechanism	The means by which people or property are affected by a flood source.
Flood Risk Area	An area determined as having a significant risk of flooding in accordance with guidance published by Defra and WAG (Welsh Assembly Government).
FSA	Flood Storage Area
Flood source	The type of flooding (e.g. fluvial, surface water, groundwater).
Flood zone	Areas defined by the probability of river and sea flooding, ignoring the presence of defences. Flood Zones are shown on the Environment Agency's Flood Map for Planning (Rivers and Sea), available on the Environment Agency's web site. There are 4 zones: • Flood Zone 1: low probability of flooding • Flood Zone 2: moderate probability of flooding • Flood Zone 3a: High probability of flooding • Flood Zone 3b: functional floodplain
Fluvial	Relating to the actions, processes and behaviour of a water course (river or stream)
Fluvial Flooding	Flooding resulting from water levels exceeding the bank level of a main river
FRA	Flood Risk Assessment - A site specific assessment of all forms of flood risk to the site and the impact of development of the site to flood risk in the area.
Functional floodplain	Land where water has to flow or be stored in times of flood. It is defined by LPAs within SFRAs. Functional floodplain (also referred to as Flood Zone 3b) is not separately distinguished from Zone 3a on the Environment Agency Flood Map for Planning
Greenfield	Previously undeveloped land
Groundwater	Water that is in the ground, this is usually referring to water in the saturated zone below the water table
Groundwater flooding	Flooding caused by groundwater, when the water table rises to or above ground level
Ha	Hectare
HELAA	Housing and Economic Land Availability Assessment – a technical study that forms a critical component of the evidence base of local

Term	Definition
	plans and neighbourhood plans. It assists in identifying suitable land that is available for housing and economic development. Assessments made through the HELAA are indicative, and decisions on which sites should be allocated are made through the local plan and neighbourhood plan process
Hydraulic modelling	A computerised model of a watercourse and floodplain to simulate water flows in rivers too estimate water levels and flood extents
Infiltration feature	A term used to describe a feature of a sustainable drainage system which is designed to allow water to soak (infiltrate) into the ground (e.g. a soakaway or infiltration basin)
JBA	Jeremy Benn Associates
LLFA	Lead Local Flood Authority - Local Authority responsible for taking the lead on local flood risk management
LPA	Local Planning Authority. The body that is responsible for responsible for controlling planning and development through the planning system
LPR	West Berkshire Local Plan Review to 2036
Main River	A watercourse shown as such on the Main River Map, and for which the Environment Agency has responsibilities and powers. However, the Environment Agency are not responsible for all maintenance on Main Rivers, as the Environment Agency have permissive powers, but the riparian owner has the responsibility.
NPPF	National Planning Policy Framework. It is a framework which sets out the Government's planning policies for England and how these are expected to be applied
Ordinary Watercourse	All watercourses that are not designated Main River. Local Authorities or, where they exist, IDBs have similar permissive powers as the Environment Agency in relation to flood defence work. However, the riparian owner has the responsibility of maintenance.
PPG	National Planning Practice Guidance
Resilience Measures	Measures designed to reduce the impact of water that enters property and businesses; could include measures such as raising electrical appliances.
Return Period	Is an estimate of the interval of time between events of a certain intensity or size, in this instance it refers to flood events. It is a statistical

Term	Definition
	measurement denoting the average recurrence interval over an extended period of time.
Residual risk	The risk that remains after measures have been taken to alleviate flooding.
Return period	The average time period between rainfall or flood events with the same intensity and effect
Risk	In flood risk management, risk is defined as a product of the probability or likelihood of a flood occurring, and the consequence of the flood.
River catchment	The areas drained by a river
RoFSW	Risk of Flooding from Surface Water map. Environment Agency national map showing risk of flooding from surface water.
Runoff	The flow of water from an area on the catchment surface, caused by rainfall
Sewer flooding	Flooding caused by a blockage or overflowing in a sewer or urban drainage system.
Sequential Test	An approach to future site planning whereby new development is directed towards areas with the lowest probability of flooding before consideration of higher risk areas. The Sequential Test helps ensure that development can be safely and sustainably delivered, and developers do not spend time promoting proposals which are inappropriate on flood risk grounds
SFRA	Strategic Flood Risk Assessment
SoP	Standard of Protection - Defences are provided to reduce the risk of flooding from a river and within the flood and defence field standards are usually described in terms of a flood event return period. For example, a flood embankment could be described as providing a 1 in 100-year standard of protection.
SPZ	Source Protection Zone - The Environment Agency have defined Source Protection Zones (SPZs) for groundwater sources such as wells, boreholes and springs used for public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution in the area. The closer the activity, the greater the risk. The maps show three main zones (inner, outer and total catchment) and a fourth zone of special interest, which is occasionally applied, to a groundwater source.
SuDS	Sustainable Drainage Systems - Methods of management practices and control structures that

Term	Definition
	are designed to drain surface water in a more sustainable manner than some conventional techniques
Surface water flooding	Flooding from surface water runoff as a result of high intensity rainfall when water is ponding or flowing over the ground surface before it enters the underground drainage network or watercourse, or cannot enter it because the network is full to capacity, thus causing what is known as pluvial flooding.
WFD	Water Framework Directive

1 Introduction

The current Local Plan for West Berkshire (which comprises of the Core Strategy Development Plan Document (DPD), Housing Site Allocations DPD, and the Saved Policies of the West Berkshire District Local Plan 1991-2006) sets out the planning policies for the district up to 2026. West Berkshire District Council is now undertaking a review of the Local Plan to cover the period up to 2036. The purpose of the Local Plan Review (LPR) is to assess the future levels of need for new homes, employment land and other land uses, and to provide an appropriate basis for housing, employment land and infrastructure provision over that period.

Two consultations on the proposed scope and content of the LPR were held in 2018, and a third is planned to take place in late Autumn 2020. Adoption of the LPR is anticipated for December 2022.

This Level 2 Strategic Flood Risk Assessment (SFRA) follows the West Berkshire Level 1 SFRA, produced in 2019 in line with the approach set out in the National Planning Policy Framework (2019). The SFRA will also provide input to assist with the consideration of individual proposals for planning decisions, however more detailed investigations will be required to support development of the sites.

This approach is consistent with the National Planning Policy Framework (2019) and in particular Section 14: Meeting the challenge of climate change, flooding and coastal change.

The SFRA Levels 1 and 2 are prepared in accordance with best practice as set out in the National Planning Practice Guidance (PPG) "Local planning authorities: strategic flood risk assessment" (last updated 28 February 2017).

1.1 SFRA Objectives

Planning Practice Guidance advocates a tiered approach to risk assessment and identifies the following two levels of SFRA:

- Level 1: where flooding is not a major issue and where development pressures are low. The assessment should be sufficiently detailed to allow application of the **Sequential Test**.
- Level 2: where land outside Flood Zones 2 and 3 cannot appropriately accommodate all the necessary development creating the need to apply the **Exception Test**. In these circumstances, the assessment should consider the detailed nature of the flood characteristics within a Flood Zone and assessment of other sources of flooding.

The Level 1 SFRA identified that Level 2 SFRA assessments were required at a number of sites in West Berkshire. Level 2 assessments should be undertaken at all sites which have been identified as 'at risk' and which may be carried forward in the LPR. The aim of the Level 2 assessments is to provide evidence to help determine whether or not the Exception Test as set out in PPG could be passed, i.e. development could be achieved safely, for sites that have been found to be at flood risk by the Level 1 assessment.

1.2 How to use the Level 2 SFRA

The Level 2 report gives a short non-technical summary of how the Level 2 sites were selected, the detailed flood risk data that was used to carry out individual site-level assessments for each of the Level 2 sites, and how climate change was assessed. Further technical detail is given in the Appendices.

The main output of the Level 2 Assessment is the individual site summary sheets (Appendix A), which offer high level flood risk assessments and conclusions for each site.

2 Identification of Level 2 sites

The Level 1 SFRA and subsequent work carried out a screening of 266 sites in West Berkshire, against available flood risk information including:

- Flood Map for Planning (Rivers and Sea) – Flood Zone 2 and 3
- Risk of Flooding from Surface Water (RoFSW)
- Flood Risk from Reservoirs mapping
- JBA Groundwater flood map
- Historic Flood Map

The 266 screened sites were those that were promoted during the 'Call for Sites' that the Council held for its Housing and Economic Land Availability Assessment (HELAA) one of the evidence documents for the LPR.

A detailed assessment of flood risk to the 266 identified sites found:

- 225 of these were entirely located within Flood Zone 1 and therefore considered to be at a low risk of fluvial flooding;
- 41 sites contained areas of Flood Zone 2;
- 19 were identified as containing areas of Flood Zone 2 and Flood Zone 3a;
- 23 sites had a total site area of greater than 10% at risk from the 1 in 100-year (1% AEP) RoFSW extent (and 17 of these sites had an area greater than 20% at risk.);
- 34 had a total site area of greater than 20% at risk from the 1 in 1,000-year (0.1% AEP) surface water flood map;
- 29 sites were identified as within the Environment Agency's historic flood outline.

Of the numerous sites published for West Berkshire, 34 sites were taken forward for Level 2 assessment.

The primary flood source for the sites (and reason they have been assessed at Level 2) are as follows:

- 18 sites are partly located within the current Flood Zones 3b, 3a and 2;
- 3 sites are located entirely in Flood Zone 1, however have greater than 10% of their area within the RoFSW 1 in 30-year (3.33%) risk area;
- 8 of the sites are located entirely in Flood Zone 1, however have greater than 30% of their area within an area of high groundwater flood risk; and
- 4 sites are shown to be within the Jacobs Groundwater Flood Risk modelling.

3 What flood risk information has been used?

3.1 Data sources

The Level 2 SFRA draws upon all the information and data sources that were compiled as part of the Level 1 assessment, examining them in more detail on a site-by-site basis. These sources include:

- Environment Agency Flood Map for Planning;
- Environment Agency Main Rivers GIS layer and OS OpenRivers GIS layer;
- Environment Agency Risk of Flooding from Surface Water Map (RoFSW);
- Surface water flood modelling of 1 in 100-year + 40% climate change event;
- Environment Agency detailed hydraulic models (summarised in Table 3-1);
- Environment Agency Recorded Flood Outline;
- Environment Agency Spatial Flood Defences layer;
- Environment Agency Risk of Flooding from Reservoirs map;
- JBA Groundwater Flood Map; and
- Jacobs Groundwater Emergence Modelling.

3.2 Flood Zones

The Flood Zones defined within the West Berkshire Level 1 SFRA have been used for assessment within the Level 2 SFRA.

3.3 Environment Agency detailed hydraulic models

The Environment Agency flood risk mapping programme has produced detailed hydraulic models covering the following watercourses:

- River Enborne
- Foudry Brook
- Lambourn
- River Kennet
- River Thames
- River Pang
- Sulham Brook

Their outputs are incorporated into the existing Flood Zones, but they also provide additional information on flood probability, rates of onset, depths, velocities and hazards.

The scope of the SFRA does not allow for re-survey and re-modelling of these river catchments. However, models for the watercourses were obtained and re-run for the latest climate change scenarios.

Table 3-1: Hydraulic models in West Berkshire used within Level 2 SFRA

Model	Year created	Model Type	Data source used in Flood Zone 3b	Data source used in Flood Zone 3a + CC	Planned updates
Foudry Brook (Silchester to M4)	2004	1D only	1 in 20 modelled outline	Flood Zone 2	None known.
Foudry Brook at Grazeley (Flood Map Challenge)	2017	1D-2D	1 in 20 modelled outline	Flood Zone 2	None known.
River Enborne (MRL to Kennet Confluence)	2007	1D only	1 in 20 modelled outline	1 in 100 + 70% modelled outline	None known.
River Kennet (Marlborough to Newbury)	2007	1D only	1 in 20 modelled outline	1 in 100 + 70% modelled outline	Early stages of updates – not available for use in Level 2 SFRA
River Kennet (Newbury to Tyle Mill)	2007	1D only	1 in 20 modelled outline	1 in 100 + 70% modelled outline	Early stages of updates – not available for use in Level 2 SFRA
River Kennet and Lambourn (Newbury)	2016	1D-2D	1 in 20 modelled outline	1 in 100 + 70% modelled outline	None known.
River Kennet (Tyle Mill to Thames Confluence)	2018	1D-2D	Flood Zone 3 (1 in 20-year modelled flood extent exceeds Flood Zone 3)	1 in 100 + 70% modelled outline	Updated in 2018, no additional updated known.
Lambourn	2007	1D only	1 in 20 modelled outline	Flood Zone 2	Updated, but not yet published (expected August 2020). Changes to Flood Zones around Eastbury.
Pang and Sulham Brook	2011	1D-2D	1 in 20 modelled outline	1 in 100 + 70% modelled outline	None known.

Model	Year created	Model Type	Data source used in Flood Zone 3b	Data source used in Flood Zone 3a + CC	Planned updates
River Pang (Bucklebury)	2011	1D only	Flood Zone 3 (1 in 20-year extent not available)	Flood Zone 2	None known.
River Pang (Hampstead Norreys)	2010	1D-2D	1 in 20 modelled outline	1 in 100 + 70% modelled outline	None known.
River Pang (Hampstead Norreys) Sewage Treatment Works	2014	1D-2D	Flood Zone 3 (1 in 20-year extent not available)	1 in 100 + 70% modelled outline	None known.
River Thames (Sandford-Mapledurham)	2018	1D-2D	Flood Zone 3 (1 in 20-year extent not available)	1 in 100 + 70% modelled outline	None known.
River Thames (Mapledurham to Sonning)	2011	1D-2D	1 in 20 modelled outline	1 in 100 + 70% modelled outline	Updated, but not yet published (expected later in 2020)

3.4 Residual Risk from Breach and Blockages

'Residual risk' refers to the risks that remain in circumstances after measures have been taken to alleviate flooding. It is important that these risks are quantified to confirm that the consequences can be safely managed. It is the responsibility of the site developer to fully assess flood risk to an individual site, to propose measures to mitigate the flood risk and demonstrate that any residual risks can be safely managed.

This Level 2 SFRA does not assess the probability of failure, other than noting that such events are rare. However, in accordance with the NPPF, all sources of flooding need to be considered. If a breach or blockage event were to occur, then the consequences to people and property could be high.

Several of the sites assessed as part of the Level 2 SFRA contain culverts which may pose a residual flood risk to the site in the event of blockage. The culvert may not be located directly within the site, but may be within close proximity.

Culverts and structures susceptible to blockage, located within or close to the allocated sites, were identified using OS mapping, the Environment Agency Culverts and Spatial Defences layers, and available hydraulic models.

A high level assessment of the potential risk to the proposed development site from culvert blockage has been carried out as part of the Level 2 SFRA. However, to fully assess the impacts of blockage to individual sites should be assessed in detail within a site-specific Flood Risk Assessment.

One site assessed within the Level 2 SFRA, London Road Industrial Estate, Newbury (NEW1), was identified as benefiting from defence by Newbury Flood Alleviation Scheme (FAS). The scheme comprises of flood defence works, including walls, embankments and ground-raising, at five locations throughout Newbury town centre. It improves protection to 381 residential properties and 69 commercial properties with a 1% (1 in 100) chance of flooding occurring in any given year.

It is recommended that the residual risk of flooding to individual sites, in the event of breach or failure of flood alleviation schemes, should be assessed in detail within a site-specific Flood Risk Assessment.

4 Assessment of climate change

4.1 Government guidance on climate change

Updated government guidance on assessing the impact of climate change on flooding in line with the UKCP09 Climate Change Projections was released in February 2016 and updated in 2017[1].

The guidance sets out a range of climate change allowances that should be considered when assessing the future risk to a proposed development. The climate change allowances are dependent on location in the country (by river basin) and lifetime and vulnerability classification of the development (epoch). It also provides several bands (termed 'central', 'higher central' and 'upper end') to test depending on the vulnerability of the development and the Flood Zone within which it is located.

The UKCP18 Climate Change Projections were released in December 2018. However, current Environment Agency guidance[2] states that the UKCP09 (February 2016) climate change allowances are still the best national representation of changes in peak river flow. Therefore, the recommended UKCP09 projections have been used to represent climate change within the Level 2 SFRA.

4.2 Climate change and fluvial modelling

Following the government guidance (Section 5.1), the key epoch considered is 2070-2115 as this reflects the lifetime of residential development; and the key vulnerability is 'more vulnerable' as this represents a conservative classification incorporating all vulnerabilities. The key allowances to consider for Flood Zone 3a are therefore the Higher Central and Upper End (35% and 70% in Thames river basin) as shown in Table 4-1.

In July 2020, a high impact climate change scenario (known as High++ or H++) was added to guidance. This scenario is recommended to be considered for development of nationally significant infrastructure projects, new settlements or significant urban extensions. It provides a 'sensitivity test' for large-scale climate change expected to occur over the lifetime of the development. No sites assessed within the Level 2 SFRA have been identified as meeting the criteria for requiring assessment of the H++ climate change scenario.

1 Environment Agency (2016) Flood risk assessments: climate change allowances. Available at: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

2 Environment Agency (2019) Using 'Flood risk assessments: climate change allowances' following publication of new climate projections in UKCP18.

Table 4-1: Climate change allowances

River basin district	Allowance category	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Thames	High++	25%	40%	80%
	Upper end	25%	35%	70%
	Higher central	15%	25%	35%
	Central	10%	15%	25%

In order to assess the impact of these climate change scenarios on the 1 in 100-year flood risk (Flood Zone 3a) at development sites, in accordance with the NPPF, we used the following hierarchy of modelling information as agreed with the Council and the Environment Agency:

- Re-run of existing detailed models with the Higher Central and Upper End climate change flows scenarios.
- Flood Zone 2 as a proxy.

Flood extents for the 35% and 70% climate change scenarios were available for the majority of models. Where the models were 1D-only, models were re-run, but climate change flood extents could not be accurately mapped from available data, and therefore Flood Zone 2 has been used as a proxy. This applies to the following models:

- Foudry Brook
- Lambourn
- River Pang (Bucklebury)

The source of climate change information and the impact on flood risk to the individual sites, is also noted on the summary sheets under 'Climate Change – Implications for the Site'.

5 How have cumulative impacts been assessed?

5.1 Principle

Cumulative impacts are defined as the effects of past, current and future activities on the environment. Under the 2019 NPPF, strategic policies and their supporting Strategic Flood Risk Assessments (SFRAs), are required to 'consider cumulative impacts in, or affecting, local areas susceptible to flooding' (para. 156).

When allocating land for development, consideration should be given to the potential cumulative impact on flood risk within a catchment. Development increases the impermeable area within a catchment, which if not properly managed, can cause loss of floodplain storage, increased volumes and velocities of surface water runoff, and result in heightened downstream flood risk. Whilst individual developments should only have a minimal impact on the hydrology and flood risk of an area, the cumulative effect of multiple developments may be more severe.

The cumulative impact should be considered throughout the planning process, from the allocation of sites within the Local Plan, to the planning application and development design

stages. Once preferred options are identified, their cumulative impact can be considered in more detail within a Level 2 SFRA, where necessary. In addition, site-specific FRAs must consider the cumulative impact of the proposed development on flood risk within the wider catchment area.

In consultation with the Environment Agency, conditions set by the Council should support the implementation of SuDS and appropriate flood mitigation measures. As a minimum, development should have a neutral impact on flood risk, and where possible it should improve existing issues, to ensure that flood risk is not exacerbated either within, or outside of, the Council's administrative area.

5.2 Methodology

The impacts of cumulative development on flood risk were assessed as part of the West Berkshire Level 1 SFRA Addendum.

A series of metrics, including predicted flood risk, existing development commitments and potential future development pressures, were used to calculate impact of any future development on areas susceptible to flooding.

Where catchments were identified as sensitive to the cumulative impact of development, the assessment concluded with potential strategic planning policy suggestions to manage the risk.

Full details of the methodology used can be found in the Addendum to the West Berkshire Level 1 SFRA.

5.3 Planning Policy Considerations for Catchments

The following catchments are identified as being at high sensitivity to the cumulative impacts of development:

- Kennet and Holy Brook - *includes Burghfield Common, Aldermaston Wharf*
- Thames Wallingford to Caversham - *including Purley-on-Thames and Streatley*
- Kennet (Lambourn confluence to Enborne confluence) - *including Thatcham, Newbury and Woolhampton*
- Holy Brook - *includes Theale, Calcot*
- Foudry Brook (West End Brook to M4) - *including Mortimer*
- Kennet and Avon Canal and Dun above Hungerford

The following catchments are identified as being at medium sensitivity to the cumulative impacts of development:

- Sulham Brook - *including Sulham*
- Burghfield Brook - *including Burghfield and Grazeley*
- Lambourn (Source to Newbury) - *including Lambourn and North Newbury*
- Bourne Rivulet
- Middle Kennet (Hungerford to Newbury) - *including Hungerford, West Newbury and Kintbury*
- Shalbourne (source to Kennet at Hungerford)
- Pang - *including Pangbourne*
- Loddon (Sherfield on Loddon to Swallowfield)

Within the Level 2 SFRA Site Summary Sheets in Appendix A, recommendations are provided for sites within catchments identified as at medium and high sensitivity to the cumulative impacts of development.

6 Level 2 flood risk summaries

6.1 Site level assessments

The flood risk summary sheets in Appendix A give flood risk information for each Level 2 site in order to determine whether the Exception Test will be required and/or the development will be viable. These include:

- Basic site information (area, type of site, % of site in each Flood Zone).
- Description of sources and mechanisms of flooding.
- Flood Zone (1% and 0.1% annual probability events) and functional floodplain extent maps, flood hazard map, flood depth map, flood velocity map, climate change impact maps. Where a site is not covered by detailed modelling, information on flood hazard, depth and velocity will not be available.
- Information on rate of onset and duration of flooding.
- Risk of Flooding from Surface Water (RoFSW) map.
- Assessment of flood defences.
- A high-level assessment of how sites might be affected during events where there is failure of flood risk management measures (breach or failure), or they are overwhelmed by events that exceed their envisaged design capacity (overtopping).
- An assessment of flood warning coverage.
- An assessment of emergency planning procedures and how safe access and egress will be managed.
- An assessment of the effect of land use and structures on flood risk both within the potential local plan site and for other development nearby.
- Recommendations on the requirements for drainage control and impact mitigation, including an assessment of likely SuDS suitability and flood betterment opportunities.
- Site-specific development control advice (including for example sequential site design, access and egress, requirements for SuDS, recommendations for drainage control and impact mitigation).
- Sensitivity of the wider catchment to the cumulative impact of development on flood risk, as assessed within the West Berkshire Level 1 SFRA Addendum.
- Information on the requirements for the Exception Test, flood risk assessments and site design.

These summary sheets form the main output of the Level 2 SFRA.

7 Implications for development and requirements for the Exception Test

7.1 Sites within Flood Zone 2 and 3 and the Exception Test

It should be noted that the 'Sequential Test' refers to the procedure of sequentially selecting sites with the lowest possible flood risk, as part of the Local Plan process. Once sites have been selected for inclusion within the Local Plan, and plans to develop the site take shape, the 'Sequential Approach' should also be applied to the site design, to ensure that vulnerable land uses are located in areas of lower flood risk.

Guidance is clear that the Sequential Test must be applied first and only if passed should the site consideration extend to Level 2. Only once the Sequential Test is passed should the Exception Test be applied.

Of the 34 sites considered in the Level 2 assessment, there are 19 sites where part of the site falls within Flood Zones 2 and 3. However, for 26 of the sites examined, less than 50% of the site area is located within Flood Zones 2 and 3. Therefore, it is expected that it will be possible to preserve Flood Zones 2 and 3 (subject to a detailed flood risk assessment) as public green space or other open land category, with built development restricted to Flood Zone 1.

For these sites, the Exception Test will only be required if built development is proposed in Flood Zone 2 or 3 and will be dependent upon their vulnerability.

Table 7-1: Sites where greater than 50% of the site area is in Flood Zone 1

Site Code	Site Name	% of site in Flood Zone 1
BEEN1	Land fronting Bath Road, Aldermaston Wharf, Reading - Site B	100%
BH1	Clappers Farm, Cross Lane, Beech Hill, Grazeley	85%
BUR14	Herons Nest, Station Road, Theale	73%
BUR3	Land off Pingewood Road North, Burghfield Bridge, RG30 3XN	58%
CA10	Sims Metal Management & J. Passey & Son Butchers, Turnpike Rd, Newbury	100%
CA15	Land at Long Lane, Newbury	100%
COM2	Land north of Hill Top House, Churn Road, Compton, RG20 6PP	100%
COM3	Land east of Mayfield Cottages, Cheseridge Road, Compton, RG20 7PL	80%
EI2	Land south of Fidler's Lane, East Ilsley	100%
ENG1	Englefield Estate Yard, The Street, Englefield, RG7 5ES	100%
HUN10	Land off Smitham Bridge Road & Marsh Lane, Hungerford (Site 4)	65%
HUN6	Hungerford Trading Estate, Smitham Bridge Road, Hungerford, RG17 0QU	73%
LAM1	Land between Folly Rd, Rockfel Rd/Bridleways, Stork House Dr, Lambourn	100%
LAM5	Windsor House Large Paddocks, Crowle Road, Lambourn	100%

Site Code	Site Name	% of site in Flood Zone 1
MID5	Land east of Colthrop Industrial Estate, Thatcham	100%
PAD1	Land fronting Bath Road, Aldermaston Wharf, Reading (Site A)	100%
PAD3	Land at Padworth Lane, Padworth	82%
PAD4	Land adjacent Padwoth IWMF, Padworth Lane, Lower Padworth	100%
SCD4	Land to the north of Newbury	100%
THA15	Hollington Place, Thatcham	100%
THA9	Land at Lower Way Farm, Thatcham, RG19 3TL	85%
THE1	Whitehart Meadow, High Street, Theale	69%
THE2	Theale Primary School, Church Street, Theale	100%
THE7	Former Theale Sewage Treatment Works, Blossom Lane, Theale, RG7 5SB	73%
WOK2	Pierces Farm, Goodboys Lane, Mortimer, RG7 3AH	100%
WOK4	Land at Grazeley	58%

Flood risk assessments must carry out detailed assessments where appropriate to define the Flood Zones and model the effect of climate change. Climate change assessments should be undertaken using the relevant allowances[3] for the type of development and level of risk and in discussion with the Environment Agency. The requirements for flood risk assessments are set out in the Level 1 SFRA. Further detail is given on the relevant summary sheets.

The remaining nine sites were found to have significant proportions (greater than 50%) of the site at fluvial flood risk, meaning that built development may need to be located within Flood Zone 2 and/or 3, if the Council wishes to take these sites forward. The sites are shown in Table 7-2.

Table 7-2: Sites with significant proportions of the site at fluvial flood risk

Site Code	Site Name	Proportion of site at fluvial flood risk
ALD5	Basingstoke Road/Fallows Road, Aldermaston Wharf	58%
NEW1	London Road Industrial Estate, Newbury	89%
NEW3	Kennet Shopping Centre, Newbury, RG14 5EN	60%
PAN5	Pangbourne College Boat House, 16 Shooters Hill, Pangbourne, RG8 7DX	65%

3 Environment Agency (2016) Flood risk assessments: climate change allowances. Available at: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

Site Code	Site Name	Proportion of site at fluvial flood risk
THA5	4 & 5 Colthrop Cottages & land adjacent, Colthrop Lane, Thatcham	87%
THE3	Station Plaza, Station Road, Theale, RG7 4AQ	100%
THE4	Kuehne & Nagel Distribution Centre, Brunel Road, Theale, RG7 4XE	100%
THE8	Land adjacent J12 of M4, Theale	90%

In this case the above sites will require application of the Exception Test depending on the vulnerability of the development[4]:

- If More Vulnerable and Essential Infrastructure is located in FZ3a.
- If Highly Vulnerable development is located in FZ2.
- If Essential Infrastructure is located in FZ3b

Development will not be permitted in the following scenarios:

- Highly Vulnerable infrastructure within FZ3a and FZ3b.
- More Vulnerable and Less Vulnerable Infrastructure within FZ3b.

The site and building design will need to ensure that the development is safe and resilient to the modelled flood risk, and any residual risk in defended areas, and that flood risk is not increased elsewhere. A flood mitigation and adaptation approach is likely to be required. Development should be designed using a sequential approach, with built development / higher vulnerabilities located towards areas of lower risk and hazard. The functional Flood Zone 3b and areas of higher hazard should be preserved as public open space. Further detail is given on the relevant summary sheets.

7.2 Sites at risk from flooding from ordinary watercourses

There are several sites which fall entirely in Flood Zone 1, but which contain an ordinary watercourse or drainage feature.

These sites must still pass the Sequential Test, taking account of the non-fluvial source of flooding, but will not require the Exception Test. In this case, the area at risk is likely to be limited and as long as it is taken into account in the site design, it should not affect the viability of development. Flood risk assessments must carry out detailed modelling where appropriate to define the Flood Zones and model the effect of climate change. The requirements for flood risk assessments are set out in the Level 1 SFRA. Further detail is given on the relevant summary sheets.

Liaison with West Berkshire Council (LLFA) is advised for sites within Flood Zone 1 that contain an ordinary watercourse.

4 Ministry of Housing, Communities & Local Government (2014) Planning Practice Guidance. Table 2: Flood risk vulnerability classification. Paragraph: 066 Reference ID: 7-066-20140306. Available at: https://www.gov.uk/guidance/flood-risk-and-coastal-change#Table-2-Flood-Risk-Vulnerability-Classification

7.3 Sites at risk of significant surface water flooding

All developments over 1Ha must carry out a flood risk assessment to assess surface water drainage and other sources of flooding. There are three sites where greater than 10% of the site area is within the RoFSW 3.33% AEP risk area. The sites are shown in Table 7-3.

Table 7-3: Sites with significant proportions of the site at surface water flood risk

Site Code	Site Name	Proportion of site in RoFSW 3.33 % AEP
CA10	Sims Metal Management & J. Passey & Son Butchers, Turnpike Rd, Newbury	21%
BEEN1	Land fronting Bath Road, Aldermaston Wharf, Reading - Site B	17%
CA15	Land fronting Bath Road, Aldermaston Wharf, Reading (Site A)	24%

These sites will still need to pass the Sequential Test, taking account of the non-fluvial source of flooding. The Exception Test is not required under the NPPF, but it must be shown that the development will be safe for its lifetime and the risk can be managed through a sequential approach to design.

Flood risk assessments should consider carrying out surface water modelling to define the level of surface water risk, and the risk areas / flow paths, including the effects of climate change. Drainage designs should 'design for exceedance' and accommodate existing surface water flow routes. Building design (threshold levels etc.) should ensure that development is safe from flooding. The requirements for surface water strategies and flood risk assessment are set out in the Level 1 SFRA. Further detail is given on the relevant summary sheets.

Liaison with the West Berkshire Council (LLFA) is advised for sites within Flood Zone 1 that contain significant surface water flood risk.

7.4 Sites at risk of significant groundwater flooding

There are eight sites where greater than 30% of the site area is within Category 4 of the JBA Groundwater Flood Map. The higher risk categories are defined as:

- Category **3** - Within this zone there is a risk of groundwater flooding to surface and subsurface assets. There is the possibility of groundwater emerging at the surface locally.
- Category **4** - Within this zone there is a risk of groundwater flooding to both surface and subsurface assets. Groundwater may emerge at significant rates and has the capacity to flow overland and/or pond within any topographic low spots.

A further four sites were selected for assessment, as they were identified as at groundwater flood risk within the Jacobs Groundwater Emergence Modelling, provided by West Berkshire Council for use in the Level 2 SFRA.

The sites are shown in Table 7-4.

Table 7-4: Sites with significant proportions of the site at groundwater flood risk selected for assessment within Level 2 SFRA

Site Code	Site Name	Criteria for Level 2 Selection
SCD4	Land to the north of Newbury	Significant proportion of site in JBA Groundwater Category 4
THE2	Theale Primary School, Church Street, Theale	Significant proportion of site in JBA Groundwater Category 4
THE8	Land adjacent J12 of M4, Theale	Significant proportion of site in JBA Groundwater Category 4
THA15	Hollington Place, Thatcham	Significant proportion of site in JBA Groundwater Category 4
PAD4	Land adjacent Padwoth IWMF, Padworth Lane, Lower Padworth	Significant proportion of site in JBA Groundwater Category 4
ENG1	Englefield Estate Yard, The Street, Englefield, RG7 5ES	Significant proportion of site in JBA Groundwater Category 4
WOK2	Pierces Farm, Goodboys Lane, Mortimer, RG7 3AH	Significant proportion of site in JBA Groundwater Category 4
MID5	Land east of Colthrop Industrial Estate, Thatcham	Significant proportion of site in JBA Groundwater Category 4
LAM1	Land between Folly Rd, Rockfel Rd/Bridleways, Stork House Dr, Lambourn	At risk of groundwater emergence in 3.3% AEP event (Jacobs modelling)
LAM5	Windsor House Large Paddocks, Crowle Road, Lambourn	At risk of groundwater emergence in 3.3% AEP event (Jacobs modelling)
COM2	Land north of Hill Top House, Churn Road, Compton, RG20 6PP	At risk of groundwater emergence in 3.3% AEP event (Jacobs modelling)
EI2	Land south of Fidler's Lane, East Ilsley	At risk of groundwater emergence in 3.3% AEP event (Jacobs modelling)

These sites will still need to pass the Sequential Test, taking into account the non-fluvial source of flooding, but will not require the Exception Test.

Flood risk assessments should consider conducting further analysis of groundwater within the site to define the level of groundwater flood risk. Site design, including any SuDS features, should be resilient to groundwater flooding and building design (threshold levels etc.) should

ensure the development is safe from flooding. Liaison with West Berkshire Council (LLFA) is advised for sites within Flood Zone 1 that contain significant groundwater flood risk.

7.5 Opportunities for flood betterment

Many of these developments offer real opportunities to provide flood betterment alongside sustainable development. Such opportunities should be discussed with the LLFA and Environment Agency as appropriate at an early planning stage. These include:

- All developments should take the opportunity to implement exemplar SuDS design, delivering multiple benefits for the development (water quality, biodiversity, amenity, green infrastructure).
- Opportunities for developer contributions to flood mitigation options under consideration by organisations such as West Berkshire Council or the Environment Agency.
- All existing watercourses on sites should remain as open channels. West Berkshire Council and the Environment Agency maintain a presumption against the culverting of watercourses. In addition, any other structures encountered on the site which may restrict flow of water should be removed, to allow better management of flood risk, provide access to green infrastructure, and improve habitats and fish passage, in accordance with West Berkshire Core Strategy Policy CS18.
- Any proposed river crossings on the sites must ensure they are clear span in design and allow sufficient clearance of flood flows, to prevent future risk of blockage and backing up, and to retain a wildlife corridor beneath the bridge.
- Opportunities for mitigation of surface water flow routes to improve flood risk on adjoining land – particularly to public buildings such as hospitals and schools.

Opportunities have been highlighted on the relevant site summary sheets in Appendix B.

8 Future use of SFRA data

The Level 2 SFRA has examined each of the sites deemed to be at flood risk in more detail. The aim of the Level 2 assessments is to determine whether or not the Exception Test could be passed, i.e. development could be achieved safely, for sites that have been found to be at flood risk by the Level 1 assessment. The limitations of the available detailed modelling have been highlighted, and detailed flood risk assessments will be required on all of these sites to ensure that they are designed safely.

It is important to recognise that the SFRA has been developed using the best available information at the time of preparation. This relates both to the current risk of flooding from rivers, and the potential impacts of future climate change. In particular the Environment Agency's detailed river models may be updated as part of their ongoing flood risk mapping programme.

The SFRA should be periodically reviewed and updated when new information on flood risk, flood warning or new planning guidance or legislation becomes available. New information on flood risk may be provided by the Council, West Berkshire (in its role as LLFA), the Highways Authority, Thames Water and the Environment Agency.

Appendices

A Updated site screening spreadsheet

B Site summary sheets

C Site maps

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