HEREFORDSHIRE STRATEGIC FLOOD RISK ASSESSMENT

LEVEL 1

APRIL 2019

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LEVEL 1

Herefordshire Council

DRAFT

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EXECUTIVE SUMMARY

This Level 1 Strategic Flood Risk Assessment (SFRA) has been prepared on behalf of Herefordshire Council to update the Level 1 SFRA published in 2009. Since 2009 new flood risk mapping has been published by the Environment Agency and prepared by Herefordshire Council. There have been a number of significant changes to legislation, national planning policies and guidance relevant to the local management of flood risk. This report updates the Level 1 SFRA to reflect these changes and forms part of the evidence base for the updated Herefordshire Local Plan that sets out the future planning in Herefordshire up to 2031.

This Level 1 SFRA has been developed in accordance with National Planning Policy Framework and in consultation with the Environment Agency. It assesses the risk of flooding from all sources, now and in the future, taking into account the impacts of climate change, and assesses the impact that land use changes and development within Herefordshire could have on future flood risk.

Specifically the Level 1 SFRA will be used to:

- Determine the risk of flooding from all sources at a county level;
- Inform the sustainability appraisal of the Local Plan, so that flood risk is fully taken into account when considering allocation options and in the preparation of plan policies;
- Apply the Sequential Test and, where necessary, the Exception Test when determining land use allocations;
- Identify the requirements for site-specific Flood Risk Assessments (FRAs), including sites at risk of flooding from sources other than rivers;
- Set out the recommended approach to the management of flood risk that can be applied through the design and planning of development within the county;
- Determine the acceptability of flood risk in relation to emergency planning capability;
- Consider opportunities to reduce flood risk to existing communities and developments.

Of key importance within this SFRA is Section 6 which sets out how Herefordshire Council expect new development to take flood risk into account, including the recommended development control policies that all developments in Herefordshire are expected to consider.

1 INTRODUCTION

1.1 PROJECT OVERVIEW

This Level 1 Strategic Flood Risk Assessment (SFRA) supersedes the previous SFRA published in 2009. It assesses the risk of flooding within Herefordshire from all sources, now and in the future, taking into account climate change, and assesses the impact that land use changes and development in the county could have on future flood risk. The update will form part of the evidence base for the updated Local Plan and assist with the preparation of Neighbourhood Development Plans and their associated site allocations.

Since the previous Level 1 SFRA prepared in 2009 there have been updates to fluvial and surface water modelling within the county. The Flood Map for Planning (Rivers and Sea) is typically updated by the Environment Agency on a quarterly basis, and as a result a more accurate understanding and representation of local fluvial flood risk is now known. Fluvial flood risk studies for the River Wye and a combined model of the River Arrow and River Lugg have also been completed in 2012 and 2013 respectively.

The Environment Agency published the Risk of Flooding from Surface Water map in 2010, subsequently updating this in 2015. As a result the knowledge and understanding of the risk of flooding from surface water has significantly improved since the previous Level 1 SFRA. Herefordshire Council also completed their Local Flood Risk Management Strategy in 2016.

There have also been significant changes in legislation and policy since the previous Level 1 SFRA, most notably the Flood and Water Management Act published in 2010, National Planning Policy Framework published in 2012, Non-Statutory Technical Standards for Sustainable Drainage published in 2015, and the Environment Agency's updated climate change guidance published in 2016.

1.2 PURPOSE OF THE SFRA

Herefordshire Council are required to prepare a SFRA in accordance with the National Planning Policy Framework (NPPF) to support the Local Plan and inform development control within the county.

The NPPF requires Level 1 SFRAs to cover the whole authority area. Specifically, the SFRA should:

- Refine information on river and sea flooding shown on the Environment Agency Flood Map for Planning;
- Determine the variations in risk from all sources of flooding;
- Inform the Sustainability Appraisal of the Local Plan;
- Enable the application of the Sequential Test and, where applicable, the Exception Test when determining land use allocations;
- Identify the requirements for site-specific flood risk assessments in particular locations;
- Determine the acceptability of flood risk in relation to emergency planning capability; and
- Consider opportunities to reduce flood risk to existing communities and developments through better management of surface water, provision for conveyance and of storage for floodwater.

1.3 SCOPE OF THE SFRA

A summary of the scope and purpose of each section this SFRA is provided in Table 1.3.1 to assist with navigating and making the most of this important document.

Table 1.3.1 Scope of the SFRA

Section	Contents
1: Introduction	Provides background to the purpose of the SFRA and update of the previous SFRA published in 2009. Provides a summary of Herefordshire and the key main rivers and ordinary watercourses within Herefordshire. Describes the key urban centres in Herefordshire and strategic development plans as outlined in the Herefordshire Local Plan.
2: Policy Framework	Provides a summary of key local, regional and national policy that is relevant to the management of flood risk in Herefordshire.
3: Approach to the SFRA	Summarises the key activities undertaken to inform the SFRA including consultation with relevant authorities, the intended use of the SFRA, the structure of the SFRA and what is meant by the different sources of flooding that are discussed within the SFRA.
4: Data Availability	Summarises the key data sources that have been used to inform the SFRA and that may also be available for use to inform site-specific flood risk assessments. A summary of key limitations is also provided.
5: Flood Risk in Herefordshire	Provides a summary of Herefordshire's key catchments. Summarises notable historic flooding events from all sources of flooding and provides a description of predicted flooding throughout the County, with a more detailed description provided for the key urban areas. Provides a summary of key flood management infrastructure and flood warning systems. Provides a summary of how climate change effects have been taken into consideration in the assessment of future flood risk within Herefordshire.
6: Policy Recommendations and Guidance	Explains the information that developers will be expected to submit when applying for development within Herefordshire, including the application of the Sequential Text and Exception Test, detail of required assessments, and requirement for flood management measures. Provides a summary of how climate change effects should be considered as part of site-specific flood risk assessments within Herefordshire.
7: Closing Remarks	Summarises the key aspects of this SFRA. States the procedures for updating this SFRA.
Appendices The following appendices are provided to support this SFRA: → A: Overview map of Herefordshire → B: Map of the main rivers in Herefordshire → C : Strategic assessment of flood risk at the strategic development sites → D: County-wide strategic maps ▪ Fluvial flood extents; Fluvial flood extents with climate change; Surface water flood extents; Herefordshire Council and Environment Agency historical flood records; Welsh Water and Severn Trent Water historic and predicted flooding from sewers → E: Hereford local maps ▪ Fluvial flood extents; Functional floodplain extent; Fluvial flood extents with climate change; Supplementary mapping of undefended fluvial flood extents; Surface water flood extents;	

Herefordshire Council and Environment Agency historical flood records; Welsh Water and Severn Trent Water historic and predicted flooding from sewers

- F: Leominster local maps
  - Fluvial flood extents; Functional floodplain extent; Fluvial flood extents with climate change; Supplementary mapping of undefended fluvial flood extents; Surface water flood extents; Herefordshire Council and Environment Agency historical flood records; Welsh Water and Severn Trent Water historic and predicted flooding from sewers
- G Ross-on-Wye local maps
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- H: Ledbury local maps
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- I: Bromyard local maps
  - Fluvial flood extents; Functional floodplain extent; Fluvial flood extents with climate change; Surface water flood extents; Herefordshire Council and Environment Agency historical flood records; Welsh Water and Severn Trent Water historic and predicted flooding from sewers
- J: Kington local maps
  - Fluvial flood extents; Functional floodplain extent; Fluvial flood extents with climate change; Surface water flood extents; Herefordshire Council and Environment Agency historical flood records; Welsh Water and Severn Trent Water historic and predicted flooding from sewers
- K: Herefordshire local fluvial flood mapping
- L: Areas at risk of Reservoir Flooding
- M: Location of sand and gravel deposits in Herefordshire
- N: Environment Agency Flood Warning and Flood Alert areas

1.4 HEREFORDSHIRE – AN OVERVIEW

The county of Herefordshire is a predominately rural county located in the south-west of the West Midlands region, on the border with Wales. The county area covers approximately 2,180 square kilometres with the perimeter predominantly bordered by the Malvern Hills and Black Mountains. A map of Herefordshire is provided in Figure 1.4.1 highlighting the key urban areas of Hereford, Ross-on-Wye, Ledbury, Leominster, Kington and Bromyard. A larger overview map also showing the operational area of the Internal Drainage Boards (IDB) and the major settlements is provided in Appendix A.

Herefordshire is a landlocked county and borders three English administrative areas comprising Shropshire County Council, Malvern Hills District Council (part of Worcestershire County Council), and Forest of Dean District Council (part of Gloucestershire County Council); and two Welsh administrative areas comprising Monmouthshire County Council and Powys County Council. Herefordshire also borders the Brecon Beacons National Park Authority that acts as the local planning authority within Monmouthshire and Powys for the Park area. As a result there is a lot of partnership working across the region, in particular with Shropshire and Worcestershire.

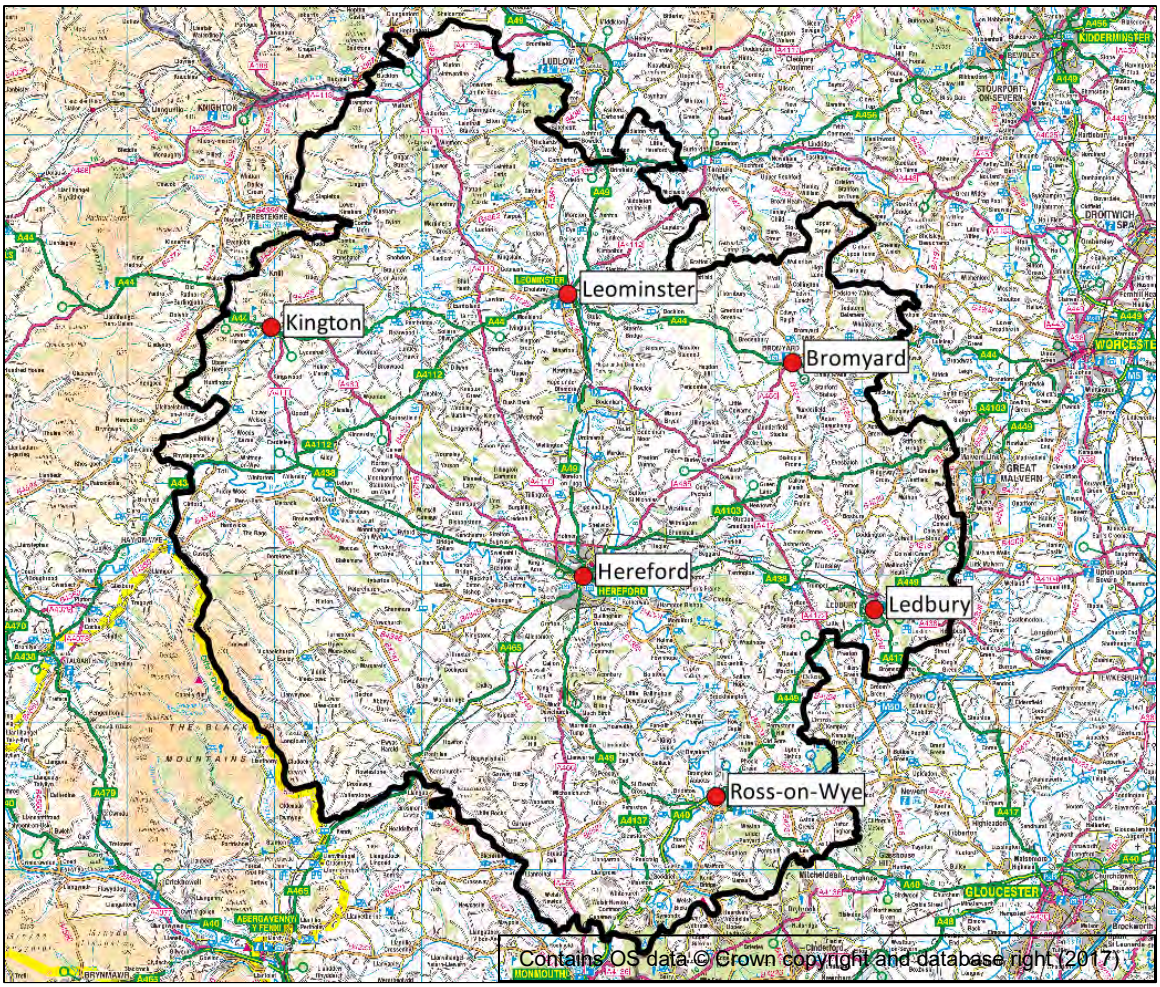


Figure 1.4.1 Map of Herefordshire

PEOPLE

Herefordshire has a population of approximately 188,100 (2015) with a population density of approximately 0.8 people per hectare. This is the 4th lowest population density in England. Population growth between 2001 and 2011 was estimated to the 5%; this is projected to grow to 12% by 2031. There are approximately 79,122 households located within Herefordshire (2011) which is projected to increase by approximately 20% by 2031[1].

Approximately 32% of the county's population resides within the city of Hereford. Approximately 23% of the population is aged 65 years or above; this figure is higher than the national average of 18%.

The predicted population growth and associated housing growth will have consequences to flood risk within the county, most likely associated with increased surface water runoff and the potential displacement of flood waters.

[1] Information sourced from the Herefordshire Local Plan Core Strategy 2011 - 2031

Herefordshire is fortunate in many ways that it does not face the same pressures as other more urban counties – the ability to implement good quality sustainable drainage systems (SuDS) and ensure that flood management forms an integral part of development proposals is often very difficult to achieve in a dense urban environment. However, a significant proportion of the predicted growth will be within the city of Hereford which is likely to pose more of a challenge to developers and the Council. The higher proportion of older generations will also influence flood risk management in Herefordshire – in particular the need to consider their vulnerability and to ensure their safety during a flood event.

Herefordshire Council have commissioned an Integrated Catchment Strategy (ICS) for Hereford city which will be completed in 2019. This will inform the Hereford Area Action Plan. The ICS seeks to determine how development may impact flood risk and water quality. The outputs from the study will be used to inform subsequent Level 2 SFRAs within the city.

NATURAL ENVIRONMENT

The natural environment throughout Herefordshire is varied and diverse. Herefordshire's historic environment includes numerous Iron Age hill forts and sites of Roman towns. There are approximately 5899 listed buildings, 263 Scheduled Ancient Monuments and 24 registered historic parks and gardens located throughout Herefordshire.

The high ecological and biodiversity value associated with the various landscapes across Herefordshire has been recognised and, as a result, there are a number of designations in place in order to protect and preserve the area:

- 2 Areas of Outstanding Natural Beauty (the Wye Valley and the Malvern Hills)
- 4 Special Areas of Conservation
- 77 Sites of Special Scientific Interest
- 3 National Nature Reserves
- 773 Local Wildlife Sites
- 131 Local Geological Sites
- 64 Conservation Areas

New development must be sensitive to the valuable natural and historic environments of Herefordshire. Of particular importance is not causing deterioration of water quality through the discharge of polluted surface water runoff, and not damaging these environments through increased flood risk.

RIVERS

There are eleven designated 'main rivers' located within Herefordshire that are under the jurisdiction of the Environment Agency. There are identified in Appendix B and listed below:

- River Teme: Flows east through the northern extents of the county to confluence with the River Severn to the south of Worcester.
- River Arrow: Flows east through the north of the county to confluence with the River Lugg south of Leominster.
- River Frome: Flows south-west through the east of the county to confluence with the River Lugg east of Hereford.
- River Lugg: Flows in a general south-east direction through the centre of the county and to the east of Leominster to confluence with the River Wye to the south-east of Hereford.

- Hindwell Brook: A small section of this watercourse flows through Herefordshire adjacent to the western county boundary to confluence with the River Lugg in the north-west.
- Back Brook: An offshoot from the Hindwell Brook to the north-east of Rodd, which flows in an easterly direction to confluence with the Hindwell Brook to the west of Combe.
- Pinsley Brook: Flows in an easterly direction to confluence with the River Lugg to the north-west of Leominster.
- River Wye: Flows south-east through the western, central and southern regions of the county to confluence with the River Severn to the south of Chepstow.
- River Leadon: Flows south through the east of the county to confluence with the River Severn to the west of Gloucester.
- River Dore: Flows south-east through the south-west of the county to confluence with the River Monnow south of Pontrilas.
- River Monnow: Flows south-east along the south-western county border to confluence with the River Wye to the south of Monmouth.

A vast number of smaller ordinary watercourses flow within Herefordshire that are under the jurisdiction of Herefordshire Council or the two Internal Drainage Boards, many of which are formed within Herefordshire from groundwater springs. An ordinary watercourse is defined as any watercourse that is not designated as a main river. There are far too many ordinary watercourses to list within this SFRA but a summary of the most significant of these watercourses (typically those with a catchment greater than 3km^2) is provided below, grouped into their main river catchment.

River Teme Catchment

- Brimfield Brook: Flows in a westerly direction through the villages of Orleton and Brimfield in the north of the county to discharge to the River Teme.

River Arrow Catchment

- Back Brook: Flows to the north of Kington to confluence with the River Arrow.
- Curl Book: Flows from Lyonshall in a north-easterly direction to confluence with the River Arrow at Pembridge.
- Tippets Brook, Stretford Brook (and upstream Newbridge Brook) and Honeylake Brook: Flow in a general north-easterly direction to towards Leominster to confluence with the River Arrow to the south of Leominster.

River Frome Catchment

- Tedstone Brook: Flows through the west of the county to confluence with the River Frome at Bromyard.
- Hackley Brook: Flows north to confluence with the River Frome to the west of Bromyard.
- River Lodon: Flows south from the A44, to the east of Pencombe and west of Stoke Lacy, to confluence with the River Frome upstream of Yarkhill.
- Tarrington Brook: Flows north of the village of Little Tarrington to confluence with the River Frome.

River Lugg Catchment

- Lime Brook: Flows south through the north-west of the county to confluence with the River Lugg south of Lingen.
- Ridgemoor Ditch and Main Ditch: Flow south from Orleton towards Leominster to confluence with the River Lugg.

- Cogwell Brook and Cheaton Brook: Flow in a westerly direction towards Leominster to confluence with the River Lugg.
- Humber Brook and its tributary Holly Brook: Flow south-west through Steen's Bridge to confluence with the River Lugg close to Hope Under Dinmore.
- Bodenham Brook and Millcroft Brook: Flow west through Bodenham and Bodenham Moor to confluence with the River Lugg west of Bodenham.
- Wellington Brook: Flows in an easterly direction through King's Pyon and Wellington to confluence with the River Lugg to the east of Wellington.
- Moreton Brook: Flows from Tillington Common in an easterly direction to confluence with the River Lugg to the east of Moreton-on-Lugg.
- Little Lugg and its tributaries, including Withington Marsh Brook and the Herefordshire and Gloucestershire Canal: Flow in a general south-westerly and westerly direction through the village of Cross Keys to confluence with the River Lugg to the north-east of Hereford.
- Pentaloe Brook: Flows west through the Village of Mordiford to confluence with the River Lugg immediately upstream of its confluence with the River Wye.

River Wye Catchment – Upstream of Hereford

- Hardwicke Brook: Flows north through the village of Hardwicke before turning west to discharge to the River Wye.
- Millhalf Brook: Flows in an easterly direction through the villages of Millhalf and Whitney-on-Wye to confluence with the River Wye at Whitney-on-Wye
- Willersley Brook and Folly Brook: Flow in a general south-east and southerly direction through the villages of Eardisley and Willersley to confluence with the River Wye just south of Willersley.
- Kinnersley Brook and its tributaries: Flow south through the Coke's Yeld Dingle and Holywell Dingle and close to the village of Upcott to confluence with the River Wye.
- Letton Lake and its tributaries: Flow south past the village of Almeley and through the village of Letton to confluence with the River Wye.
- Maddle Brook: Flows south from Norton Canon to confluence with the River Wye to the east of Monnington-on-Wye.
- Preston Brook: Flows in a general northerly direction past the village of Preston-on-Wye to confluence with the River Wye.
- Cage Brook: Flows in a general north-easterly direction from the village of Kingstone and to the north of Clehonger to confluence with the River Wye near Ruckhall.
- Norton Brook: Flows north, parallel to the A49 towards Hereford and south of the village of Bullinghope, before entering a culvert at its crossing with the railway and flowing beneath the Putson area of Hereford and discharging to the River Wye.
- Red Brook and Twyford Brook: Flow north towards Hereford and through the Rotherwas area of Hereford, flowing within culverted and engineered channels through this area before discharging to the River Wye.
- Yazor Brook: Flows through Credenhill and the north-west of Hereford to confluence with the River Wye in Hereford.

River Wye Catchment – Downstream of Hereford

- Tar's Brook: Flows north from Nether Wood and to the south of Dinedor to confluence with the River Wye upstream of Holme Lacy.
- Tan Brook: Flows through the village of Fownhope prior to discharging to the River Wye.
- Wriggles Brook: Flows from Kings Thorn in a south-easterly direction through the village of Hoarwithy towards the River Wye.
- How Caple Brook: Flows in a general southerly direction from the north of Woolhope to How Caple adjacent to the River Wye.
- Wells Brook: Flows east from Peterstow and through Bridstow before discharging to the River Wye to the west of Ross-on-Wye.
- Rudhall Brook: A significant watercourse that starts in the east of the county and flows through the village of Rudhall and through the centre of Ross-on-Wye.
- Chatterley Brook: Flows in an east-westerly direction starting in Weston under Penyard and confluences with the Rudhall Brook to the west of the A40 in Ross-on-Wye.
- Walford Brook: Flows from Pontshill in a westerly direction and through the village of Walford to confluence with the River Wye.
- Garren Brook and its main tributaries The Gamber, Luke Brook, Llanerch Brook and Llantywaun Brook: A significant network of watercourses that start near the villages of Orcop Hill, Garway Hill and Llanwarne, flowing in a general south-easterly direction to the south of Llangarron and confluencing with the River Wye upstream of Whitchurch.

River Leadon Catchment

- Upper reaches of the River Leadon: Flows south from its source north of Evesbatch towards Bosbury at which point the River Leadon becomes a designated main river north of Bosbury.
- Stony Brook: Flows in a general easterly direction from its source near Durlow Common to confluence with the River Leadon to the north of Ledbury.
- Preston Brook: Watercourse with multiple tributaries, with the most notable flow route from Much Marcle in the south, flowing north to confluence with tributaries near Kynaston, and turning east to flow across the Herefordshire border and towards the River Leadon.

Worm Brook, River Dore and River Monnow Catchment

- Capacity improvements were made in the 1970s on the Worm Brook where it is conveyed through culverts below a railway embankment near Kilpeck.
- The upper reaches of the River Dore and Pont-y-Weston Brook: Flow east and south where the watercourses confluence at Dorestone, continuing south at which point the River Dore becomes a designated main river north of Peterchurch.
- Dulas Brook: Flows south parallel to the River Dore from its source close to Middle Maes-Coed, through Ewyas Harold and discharging to the River Dore near Pontrilas.
- Upper reaches of the River Monnow: Flows south in a steep sided valley from its source close to the Welsh border, through the villages of Craswall, Longtown and Clodock, following the border between Wales and Herefordshire and turning to flow in an easterly direction at which point the River Monnow becomes a designated main river.

- Escley Brook: A significant watercourse starting in the west of the county near to the Welsh border, flowing south through a steep sided valley and the village of Michaelchurch Escley and confluencing with the upper reaches of the River Monnow near Longtown.
- Olchon Brook: Flows south in the Olchon Valley parallel to the Welsh border, confluencing with the upper reaches of the River Monnow south of Longtown.

KEY URBAN AREAS

Herefordshire is a predominantly rural county with the main city of Hereford located in the centre of the county surrounded by a number of smaller market towns located towards the outer areas of the county. As part of the Local Plan, the Core Strategy sets out a vision and proposals for housing and employment provision within each of the main urban areas of Herefordshire. These are summarised below.

HEREFORD

Hereford has a population of approximately 58,900 people and is the main economic hub within the county. The River Wye, designated as a main river, flows through the centre of Hereford in a general easterly direction. The River Lugg, also designated as a main river, flows in a southerly direction to the east of the main urban area of Hereford.

The Core Strategy (Herefordshire Local Plan) proposes that an additional 6,500 new houses and a minimum of 15 hectares of new employment land are provided within Hereford during the Local Plan period. A significant proportion of the housing allocations are proposed to be located within Hereford City Centre and urban expansion areas to the north (Holmer West), west (Three Elms) and south (Lower Bullingham) of Hereford.

In summary, the development proposals for these areas are as follows:

- Site HD2 Hereford City Centre: Mixed use development of around 800 new dwellings, largely located within the Edgar Street Grid (ESG) redevelopment area.
- HD4 Holmer West: The northern urban expansion area at Holmer Road West aims to accommodate around 500 new homes.
- HD5 Three Elms: The western urban expansion area at Three Elms aims to accommodate around 1,000 new homes and 10ha of employment land.
- HD6 Lower Bullingham: The southern urban expansion area at Lower Bullingham aims to accommodate around 1,000 new homes and 5ha of employment land.

Further details of the development proposals (including maps) can be found on the Herefordshire Council website

These development pressures have the potential to increase the existing fluvial and surface water flooding issues. New development will have to incorporate flood risk infrastructure that takes into consideration local flooding issues and contributes to reducing local flood risk. The Yazor Brook Flood Alleviation Scheme has been operational since 2012 and diverts floodwater from the Yazor Brook at Credenhill to the River Wye near Breinton which helps to alleviate flood risk within Hereford.

LEOMINSTER

The market town of Leominster is located approximately 19km to the north of Hereford and has a population of approximately 11,700 people. The River Arrow, designated as a main river, flows in an easterly direction to the south of Leominster. The River Lugg, also designated as a main river, flows in a general south-easterly direction around the northern and eastern edge of the town, and confluences with the River Arrow approximately 2.8km to the south-east of Leominster.

The Core Strategy (Herefordshire Local Plan) proposes approximately 2,300 new houses and a 10 hectare extension of the Leominster Enterprise Park during the Local Plan period. Of these, 1,500 new houses will be located within a strategic urban extension to the south-west of Leominster. The other new houses will be accommodated through the Leominster NDP and smaller non-strategic sites located within existing built up areas. There are existing fluvial flood issues to the north of the town associated with the River Lugg and to the south of Leominster associated with the River Arrow. The proposed strategic areas of new housing are located away from land identified to be vulnerable to fluvial flooding.

ROSS-ON-WYE

The market town of Ross-on-Wye is located approximately 17.5km to the south-east of Hereford with a population of approximately 10,600 people. The River Wye, designated as a main river, flows in a general south-westerly direction to the west of Ross-on-Wye. The Rudhall Brook and Chatterley Brook, both designated as ordinary watercourses, flow in a westerly direction through the centre of Ross-on-Wye and confluence with the River Wye approximately 0.8km to the west of the town centre. The Rudhall Brook and Chatterley Brook also pose flood risk to areas of the town when periods of high flows within the River Wye cause water to back up in the brooks and overtop. The Wye Valley Area of Outstanding Natural Beauty incorporates the majority of Ross-on-Wye and the surrounding land to the north and south of the town.

The Core Strategy proposes that an additional 900 new houses and approximately 10 hectares of allocated employment land are required within Ross-on-Wye during the Local Plan period. A strategic housing location (land at Hildersley) will provide 200 new houses to the south-east of the town. The remaining new houses will be provided through sites allocated as a part of the NDP. The proposed strategic housing location is located away from the land at risk of fluvial flooding from the River Wye and the Rudhall and Chatterley Brooks.

LEDBURY

The market town of Ledbury is located approximately 19km to the east of Hereford with a population of approximately 9,600 people. The River Leadon, designated as a main river, flows in a southerly direction to the west of Ledbury. The Malvern Hills Area of Outstanding Natural Beauty is located to the east of Ledbury.

The Core Strategy identifies a proposal for 800 new houses and a minimum of 15 hectares of new employment land to be located within Ledbury during the Local Plan period. The majority of the new housing proposals are proposed to be located on land north of the viaduct providing approximately 625 dwellings, to the north of the town centre. This keeps new development away from the land to the west of Ledbury which is vulnerable to flooding from the River Leadon.

BROMYARD

The market town of Bromyard is located approximately 18.5km to the north-east of Hereford with a population of approximately 4,500 people. The River Frome, designated as a main river, flows in a general south-westerly direction around the northern and eastern edge of Bromyard.

The Core Strategy proposes that Bromyard will accommodate a minimum of 500 new houses and approximately 5 hectares of new employment land during the Local Plan period. A strategic urban extension (Hardwick Bank) is proposed to the north-west of Bromyard to provide approximately half of the additional housing needs. The rest of the new housing will be provided through the implementation of existing plans, windfall development and sites allocated in the Bromyard Development Plan.

KINGTON

The market town of Kington is located approximately 26km to the north-west of Hereford with a population of approximately 3,200. The Back Brook, designated as an ordinary watercourse, flows

in an easterly direction to the north of Kington and confluences with the River Arrow to the east of the town. The River Arrow, designated as a main river, flows in a general north-easterly direction to the south of Kington.

The Core Strategy proposes that approximately 200 new houses will be located within Kington during the Local Plan period. These will be allocated across a number of sites as part of the Neighbourhood Development Plan (NDP) instead of strategic development sites. The NDP will also encourage provision for new employment land.

ASSESSMENT OF FLOOD RISK

A strategic assessment of flood risk at each of the main strategic development sites was undertaken in February 2015 and included the following sites :

- Site HD5 Western Urban Expansion Area at Three Elms, Hereford;
- Site HD6 Southern Urban Expansion Area at Lower Bullingham, Hereford;

These two documents are presented in Appendix C of this SFRA. In 2019 the following sites have been subjected to a Level 2 SFRA.

- Site BY2 Land at Hardwick Bank in Bromyard;
- Site LB2 Land North of the Viaduct in Ledbury;
- Site LO2 Leominster Urban Expansion;
- Site RW2 Land at Hildersley, Ross-on-Wye.

2 POLICY FRAMEWORK

This section provides an overview of the national, regional and local strategy and policy context relevant to flood risk in the county of Herefordshire. The Level 1 SFRA is a key point of reference to the Council in developing their local flood risk policies and this section is designed to facilitate future policy development, as well as raise awareness of the policy that must be considered by developers wishing to build within Herefordshire.

The success of the Level 1 SFRA is heavily dependent upon the Council's ability to implement the recommendations put forward for future sustainable flood risk management, both with respect to planning decisions and development control recommendations (for further information refer to Section 6). A framework of national, regional and local policy and strategy directives are in place to provide guidance and direction to Local Planning Authorities. Ultimately, however, it is the responsibility of the Council to establish robust policies and strategies that will ensure future sustainability with respect to local flood risk.

2.1 NATIONAL POLICY

NATIONAL PLANNING POLICY FRAMEWORK

The NPPF was published in 2012 and sets out the Government's planning policies for England and provides a framework which allows Local Authorities to produce their own plans that better reflect the specific needs of local communities.

SEQUENTIAL APPROACH

Section 10 of NPPF requires Local Plans to be supported by a SFRA and to develop local policies to manage flood risk from all sources. In the preparation of a SFRA the Environment Agency and any other relevant Risk Management Authorities should be consulted. Local Plans should apply a sequential, risk-based approach to the location of new development in order to avoid, where possible, flood risk to people and property and manage any residual risks, taking into account the impacts of climate change. In general, these requirements will be met by:

- Applying the Sequential Test and if necessary, applying the Exception Test;
- Safeguarding land from development that is required for current and future flood management;
- Using opportunities offered by new development to reduce the causes and impacts of flooding;
- Where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking opportunities to facilitate the relocation of development, including housing, to more sustainable locations.

Development should be steered to areas with the lowest probability of flooding and should not be allocated or permitted in areas where there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding. The Sequential Test is used as the principal step to identify preferred locations, i.e. those not exposed to the risk of flooding.

EXCEPTION TEST

If, following the application of the Sequential Test, it is determined that development cannot be located within an area with a lower probability of flooding and is deemed necessary in a Flood Zone, the Exception Test can be applied. For the Exception Test to be passed:

- It must be demonstrated that it is not possible for the development to be located on land with a lower probability of flooding;
- It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared; and
- A site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

The Planning Practice Guidance provides guidance on the implementation of the planning policies set out in the NPPF including a framework for the production of SFRAs.

SUSTAINABLE DRAINAGE SYSTEMS

The Planning Practice Guidance to NPPF sets out the requirement to consider sustainable drainage systems (SuDS) within all new development where appropriate. It states that developments should aim to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable:

1. Into the ground (infiltration);
2. To a surface water body;
3. To a surface water sewer, highway drain, or another drainage system;
4. To a combined sewer.

The Planning Practice Guidance also states the local planning authority will want to be satisfied that the proposed minimum standards of operation are appropriate and that there are clear arrangements in place for on-going maintenance. Information regarding expected minimum standards is provided within the Non-Statutory Technical Standards for Sustainable Drainage Systems published by Defra in March 2015 (discussed below) and the Council's SuDS Handbook.

FLOOD RISK REGULATIONS

The Flood Risk Regulations (2009) transposes the European Commission (EC) Floods Directive (2007/60/EC) into domestic law in England and Wales and implements its provisions.

The key objective of the Floods Directive is to coordinate the assessment and management of flood risks within Member States. Specifically it requires Lead Local Flood Authorities (LLFAs) of Member States to assess if all watercourses and coast lines are at risk from flooding, map the flood extent and assets/people at risk in these areas, and take adequate and coordinated measures to reduce this flood risk. In particular it places duties on the LLFAs to prepare a number of documents including:

- Preliminary Flood Risk Assessment (PFRA) Report that identifies Flood Risk Areas that warrant further examination through the production of maps and management plans.
- Flood Hazard and Flood Risk Maps that summarise identified local flood risks and flood hazards within the Flood Risk Areas. These are scheduled to be updated.
- Local Flood Risk Management Plans that set out the actions and measures that will be taken to manage identified flood risks within the Flood Risk Areas. These are scheduled to be updated.

The Herefordshire PFRA was published in 2011 and confirmed that there are there are no Flood Risk Areas located within the county as defined by the Flood Risk Regulations. The Herefordshire PFRA provides a valuable summary of local sources of flood risk in Herefordshire and key infrastructure that may be affected by flooding. The Herefordshire PFRA has been and

will continue to be updated in accordance with the intended six-year cycle of the Flood Risk Regulations.

FLOOD AND WATER MANAGEMENT ACT

The Flood and Water Management Act (2010) sets out a methodology to implement the recommendations from Sir Michael Pitt's Review of the major floods in 2007. The Review placed a series of responsibilities on Local Authorities with the primary aim of improving local flood risk management.

LEAD LOCAL FLOOD AUTHORITIES

The Act created the role of the Lead Local Flood Authority (LLFA) who are typically the county council or unitary authority for the area. LLFAs are responsible for a number of important aspects in coordinating the management of local flood risk, including:

- The investigation of flood incidents: a duty to investigate and record details of significant flood events within the LLFA administrative area. This includes identifying which organisations have flood risk management functions and what will be done to investigate flood incidents, notifying risk management organisations where necessary and publishing the results of any investigations carried out.
- Asset Register: maintaining a register of structures or features which are considered to have an effect on flood risk, including details on ownership and condition as a minimum. The register must be available for inspection by the Secretary of State.
- Local Flood Risk Management Strategy: a requirement to develop, maintain, apply and monitor a local strategy for flood risk management in the LLFA area. This local strategy must build upon national and local information and will use consistent risk-based approaches across local authority areas and catchments.
- Powers to Undertake Works: powers to undertake works to manage flood risk from surface runoff and groundwater, consistent with the Local Flood Risk Management Strategy for the area.
- Powers to Designate: alongside the Environment Agency, the LLFA now has power to designate structures and features that affect flooding or coastal erosion. This will safeguard assets that are relied upon for flood or coastal erosion risk management.

SUSTAINABLE DRAINAGE SYSTEMS

Under Schedule 3 of the Flood and Water Management Act, LLFAs would be the designated Sustainable Drainage Systems (SUDS) Approval Body (SAB) for any new drainage system, and therefore must approve, adopt and maintain any new SUDS within their administrative area. Schedule 3 has not yet been enacted in full, so full implementation is still in question.

However, as of the 6th April 2015, LLFAs have a duty to review and comment on the management of surface water relating to planning applications as a statutory consultee for major development and confirm that the proposals are in accordance with the Non-Statutory Technical Standards for Sustainable Drainage Systems.

NATIONAL STRATEGY FOR FLOOD AND COASTAL EROSION RISK MANAGEMENT

The Environment Agency's National Strategy for Flood and Coastal Erosion Risk Management (FCERM) sets out how the Environment Agency intends on meeting their obligations under the Flood and Water Management Act to 'develop, maintain, apply and monitor a strategy for flood and coastal erosion risk management in England'.

The National Strategy describes what needs to be done by all organisations involved in flood and coastal erosion risk management. These include Local Authorities, Internal Drainage Boards, water and sewerage companies, highways authorities, and the Environment Agency.

The National Strategy also sets out a statutory framework that will help communities, the public sector and other organisations to work together to manage flood and coastal erosion risk. It will make sure that risks are managed in a co-ordinated way across catchments and along each stretch of coast. This includes the development of a Local Flood Risk Management Strategy by LLFAs, as well as a strategic overview of all sources of flooding and coastal erosion. The measures set out by the LLFA within their Local Flood Risk Management Strategy should therefore be compatible with the Environment Agency's National Strategy.

The National Strategy states that the Government will work with individuals, communities and organisations to reduce the threat of flooding and coastal erosion by:

- Understanding the risks of flooding and coastal erosion, working together to put in place long-term plans to manage these risks and making sure that other plans take account of them;
- Avoiding inappropriate development in areas of flood and coastal erosion risk and being careful to manage land elsewhere to avoid increasing risks;
- Building, maintaining and improving flood and coastal erosion management infrastructure and systems to reduce the likelihood of harm to people and damage to the economy, environment and society;
- Increasing public awareness of the risk that remains and engaging with people at risk to encourage them to take action to manage the risks that they face and to make their property more resilient;
- Improving the detection, forecasting and issue of warnings of flooding, planning for and co-ordinating a rapid response to flood emergencies and promoting faster recovery from flooding.

The Herefordshire SFRA therefore contributes to meeting these strategic goals through the understanding and communication of risks within the county, and through informing appropriate development.

NON-STATUTORY TECHNICAL STANDARDS FOR SUSTAINABLE DRAINAGE SYSTEMS

The Non-Statutory Technical Standards for Sustainable Drainage Systems, published by DEFRA in March 2015, set out the core technical standards for SuDS proposed within England. These standards should be used in accordance with the NPPF and Planning Practice Guidance.

Whilst the standards should be considered for new and existing development of any size within Herefordshire, they are considered to be of particular importance to major development as set out in the Town and Country Planning (Development Management Procedure) (England) Order 2010, incorporating:

- Mineral working sites;
- Waste sites;
- Developments of 10 dwellings or more, or residential development with a site area of 0.5 hectares or greater;
- Building(s) where the proposed flood space in 1,000m^2 or more; or
- Any development with a site area of 1 hectare or greater.

The standards include guidance on controlling flood risk within a development boundary and elsewhere, peak flow and runoff volume control, and the structural integrity of SUDS. As discussed above, LLFAs now have a duty to review and comment on the management of surface water relating to planning applications for major development and that the proposals are in accordance with the Non-Statutory Technical Standards for Sustainable Drainage Systems.

For non-major developments the Herefordshire SuDS Handbook states that it is still anticipated that SuDS will be incorporated as part of the drainage design, however it is appreciated that best practice SuDS is not always possible to implement on non-major developments.

LAND DRAINAGE ACT

Herefordshire Council and the two Internal Drainage Boards have additional duties and powers associated with the management of flood risk under the Land Drainage Act 1991. As the Land Drainage Authorities, the Council or Internal Drainage Board must give consent for any permanent or temporary works that could affect the flow within an ordinary watercourse under their jurisdiction in order to ensure that local flood risk is not increased. The Environment Agency has a similar role for any permanent or temporary works that could affect the flow within a main river (discussed below).

The Land Drainage Act specifies that the following works will require formal consent from the appropriate authority:

- Construction, raising or alteration of any mill dam, weir or other like obstructions to the flow of a watercourse;
- Construction of a new culvert;
- Any alterations to an existing culvert that would affect the flow of water within a watercourse.

The Land Drainage Act also sets out the maintenance responsibilities riparian owners have in order to reduce local flood risks. Riparian owners, who are land owners with a watercourse either running through their land or adjacent to, have the responsibility to ensure that the free flow of water is not impeded by any obstruction or build-up of material within the watercourse. A riparian owner has the duty to accept the natural flow of water from upstream and has the right to convey the flows unimpeded downstream.

ENVIRONMENTAL PERMITTING (ENGLAND AND WALES) REGULATIONS

The Environmental Permitting (England and Wales) Regulations 2010 (updated in 2016) replaced the Water Resources Act 1991 as the key legislation for controlling the discharge of harmful substances in the UK. Under the Environmental Permitting Regulations it is an offence to cause or knowingly permit the discharge of polluting materials to surface waters or groundwater, unless complying with an exemption or a Discharge Activities Permit that can be obtained from the EA. Since 2016 under the Environmental Permitting Regulations it is also a requirement to obtain a Flood Risk Activities Permit (previously known as Flood Defence Consent) for any works on or near a main river, on or near a flood defence structure, in a flood plain, or on or near a sea defence.

LOCALISM ACT

The Localism Act enacted in November 2011 aims to transfer certain decision-making powers from central government to local government, communities and individuals. In relation to the planning of development, the Localism Act provides new rights to allow local communities to come together and shape new developments by preparing Neighbourhood Development Plans. This means that local people can decide not only where new homes and businesses should go but also what they should look like. As neighbourhoods draw up their proposals, Local Planning Authorities will be required to provide technical advice and support.

The Localism Act also supported and reformed the Community Infrastructure Levy (CiL) that provides Councils with an alternative source of potential funding for infrastructure schemes. It enables the Council to raise funds from new development in Herefordshire in order to support growth and pay for the impact that the development has on local infrastructure. In areas where a CiL is in force, land owners and developers must pay the levy to the local authority, in this case Herefordshire Council. The charges are set by the Council based on the size and type of the new development and the value of the land in that location. The money raised from the CiL can be used to fund new infrastructure that the Council, local community and neighbourhoods want, including flood defence works. This can include the construction of new infrastructure and increasing the capacity of existing infrastructure.

WATER FRAMEWORK DIRECTIVE

The Water Framework Directive (WFD) (2000/60/EC) was transposed into law in England and Wales by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003. In England, the Environment Agency is responsible for the delivery of the WFD objectives.

The overall objective of the Water Framework Directive (WFD) is to bring about the effective co-ordination of water environment regulation and policy across Europe. The main aims of the legislation are to ensure that all surface water and groundwater bodies reach 'good' status (in terms of ecological and chemical quality and water quantity, as appropriate). Other aims of the WFD are to:

- prevent further deterioration and protect and enhance the status of water bodies;
- promote sustainable water use based on long-term protection of available water resources;
- enhance protection and improvement of the aquatic environment through specific measures for the progressive reduction of discharges, emissions and losses of priority substances and the cessation or phasing-out of discharges, emissions and losses of the priority hazardous substances;
- ensure the progressive reduction of pollution of groundwater and prevent its further pollution; and
- contribute to mitigating the effects of floods and droughts.

Any activity which has the potential to have an impact on the biological, chemical or hydromorphological quality of a waterbody (or the chemical or quantitative status of a groundwater body) will need to be given consideration in terms of whether it could pose a risk to that waterbody (or the catchment within which is sits) from achieving the objectives of the WFD. Some works that have the potential to pose risk to a waterbody may also require a WFD Assessment to be undertaken to assess and mitigate, as far as practicable, the potential impacts.

2.2 REGIONAL POLICY

SEVERN FLOOD RISK MANAGEMENT PLAN AND RIVER BASIN MANAGEMENT PLAN

The Severn River Basin District Flood Risk Management Plan (FRMP) (2016) describes the risk of flooding from rivers, the sea, surface water, groundwater and reservoirs as set out in the EU Floods Directive (2007). It also sets out how the relevant authorities responsible for local flood risk management will work in partnership alongside local communities in order to manage flood and coastal risk between 2015 and 2021, helping to deliver the requirements of the FCERN strategy. The Severn FRMP has three main objectives:

- The development and promotion of a better level of understanding local flood and coastal erosion risks;
- Provide a baseline of information regarding the economic and environmental benefits in order to inform key decisions; and
- Identify the communities considered to be at the highest risk of flooding so that appropriate investment and resources can be targeted towards the most vulnerable.

A number of measures have been identified within the Severn FRMP designed to achieve the objectives set out. The measures have been grouped into four categories: preventing risk, preparing for risk, protecting from risk, and recovery and review. In particular, within the preventing risk category, measures include avoiding inappropriate development in flood risk areas and encouraging sustainable development which takes into account future climate change.

The Severn River Basin Management Plan (RBMP) is another policy document prepared by the Environment Agency and is updated every 6 years in line with the corresponding FRMP. The Severn RBMP informs land use planning decisions in order to protect and enhance water resources. The plan sets out the:

- Current state of the water environment;
- Pressures affecting the water environment;
- Environmental objectives for protecting and improving water bodies; and
- A programme of measures to achieve the objectives.

CATCHMENT FLOOD MANAGEMENT PLANS

Catchment Flood Management Plans (CFMPs) are a planning tool through which the Environment Agency aims to work in partnership with other key decision-makers within a river catchment to explore and define long term sustainable policies for flood risk management. The Wye and Usk CFMP covers the majority of the Herefordshire county area. The Lower Severn Corridor and Leadon Catchment, which forms part of the River Severn CFMP, covers a much smaller area to the south of Ledbury.

WYE AND USK CATCHMENT FLOOD MANAGEMENT PLAN

The Wye and Usk CFMP was published by the Environment Agency in 2010. The CFMP divides the Wye and Usk catchment into seven distinct sub-areas based on similar characteristics, sources of flooding and level of risk. For each sub-area one of the six generic flood risk management policy options will be applied. Figure 2.2.1 shows the location of each sub-area within the Wye and Usk CFMP and identifies which policy option will be applied.

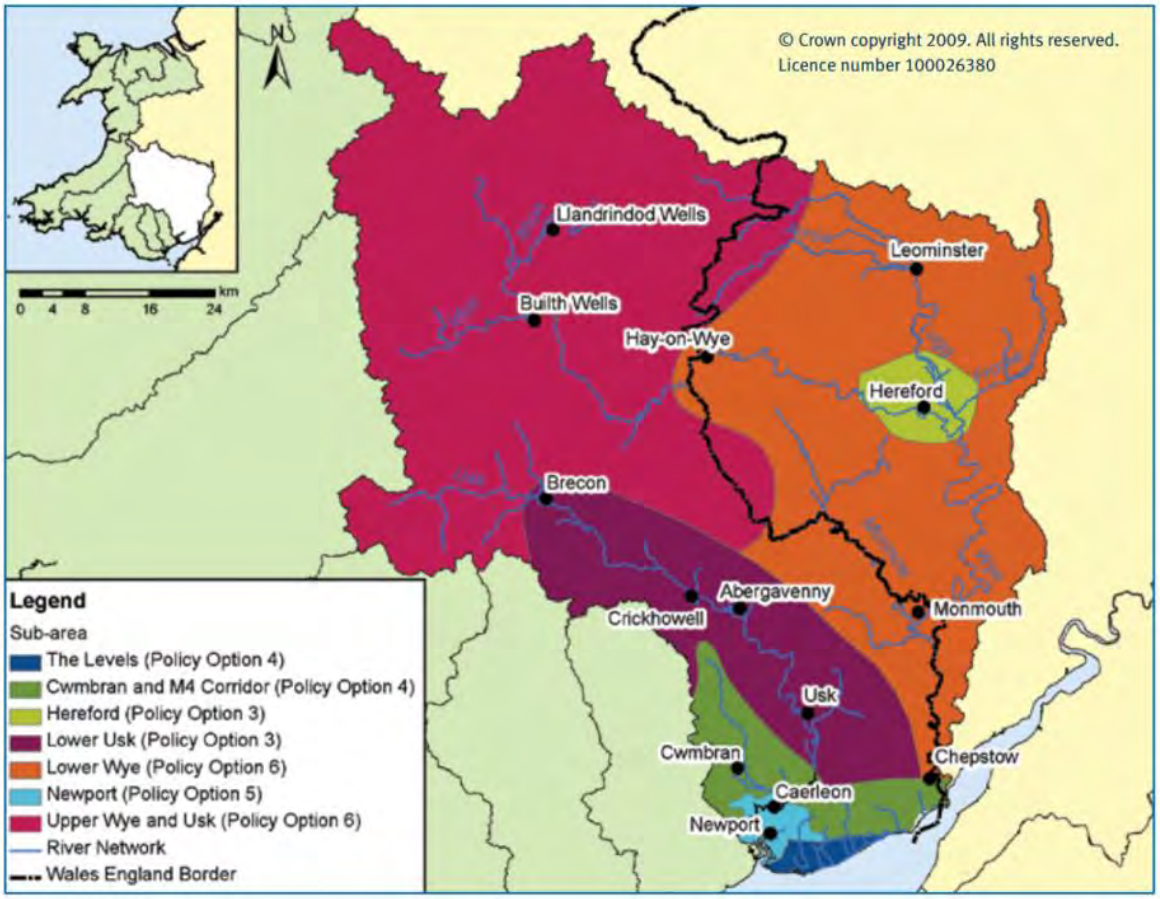


Figure 2.2.1 Sub-areas and policy options for the Wye and Usk CFMP[2]

As shown in figure 2.2.1, there are 3 sub-areas relating to Herefordshire:

- 'Hereford' sub-area: this includes sections of the River Wye, River Lugg and River Frome around Hereford. Policy Option 3 is the preferred policy for this sub-area. Flood risk is considered to be low to moderate and is not expected to increase significantly in the future. Flood risk is currently considered to be managed at an appropriate level, but will be reviewed as necessary to ensure that flood risk activities are appropriate to the level of risk.

- 'Lower Wye' sub-area: this encompasses the majority of Herefordshire including sections of the River Arrow, River Lugg, River Frome, River Wye and River Monnow. Policy Option 6 is the preferred policy for this sub-area. Flood risk is considered to be relatively high and is expected to increase significantly in the future. The rural nature of this sub-area provides the opportunity to sustainably reduce local flood risk through land use and land management practices. This will put quality agricultural land at greater risk of flooding.

- 'Upper Wye and Usk' sub-area: this includes a small section of the River Lugg and River Arrow to the north-east of Herefordshire. Policy Option 6 is the preferred policy for this sub-area. Flood risk is considered to be relatively high and is expected to increase

[2] Wye and Usk Catchment Flood Management Plan: Summary Report, January 2010

significantly in the future. The rural nature of this sub-area provides the opportunity to sustainably reduce local flood risk through land use and land management practices.

In order to achieve the Policy Options within the sub-areas, a number of actions have been set out in the CFMP:

- The Environment Agency will continue to maintain flood defences under their ownership and provide a flood warning service;
- Review current actions within the sub-area to ensure that the areas considered to be at the greatest risk of flooding are prioritised;
- Work in partnership with other key stakeholders to engage with local landowners to encourage and support land use and management changes to reduce flood risk and gain wider environmental benefits;
- Identify opportunities to reduce flood risk through storing water and appropriately manage runoff;
- Encourage and provide support to the production of long term plans focusing on the management of all flood risk. This is a particular focus for Leominster and Hereford and should take into consideration the future impacts on people and property elsewhere;
- The publishing of local flood risk studies and assessments identifying surface water and sewer flooding issues is encouraged in order to provide a greater understanding of the flooding mechanisms. The CFMP highlights this as a key issue for Ross-on-Wye, Leominster, Hereford and Pembridge; and
- Engagement with local communities is key to encouraging people who are at risk of flooding to take action in order to help protect themselves.

RIVER SEVERN CATCHMENT FLOOD MANAGEMENT PLAN

The River Severn CFMP was published by the Environment Agency in 2009. As with the Wye and Usk CFMP, the plan has been spilt up into nine distinct sub-areas based on similar characteristics, sources of flooding and level of risk. For each sub-area one of the six generic flood risk management policy options will be applied. Figure 2.2.2 shows the location of each sub-area within the River Severn CFMP and identifies which policy option will be applied.

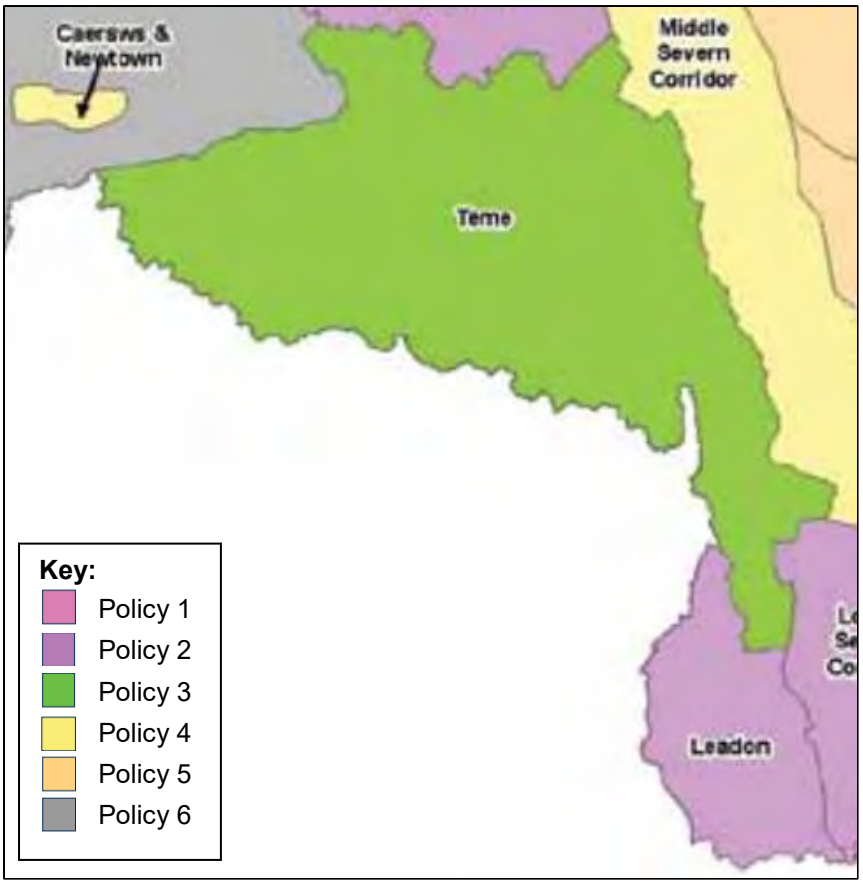


Figure 2.2.2 Sub-areas and policy options for the River Severn CFMP[3]

There are 2 sub-areas relating to Herefordshire:

- 'Lower Severn Corridor and Leadon Catchment' sub-area: this includes a section of the River Leadon at Ledbury and is subject to Policy Option 2. The overall flood risk is considered to be low to moderate and as a result a review of the current flood risk management actions in place will be undertaken to ensure that they are proportionate to the level of risk. It may be acceptable to allow the risk of flooding to increase in the future through a managed approach so as to not create any unacceptable risks to people and property.

- 'Middle Avon, Tributaries, Arrow and Alne, Redditch, Rugby and Teme' sub-area: this includes two sections of the River Teme between Bromfield and Brampton Bryan and a small section of the River Teme between Little Hereford and Tenbury Wells and is subject to Policy Option 3. It aims to maintain the existing level of flood risk within areas of low to moderate flood risks and is not expected to significantly increase in the long term. This may include a review of the current flood warning service in place and an assessment of how current flood risk assets are being managed.

[3] River Severn Catchment Flood Management Plan: Summary Report December 2009

POLICY OPTIONS

There are six generic flood risk management policies. Each sub-area has been assigned a policy option. These are expanded upon below.

Policy Option 2 applies to areas of low to moderate flood risk. The objective is to reduce existing flood risk management actions.

Policy Option 3 applies to areas of low to moderate flood risk. The objective is to continue to generally manage existing flood risk effectively.

Policy Option 6 applies to areas of low to moderate flood risk. It aims to store water or manage runoff in locations that provide overall flood risk reduction or environmental benefits.

The following actions have been put forward by the Environment Agency in order to implement Policy Option 2:

- Encourage the use of best practices regarding land use and land management in both urban and rural areas aiming to reduce runoff and restore more sustainable and natural floodplains;
- Engage with the general public and key stakeholders to increase the resilience and resistance of vulnerable buildings, infrastructure and businesses to flooding;
- Ensure the Sequential Test is being applied during the planning process; and
- Review the effectiveness of flood defences and assess maintenance operations and how proportionate to the level of flood risk they are.

The following actions have been put forward by the Environment Agency in order to implement Policy Option 3:

- Encourage the use of best practices regarding land use and land management in both urban and rural areas aiming to reduce runoff and restore more sustainable and natural floodplains;
- Engage with the general public and key stakeholders to increase the resilience and resistance of vulnerable buildings, infrastructure and businesses to flooding;
- Ensure the Sequential Test is being applied during the planning process;
- Actively encourage the use of SuDS in all proposed development, including the retro-fitting of SuDS in areas where surface water flooding is a known issue;
- Maintain existing flood warning systems, and assess opportunities for improvements;
- Explore opportunities where urban open spaces are able to store flood waters during flood events and appraise strategies for ‘blue corridors’ developing links between these spaces; and
- Gain a more in depth understanding of local surface water, ordinary watercourses and land drainage flooding issues; and produce a strategy for their operation and investment to integrate these with main rivers.

2.3 LOCAL POLICY

HEREFORDSHIRE LOCAL PLAN

The Herefordshire Local Plan was adopted by the Council in 2015 and sets out the future planning of the county up to 2031.

A number of statutory planning documents are at the centre of the Local Plan:

- The Core Strategy;
- Hereford Area Plan;
- Other Development Plan documents (Traveller Sites and Natural Resources); and
- Neighbourhood Development Plans.

CORE STRATEGY

The Core Strategy sets out the Council's long term vision, spatial strategy and core strategies for shaping the future development of Herefordshire up to 2031. It provides the strategic planning framework via a range of policies against which planning applications are to be determined.

The main policy concerning flood risk is Policy SD3: Sustainable water management and water resources. This policy states that measures for sustainable water management will be required to be an integral element of new development in order to reduce flood risk; to avoid an adverse impact on water quantity; to protect and enhance groundwater resources and to provide opportunities to enhance biodiversity, heath and recreation. This will be achieved by ensuring that:

- Development proposals are located in accordance with the Sequential Test and Exception Tests (where appropriate) and have regard to the SFRA for Herefordshire;
- Development is designed to be safe, taking into account the lifetime of the development and the need to adapt to climate change by setting appropriate floor levels, providing safe pedestrian and vehicular access, where appropriate, implementing a flood evacuation management plan and avoiding areas identified as being subject to rapid inundation from a breach of a flood defence;
- Where flooding is identified as an issue, new development should reduce flood risk through the inclusion of flood storage compensation measures, or provide similar betterment to enhance the local flood risk regime;
- Development will not result in the loss of open watercourse and culverts should be opened up where possible to improve drainage and flood flows. Proposals involving the creation of new culverts (unless essential to the provision of access) will not be permitted;
- Development includes appropriate sustainable drainage systems (SuDS) to manage surface water appropriate to the hydrological setting of the site. Development should not result in an increase in runoff and should aim to achieve a reduction in the existing runoff rate and volumes, where possible;
- The separation of foul and surface water on new developments is maximised;
- Development proposals do not lead to deterioration of EU Water Framework Directive water body status and development should not cause an unacceptable risk to the availability or quality of water resources; and
- In particular, proposals do not adversely affect water quality, either directly through unacceptable pollution of surface water or groundwater, or indirectly through overloading of Wastewater Treatment Works.

The policy also states that development proposals should help to conserve and enhance watercourses and riverside habitats, where necessary through management and mitigation measures for the improvement and/or enhancement of water quality and habitat of the aquatic environment. Proposals which are specifically aimed at the sustainable management of the water environment will in particular be encouraged.

Policy SD1: Sustainable design and energy efficiency also refers to flood risk and states that all developments must demonstrate how they have been designed and how they have incorporated measures to make them resilient to climate change in respect of carbon reduction, water efficiency and flood risk.

HEREFORDSHIRE LOCAL FLOOD RISK MANAGEMENT STRATEGY

In accordance with the Flood and Water Management Act, Herefordshire Council as LLFA is required to prepare a Local Flood Risk Management Strategy (LFRMS). The strategy sets out the framework for how the Council will work with other local flood risk management authorities and the general public to better understand and manage existing and future flood risks from all potential sources of flooding.

The LFRMS was prepared in 2016 with the overall aim to:

- Continue to improve understanding of flood risks within the county, both within the Council and general public;
- Continue to reduce flood risk to communities and businesses within the county, through fair and transparent means;
- Ensure good communication and coordination between the relevant risk management authorities for the management of flood risk; and
- Prepare an action plan setting out measures to be taken forward.

The LFRMS reinforces the importance of sustainable development in the management of current and future flood risk, ensuring that new development is resilient to flooding without increasing flood risk elsewhere and maximising opportunities to reduce flood risk. The LFRMS recognises the importance of the SFRA in achieving this.

HEREFORDSHIRE SUDS HANDBOOK

Herefordshire Council have developed a local guidance document setting out the local requirements for developers regarding SuDS. It sets out the local standards which the Council expect regarding surface water runoff to assist developers during the planning application process. The adoption requirements for SuDS, including maintenance regimes, are also detailed within the guidance document. The SuDS Handbook is available on the Herefordshire Council website

2.4 ROLE AND RESPONSIBILITIES

The majority of responsibility for flood risk management resides with a number of key risk management authorities including the Environment Agency and Herefordshire Council, although it is important to note that there is no statutory requirement for the Government to protect property against the risk of flooding.Table 2.4.1 provides a summary of key roles and responsibilities of the Environment Agency, Herefordshire Council, Internal Drainage Boards, Sewerage Companies and developers with regards to this SFRA and flood risk management, although it is important to note that this table only provides a small extract of the full responsibilities of each party.

Table 2.4.1 Role and Responsibilities

Authority	Roles and Responsibilities
Environment Agency	→ Consultee for strategic plans including this SFRA. → Strategic overview of the management of all sources of flooding. → Operational responsibility for managing the risk of flooding from main rivers and reservoirs. → Responsible for flood forecasting and flood warning. → Issuing levies to local authorities to support the implementation of flood defence schemes and managing the allocation of funding for flood defence and flood resilience schemes. → Power for enforcing, consenting and carrying out works for main rivers. → Enforcement authority for Reservoirs Act 1975. → Issuing of environmental permits for the use of non-mains drainage and works within 8m of a fluvial main river or flood defence structure. → Consultee for the majority of development located in Flood Zones 2 and 3 and all development within 20m of a main river[4].
Herefordshire Council	→ Preparation of a Local Plan to guide development. → Lead Local Flood Authority under the Flood and Water Management Act. → Land Drainage Authority, power for enforcing, consenting and carrying out works for ordinary watercourses. → Operational responsibility for managing the risk of flooding from local sources of flooding (i.e. surface water, groundwater and ordinary watercourses). → Preparing and publishing a SFRA, PFRA, LFRMS and, where necessary, SWMPs. → Consultee for all planning applications in regard to flood risk and drainage aspects, including approval of drainage schemes, and have the ultimate decision on the suitability of a site in relation to flood risk and management of surface water runoff. → Investigating significant flood events in accordance with Section 19 of the Flood and Water Management Act. → Keeping asset registers of structures and features which have a significant effect on local flood risk. → Designating authority of assets that have a significant impact on flood risk.

[4] Refer to Section 6.15 for a full explanation

Authority	Roles and Responsibilities
	→ Responsibilities for emergency planning as a responder to a flood event.
River Lugg Internal Drainage Board Lower Severn Internal Drainage Board	→ Power for enforcing, consenting and carrying out works for ordinary watercourses located in the operational area of the IDB. → Manage water levels and reduce the risk from flooding within their districts. → Maintenance and improvement of IDB maintained watercourses and related infrastructure within their districts. → Statutory consultee for development proposals within their districts. → Land drainage authority within their districts.
Welsh Water Severn Trent Water	→ Statutory consultee for any proposed discharge to the public sewerage system. → Obligation to receive surface water flows if infiltration to ground or discharge to a watercourse not feasible. → Ensure systems have the appropriate level of resilience to flooding, and maintain essential services during emergencies. → Maintain and manage water supply and sewerage systems to manage the impact and reduce the risk of flooding and pollution to the environment → Provide advice to LLFAs on how water and sewerage company assets impact on local flood risk. → Work with developers, landowners and LLFAs to understand and manage risks, for example by working to manage the amount of rainfall that enters sewerage systems → Where there is frequent and severe sewer flooding, sewerage undertakers are required to address this through their capital investment plans.
Developers	→ Assessing flood risk and demonstrating that development will not be at an unacceptable risk of flooding and will not increase flood risk elsewhere. → Providing an appropriate surface water drainage system and ensuring appropriate systems are in place for the long term maintenance of this system over the lifetime of the development. → Providing statutory consultees with the information that is required to enable a review of flood risk and surface water management to be completed. → Obtaining all required consents. → Ensuring compliance with relevant legislation and policy.

3 APPROACH TO THE SFRA

This Level 1 SFRA has been completed in accordance with the NPPF and via the key tasks as listed below:

- Review changes in key national, regional and local planning policy and strategies relevant to the management of local flood risk within Herefordshire;
- Consultation with the relevant authorities and stakeholders to obtain up to date datasets, discussing current and future flood risk and understanding development control and flood management requirements;
- Review of available datasets to understand historic, current and future flood risks within the county from all sources of flooding;
- Interpretation of available data in order to understand the local flood risks to people and property for the purpose of informing development control policies; and
- Recommendation of measures to ensure the sustainable management of flood risk within the county through the development and re-development of brownfield sites.

3.1 CONSULTATION AND ENGAGEMENT

Consultation has formed a vital part of the preparation of this Level 1 SFRA. The following key stakeholders have been consulted:

HEREFORDSHIRE COUNCIL

Consultation has been undertaken with a number of departments within Herefordshire Council to understand the Council's approach to flood risk management and aspirations for future development. This has included:

- Development planning officers to discuss the formulation of the updated Local Plan and Neighbourhood Development Plans, and development control priorities for all proposed development with the county;
- Flood risk and asset management officers to discuss historic flood events, recent flood improvement and alleviation works, and proposed or planned flood improvement and alleviation works; and
- Emergency planning and response officers to discuss existing plans and protocols before, during and after a flood event, critical infrastructure as well as understand recommendations and requirements for new development.

ENVIRONMENT AGENCY

Consultation has been undertaken with the Environment Agency primarily to:

- Obtain the most up-to-date flood risk modelling and mapping available;
- Understand historic flood events;
- Obtain information regarding the location, nature and standard of protection of existing flood defence infrastructure; and
- Discuss recent flood improvement and alleviation works, and proposed or planned flood improvement and alleviation works.

In addition, the Environment Agency is a statutory consultee for the preparation of the SFRA in accordance with the NPPF and therefore must be satisfied with the findings and recommendations for sustainable flood risk management as set out within this document.

WELSH WATER AND SEVERN TRENT WATER

Welsh Water and Severn Trent Water are the authorities responsible for the sewerage network within Herefordshire. Welsh Water is responsible for the majority of the county, and Severn Trent Water is responsible for the north and east of Herefordshire.

Welsh Water and Severn Trent Water were both consulted to discuss the risk of localised flooding associated with the existing drainage systems within their operational areas and provided records from their historic flood register.

Welsh Water and Severn Trent Water were also consulted regarding planned flood management works.

INTERNAL DRAINAGE BOARDS

There are two Internal Drainage Boards located within Herefordshire:

- The River Lugg Internal Drainage Board who are responsible for the maintenance of the land drainage assets within the low-lying land within the catchments of the Rivers Lugg, Arrow, Frome and Worm Brook, and who have taken over the responsibility from the Lower Wye Internal Drainage Board for the maintenance of the land drainage assets within the low-lying land within the catchment of the River Monnow.
- Lower Severn Internal Drainage Board who are responsible for the maintenance of the land drainage assets within the low-lying land within the catchment of the River Leadon.

3.2 PROPOSED USE

This Level 1 SFRA assesses the risk of flooding from all sources, now and in the future, taking account of the impacts of climate change, and assesses the impact that land use changes and development in the area will have on flood risk.

In relation to the Herefordshire Local Plan, this Level 1 SFRA will be used to:

- Determine the variations in risk from all sources of flooding;
- Inform the sustainability appraisal of the Local Plan, so that flood risk is fully taken into account when considering the allocation options and in the preparation of plan policies, including policies for flood risk management to ensure that flood risk is not increased;
- Assist in the application of the Sequential Test and, where necessary, the Exception Test when determining land use allocations;
- Identify the requirements for site-specific flood risk assessments in particular locations, including those at risk from all sources of flooding other than river flooding;
- Determine the acceptability of flood risk in relation to emergency planning capabilities; and
- Consider any opportunities to reduce local flood risk to existing communities and developments through better management of surface water runoff, provision for conveyance and of storage for flood waters.

3.3 STRUCTURE

The Level 1 SFRA has been set out in a structure that is intended to provide a simple yet informative tool to support sustainable development within Herefordshire. In summary, key information is provided within the following sections:

- Data availability
  - A summary of the data used within the Level 1 SFRA and that is likely to be available for use by developers to inform site-specific assessments, identifying any limitations and other sources of data which were not available at the time of assessment but may be useful for any future updates or location specific studies.
- Summary of flood risk
  - An overview of the main river catchments located within the county;
  - A summary of notable flood incidents;
  - An overview of the current approach to flood risk management;
  - An assessment of flood risk from all sources of flooding and a summary of the flood risk from all sources at a number of key locations within the county;
  - A summary of flood risk in respect of emergency planning; and
  - A summary of how climate change has been taken into consideration in the assessment of future flood risk.
- Policy recommendations and guidance to support applications for development

A number of maps have been produced as part of the Level 1 SFRA to illustrate mapped flood risk within the county, assist with local planning policies and give guidance to the Council and developers on the application of the Sequential and Exception Tests.

In summary the appendices and maps that support the Level 1 SFRA include:

- Appendix A: Overview map of Herefordshire
- Appendix B: Map of main rivers in Herefordshire
- Appendix C: Strategic assessment of flood risk at the strategic development sites
- Appendix D: County-wide strategic flood risk maps
  - Fluvial flood extents
  - Fluvial flood extents with climate change
  - Surface water flood extents
  - Herefordshire Council and Environment Agency historical flood records
  - Water and Severn Trent Water historic and predicted flooding from sewers
- Appendix E: Hereford local maps
- Appendix F: Leominster local maps
- Appendix G: Ross-on-Wye local maps
- Appendix H: Ledbury local maps
- Appendix I: Bromyard local maps
- Appendix J: Kington local maps
- Appendix K: Herefordshire local fluvial flood mapping

- Appendix L: Areas at risk of Reservoir Flooding
- Appendix M: Location of sand and gravel deposits in Herefordshire
- Appendix N: Environment Agency Flood Warning and Flood Alert areas

3.4 FLOOD RISK DEFINITIONS

The method of defining flood risk depends on the source of flood risk. Fluvial and surface water flood risks are most commonly defined using the annual probability of occurrence and, in the case of fluvial flood risks from catchments typically larger than 3km^2, through the use of the Environment Agency Flood Zones. Other sources of flood risk, including flooding from groundwater, reservoirs or other artificial sources, do not have the same annual probability of occurrence but are based more on the likely extent should flooding from these sources occur.

The Environment Agency Flood Maps provide a comprehensive overview of flood risks from fluvial, tidal, surface water and reservoir sources. The maps are updated regularly following a periodic review and/or following any changes to flood risk infrastructure. Information regarding other sources of flooding is based on a review of likely ground conditions and the presence of features that may cause flooding should they fail.

A summary of how flood risk from different sources is defined for the purpose of informing development control is provided below.

FLOOD ZONES

The Environment Agency has two datasets which provide information regarding fluvial and tidal flood risk: the Flood Map for Planning (Rivers and Sea) and the Risk of Flooding from Rivers and Sea. The differences between the two datasets are explained in more detail below.

The Environment Agency's Flood Map for Planning (Rivers and Sea) indicates the 'natural' fluvial floodplain ignoring the presence of defences and, therefore, areas potentially at risk of flooding from rivers or the sea. It also illustrates the majority of Environment Agency flood defences and areas that benefit from these flood defences, typically defining areas that are protected up to the 1 in 100 year (1%) annual probability event.

The Flood Map for Planning is principally used to inform land use planning and defines Flood Zones that align with the terminology of NPPF and its supporting Planning Practice Guidance to indicate the predicted annual probability of flooding from fluvial and tidal sources. In summary, all land within England is indicated to fall within one of the following Flood Zones:

- Flood Zone 1 (low probability) - less than 1 in 1000 (0.1%) annual probability of flooding from fluvial or tidal sources.
- Flood Zone 2 (medium probability) - between 1 in 100 (1%) and 1 in 1000 (0.1%) annual probability of flooding from fluvial sources, or between 1 in 200 (0.5%) and 1 in 1000 (0.1%) annual probability of flooding from tidal sources.
- Flood Zone 3 (high probability) - greater than 1 in 100 (1%) annual probability of flooding from fluvial sources, or greater than 1 in 200 (0.5%) annual probability of flooding from tidal sources.

Within Herefordshire, the Environment Agency's Flood Map for Planning has been created using a national generalised model (JFLOW). Whilst more detailed modelling has been undertaken for Herefordshire (as discussed in Section 4) the outputs from these models have not yet been incorporated into the Environment Agency's Flood Map for Planning. Consultation with the Environment Agency to inform the preparation of this SFRA indicated that a review of the model data for Herefordshire is currently underway and that the Environment Agency's Flood Map for Planning may be updated as part of future periodic reviews. However, the current Flood Map for Planning still provides the basis from which Flood Zones are defined and the need for further detailed study is identified.

The Environment Agency's Risk of Flooding from Rivers and the Sea map illustrates similar extents of fluvial and tidal flooding to that illustrated within the Environment Agency's Flood Map for Planning. However, these maps delineate the likelihood of flooding from rivers and the sea whilst considering the presence and effect of all flood defences and predicted flood levels. It is important to note the differences between the two sets of data and what they show. The Environment Agency's Risk of Flooding from Rivers and the Sea map can provide a useful reference when assessing risk to a site, but the methods used to create this mapping are not considered appropriate to inform development control or land use planning as this purpose of this mapping is principally to inform national flood risk assessments.

The Environment Agency's Flood Map for Planning also illustrates the majority of Environment Agency flood defences and areas that benefit from these flood defences, typically defining areas that are protected up to the 1 in 100 (1%) annual probability event.

The Environment Agency's Flood Map for Planning does not illustrate the extents of the Functional Floodplain, Flood Zone 3b. The Functional Floodplain is defined as land where water has to flow or be stored in times of flood, typically representing areas that flood during the 1 in 20 (5%) annual probability event or areas that are designed to flood in an extreme 1 in 1000 (0.1%) annual probability event. However, urban areas or areas that are located behind flood defences are not usually classified as Functional Floodplain. Areas classified as Functional Floodplain are defined as part of this Level 1 SFRA.

SURFACE WATER FLOOD RISK

The Environment Agency's Risk of Flooding from Surface Water map shows the approximate overland flow routes and areas that would flood as a result of rainfall being unable to soak into the ground or enter a drainage system, leading to overland flow. The probability of flooding from surface water is defined as being high, medium, low or very low, typically defined as follows:

- Very Low - less than 1 in 1000 (0.1%) annual probability of flooding from surface water sources.
- Low - between 1 in 100 (1%) and 1 in 1000 (0.1%) annual probability of flooding from surface water sources.
- Medium - between 1 in 30 (3.33%) and 1 in 100 (1%) annual probability of flooding from surface water sources.
- High - greater than 1 in 30 (3.33%) annual probability of flooding from surface water sources.

The Environment Agency's Risk of Flooding from Surface Water map provides information relating to flood extents, flood depth, flood hazard and the main flow paths through the county, and has been used to identify the main areas in which surface water flooding may be a problem.

The Flood Risk from Surface Water map has been produced by the Environment Agency using a combination of a national generalised computer model, and improved using information from the LLFAs where it is available. As such, depending on the location, the modelling may not accurately represent all flow paths (for example pipe drainage systems or small culverts on watercourses may not be included). The purpose of the map is to highlight those areas potentially at risk of flooding. Where flooding is shown, this should prompt further consideration to the actual risk. Further discussion of the limitations of this data is provided in Section 5.3. Periodic updates of the maps are issued as more accurate information becomes available.

The Environment Agency's Flood Risk from Surface Water maps should also be used to understand the likely fluvial flood risk associated with smaller watercourses not included in the Environment Agency's Flood Map for Planning. These smaller watercourses are those that typically have a catchment of less than 3km^2. Where the Environment Agency's Flood Risk from Surface Water map indicates fluvial flood risk from a watercourse that may pose risk to a development, it may be necessary to undertake more detailed hydraulic modelling to better define these areas. For small developments where hydraulic modelling is not a planning requirement, it may be prudent to provide a buffer area between the development and the watercourse. LIDAR or topographical survey can be used as an effective tool as part of a site specific flood risk assessment.

The Environment Agency's Flood Risk from Surface Water maps do not identify surface water flood risks associated with sheet flow from sloping topography, particularly where this is not 'channelled' into a defined overland flow route. Flood risks associated with sheet flow are better assessed using OS mapping and other topographical data.

RESERVOIR FLOOD RISK

The Environment Agency's Risk of Flooding from Reservoirs map shows the likely extent of flooding in the event of reservoir failure. Although the likelihood of such an occurrence is low, as all large reservoirs are stringently governed under the Reservoirs Act 1975, a large volume of water could escape with little or no warning if a failure were to occur. As such, following a recommendation in the Pitt Review, the Environment Agency completed a programme of breach assessments to ascertain the areas at potential risk.

GROUNDWATER FLOOD RISK

Groundwater flooding occurs when groundwater rises to within close proximity of the ground's surface, either emerging above ground or causing flooding of below ground structures such as basements. Groundwater flooding is typically associated with permeable geology such as chalks and gravels, but can also be attributable to natural groundwater springs and where permeable deposits sit over impermeable geology causing a perched water table to occur which can lead to groundwater emergence.

Review of local geology can provide an indication of where groundwater flooding may occur. However, it is important to remember that once groundwater has reached the ground's surface, it is likely to flood overland and may therefore pose similar risks to those identified by the Environment Agency's Flood Risk from Surface Water map. It is therefore not necessarily those areas susceptible to groundwater emergence that are at risk, but the areas that are located downhill of those areas susceptible to groundwater emergence.

SEWERAGE FLOOD RISK

Flood risk from the sewerage system can occur as a result of blockage of the sewerage network or as a result of a rainfall event that exceeds the design capacity of the sewerage network. This can include the Welsh Water and Severn Trent Water public sewerage systems, the Highways

England, Network Rail and Herefordshire Council highways drainage systems, as well as systems in private (or third party) ownership.

Flood risk associated with the potential surcharging of the sewerage network is extremely hard to predict and there are currently no datasets available that provide an indication of areas that may be at risk of flooding from the sewerage network. However, as most drainage systems are not designed for events greater than a 1 in 30 (3.33%) annual probability rainfall event (typically reducing to 1 in 5 (20%) for highway drainage systems and most likely less for older drainage systems) new development should always give consideration to likely overland flow paths should flooding from these systems occur.

As emergence from sewerage systems is likely to follow the ground's topography, it is recommended that consideration is given to the Environment Agency's Risk of Flooding from Surface Water map and other available topographic data as this will provide an indication of likely flow routes should surcharging of the sewerage system occur.

FLOOD RISK FROM OTHER ARTIFICIAL SOURCES

Flood risk from artificial sources typically includes flooding from structures such as canals or other water retaining structures are not included within the Environment Agency's Risk of Flooding from Reservoirs map. This source of flood risk is often rarely mapped due to the lack of available data, but should be considered on a case-by-case basis within planning applications and their supporting Flood Risk Assessments.

4 DATA AVAILABILITY

4.1 SUMMARY

The following section provides a summary of the data available to inform this Level 1 SFRA and, where appropriate, data available to inform future planning applications within Herefordshire. Consideration has also been given to the limitations and gaps that were identified at the time of writing but may be useful for future updates of the SFRA or other site-specific flood risk assessments.

4.2 HEREFORDSHIRE COUNCIL FLOOD DATA

SURFACE WATER MANAGEMENT PLANS

The Ross-on-Wye Surface Water Management Plan (SWMP) was completed in 2011 prior to a foul sewer diversion and focusses on Brookend Street located in the centre of Ross-on-Wye. Brookend Street is located at a low point within the town centre and surface water runoff therefore accumulates in this area. In order to assess the risk of flooding a hydraulic model using InfoWorks CS and LiDAR data was used to better understand the local issues.

PRELIMINARY FLOOD RISK ASSESSMENT

The Herefordshire PFRA that was first published in 2011 provides a summary of recorded historic flooding events and areas predicted to be at risk of flooding from predominantly local sources of flooding. Whilst much of the information provided within the PFRA has been summarised within this SFRA, the PFRA provides a more detailed summary of areas that are indicated to be at risk of flooding as informed through review of historic records and modelled flood data.

The Herefordshire PFRA can be requested directly from Herefordshire Council. It has been updated in 2017 in accordance with the six-year cycle of the Flood Risk Regulations.

HYDRAULIC MODELLING

The Council has commissioned a number of hydraulic studies to gain further understanding of local flood risk and assist in the assessment and, where appropriate, design of flood management solutions to mitigate the impacts to local communities. Information held by the Council includes:

- Yazor Brook (including Widemarsh Brook and Eign Brook) combined 1D/2D hydraulic model that was initially prepared in 2005 and has since undergone a number of updates. This data is held by the Council and can be requested by developers to inform new development. Model outputs are provided in Appendix K and should be used to supplement information provided by the Environment Agency's indicative flood mapping. The model outputs include the undefended and defended scenarios with the Yazor Brook Flood Alleviation Scheme in place.
- Folly Brook, Willersley Brook and Mill Stream combined 1D/2D model prepared in 2016 and used to assess flood risks to the village of Eardisley. Model outputs are provided in Appendix K and should be used to supplement information provided by the Environment Agency's indicative flood mapping.
- Cherry Brook combined 1D/2D model prepared in 2015 and used to assess flood risks to the village of Hope under Dinmore. Model outputs are provided in Appendix K and should be

used to supplement information provided by the Environment Agency's indicative flood mapping.

The Council has also undertaken flood management studies in the villages of Lea and Five Bridges (near Bishops Frome). 1D models were prepared to inform these studies but the outputs are not considered appropriate to map within this SFRA. Information regarding the studies completed for these areas can be requested from the Council to inform development control and supplement the information available from the Environment Agency.

HISTORICAL FLOODING

Herefordshire Council has provided historical flood records to assist with the preparation of this Level 1 SFRA. The data includes the database used for the previous SFRA analysis, as well as additional data supplied by the Emergency Planning Team at Herefordshire Council, Parish Councils, Internal Drainage Boards, and flood incidents reported by members of the public via the Council's website and local media outlets.

4.3 ENVIRONMENT AGENCY FLOOD DATA

FLOOD MAPS

The Environment Agency Flood Maps provide a comprehensive overview of flood risks from fluvial, tidal, surface water and reservoir sources. The Environment Agency also maintains a map that illustrates areas that receive flood warnings and flood alerts. These maps are updated following periodic review and/or following changes to flood management infrastructure. The Environment Agency flood maps that have been used as a part of this Level 1 SFRA include:

- Flood Map for Planning (Rivers and Sea);
- Risk of Flooding from Surface Water map;
- Risk of Flooding from Reservoirs map; and
- Flood Warning Areas map.

These maps were downloaded from the www.gov.uk website or received directly from the Environment Agency to inform this SFRA.

Hydraulic models of the River Wye and River Lugg have also been used to make supplementary maps.

Hereford Integrated Catchment Strategy will be completed in 2019 and this work includes updating the River Wye fluvial flood extents in accordance with the 2016 Climate Change guidance.

Flood Map for Planning

Information regarding fluvial and tidal Flood Zones that are key to the development control policies discussed within this SFRA has been obtained from the Environment Agency's Flood Map for Planning[5]. This map is recreated in Appendix D for the whole of the county, with more detailed maps of each of the six key urban areas in Appendices E to J of this SFRA.

[5] https://flood-map-for-planning.service.gov.uk/

Outputs from the River Wye hydraulic model and the River Lugg hydraulic model are included in Appendices E, F and G. These provide more refined data than shown on the Flood Map for Planning

Within Herefordshire, the Environment Agency's Flood Map for Planning has been created using a national generalised model (JFLOW). Whilst more detailed modelling has been undertaken for Herefordshire by both the Council and Environment Agency, the outputs form these models have not yet been incorporated into the Environment Agency's Flood Map for Planning. Consultation with the Environment Agency to inform the preparation of this SFRA indicated that a review of the model data for Herefordshire is currently underway and that the Environment Agency's Flood Map for Planning may be updated as part of future periodic updates.

It is important to review the current day mapping from the www.gov.uk website and use this instead of using any flood maps. The mapping is reviewed periodically and so may have become outdated.

The current Flood Map for Planning still provides the basis from which Flood Zones are defined and the need for further detailed study is identified. However, when undertaking site-specific flood risk assessments to support development, developers are advised to also refer to the outputs of the detailed modelling completed by the Council and Environment Agency early in the process to supplement the information provided in the Flood Map for Planning.

The Environment Agency's Flood Map for Planning also illustrates the majority of Environment Agency flood defences and areas that benefit from these flood defences, typically defining areas that are protected up to a 1 in 100 (1%) annual probability event. Further information has been provided directly by the Environment Agency, as discussed below.

Risk of Flooding from Rivers and the Sea map

The Environment Agency's Risk of Flooding from Rivers and the Sea map[6] illustrates similar extents of fluvial and tidal flooding to that illustrated within the Environment Agency's Flood Map for Planning. However, the purpose of these maps are to principally inform national flood risk assessments are not intended to inform development control. The Environment Agency's Risk of Flooding from Rivers and the Sea is therefore not used within this SFRA and should not be used to inform site-specific flood risk assessments.

Risk of Flooding from Surface Water map

Information regarding surface water flood risk has been obtained from the Environment Agency's Risk of Flooding from Surface Water map. The information provided within the SFRA relates to the extent of surface water flooding during different storm events, defined as high, medium, low and very low as discussed in Section 3.4. County-wide mapped surface water flood extents are illustrated in Appendix D, with more detailed maps of each of the six key urban areas in Appendices E to J of this SFRA.

Further information regarding the depth and velocity of surface water flooding can be obtained directly from the Environment Agency's Risk of Flooding from Surface Water map as provided on the www.gov.uk[6] website.

[6] https://flood-warning-information.service.gov.uk/long-term-flood-risk

Smaller watercourses with a catchment of typically less than 3km^2 are not accurately represented within the Environment Agency's Flood Map for Planning (Rivers and Sea). The Environment Agency's Risk of Flooding from Surface Water map therefore provides a good indication of the likely flood risks associated with these smaller watercourses, although where the Flood Risk from Surface Water map indicates fluvial flood risk from a watercourse that may pose risk to a development, it may be necessary to undertake more detailed hydraulic modelling to better define this risk.

The Environment Agency's Risk of Flooding from Surface Water map should be used as a first step in the assessment of fluvial flood risk from smaller watercourses with a catchment of typically less than 3km^2.

Flood Warning map

The Environment Agency's Flood Warning map that is available through the Environment Agency data.gov.uk website[7] indicates those areas that benefit from the Environment Agency's flood warning schemes. The schemes have been set up for a number of areas that are considered to be at particular risk from flooding. Within these areas, the Environment Agency can warn residents in advance when flooding may be likely and how severe the flooding could be. The Environment Agency constantly monitor rainfall and river levels to forecast the possibility of flooding, and if flooding is forecast, will issue Flood Warnings and Alerts. Flood Warnings are issued to specific areas where flooding is expected. Flood Alerts cover larger areas and are issued more frequently to areas when flooding is possible. Areas that are served by Environment Agency Flood Warnings and Flood Alerts are illustrated in Appendix N of this SFRA.

Risk of Flooding from Reservoirs map

The Environment Agency's Risk of Flooding from Reservoirs map[8] shows the likely extent of flooding in the event of reservoir failure. Although the likelihood of such an occurrence is low, as all large reservoirs are stringently governed under the Reservoirs Act 1975, a large volume of water could escape with little or no warning if a failure were to occur. As such, following a recommendation in the Pitt Review, the Environment Agency completed a programme of breach assessments to ascertain the areas at potential risk. Areas that are considered to be at risk of reservoir flooding are illustrated in Appendix L of this SFRA.

FUNCTIONAL FLOODPLAIN

The indicative extent of the Functional Floodplain was created using the national generalised floodplain model (JFLOW) to indicate the fluvial extent of the 1 in 20 (5%) annual probability event. This mapping provided the starting point for this SFRA and has been further defined taking into account the presence of flood defences and urban areas which are generally not considered to be a part of the Functional Floodplain. The mapped Functional Floodplain extents for each of the six key urban areas are illustrated in Appendices E to J of this SFRA.

JFLOW ignores the presence and impacts of structures such bridges and culverts. Accordingly, detailed modelling is often promoted to facilitate improved understanding of fluvial flood risk.

[7] https://data.gov.uk/dataset/0d901c4a-6e1a-4f9a-9408-73e0c1f49dd3/flood-warning-areas
[8] https://flood-warning-information.service.gov.uk/long-term-flood-risk

DETAILED HYDRAULIC MODELLING

The Environment Agency holds the below detailed hydraulic models for the watercourses that flow through Herefordshire. These are:

- River Wye: 1D ISIS (now Flood Modeller Pro) hydraulic model prepared in 2012.
- River Arrow / River Lugg: 1D-2D ISIS (now Flood Modeller Pro)-TUFLOW hydraulic model prepared in 2013.

As discussed above, the outputs of these models are not currently included within the Environment Agency's Flood Map for Planning. Whilst the Flood Map for Planning should still be used as the starting point for defining Flood Zones and the need for further assessment, the outputs of these more detailed models should be used to inform the site-specific flood risk assessments and supplement the Flood Map for Planning.

Other watercourses within Herefordshire have been modelled for a variety of reasons, for example informing the assessment and design of flood management schemes. However these models are now quite old and were not provided by the Environment Agency to inform this SFRA. Proposed developments that may be at risk of flooding within catchments such as the Teme, Leadon and Dore are likely to require more detailed and up-to-date modelling to be undertaken.

HISTORICAL FLOODING

The Environment Agency hold records of historic flooding which can be obtained directly from the Environment Agency to inform development proposals. The Environment Agency's recorded flood outlines and historic flood map extents were downloaded from the www.gov.uk website. These datasets indicate the extent of Environment Agency recorded flood incidents. Details such as the date that the flood incident occurred, location and source of flooding are included.

Environment Agency historic flood records are illustrated on a county-wide scale in Appendix D with more detailed maps of each of the six key urban areas in Appendices E to J of this SFRA.

4.4 SEWERAGE COMPANY FLOOD DATA

Welsh Water provided data from their Flooding Register, comprising sites at risk of flooding due to hydraulic overloading. Each site has been assigned a degree of risk (high, medium or low) based on the frequency of recorded flooding. It does not contain data regarding flooding caused by blockages, collapses or equipment failure as these are considered to be temporary issues.

Severn Trent Water provided data from their Hydraulic Sewer Flood Risk Register based on the drainage areas that are located within Herefordshire. The data is a register of properties and areas that are considered to be at risk of sewer flooding due to hydraulic overloading or where flows exceed the capacity of the sewer system.

Both water companies' registers contain data regarding recorded flood incidents, which was previously held on a DG5 register, and other receptors such as properties, highways and open spaces which are deemed to be at risk.

Historic and predicted flooding associated with Welsh Water and Severn Trent are illustrated on a county-wide scale in Appendix D with more detailed maps of each of the six key urban areas in Appendices E to J of this SFRA.

4.5 LIMITATIONS

Much of the modelling of watercourses in Herefordshire uses national generalised modelling. The outputs of this technique are therefore quite indicative and often do not provide the level of detail that is required to inform site-specific flood risk assessments.

The use of hydraulic modelling data also has a number of limitations. Hydraulic models will use the most up to date data that is available at the time of modelling. Once any datasets have been updated the hydraulic modelling will need to be updated in line with the new datasets. The majority of hydraulic models held by the Environment Agency and Herefordshire Council do not use the most up to date climate change allowances that were published by the Environment Agency in February 2016. Similarly, these models may not use the most up to date methods of calculating catchment hydrology, as the newest methods were only recently released.

It is not possible to predict all flood scenarios and flooding may still occur in areas that have not been identified to be at risk. Similarly, the unruly nature of the UK's weather can also mean that flooding can occur in a different way than recorded in previous events or than predicted by flooding models.

Important Note

It is ultimately the developer's responsibility to satisfy themselves (and demonstrate to the Council and other relevant stakeholders) that the risk of flooding to any proposed development has been adequately assessed and is considered appropriate without causing any notable increase in flood risk elsewhere.

5 FLOOD RISK IN HEREFORDSHIRE

5.1 SUMMARY

The following section provides a summary of flood risk in Herefordshire from all sources of flooding, now and in the future, and provides a summary of existing and proposed flood defence and management schemes. This section does not discuss how flood risk should be addressed within new development – this information is provided in Section 6 Policy Recommendations and Guidance.

5.2 CATCHMENT OVERVIEW

Herefordshire has a large number of main rivers that flow through the county ultimately forming part of the Wye and Usk Catchment or River Severn Catchment. A summary of the main rivers within Herefordshire in provided in Section 1 and a map of these watercourses is provided in Appendix B. Figure 5.2.1 defines the key sub-catchments that drain to each of these main rivers.

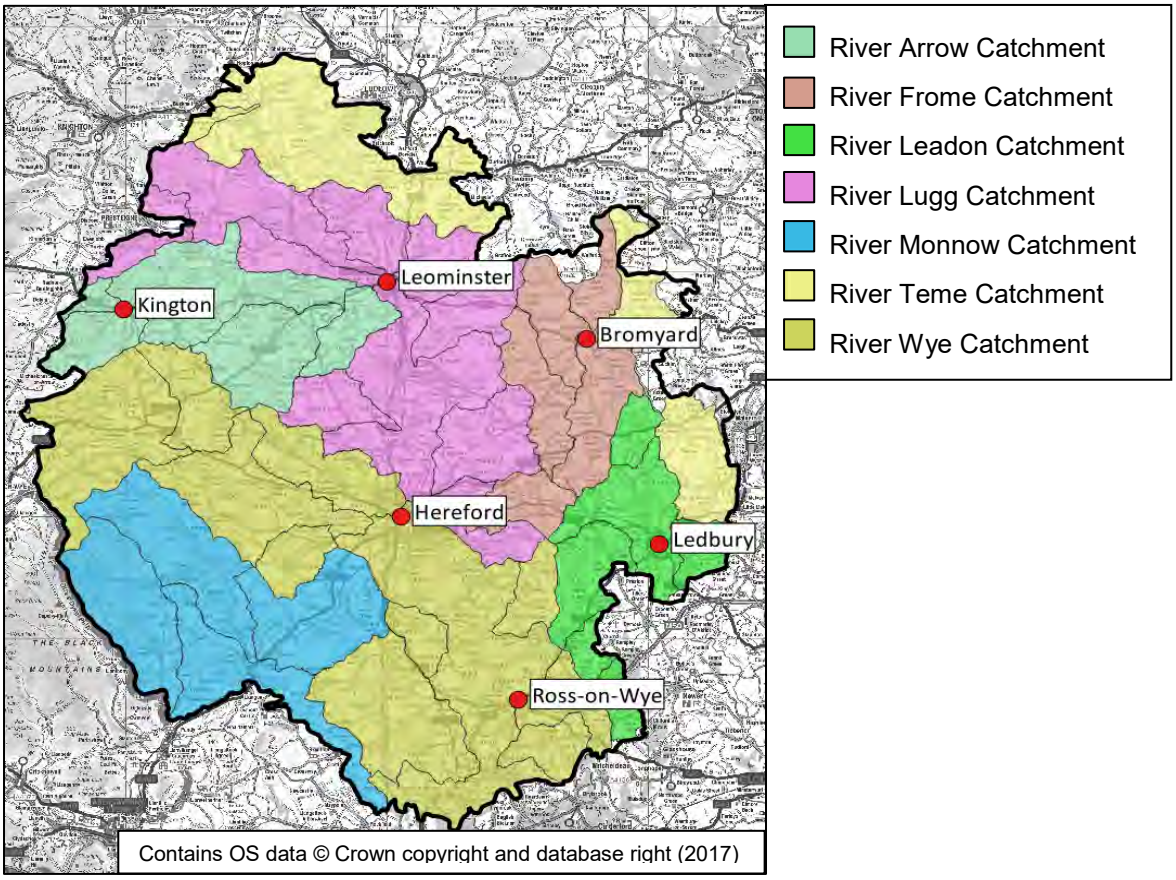


Figure 5.2.1 Main river catchments within Herefordshire

5.3 FLOOD HISTORY

A brief summary of the most notable flood events recorded by Herefordshire Council is provided in Table 5.3.1. The historical flood data available for Herefordshire ranges from 1931 to 2018

Table 5.3.1 Summary of notable historic flood events

Date	Locations	Approximate no. of properties affected	Likely source of flooding
May 1931	Pontrilas Ewyas Harold	unknown	River Dore Dulas Brook
December 1960	Hereford , Hampton Bishop, Tenbury	unknown	River Wye, River Lugg, River Teme
December 1979	Eardisley, Eardisland	18	River Arrow, Folly Brook, Willersley Brook
November 1980	Pontrilas Ewyas Harold	unknown	River Dore Dulas Brook
June & December 1985	Kingstone, Llanfihangel, Talgarth, Presteigne	16	Ordinary watercourses
January 1986	Eardisland, Kington and Pembridge	42	River Arrow
March 1998	Bosbury Ledbury	25	River Leadon Dowdings Brook Surface Water
October 1998	Hereford, Presteigne, Bodenham, Bosbury Eardisland, Pontrilas, Ewyas Harold Ledbury	70	River Wye, River Lugg, Millcroft Brook, Red Brook, River Leadon, River Arrow, River Dore, Dulas Brook Surface Water
December 2000	Ross-on-Wye Bosbury Pontrilas, Eyas Harold Ledbury	7	Rudhall Brook River Leadon, Dowdings Brook River Dore, Dulas Brook Surface Water
August 2006	Ross-on-Wye	20	River Wye
July 2007	County-wide	309	Main river, ordinary watercourse and surface water
2008	Eardisley, Ewyas Harold, Whitney on Wye, Fownhope, Yarkhill	36	Folly Brook, Willersley Brook, Mill Stream, Dulas Brook, Millhalf Brook, Highland Stream
2012	County-wide	260	Main river, ordinary watercourse and surface water
2014	County wide	120	Main river, ordinary watercourse and surface water

Further details of the county-wide events of 2007, 2012 and 2014 are provided in Table 5.3.2, Table 5.3.3 and Table 5.3.4. It is important to note that the information provided within this SFRA is the best available information at the time of writing, but that a detailed assessment of the causes of flooding has not been undertaken. It is also important to note that only areas that

experienced significant flooding (typically 5 properties or more) have been recorded in the tables below.

Table 5.3.2 July 2007 floods

Location	Likely source of flooding
Aston Ingham	Ell Brook
Bodenham	Millcroft Brook River Lugg
Bosbury	River Leadon
Brimfield	Brimfield Brook
Bromyard	River Frome / Ordinary watercourse
Cobnash	Pinsley Brook
Colwall	Surface Water
Dormington	River Frome / Ordinary watercourse
Eardisland	River Arrow
Eastnor	Surface Water
Eyson	Brimfield Brook
Five Bridges (near Bishops Frome)	River Frome
Fownhope	Highland Stream
Hope under Dinmore	Cherry Brook
How Caple	Sollers Brook
Ledbury	Ordinary watercourse Surface Water
Leominster	Surface water

Location	Likely source of flooding
Little Hereford	River Teme / Ledwyche Brook
Llangarron	Garren Brook
Luston	Luston Brook
Mordiford	River Lugg / Pentaloe Brook
Much Marcle	Unnamed Watercourse
Orleton	Mill Brook / Brimfield Brook
Prior's Court	River Leadon
Risbury	Surface water
Steen's Bridge	Humber Brook
Stifford's Bridge	Cradley Brook
Stretton Grandison	Back Brook / Surface water
Stretton Sugwas	Yazor Brook
Sutton St Nicholas	Surface water
Westfield (Cradley)	Surface water
Withington Marsh	Little Lugg
Wyson	Brimfield Brook
Yarkhill	River Frome

Table 5.3.3 Summer and winter 2012 floods

Location	Likely source of flooding
Bill Mills near Pontshill	Ordinary watercourse
Bishops Frome	River Frome
Colwall	Surface water
Cradley	Surface water
Eardisland	River Arrow
Ewyas Harold	Dulas Brook

Location	Likely source of flooding
Leominster	Surface water
Llangarron	Garren Brook
Mordiford	River Lugg / Pentaloe Brook
Much Birch	Surface water
Much Marcle	Preston Brook
Peterchurch	Unknown

Location	Likely source of flooding
Five Bridges (near Bishops Frome)	River Frome
Fownhope	Surface water
Hampton Bishop	River Wye / River Lugg
Hereford	Yazor Brook / Newton Brook / Withy Brook / Surface water
Hoarwithy	Wriggle Brook
Lea	Surface water
Ledbury	River Leadon / Ordinary watercourse

Location	Likely source of flooding
Richards Castle	Surface water
Ross-on-Wye	River Wye / Rudhall Brook
Sutton St Nicholas	Surface water
Tarrington	Surface water
Welsh Newton	Ordinary watercourse / Surface water
Wigmore	Surface water

Table 5.3.4 Spring 2014 floods

Location	Likely source of flooding
Madley	Surface water
Hampton Bishop	River Wye / River Lugg
Kings Acre (Hereford)	Surface water
Kingsland	River Lugg / Surface water

Location	Likely source of flooding
Lea	Surface water
Leominster	Surface water
Ross-on-Wye	River Wye / Rudhall Brook
Steen's Bridge	Humber Brook / Surface water

Herefordshire Council's historic flood records are illustrated on a county-wide scale in Appendix D with more detailed maps of each of the six key urban areas in Appendices E to J of this SFRA. A location-specific assessment of flood risk is required for new developments to understand how this may influence local development control requirements.

5.4 FLOOD DEFENCE SCHEMES

ENVIRONMENT AGENCY FLOOD DEFENCE SCHEMES

Information regarding Environment Agency flood defence schemes has been obtained through consultation with the Environment Agency and Lugg IDB to inform this SFRA. A summary of Environment Agency operated defences is provided below.

HEREFORD

The Hereford Flood Defence Scheme comprises raised defences along the south bank of the River Wye, broadly between Belmont and St Martins. The scheme was constructed in 2007 and aimed to provide a 1 in 200 (0.5%) annual probability standard of protection. The majority of the scheme comprises sheet pile, reinforced concrete and brick defence walls, with one section of earth embankment between the Halo Leisure Pool and Hinton Road. The intention is to replace the majority of the existing demountable flood defences with permanent glass panels as part of an Invest to Save Scheme, during 2019.

Mapping of the area that is protected by the flood defence scheme is provided in Appendix E.

HAMPTON BISHOP

A historic flood bank named The Stank exists along the northern bank of the River Wye through Hampton Bishop. This is shown on the 1900's mapping although its exact date of construction is unknown. The alignment of the bunding is shown on the flood map for planning. This flood bank protects the village of Hampton bishop.

The bunding has been extended above Mordiford Bridge to tie into high ground above Hampton Bishop. There has been historic extensions of the bunding up to Tupsley bridge as an agricultural flood defence however the exact dates of both the extensions are unknown. Hampton Bishop is drained via ditches on the B4224, which then drain through the bund via two culverts. Flap valves restrict backflows when the river levels are high. The agricultural bunds run as far as Longworth bridge and also Tidnor Mill.

There were major breaches of The Stank during the December 1960 flood and in July 2007, when the defences were overtopped by record flood levels due to coincidences of peak flows in the River Lugg and River Frome.

An extensive technical assessment to determine the extent of flood protection that this defence may provide would be difficult to deliver. The flood map for planning identifies the areas adjacent to the bund in Flood Zone 3.

LEOMINSTER

The Leominster Flood Alleviation Scheme was first constructed in the 1970s to protect the town from flooding from the River Lugg. The scheme is located to the north of Leominster. It consists of raised embankments and walls throughout the town and the River Lugg Bypass Channel to the north that flows west to east from Summergalls Farm along the northern edge of the town. The channel drains to where the Ridgemoor Brook joins the River Lugg upstream of the confluence of the Lugg and Kenwater. The original course of the River Lugg through the town centre was also improved, and excess floodwater is stored in the sports centre playing field adjacent to Leominster Town FC.

Further works were undertaken by the Environment Agency in the 1980's to construct a flood defence wall along the north-east bank of the Pinsley Brook / River Kenwater between Osborne Place and the A44 Broad Street as the watercourse flows through the north-east of Leominster.

The Environment Agency is investigating options for further works to improve protection from river flooding to properties in the Marsh area of Leominster. These works are likely to comprise a raised embankment to increase existing flood defence levels.

Mapping of the area that is protected by the flood alleviation scheme is provided in Appendix F. Development within areas identified to be at fluvial flood risk in Leominster should be informed by consultation with the Environment Agency and review of the River Lugg/Arrow 1D-2D ISIS-TUFLOW hydraulic model.

Developers may contribute to this scheme as part of CIL and/or developer contributions where necessary and relevant.

BOSBURY

A culvert upsize was completed in Bosbury in 2005, following episodes of flooding in 1998 and 2000 associated with the River Leadon and Dowdings Brook. The highway culvert north of Bosbury Parish Church was designed for a 1 in 100 (1%) annual probability event as indicated on the Environment Agency's Flood Map for Planning. However in 2007, flooding occurred again at this location.

PETERCHURCH

Following fluvial flooding in 1979, the former Welsh Water Authority installed bunding on the bank of the River Dore. This is not shown on EA mapping. The standard of protection served by these defences is unknown.

PONTRILAS

The former Welsh Water Authority installed bunding on the right bank of the Dulas Brook although it is not shown on EA mapping. The Flood Map for Planning identifies the area adjacent to this bund as Flood Zone 1.

A flood defence wall / bund on the left bank of the River Dore (at a BT Exchange) was also installed by the former Welsh Water Authority. This is not shown on EA mapping. The standard of protection served by this defence is unknown although the Flood Map for Planning identifies the area adjacent to this bund as Flood Zone 3.

PRESTEIGNE

Following fluvial flooding in 1983, the former Welsh Water Authority installed bunding on both banks of the River Dore although there are no defences shown on EA mapping. Flood defences on the left bank (English side) breached in 1998, causing flooding of properties in Ford Street near Lugg Bridge. The Environment Agency (NRW) completed some works to rebuild and extend the left hand bund to reduce the risk of water spilling into a land drainage channel that runs parallel with the river.

The standard of protection served by these defences are unknown although the Flood Map for Planning identifies the areas adjacent to these bunds as Flood Zone 3.

PLANNED SCHEMES

The Environment Agency's FCERM programme details the programme of works identified by the Environment Agency to receive Government funding through Grant in Aid (GiA) over a period of six years. The English Severn and Wye Regional Flood and Coastal Committee (RFCC) for Herefordshire consent the programme of works within Herefordshire. Within Herefordshire and at the time of preparing this SFRA there are currently two Environment Agency (main river) projects at the development stage inline to receive GiA funding:

- → Leominster: Flood Alleviation Scheme improvements
- → Ewyas Harold: Flood Alleviation Scheme

The FCERM programme is subject to change due to changes in the availability of additional funding opportunities. Projects may be delayed or new projects may be added to the programme.

DEVELOPER FUNDING TOWARDS MAINTENANCE OF FLOOD DEFENCE SCHEMES

Contributions for Flood Risk Alleviation scheme maintenance may be funded partly from either Community Infrastructure Levy or under Section 106 of the Town & Country Planning Act 1990.

Where necessary, contributions are sought towards existing maintenance, upgrade of flood defences, new flood alleviation schemes or flood warning systems. These contributions are typically secured through the planning process.

HEREFORDSHIRE COUNCIL FLOOD DEFENCE SCHEMES

A summary of Herefordshire Council operated defences is provided below.

HEREFORD

The Yazor Brook Flood Alleviation Scheme has been operational since 2012 and includes a weir offtake from the Yazor Brook at Credenhill, with flows entering an approximate 1.4km culvert that discharges flow to the River Wye at The Old Weir. The scheme was designed to provide a significant reduction in flows in the Yazor Brook for events up to the 1 in 100 (1%) annual probability event, and included a 20% increase in flow for climate change. Flows during larger events are still reduced but the effect is less significant. The primary driver for the scheme was the need for a strategic solution to flood risk in central Hereford, and thus to enable the planned redevelopment of the Edgar Street Grid area. However, the scheme also reduces flood risks to existing properties and land downstream of Credenhill.

Model outputs of the Yazor Brook flood alleviation scheme are provided in Appendix K and should be used to supplement information provided by the Environment Agency's indicative flood mapping.

A flood alleviation scheme was implemented for the Hereford Enterprise Zone at Rotherwas. Further details are available from Herefordshire Council.

ROSS-ON-WYE

The Ross-on-Wye Flood Alleviation Scheme was constructed in 2008 as a result of a severe flood event in 2000. The scheme protects Ross-on-Wye from flooding associated with the Rudhall Brook and comprises an inverted flood relief siphon, improved culvert and channel capacities for the Rudhall Brook and Chatterley Brook, and a flood storage area upstream of Ross-on-Wye to the east of the A40. During periods of high flows within the Rudhall Brook, excess water is diverted away from the culverted section of Rudhall Brook located beneath Greytree Road and into an inverted siphon that flows between the Kings Acre and Homs Road Car Park. The flood flow is conveyed back into Rudhall Brook downstream of Ross-on-Wye after the flood waters subside.

The scheme was designed to provide a 1 in 100 (1%) annual probability standard of protection including a 20% increase in flow for climate change. This was corroborated by analysis of a hydraulic model of the Ross-on-Wye flood alleviation scheme that indicated that flood flows during the 1 in 100 (1%) annual probability event plus a 20% climate change allowance were largely contained within the river channel. Sections of the Rudhall and Chatterley Brooks are culverted below the town centre and so the risk of partial blockage cannot be fully mitigated.

Mapping of the area that is protected by the flood alleviation scheme is provided in Appendix G.

ALLENSMORE

The Environment Agency's Risk of Flooding from Surface Water map identifies that Cobhall Common is a natural low spot. There is inadequate surface drainage and consequently surface water flooding has occurred. Herefordshire Council have installed a deep culvert that discharges flow below farmland into an upstream tributary of the Worm Brook. Further details of this culvert can be obtained via consultation with Herefordshire Council.

FIVE BRIDGES (BISHOPS FROME)

A flap valve has been installed on the Filly Brook immediately downstream of the A4103 to reduce flood risk at Five Bridges (near Bishops Frome) in low order storm events.

KINGSTONE

The Environment Agency's Risk of Flooding from Surface Water map identifies that the main road through Kingstone is a natural low spot. The former South Herefordshire District Council installed a culvert that conveys runoff from a riparian maintained ditch on adjacent playing fields that discharges to an ordinary watercourse west of the village. Further details of this culvert can be obtained via consultation with Herefordshire Council.

PETERCHURCH

Surface water runoff causes flooding problems at several locations in Peterchurch. To reduce runoff effects onto Mowbage Lane, Herefordshire Council completed capacity improvements to the adjacent watercourse which discharges to the River Dore. This included installing new culverted sections below farmland. Further details of this culvert can be obtained via consultation with Herefordshire Council.

WHITNEY ON WYE

Property flooding has occurred when the Millhalf Brook spilled onto Mill Road. It is likely that the alignment of this watercourse has been diverted. Herefordshire Council built a side channel to increase capacity. This operates via a penstock and diverts flow to an existing ordinary watercourse to the south of the A438. Further details of this scheme can be obtained via consultation with Herefordshire Council.

FLOOD STUDIES AND PLANNED SCHEMES

Herefordshire Council are responsible for managing the risk of flooding from local sources and implementing the programme of measures to reduce flood risk in accordance with their Local Flood Risk Management Strategy. As such the Council have a rolling programme of works to investigate flooding, assess options to manage flood risk, and implement flood management scheme where appropriate and economically viable.

A flood alleviation scheme is proposed in the village of Lea to reduce flood to properties associated with flooding from the Rudhall Brook and surface water flows from surrounding high land. The scheme is subject to further feasibility and design but if taken forward will likely include drainage improvements, large capacity gullies to capture flows and a new diversion culvert through the village. Further details of this scheme can be obtained via consultation with Herefordshire Council.

Herefordshire Council has commissioned studies to investigate options for flood alleviation and defence at the villages of Eardisley, Bodenham, Hope Under Dinmore, Cradley, Brimfield and Orleton. A further study was commissioned by Eardisland Parish Council. Details of these feasibility studies are not available for inclusion within this SFRA but it is recommended that Applicants consult with the Council for any development proposals at these locations.

Investigations of flooding events to fulfil the requirements of the Flood & Water Management Act Section 19 reporting may also include supporting flood studies. Retrospective Section 19 investigations are planned at several sites where historic flooding evidence has been presented or where parish councils have identified flooding issues that have affected property. Information regarding the location of Section 19 investigations can be requested from the Council.

RIVER LUGG IDB FLOOD DEFENCE SCHEMES

BODENHAM

An overflow channel and bund has been constructed to increase flow capacity on the Millcroft Brook at Millcroft Farm, Bodenham. Further details of this scheme can be obtained via consultation with the Lugg IDB.

PONTRILAS

Lugg IDB modified an existing farm access track to create a spillway to receive peak flows from an unnamed ordinary watercourse near Westwood Industrial Estate. This project was implemented due to property flooding. The Environment Agency's Risk of Flooding from Surface Water map indicates two flow routes and demonstrates the presence of the concrete access track. The overflow channel is diverted below a road and anti-clockwise around a timber yard, then below the A465 and the adjacent farmland in culvert. The overflow ultimately discharges into the River Dore. Further details of this scheme can be obtained via consultation with the Lugg IDB.

WITHINGTON MARSH

Capacity improvements were made to a tributary of the River Lugg at Withington Marsh in 1983 to reduce fluvial flood risk . A former canal was utilised to serve as a secondary flow channel by installing a throttle pipe and a spillway. Bunding was also installed to contain flows within the channel. Further details of this scheme can be obtained via consultation with the Lugg IDB.

WELSH WATER FLOOD MANAGEMENT SCHEMES

Welsh Water has launched their innovative RainScape project that aims to reduce surface water flood risk by incorporating SuDS measures into traditional piped drainage systems. There is a rolling programme of Asset Management Plan (AMP) sewerage works and a summary of recent schemes is provided below.

Welsh Water has recently completed significant works to improve the performance of the sewerage system in the Kings Acre area of Hereford. The schemes typically aim to reduce the amount of surface water which currently causes flooding from the network.

Smaller flood risk schemes are currently being undertaken in Bromyard and Lea. The works in Bromyard aim to resolve an ongoing flooding problem affecting properties externally through improvements to the existing sewer network and sewage pumping station. The works in Lea aim to reduce flood risk to properties which have flooded externally by sealing manholes and repairing defects on the foul sewer in order to prevent the ingress of surface water.

Welsh Water is also undertaking investigations into historic flooding issues in Wellington and Fownhope in order to identify possible solutions. Welsh Water are also working in partnership with other flood risk management authorities such as the Environment Agency and Herefordshire Council in order to identify potential opportunities for joint investment of investigations.

5.5 ASSESSMENT OF FLOOD RISK

FLUVIAL FLOOD RISK

The majority of fluvial flood risk in Herefordshire is associated with the main rivers that flow through the country, with the most extensive floodplains attributable to the River Teme, River Lugg, River Arrow, River Wye, River Frome, River Dore, River Leadon and Worm Brook.

Ordinary watercourses that are under the jurisdiction of Herefordshire Council also pose significant flood risk in many areas of Herefordshire. There are too many to list but those that tend to pose the greatest flood risk to properties in Herefordshire include the Yazor Brook and Widemarsh Brook, Red Brook, Back Brook, Brimfield Brook, Mill Brook, Dulas Brook, Humber Brook, Holly Brook, Wellington Brook, Little Lugg, , Rudhall Brook, Garren Brook, Willersley Brook, Folly Brook Millcroft Brook, Tan Brook, Wriggle Brook, Cherry Brook, Luston Brook, Preston Brook, Cradley Brook and Millhalf Brook.

The fluvial flood extents in Herefordshire are mostly contained within currently rural areas, reflecting the largely rural nature of the county. The most significant towns and villages that are indicated to be at notable risk of fluvial flooding from main rivers and ordinary watercourses include Hereford, Leominster, Ross-on-Wye, Kington, Leintwardine and Bromyard, as well as the villages of Hampton Bishop, Eardisland, Eardisley, Orleton, Brimfield, Mordiford, Fownhope, Withington Marsh, Steen's Bridge, Five Bridges (near Bishops Frome), Hope under Dinmore, Yarkhill, How Caple, Ledbury, Little Hereford, Llangarron, Luston, Much Marcle, Ewyas Harold, Whitney on Wye and Wyson.

Other villages that are indicated to be at flood risk or are known to have experienced flooding in the past include Wellington, Letton, Whitchurch, Credenhill, Bosbury, Bodenham, Pembridge**,** Peterchurch, Bill Mills near Pontshill, Dorstone, Yarpole, Kingsland, Presteigne, Prior's Court, and Stretton Sugwas.

APPROPRIATE USE OF MAPPING

Areas within Herefordshire that are illustrated to be located within Flood Zone 2, 3a and 3b are shown on the county-wide fluvial flood map available in Appendix D with more detailed maps of each of the six key urban areas in Appendices E to J of this SFRA. As discussed previously, these maps have been generated using the Environment Agency's Flood Map for Planning that define the fluvial Flood Zones, but that are based on broadscale JFLOW modelling. Although indicative, these maps still provide the starting point from where development planning decisions are taken – for example, the need to apply the Sequential Test and the need to undertake a site-specific flood risk assessment.

JFLOW is a broad scale modelling programme designed to provide quick and simple results for a wide area. JFLOW does not take into account the presence of structures such as embankments and bridges which will affect flood levels and extents. Flood Zones derived solely from JFLOW must therefore be treated with caution.

Outputs from the River Wye hydraulic model and the River Lugg hydraulic model are included in Appendices E, F and G.

It is important to remember that the Environment Agency's Flood Map for Planning does not capture fluvial flood risks associated with watercourses with a small catchment of typically less than 3km^2. Flooding associated with these watercourses will be better represented on the Environment Agency's Risk of Flooding from Surface Water map. If this flooding is attributable to a watercourse then Herefordshire Council will expect a similar approach to be taken in the assessment and management of these risks as would be expected for the Environment Agency Flood Zones. .

Other sources of data that are held by the Council and the Environment Agency will supplement the Environment Agency's indicative flood maps. For models held by the Council, this includes the detailed hydraulic models of the Yazor Brook (including Widemarsh Brook and Eign Brook) in Hereford; Folly Brook, Willersley Brook and Mill Stream in Eardisley; and Cherry Brook in Hope under Dinmore. For models held by the Environment Agency, this includes the detailed hydraulic models of the River Wye, River Arrow and River Lugg.

Model outputs for these studies are provided in Appendix D (county-wide mapping), and Appendix K (Studies completed by Herefordshire Council). This information should be used to supplement information provided by the Environment Agency's indicative flood mapping, along with any records of historic flooding. However it is important to note that the undefended case as mapped on the Environment Agency's indicative flood mapping will still form the starting point of any flood risk assessment in these areas.

The 1D hydraulic models prepared to investigate flood risk in Lea and Five Bridges (near Bishops Frome) are not considered appropriate to map within this SFRA, however information regarding these studies can be requested from the Council.

SURFACE WATER FLOODING

The most comprehensive source of information regarding surface water flood risk is the Environment Agency's Risk of Flooding from Surface Water map. The majority of surface water flooding in Herefordshire is associated with ordinary watercourses that are not represented on the Environment Agency's Flood Map for Planning. The large size of Herefordshire county makes it impractical to provide a summary of surface water flood risk within this SFRA although a county-wide map of areas at high, medium, low and very low (as defined in Section 3.4) is provided in Appendix D with more detailed maps of each of the six key urban areas in Appendices E to J of this SFRA.

The most significant towns and villages that are indicated to be at notable risk of flooding from surface water sources include Hereford, Leominster, Ross-on-Wye, Kington, and Bromyard. Other villages that are indicated to be at flood risk or are known to have experienced flooding in the past include Stretton Sugwas, Tarrington, Lea, Hope Under Dinmore, Withington, Risbury, Much Birch, Yarpole, Welsh Newton, Sutton St. Nicholas, Wigmore, Richard's Castle, Stoke Prior, Westfield, Bishop's Frome, Colwall, Kingsland, Kingstone, Madley, Donnington, and Llangrove and Knapton Green.

As discussed in Section 4.2, Herefordshire Council has commissioned detailed flood studies of the villages of Hope under Dinmore and Lea for the purpose of understanding flood risk that is likely to be partly attributable to surface water sources. The information held by the Council for these locations may therefore supplement the information held by the Environment Agency. It is therefore recommended that developers contact Herefordshire Council to discuss any proposed developments at these locations.

Also as discussed above, it is important to remember that surface water flood risk that is actually attributable to an ordinary watercourse is likely to be classified by Herefordshire Council as fluvial flooding and is expected to be assessed and managed in a similar manner to the Environment Agency Flood Zones..

GROUNDWATER

Records of groundwater flooding in Herefordshire are limited. However this is likely to be because groundwater flooding is often perceived as surface water flooding as is therefore not accurately recorded, rather than groundwater flooding not being a potentially significant source of flood risk. The large number of natural springs located throughout Herefordshire and that form many of the country's ordinary watercourses indicates that groundwater emergence can be common.

Historic records of groundwater flooding held by the Environment Agency indicate occurrences near Clehonger, Newtown, Tarrington, Much Marcle, Westfield, Cradley and Stifford's Bridge. The Council are aware of springs which pose a risk to Colwall (Evendine), Wetmore, Lea, Yarkhill and Peterchurch.

Groundwater flooding will typically occur in permeable geology such as sand and gravels that allow for the relatively free movement of groundwater, often responding to rising river levels if located in close proximity to a watercourse or following extended periods of rainfall that will cause groundwater levels to rise. A review of superficial and bedrock geology available through the British Geological Survey (BGS) can therefore provide an indication of where groundwater flooding is most likely to occur. The location of mapped sand and gravel deposits is provided in Appendix M[9].

A summary of the most prominent superficial sand and gravel deposits is provided below. These typically follow the natural floodplains of significant watercourses, often reflecting the floodplain prior to urban development or amendments to channel alignment or hydrology. It is also important to remember that although groundwater may emerge within these areas, areas at a lower elevation will also be at risk as groundwater flow will follow the ground's topography.

- Land adjacent to the River Teme to the south of Leintwardine.
- Land adjacent to the River Teme to the north and west of Brimfield and along the alignment of Brimfield Brook, encompassing the villages of Brimfield and Orleton and Little Hereford.
- Land adjacent to Ridgemoor Brook and Main Ditch that flow south from Orleton towards Leominster.
- The entire length of Allcock's Brook as it flows to the east of Wigmore in a northerly direction from Yatton to confluence with the River Teme.
- The channel of the River Lugg and its tributary Hindwell Brook, increasing to the width of the natural floodplain at Mortimer's Cross and encompassing the village of Kingsland and The Marsh to the north of Leominster, as well as land within the east of Leominster.
- The channel of Back Brook and the River Arrow, increasing in size to the north of Pembridge and encompassing the village of Eardisland and merging with the floodplain of the Lugg to the south of Leominster.
- Land adjacent to tributaries of the River Arrow to the west of Leominster including the Little Arrow, Stretford Brook and Newbridge Brook, as well as an area of land close to Luntley along the alignment of Tippet's Brook.
- Land adjacent to the Lugg as it continues to flow south to confluence with the River Wye at Hereford, including the floodplain of the tributaries of Marl Brook, Cherry Brook through Hope under Dinmore, Wellington Brook, the Little Lugg and encompassing the villages of Bodenham, Wellington, Marden, and Moteton on Lugg.
- Isolated patches to the north and east of Hereford within the vicinity of the villages of Portway, Moteton on Lugg, Walkers Green, Bartestree and Hagley, as well as the upper reaches of Yazor Brook within the vicinity of Credenhill and Mansel Lacy.
- Within Hereford, significant areas within the centre and north of Hereford encompassing Widemarsh, Moorfield, Portfields and Bartonsham that are underlain by sand and gravel deposits, as well as significant areas in the south encompassing Hunderton, Blackmarstone, Putson, Lower Bullingham and Rotherwas.
- Land adjacent to the River Frome from the north of Bishops Frome as it flows south to confluence with the River Lugg, and including the floodplain of the River Lodon.
- The expansive floodplain of the River Wye as it flows from Hay-on-Wye towards Hereford encompassing the villages of Monnington-on-Wye and Lower Breinton. To the south of

[9] Reference: Onshore GeoIndex (http://www.bgs.ac.uk/geoindex). Printed outputs delivered under the terms of the Open Government Licence, subject to the following acknowledgement accompanying the reproduced BGS materials: Contains British Geological Survey materials © NERC [2017].

Hereford, the sand and gravels continue to follow the river channel of the Wye and encompass the villages of Hampton Bishop, Holme Lacy, Wilton, Bridstow, and Walford.

- The alignment of Rudhall Brook as it flows through Ross-on-Wye.
- An expanse of land in the vicinity of Cage Brook to the west of Clehonger, as well as land in the vicinity of Allensmore, Cobhall Common, Winnal Common.
- Land along the alignment of Worm Brook from Wormlow Trump, through Much Dewchurch, Wormbridge and Howton.
- The River Dore from Peterchurch to Pontrilas, encompassing the villages of Turnstone.
- The floodplain of the River Leadon, Stoney Brook, Preston Brook to the south of the A449 and minor tributaries encompassing Bosbury and continuing south past Ledbury.

Information about groundwater levels can also be obtained from the BGS Geology of Britain Viewer by viewing historic borehole logs that are available for free through this portal[10].

SEWERS

Welsh Water has provided data from the Flooding Register that includes data of sites that are assessed to be at risk of flooding due to hydraulic overloading over the sewerage system. Each site has been assigned a degree of risk (high, medium or low) based on historic records of flooding at these locations and the frequency of recorded flooding. The dataset provided by Welsh Water does not contain data associated with blockages, collapses or equipment failure as these are considered to be temporary issues and therefore not long term or permanent risks.

Severn Trent Water has provided similar data from the Hydraulic Sewer Flood Risk Register for drainage areas that are located within Herefordshire. The data provides a register of properties and areas that are considered to be at risk of sewer flooding due to hydraulic overloading or where flows exceed the capacity of the sewer system.

Welsh Water and Severn Trent Water have also provided data of recorded flood incidents that was previously held on the DG5 register.

A county-wide map of historic flood records and at-risk areas is provided in Appendix D with more detailed maps of each of the six key urban areas in Appendices E to J of this SFRA.

Unsurprisingly the majority of sewerage flooding has occurred within the key urban areas of Herefordshire including Hereford, Leominster, Ledbury, Ross-on-Wye and Bromyard. Multiple records are also indicated at the following villages:

- Leintwardine;
- Wigmore;
- Yarpole;
- Shobdon;
- Kingsland;
- Ivington;
- Westfield;
- Stifford's Bridge;
- Colwall;
- Swainshill;
- Fownhope;
- Ewyas Harold;

[10] British Geological Survey Geology of Britain Viewer: http://www.bgs.ac.uk/discoveringGeology/geologyOfBritain/viewer.html

- Sollers Dilwyn;
- Moreton-on-Lugg;
- Bodenham Moor;
- Lea;
- Whitchurch

ARTIFICIAL SOURCES

Structures such as raised reservoirs or raised canals (i.e. structures designed to hold, or capable of holding, water above the surrounding ground levels) can pose a significant flood risk if they were to fail.

RESERVOIRS

The most significant risk of flooding from artificial sources is attributable to reservoir failure. The Environment Agency's Risk of Flooding from Reservoirs map shows the likely extent of flooding in the event of reservoir failure. The key purpose of these maps is to highlight those areas where developers and the public need to be aware of the potential risks should a breach of a reservoir occur and therefore the actions that should be taken. The maps provide information of the extent, depth and velocity of flow that in turn can inform an assessment of hazard.

The Water Act (2003) (amended the Reservoirs Act (1975)) requires the preparation of dedicated Flood Plans for large raised reservoirs, to be prepared by the asset owner. A large raised reservoir is defined in the Act as a structure 'designed to hold, or capable of holding, more than 25,000m^3 of water above that level (the natural level of any part of the land adjoining it)'.

As of 2009 dedicated Flood Plans must be prepared by the reservoir owner for all large raised reservoirs that may pose flood risk. A Flood Plan is a set of documents that describe the arrangements to be put into operation in response to a sudden large release of water from a reservoir that could pose a threat to property and life downstream. They include an assessment of the impacts of dam failure, a review of the measures that can be taken by the reservoir operator to prevent the catastrophic failure and an assessment of the emergency response mechanism required to minimise risk to life and property should a failure occur.

Reservoirs must undergo regular inspections to the requirements of the Reservoirs Act by suitably qualified engineers. On this basis therefore, the probability of structural failure of these reservoirs is considered to be low.

For reservoirs below the threshold of 25,000 m^3 (small reservoirs) there are different regulations governing safety, although the Environment Agency considers them to be a significant risk since there is no regulation equivalent to that afforded by the Reservoir Act. Where people are at risk, the Local Authority has a duty under clause 77 of 1984 Building Regulations to serve the owners notice if a small reservoir is deemed unsafe.

The Environment Agency's Risk of Flooding from Reservoirs map indicates flood risk from reservoirs at the following locations:

- Flood flow route that follows the alignment of the River Teme, originating from the Walcot Hall Lakes located on the Walcot Hall Estate near Lydbury North in Shropshire. On reaching Herefordshire, the flood waters are largely contained within the watercourse channel and are not indicated to pose significant risk to adjacent land.
- Flood flow route that originates at the Flintsham and Titley Pools SSSI to the north-east of Kington, flowing overland to the River Arrow to the south-west. On entering the River Arrow, the flood waters largely remain within the watercourse channel.
- Flood flow route that originates at a lake located in the gardens of Nieuport House to the east of Almeley. The water within the lake is retained by a large dam, with an outflow channel

conveying water south through the Coke's Yeld Dingle woodland to a fishing pond located at Almeley Bridge adjacent to Upcott. The flow continues south, largely within the channel of an ordinary watercourse, and mirrors the mapped fluvial floodplain associated with the River Wye.

- Flood flow route from a reservoir to the east of Burghill that flows in an easterly direction overland towards Morton-on-Lugg and eventually to the River Lugg, as well as overland in a westerly direction through Burghill and eventually to the Yazor Brook.
- Flood flow route that originates at Hartleton Lakes to the east of Ross-on-Wye, with flood waters following the alignment of the Rudhall Brook towards to the River Wye and mirroring the mapped fluvial flood extents associated within this watercourse.
- Flood flow route from a series of reservoirs to the north of Much Marcle, flowing within a northerly direction within ordinary watercourses that discharge to Preston Brook. The flood extents are similar to those mapped for fluvial flooding.
- Flood flow route that originates at Berrington Pool – a Capability Brown lake that forms part of the Berrington Estate. Flood waters form the lake flow overland towards Ridgemoor Brook and Main Ditch, continuing south towards Leominster. Once within the ordinary watercourses, the flood extent is similar to the fluvial flood extent associated with the watercourses.

Information from the Environment Agency's Risk of Flooding from Reservoirs map is illustrated on the maps provided in Appendix L.

As outlined above, reservoirs with a volume above 25,000m^3 require annual inspections by a registered Panel Engineer. The Flood and Water Management Act 2010 included proposals to reduce this figure to 10,000m^3, however currently this has not been implemented in England.

Reservoirs with a volume typically greater than 10,000 m^3 may be designated under Section 3 of the Flood and Water Management Act 2010. This legislation allows a LLFA to designate components of a drainage system. Changes to these structures are not permitted without approval.

Flood risk associated with smaller reservoirs (i.e. those not included in the Environment Agency's Risk of Flooding from Reservoirs map) has not been mapped, but consideration must be given to this risk via review of other sources of information such as OS mapping and site visits.

OTHER STRUCTURES

There are currently no operational canals within Herefordshire. However, the Herefordshire and Gloucestershire Canal Trust are pursuing the full restoration of approximately 34 miles of canal between Hereford and Gloucester. Works are currently underway and stretches of the canal at Monkhide, Yarkhill and Aylestone have been restored by the Trust and with the help of the Waterways Recovery Group. It is currently the intention that the maintenance and management of flood risk and associated assets related to the canal network within Herefordshire will be the responsibility of the Herefordshire and Gloucestershire Canal Trust.

Review of the Environment Agency's Risk of Flooding from Surface Water map indicates that any floodwaters that would be associated with the canal would flow towards the west towards the Little Lugg. The canal is broadly located within a local valley although the village of Cross Keys is likely to be at greatest risk in the event of a significant failure.

5.6 EMERGENCY PLANNING

Herefordshire Council is part of the West Mercia Local Resilience Forum that encompasses Herefordshire, Worcestershire, Shropshire, Telford and Wrekin. Local Resilience Forums are multi-agency partnerships made up of representatives from local public services, including the emergency services, local authorities, the NHS, the Environment Agency and others. These agencies are known as Category 1 Responders, as defined by the Civil Contingencies Act. The West Mercia Local Resilience Forum plans and prepares for localised incidents and catastrophic emergencies which can include significant flooding events.

With regard to flood risk and the planning of new developments, the Environment Agency and Herefordshire Council are the two key organisations responsible for the majority of emergency planning activities within Herefordshire.

ENVIRONMENT AGENCY

The Environment Agency's Flood Warning map indicates those areas that benefit from its flood warning service. The Environment Agency issues three different kinds of flood warnings:

- Flood Alert: Flooding is possible. Be prepared. Used two hours - two days in advance of flooding.
- Flood Warning: Flooding is expected. Immediate action required. Used half an hour - one day in advance of flooding.
- Severe Flood Warning: Severe flooding. Danger to life. Used when flooding poses significant threat to life.

Flood warnings are currently issued for the following at-risk areas:

- Land located in the floodplain of the River Wye between Hay-on-Wye and Ross-on-Wye, including the centre of Hereford and village of Winforton, as well as a smaller stretch of the River Wye floodplain between Kerne Bridge and Welsh Bicknor;
- Land within the north of Hereford at risk of flooding from the Yazor Brook, Widemarsh Brook and Eign Brook;
- East of Bromyard and, further south, land near Bishops Frome and Five Bridges (near Bishops Frome) associated with flooding from the River Frome;
- South of Leintwardine and village of Walford associated with flooding from the River Teme and its tributaries;
- North and east of Leominster associated with flooding from the River Lugg and its tributaries;
- Land located within the floodplain of the River Arrow, including the town of Kington and village of Eardisland.

Flood Alerts are provided for a wider area of Herefordshire, broadly comprising land within floodplains associated with the River Teme, River Clun, River Frome, River Lugg, River Arrow, River Dore, River Leadon, Stony Brook, Cradley Brook, Rudhall Brook, Worm Brook, Garren Brook, The Gamber and Preston Brook.

Areas that benefit from Flood Warnings and Flood Alerts are illustrated in Appendix N.

HEREFORDSHIRE COUNCIL

Emergency planning within Herefordshire is led by the Council's Emergency Planning Team that can be contacted at resilienceteam@herefordshire.gov.uk.

There are currently no flood warning services available for flooding from ordinary watercourses, surface water or groundwater sources. However, Herefordshire Council endeavour to provide real-time information of significant flood events on the Herefordshire Council website and via local radio and social media.

With regard to the planning of new developments, the Council are responsible for reviewing development applications within Herefordshire with a view to understand the hazard posed to these developments should a flooding event occur and the ability to safely evacuate these developments in an emergency. This will include consideration of the pressures that new development may place on the services provided by the Council and their multi-agency partners, as well as the ability to reach critical services such as hospitals or community rest centres.

5.7 MAPPING THE IMPACTS OF CLIMATE CHANGE

Updated climate change recommendations were published by the Environment Agency in February 2016 and must be used when assessing the future flood risk to all new developments. These supersede the previous recommendations that were included within PPS25 and, later, the NPPF Planning Practice Guidance.

A summary of the updated climate change recommendations for peak river flow within the Herefordshire area is provided in Table 5.7.1. Herefordshire is within the Severn River Basin District. Guidance on how these climate change recommendations should be considered in new development is provided in Section 6.5.

Table 5.7.1 Peak river flow allowances[11]

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)
High++[12]	25%	45%	90%
Upper End	25%	40%	70%
Higher Central	15%	25%	35%
Central	10%	20%	25%

The majority of development in Herefordshire is likely to extend beyond 2070 therefore the '2080s' allowances are considered most relevant to updated fluvial flood mapping.

The updated Environment Agency recommendations were supported by local guidance for the Shropshire, Herefordshire, Worcestershire and Gloucestershire area. This provided guidance on recommended nominal increases in rivers levels to assist in qualitative assessments of fluvial flood risk. This is summarised in Table 5.7.2.

[11] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

[12] The use of the High++ allowance category is generally reserved for schemes where the probability of flooding is rare but the consequences of flooding could be extreme (e.g. a nationally significant power station) or where the scheme will significantly change existing settlement patterns (e.g. new urban extensions). The High++ category was derived based on research of non-standard catchments that exhibited significantly greater increases in river flows than the standard catchment.

Table 5.7.2 Nominal allowances peak river levels[13]

	Change in peak flow		
Watercourse	**20 - 25%**	**35 - 40%**	**70%**
River Wye	600mm	850mm	1500mm
River Teme			
Lower Severn (downstream of Lincomb weir, Worcestershire)	400mm	600mm	1000mm
Tributaries and ordinary watercourses	200mm	300mm	500mm

Updated climate change mapping has been prepared to inform this SFRA. This is based on a purely qualitative methodology and no updated hydraulic modelling has been undertaken. This approach is considered appropriate for a Level 1 SFRA and for the purpose of a) identifying the potential effects of climate change and, b) identifying where development is likely to be required to be supported by more detailed analysis.

The potential effects of climate change on the mapped fluvial Flood Zones has been considered for (broadly) the 1 in 100 (1%) annual probability flood event with a 70% increase in peak flow. This is considered appropriate for the majority of development in Herefordshire that is likely to comprise More Vulnerable development[14] with a design life beyond 2070. The analysis completed for this SFRA adopted the following approach:

- Broadly assuming that the mapped extent of Fluvial Flood Zone 2 (i.e. extent of the 1 in 1000 (0.1%) annual probability event) provides a good indication of the 1 in 100 (1%) annual probability event plus 70% peak river flow (i.e. upper end allowance category);
- Where detailed model data exists, comparing the model hydrology for the 1 in 100 (1%) annual probability event to the model hydrology for the 1 in 1000 (0.1%) annual probability event (i.e. for the Yazor Brook, River Wye and combined River Arrow / River Lugg) to verify that the modelled Flood Zone 2 will be representative of the future Flood Zone 3 with climate change allowance.
- Undertaking spot checks at a number of locations throughout Herefordshire, using LiDAR data where modelled flood levels were not available for the national generalised modelling, to compare the estimated 1 in 1000 (0.1%) annual probability flood level against the estimated present day 1 in 100 (1%) annual probability flood level plus the Environment Agency's nominal allowances (i.e. Table 5.7.2).
- The 1 in 1000 (0.1%) annual probability flood extent was considered appropriate where the differences in calculated flows and levels were less than c.20% of the Environment Agency's recommended increase in peak flow or nominal allowances.

The outputs of this analysis are provided within the county-wide climate change mapping in Appendix D, as well as location specific maps in Appendix E (Hereford local mapping), Appendix F (Leominster local mapping) and Appendix K (Studies completed by Herefordshire Council).

As outlined above, the flood mapping outputs that have been presented have not been accurately assessed in accordance with the 2016 Climate Change criteria (70% peak river flow). It is therefore possible that as a result, less housing than anticipated may be built at allocated sites

[13] Flood Risk and Coastal Change: Climate change allowances for planning (SHWG area), Environment Agency, March 2016

[14] In accordance with NPPF Vulnerability classifications as summarised in Table 6.3.1 of this SRFA.

should any climate change impacts identified in the site specific Flood Risk Assessment be greater. Conversely some development plots may not be at risk of fluvial flooding.

The mapping prepared to inform this Level 1 SFRA is purely to indicate the likely effects of climate change for the purpose of informing the need for further detailed analysis. If a development site is located within an area deemed to be at risk, it is the developer's responsibility to adequately assess this risk in more detail.

This analysis has not been undertaken for smaller watercourses (typically with a catchment less than 3km^2) that are not included within the Environment Agency's Flood Map for Planning, or for areas that are identified to be at risk of flooding from surface water. It is the developer's responsibility to undertake analysis of climate change effects for these areas in accordance with the guidance provided for site-specific assessments as summarised in Section 6.5.

Important Note

The updated climate change mapping provided within this Level 1 SFRA is indicative only, prepared to provide an indication of the potential effects of climate change and the likely need for more detailed assessment. It is ultimately the developer's responsibility to undertake an assessment of the potential impacts of climate change that is appropriate to the size, vulnerability and location of a proposed development. This is discussed in greater detail in Section 6.5.

6 POLICY RECOMMENDATIONS AND GUIDANCE

6.1 INTRODUCTION

Ensuring that the risk of flooding is taken into account in the planning of new development is essential to protect the future occupants of these developments as well as people, property and infrastructure elsewhere – both now and in the future.

Developers are encouraged to contact the Environment Agency Sustainable Places (Planning) team and/or Herefordshire Council to engage in pre-application discussions on master-planning and individual planning applications, with fees levied accordingly.

The Council seeks to promote green SuDS, particularly at larger sites where an exemplar approach to SuDS design is expected. Sufficient space needs to be allocated when the site layout is first considered. Attenuation features need to be located appropriately near the start of the design process outside flood zone 3.

The risk of flooding is most effectively addressed through avoidance, which in very simple terms equates to guiding future development (and regeneration) away from areas at risk. Development that is sustainable for future generations is essential and it is widely recognised that the risk of flooding cannot be considered in isolation. There are many tests and measures of 'sustainability' that must be weighed in the balance when locating and designing future development.

The NPPF endeavours to guide Local Planning Authorities and the Environment Agency in this decision making process and the Sequential and Exception Tests underpin the method by which flood risk should be taken into consideration as part of the planning process.

This section of the SFRA sets out the way in which Herefordshire Council expects new development to take flood risk into account, including the application of the Sequential and Exception Tests and preparation of site-specific flood risk assessments.

The majority of advice in this Section applies to ALL development proposals, regardless of size, nature or location. Where advice is only applicable to certain types of development, for example those located within Flood Zone 3, this is clearly identified.

Important Note

Development control policies that are considered important to Herefordshire and that may go beyond those that are considered 'standard practice' are highlighted in blue boxes. Developers should take particular note of these requirements.

SOURCES OF FLOOD RISK

All development proposals must give consideration to all sources of flooding in accordance with the NPPF. This includes flooding from main rivers, ordinary watercourses, surface water, groundwater emergence, the sewerage system, reservoirs and other artificial sources, as well as flooding that could be attributable to overland flow, blocked culverts, temporary exceedance of drainage systems and failure of flood defence schemes.

Important Note

All development proposals must give consideration to all sources of flooding in accordance with the NPPF. Within Herefordshire, developers are also expected to give consideration to flooding associated with overland flow, culvert blockage, temporary exceedance of drainage systems and failure of flood defence schemes.

OVERLAND FLOW

Flood risk associated with overland flow from adjacent land is an important consideration in Herefordshire. This type of overland sheet flow may not be visible on the Environment Agency's Risk of Flooding from Surface Water map as it is not channelled into defined overland flow routes. Developers must look at surrounding topography and consider these risks to development proposals. This must also demonstrate that overland flow will not overwhelm the capacity of the development's surface water drainage system, and that diversion of this flow will not increase flood risk elsewhere. It is recommended that OS mapping, LiDAR data or topographic survey data is used to assess the flood risk associated with overland flow from adjacent higher land.

Important Note

Where uphill edges of development plots are bordered by roads, highway drain orifices or culverted watercourses may emerge on the development plot. Developers need to complete topographical surveys within the highway verges and across the carriageway. In some cases there are no culverts but the route that overland flow will take as it spills across the highway needs to be defined.

CULVERT BLOCKAGE

Many development proposals in Herefordshire do not adequately consider flood risks associated with blocked culverts, particularly those associated with minor watercourses that do not have a mapped fluvial flood extent due to their small catchment.

Important Note

If a proposed development site is located in close proximity (c. 20m) of a culvert then it is expected that consideration will be given to flood risk to the site if this culvert were to become blocked.

A two stage approach is considered appropriate: first undertaking a qualitative assessment of the potential risk to the development and the consequences of a flooding incident; and second undertaking a more detailed quantitative and more detailed assessment if the risks are considered significant.

If the developer proposes to introduce a new culvert (for example a new access road) or amend an existing culvert, then quantitative analysis (i.e. typically modelling) is likely to be required to inform the site-specific flood risk assessment.

EXCEEDANCE FLOWS

Temporary exceedance of flood management infrastructure (including drainage systems) is often not adequately assessed within new development. This could occur as a result of system blockage, or it could be caused by an intense rainfall event that temporarily overwhelms inlet structures such as gullies. Developers in Herefordshire are expected to demonstrate how flood waters will be managed during these two scenarios:

1. The management of exceedance flows that overwhelm the design capacity of the drainage system (i.e. typically greater than 1 in 30 annual probability events) or that occur as a result of blockage; and
2. The management of exceedance flows that occur during short but intense rainfall events that are likely to overwhelm the inlet capacity of drainage systems (i.e. typically greater than 1 in 5 annual probability events). This is particularly important for sites located on sloping topography as surface water could easily bypass the system and thus result in overland flow during events smaller than the design event.

Developers must be able to demonstrate how exceedance flows will be retained within the site boundary without increasing flood risk elsewhere.

In areas of high surface water flood risk, the Council may request the management of surface water during events larger than the 1 in 100 (1%) annual probability event including climate change allowances. This will be agreed on a case-by-case basis.

FAILURE OF FLOOD DEFENCE SCHEMES

The Environment Agency's Flood Map for Planning illustrates the location of Environment Agency flood defences and areas that benefit from flood defence schemes. However, as discussed in Section 5.4 there are many other defences and flood alleviation schemes located throughout Hereford that are not illustrated on the Flood Map for Planning. It is therefore the developer's responsibility to ensure that a robust assessment of the location and standard of protection served by adjacent flood defences is undertaken to inform new development.

The assessment of flood risk for development proposed within areas that benefit from flood defences must include an assessment of risk following overtopping or a breach in the flood defences undertaken in consultation with the Environment Agency and Herefordshire Council. In most circumstances this will be considered as the 'test' scenario against which the resilience of the development should be tested to ensure no unacceptable risk should a failure of the defences occur.

Large flood alleviation schemes are also present in Hereford (associated with the Yazor Brook Flood Alleviation Scheme) and in Ross-on-Wye, as discussed in Section 5.4. Development within these areas must consider the full or partial blockage of these schemes, with the scope of the assessments agreed with the Environment Agency and Herefordshire Council on a case-by-case basis following a review of the likely flood risk and consequences of flooding. Again in most circumstances this will be considered as the 'test' scenario against which the resilience of the development should be tested to ensure no unacceptable risk should a failure of the defences occur.

DEVELOPER CONTRIBUTIONS

Flood Risk Alleviation schemes may be funded partly from either Community Infrastructure Levy or under Section 106 of the Town & Country Planning Act 1990.

The Council urges developers to explore through site specific Flood Risk Assessments, any opportunities to provide wider community flood risk benefit through new developments. The enhancement or provision of community flood defences outside of their red line boundary in these catchments may also be considered to provide wider benefit and help offset the cumulative impact of development.

6.2 THE SEQUENTIAL TEST

The ideal solution to effective and sustainable flood risk management is a planning led one, i.e. steer urban development away from areas that are susceptible to flooding.

The NPPF advocates a sequential approach that will guide the planning decision making process (i.e. the allocation of sites) through the application of the Sequential Test. In simple terms, the Sequential Test aims to steer new development to areas with the lowest probability of flooding and requires planners to seek to allocate sites for future development within areas of lowest flood risk in the initial instance. Only if it can be demonstrated that there are no suitable sites within these areas should alternative sites (i.e. within areas that may potentially be at risk of flooding) be considered. Within Herefordshire, it is expected that the Sequential Test will also take into consideration risks associated with safe access and egress (for example, if a site is located in Flood Zone 1 and is a dry island surrounded by Flood Zone3).

In accordance with the NPPF, the Sequential Test does not need to be applied for individual developments on sites which have been allocated in the Local Plan or Neighbourhood Development Plans that have already applied the Sequential Test, or for applications for minor development in accordance with NPPF[15], or for change of use (e.g. from commercial to residential) unless the change of use is to a caravan, camping or chalet site, or to a mobile home or park home site.

The process for applying the Sequential Test to inform the preparation of the Local Plan is illustrated in Figure 6.2.1, recreated from the NPPF Planning Practice Guidance document.

[15] In accordance with NPPF, minor development means: minor non-residential extensions with a footprint less than 250 square metres; alterations that do not increase the size of buildings (e.g. external appearance); and householder development (e.g. sheds, garages, games rooms etc) within the curtilage of the existing dwelling or physical extensions to the existing dwelling itself (excludes any proposed development that would create a separate dwelling within the curtilage of the existing dwelling (e.g. subdivision of houses into flats). Note that this definition of minor development is not the same as that used in the Town and Country Planning Act.

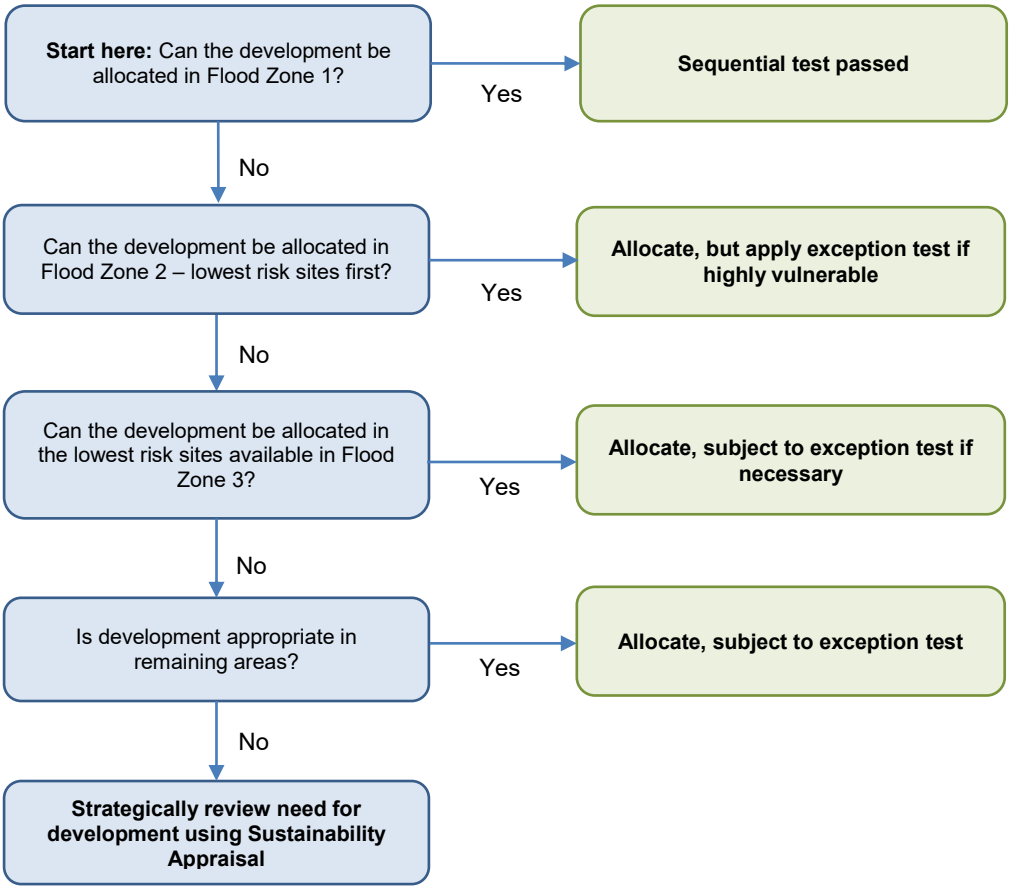


Figure 6.2.1 Application of the Sequential Test

The most significant sources of flood risk considered during the development control process are typically associated with fluvial sources of flooding. Development should be steered to Flood Zone 1 in the first instance, and only if there are no reasonably available sites located in Flood Zone 1 should sites be considered in Flood Zones 2 and 3, supported by an appraisal of risk and the implementation of appropriate reduction and management measures.

Important Note

Herefordshire Council expects the potential effects of climate change over the lifetime of the development to be taken into consideration when applying the Sequential Test.

The Environment Agency's Flood Map for Planning should provide the starting point for applying the Sequential Test, supplemented by the indicative climate change mapping provided in Appendix D. Detailed modelling that has been completed for specific watercourses will also be used as part of the evidence base for the subsequent analysis of the Sequential Test and, if necessary, the Exception Test, but the application of the Sequential Test will first be based on the Environment Agency's indicative flood maps as per above.

The assessment of flood risk considers both the risk of flooding to a development site as well as the vulnerability of the proposed development to the impacts of flooding. The Planning Practice Guidance to NPPF summarises the proposed vulnerability classification for different types of development to flood risk. Within a proposed development site, a sequential approach should be promoted that proposes to locate the most vulnerable areas of a development to those areas of

the site that are at least flood risk. Similarly, the redevelopment of previously developed sites should aim to relocate vulnerable development to areas at lesser flood risk, using the redevelopment of the site to reduce existing flood risk.

The sequential approach must also take into account flood risk associated with minor watercourses not mapped on the Environment Agency's Flood Map for Planning. This can be first informed by review of the mapped fluvial flood extents as indicated by the Environment Agency's Risk of Flooding from Surface Water map. In applying the sequential approach, Herefordshire Council is likely to apply the same Flood Zone definitions (as described in Section 3.4) and planning requirements as those mapped for larger watercourses. Given the highly indicative nature of the Risk of Flooding from Surface Water map it may be necessary to undertake hydraulic modelling for sites that are considered to be at significant fluvial flood from minor watercourses to inform this process.

Important Note

The Environment Agency's Flood Map for Planning does not capture fluvial flood risks associated with watercourses with a small catchment of typically less than 3km^2. Flooding associated with these watercourses may be better represented on the Environment Agency's Risk of Flooding from Surface Water map. When applying the sequential approach Herefordshire Council is likely to apply the same Flood Zone definitions (as described in Section 3.4) and planning requirements as those mapped for larger watercourses.

When applying a sequential approach to development layout, consideration should also be given to other local sources of flood risk including surface water, groundwater, surcharging of sewers, reservoirs and any other artificial sources. Whilst these sources of flood risk may have less influence over the suitability of land for development, it is essential that any new or redeveloped sites take these risks into account and, where necessary, protect the development against flood risk and ensure no increased flood risk elsewhere as a result of development.

Important Note

Developers are expected to demonstrate that a sequential approach has been applied to the development layout to locate the most vulnerable areas of a development to those areas of the site that are at least flood risk. This applies to sites that are located in Flood Zone 1 and to all sources of flood risk.

It is considered appropriate that the availability of suitable sites at a lower risk of flooding is assessed on the county-wide scale and in accordance with the Local Plan – for example where growth is specifically targeted in key areas. However, it is also appreciated that there are many factors affecting site selection and development needs. Ultimately the application of the Sequential Test must be discussed and agreed in consultation with Herefordshire Council.

It is important to recognise that the principles of the sequential approach are applicable throughout the planning cycle and refer equally to the forward planning process (delivered by Council as part of their Local Plan) as they do to the assessment of windfall sites. Where windfall sites come forward for consideration, it is essential that the developer considers the planning 'need' for the proposed site.

6.3 THE EXCEPTION TEST

If, following application of the Sequential Test, it is not possible for the development to be located in zones with a lower probability of flooding; the Exception Test can be applied if appropriate. For the Exception Test to be passed:

- It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared; and
- A site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

All elements of the test will have to be passed for development to be allocated or permitted.

Planning Practice Guidance to the NPPF provides recommendations on the vulnerability of different types of development and the compatibility of each vulnerability classification within each of the mapped fluvial and tidal Flood Zones.

Table 6.3.1 summarises the vulnerability classifications as set out within the NPPF Planning Practice Guidance.

Table 6.3.1 NPPF Vulnerability classifications

Vulnerability classification	Examples of Development
Essential Infrastructure	Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. Essential utility infrastructure which has to be located in a flood risk area for operational reasons. Wind turbines.
Highly Vulnerable	Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding. Emergency dispersal points. Basement dwellings. Caravans, mobile homes and park homes intended for permanent residential use. Installations requiring hazardous substances consent.
More Vulnerable	Hospitals Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. Non–residential uses for health services, nurseries and educational establishments. Landfill and sites used for waste management facilities for hazardous waste. Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.

Vulnerability classification	Examples of Development
Less Vulnerable	Police, ambulance and fire stations which are not required to be operational during flooding. Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the More Vulnerable class; and assembly and leisure. Land and buildings used for agriculture and forestry. Waste treatment (except landfill and hazardous waste facilities). Minerals working and processing (except for sand and gravel working). Water treatment works which do not need to remain operational during times of flood. Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.
Water-Compatible Development	Flood control infrastructure. Water transmission infrastructure and pumping stations. Sewage transmission infrastructure and pumping stations. Sand and gravel working. Ministry of Defence defence installations. Water-based recreation (excluding sleeping accommodation). Lifeguard and coastguard stations. Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

Table 6.3.2 summarises the compatibility of each vulnerability classification within each of the mapped fluvial and tidal Flood Zones and where the Exception Test will be required.

It is important to note that even where development is considered acceptable, the Sequential Test and sequential approach (as discussed above) should still be applied.

Table 6.3.2 Flood risk vulnerability and flood zone compatibility

EA Flood Zone	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception test required	✓	✓
Zone 3a	Exception test required	✓	×	Exception test required	✓
Zone 3b	Exception test required	✓	×	×	×

✓ Development considered acceptable

× Development considered unacceptable

Important Note

Herefordshire Council expects the potential effects of climate change over the lifetime of the development to be taken into consideration when applying the Exception Test.

As set out in the NPPF and as summarised within Environment Agency Standing Advice, local planning authorities should only consider development in flood risk areas where informed by a site-specific flood risk assessment.

Figure 6.3.1, recreated from the NPPF Planning Practice Guidance, summarises the application of the Exception Test in the preparation of a Local plan.

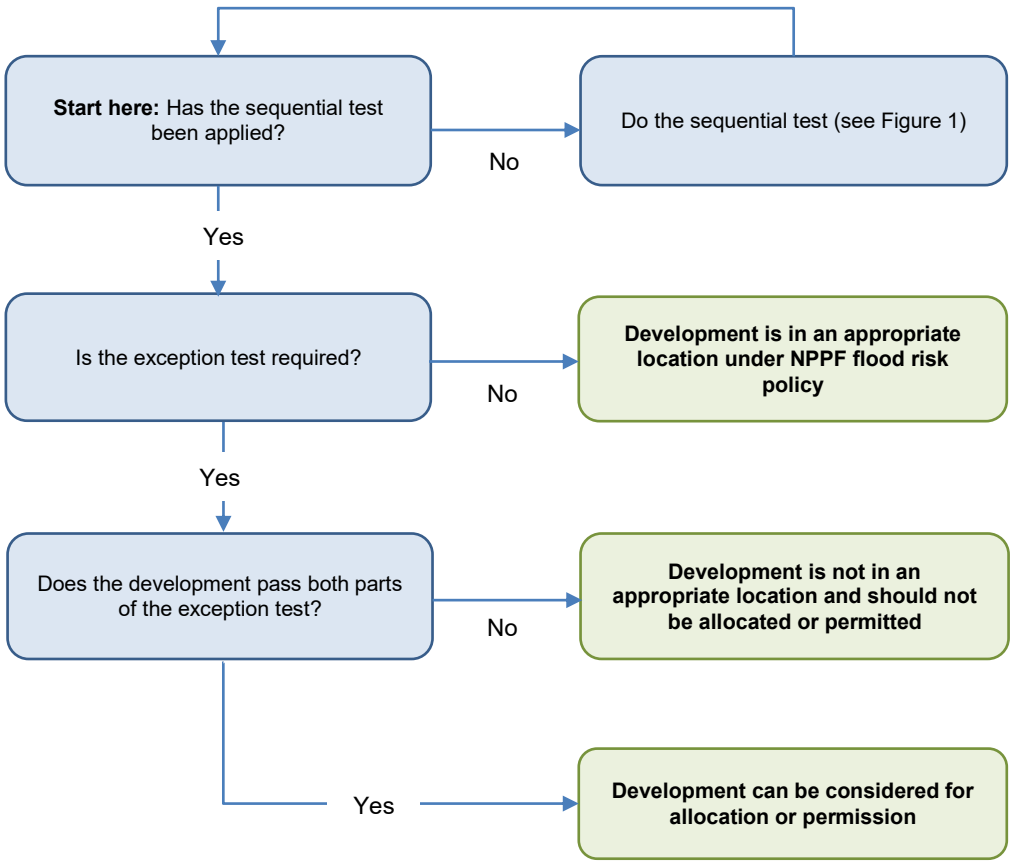


Figure 6.3.1 Application of the Exception Test

The developer will be required to demonstrate within the site-specific flood risk assessment that the Sequential Test has been applied and, where appropriate, that the risk of flooding has been adequately addressed in accordance with NPPF. The site-specific flood risk assessment must also demonstrate the application of a sequential approach within the site boundary. A detailed description of when a site-specific flood risk assessment is required and the required content of that assessment is provided in Section 6.10 and via information available at www.gov.uk[17].

[16] https://www.gov.uk/flood-risk-assessment-for-planning-applications

Important Note

Developers are reminded that even where a development passes the Exception Test and is considered acceptable in accordance with

Table 6.3.2, the Sequential Test and sequential approach (as discussed above) must still be applied and summarised within the site-specific flood risk assessment.

6.4 ASSESSING FLOOD HAZARD

Considering flood hazard is extremely important in understanding the likely risk of flooding to development, most notably flooding associated with fluvial and surface water sources. Essentially flood hazard takes into account the depth of flood water and the velocity that this water is moving at to assess the hazard that this could pose to people located within flooded areas.

The principal of flood hazard is that it is not always deep water that is the most dangerous. Shallow but fast flowing water can also easily knock people off their feet or transport potentially damaging debris. However, deep flood waters will generally pose greater risk – not only due to the depth of water but also its ability to transport larger debris.

Information regarding methods to calculate flood hazard, notably the Flood Hazard Rating, is available from the Environment Agency. A summary of the methodology that is most commonly used is provided below for information[18].

The Flood Hazard Rating considers the depth of flooding, the velocity of the flood waters and a debris factor that considers the likelihood of debris being transported by the flood flow. In summary, the formula used to calculate the Flood Hazard Rating is:

$$HR = d \times (v+n) + DF$$

where: HR = Flood Hazard Rating
d = Depth of flooding (m)
v = Velocity of flood waters (m/s)
DF = Debris factor (0, 0.5 or 1 depending on the probability that debris will lead to a hazard)
n = a constant of 0.5

Table 6.4.1 provides guidance on the debris factors for different flood depths, velocities and dominant land uses.

Table 6.4.1 Guidance on debris factors

Depth or Velocity	Arable	Woodland	Urban
0 to 0.25m	0	0	0
0.25 to 0.75m	0	0.5	1
Greater than 0.75m	0.5	1	1
Greater than 2 m/s	0.5	1	1

[17] https://www.gov.uk/flood-risk-assessment-for-planning-applications

[18] This information has been sourced from the 'Supplementary Note on Flood Hazard Ratings and Thresholds for Development Planning and Control Purpose – Clarification of the Table 13.1 of FD2320/TR2 and Figure 3.2 of FD2321/TR1', Environment Agency and HR Wallingford, May 2008

The Flood Hazard Ratings calculated using the methodology above can be translated into an assessment of likely Hazard to People Classification using the guidance provided in Table 6.4.2.

Table 6.4.2 Hazard to People Classification

Flood Hazard Rating	Colour Code[19]	Hazard to People Classification
Less than 0.75		Very low hazard – Caution
0.75 to 1.25		Moderate - Danger for some – includes children, the elderly and the infirm
1.25 to 2.0		High - Danger for most – includes the general public
More than 2.0		Very high - Danger for all – includes the emergency services

For development proposed in areas at risk of flooding, the use of the Flood Hazard Rating and Hazard to People Classification is most applicable to the assessment of access and egress routes that people and the emergency services will be required to use should a flooding event occur. This is discussed further in Section **Error! Reference source not found.**.

6.5 CONSIDERING THE IMPACTS OF CLIMATE CHANGE

All new developments in Herefordshire must consider the potential impacts of climate change on flood risk in accordance with the Environment Agency's updated climate change recommendations (published in February 2016) and local guidance for the Shropshire, Herefordshire, Worcestershire and Gloucestershire area over the lifetime of the development.

It is important to note that studies (such as flood mapping and assessment studies) completed prior to the publication of the updated Environment Agency climate change guidance, used previous climate change recommendations as included with Planning Policy Statement 25 or, later, the NPPF Planning Practice Guidance. Of particular note is the potential increase in fluvial flood flows compared to previous recommendations that could significantly increase the mapped extents of fluvial flood risk during extreme events.

LIFETIME OF DEVELOPMENT

Herefordshire Council consider that a lifetime of 100 years is appropriate for residential development and essential infrastructure, and that a lifetime of 60 years is appropriate for other non-residential developments. Developers are welcome to suggest an alternative design life for their development where this is considered appropriate, for example agricultural facilities or temporary developments. For the majority of agricultural developments including poultry farms and polytunnels, a design life of 50 years is considered appropriate unless the operational duration of the site is to be governed by planning conditions.

SELECTION OF ALLOWANCE CATEGORY

The climate change allowance category that is considered most applicable to a development will depend on the vulnerability of the development to flood risk. The EA's Shropshire, Herefordshire, Worcestershire and Gloucestershire Sustainable Places Team recommends allowance categories for different types of development vulnerability. These recommendations have been adopted and interpreted by Herefordshire Council as set out in Table 6.5.1.

The approach adopts a 'design' and 'test' scenario:

[19] Colour codes typically used within Flood Hazard mapping.

- The **design** scenario is the scenario for which the development and its associated mitigation should be designed for – for example setting finished floor levels an appropriate height above the design flood level or ensuring sufficient freeboard within a culvert design.
- The **test** scenario is used to test the resilience of the development and potential risks elsewhere during more extreme flooding events – for example ensuring no flooding of vulnerable buildings during the test scenario and demonstrating no increased flood risk elsewhere if a culvert were to surcharge.

Table 6.5.1 Allowance categories for different development types

Development type	Design allowance category	Test allowance category
Nationally important infrastructure[20] or schemes with a design life beyond 2115	Upper End	High++[21]
Essential Infrastructure	Upper End	-
Highly Vulnerable or More Vulnerable development	Higher Central	Upper End
Water Compatible or Less Vulnerable development	Central	Higher Central

This approach may not be appropriate for identifying the Allowance Category for developments adjacent to rivers with a catchment less than 3km^2. The approach for assessing risks associated with smaller watercourses is discussed below.

It is important to note that these allowances apply to development located in all of the Environment Agency's Flood Zones, including the low risk Flood Zone 1 where an assessment of flood risk from an adjacent floodplain may be required to understand the risk to the development in the future or the risk to access and egress routes.

When designing compensation for lost floodplain storage up to the 1 in 100 (1%) plus climate change annual probability event, developers should give consideration to the vulnerability of the developments that are likely to be affected by the lost flood storage – for example of the proposed development site is located adjacent to a hospital that could be significantly affected by increased flood risk. For most developments, it is expected that floodplain compensation will need to be designed for the Higher Central allowance category that is considered appropriate for Highly Vulnerable or More Vulnerable development.

[20] Nationally important infrastructure projects are defined by the Planning Act (2008) and include a range of projects in the energy, transport, water and waste sectors above certain size thresholds. Permission for these developments is granted via Development Consent Order submitted to the Infrastructure Planning Inspectorate, as opposed to the Town and County Planning Act submitted to the Local Planning Authority.

[21] Defined in Section 5.7. Within Herefordshire, the use of the High++ allowance category may be applied for large urban extensions that place a large number of people at increased flood risk or that that pose significant increased risk elsewhere.

IMPACTS OF CLIMATE CHANGE ON FLUVIAL FLOOD RISK

A summary of the updated climate change recommendations for peak river flow within the Herefordshire area is provided in Table 6.5.2. Herefordshire is within the Severn River Basin District.

Table 6.5.2 Peak river flow allowances[22]

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)
High++[23]	25%	45%	90%
Upper End	25%	40%	70%
Higher Central	15%	25%	35%
Central	10%	20%	25%

QUANTITATIVE DETAILED, INTERMEDIATE AND QUALITATIVE APPROACHES

Hydraulic modelling of fluvial flood risks should be undertaken wherever appropriate as this will provide the greatest certainty of likely climate change effects and impacts to development. However, it is recognised that this level of assessment is not always applicable to all developments, particularly if no model currently exists of the watercourse that is the cause of flood risk.

The level of assessment required to consider the new climate change allowances will therefore be dependent on the location, vulnerability and scale of the proposed development, as well as the nature of flood risk.

An indication of the level of technical assessment (Quantitative Detailed, Quantitative Intermediate or Qualitative)) that may be considered appropriate for different types of development is provided in Table 6.5.. It is important to note, however, that the level of assessment deemed appropriate by the Environment Agency and Herefordshire Council will ultimately be agreed on a case-by-case basis.

[22] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances
[23] Defined in Section 5.7.

Table 6.5.3 Indicative guide to assessment approach

Development Vulnerability	Development Size	Flood Zone 1	Flood Zone 2	Flood Zone 3a	Flood Zone 3b
Essential Infrastructure	**All**	Qualitative	Detailed	Detailed	Detailed
Highly Vulnerable	**Major (Large)**	Qualitative	Detailed	Detailed	Detailed
	Major (Small)	Qualitative	Intermediate	Detailed	Detailed
	Non-Major	Qualitative	Intermediate	Detailed	Detailed
More Vulnerable	**Major (Large)**	Qualitative	Detailed	Detailed	Detailed
	Major (Small)	Qualitative	Intermediate	Detailed	Detailed
	Non-Major	Qualitative	Intermediate	Intermediate	Detailed
Less Vulnerable	**Major (Large)**	Qualitative	Detailed	Detailed	Detailed
	Major (Small)	Qualitative	Intermediate	Intermediate	Detailed
	Non-Major	Qualitative	Qualitative	Intermediate	Detailed
Water Compatible	**All**	Qualitative	Qualitative	Intermediate	Detailed

Non-Major: 1-9 dwellings; residential site area less than 0.5 ha; retail, office or industrial site area under 1ha; gypsy/traveller site between 0 and 9 pitches.

Major (Small): 10 to 30 dwellings; retail, office or industrial site area 1ha to 5ha; gypsy/traveller site 10 to 30 pitches.

Major (Large): 30+ dwellings; retail, office or industrial site area 5ha+; gypsy/traveller site over 30+ pitches; any other development that creates a non-residential building or development over 1000 square metres.

The term 'Major Development' is as defined by the Town and Country Planning Order 2010

Quantitative Detailed Assessment

A 'detailed' assessment will usually require hydraulic modelling to be undertaken to inform the development and the design of appropriate mitigation. This can be achieved by re-running one of the existing Environment Agency or Herefordshire Council models, or constructing a new model for this purpose. Detailed hydraulic models are available for a number of watercourses within Herefordshire as summarised within Section 4. However it is ultimately the developer's responsibility to obtain and provide data that is considered appropriate to the size, nature and location of the development.

Quantitative Intermediate Assessment

Where re-running or building a hydraulic model is not considered proportionate to the size and/or vulnerability of the development, an 'intermediate' approach to the assessment of the potential impacts of climate change may be adopted. Indicative flood levels can be generated by using existing modelled flood and flow data and, from this, interpolating a flood level based on the required peak flow allowance to apply to the 'design flood' flow. For example, if an existing model provides estimated flood levels for the 1 in 100, 1 in 100 plus 20% climate change allowance and 1 in 1000 annual probability events, then these levels could be interpolated to generate an estimated 1 in 100 plus 70% climate change allowance annual probability event flood level. This method assumes that the 'base data' is still considered appropriate – i.e. that the information that is used to inform the interpolation is still representative of the catchment and watercourse. If the base data is no longer considered appropriate then it is likely that the detailed assessment (as discussed above) would be required.

Where an existing model is not available or the modelling software that was used is not appropriate for this type of assessment (i.e. JFLOW) then it is likely that a detailed approach, as described above, will be required. Alternatively it may also be possible to incorporate more robust flood management measures into the design. This will need to be agreed on a case by case basis with Herefordshire Council and the Environment Agency.

Qualitative Assessment

Where no detailed modelling data is available a qualitative approach to the assessment of the potential impact of climate change may be adopted where appropriate. JFLOW modelling may be readily available and this is likely to provide suitable outputs for a qualitative assessment by analysing the modelled flood extent against topographic survey data for the site area. This approach is also recommended for development in Flood Zone 1, particularly for understanding the likely future extents of Flood Zone 2 and 3 and, subsequently, the potential need to undertake a more detailed assessment as outlined above (this is illustrated in Figure 6.5.1).

In the absence of robust model data, the information in Table 6.5.4 should be used to define the likely peak river levels by adding these levels to the estimated flood level. This must be agreed on a case-by-case basis with the Environment Agency and Herefordshire Council. The information provided in Table 6.5.4 adapts the nominal increase in rivers levels provided by the Environment Agency's Shropshire, Herefordshire, Worcestershire and Gloucestershire Sustainable Places to inform the assessment of future fluvial flood risk. It is important to remember that as this is a qualitative assessment, a conservative approach to the estimation of flood levels and design of subsequent mitigation is expected.

Table 6.5.1 Nominal allowances peak river levels[24]

	Change in peak flow		
Watercourse	**20 - 25%**	**35 - 40%**	**70%**
River Wye	600mm	850mm	1500mm
River Teme			
Lower Severn (downstream of Lincomb weir, Worcestershire)	400mm	600mm	1000mm
Tributaries and ordinary watercourses	200mm	300mm	500mm

Important Note

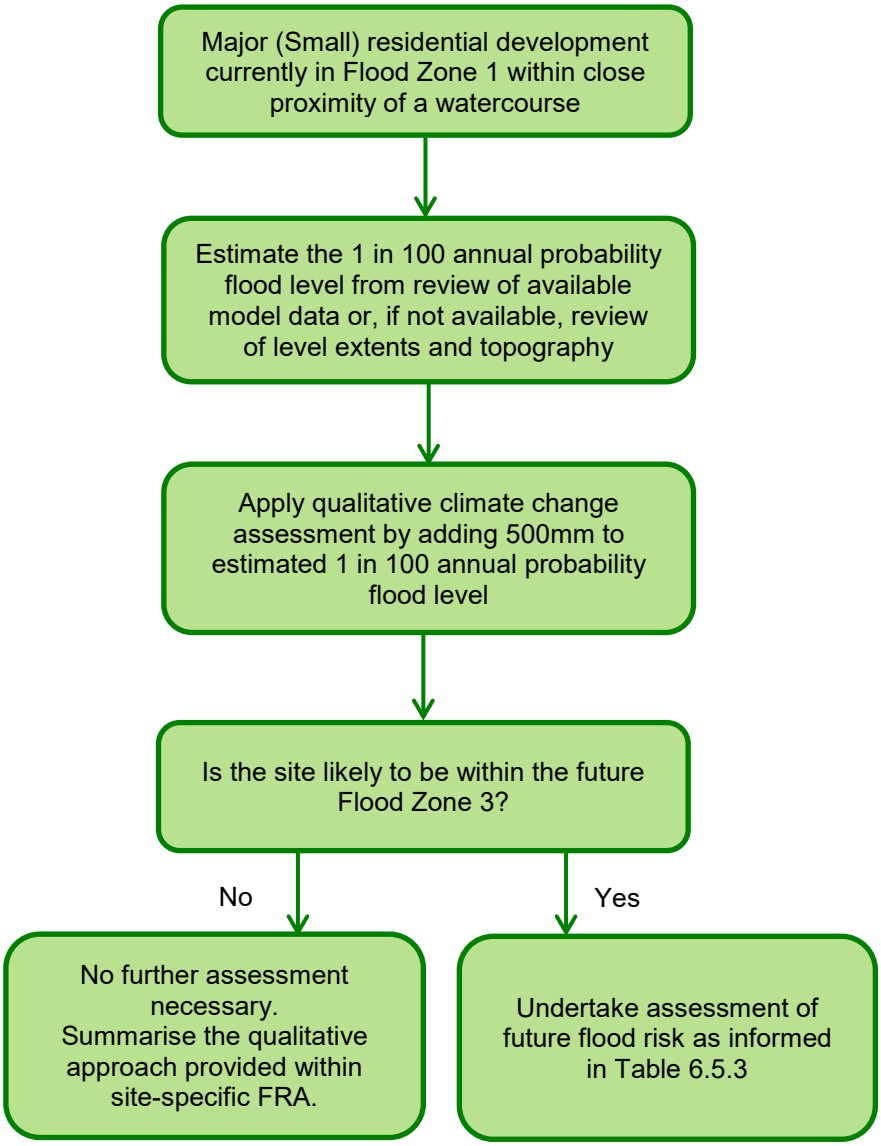
If the Qualitative assessment of flood risk for a development located in Flood Zone 1 indicates that the development may be located in the higher risk Flood Zone 2 or 3 when the potential effects of climate change are considered, then a more detailed assessment of flood risk is likely to be required in accordance with the guidance set out in Table 6.5.. The 'test' scenario should be applied when undertaking this analysis.

Example

The flow chart in Figure 6.5.1 shows the method by which Herefordshire Council expect developers to determine the need for detailed, intermediate or qualitative analysis. The example is provided for a major (small) residential development located in Flood Zone 1 but in close proximity to a mapped floodplain.

As the example site is classed as More Vulnerable, then according to Table 6.5.1 for the 'test' scenario the 'Upper End' Climate Change allowance category applies. As the site has a lifetime of 100 years, this equates to an increase in peak river flow of 70%, as indicated in Table 6.5.2, which correlates to a nominal increase in flood depth of 500mm as indicated in Table 6.5.4

Figure 6.5.1 Example for determining appropriate climate change assessment approach



SMALLER WATERCOURSES

It may not be appropriate to apply the climate change recommendations above to smaller watercourses that are not mapped on the Environment Agency's Flood Map for Planning (i.e. those with a catchment typically less than 3km^2). Instead, it is recommended that the Environment Agency's guidance on peak rainfall intensity is considered during hydraulic modelling, when assessing the potential impacts of climate change on the fluvial flood extents associated with these smaller watercourses. These recommendations are discussed below.

The need to undertake a detailed, intermediate or qualitative approach will still apply as described above. For example, 'quantitative detailed' analysis using the peak rainfall intensity allowances below in Table 6.5.5. will still be required for a More Vulnerable development if at risk of fluvial flooding from a minor watercourse during the 1 in 100 (1%) annual probability event.

Similarly, if undertaking a 'qualitative' assessment for a More Vulnerable development in Flood Zone 1, the assessment of flood risk from a minor watercourse would still increase estimated flood levels as set out in Table 6.5.4. However, the increase in flood level for the 'test' scenario would reduce to 300mm as the Upper End climate change allowance for a 100 year design life using the peak rainfall intensity guidance is 40% rather than 70% as explained below.

Important Note

For river catchments with a catchment of less than 3km^2, the use of the Environment Agency's climate change recommendations for peak river flow may be inappropriate, Instead, the allowances recommended for peak rainfall intensity may be considered to be more appropriate for the assessment of future fluvial flood extents.

IMPACTS OF CLIMATE CHANGE ON RAINFALL INTENSITY

The Environment Agency's recommendations for assessing the impacts of climate change on rainfall intensity applies to assessing future surface water flooding extents (and smaller watercourses as discussed above) and in the design of surface water drainage systems.

As discussed above, Herefordshire Council consider that a lifetime of 100 years is appropriate for residential development and essential infrastructure, and that a lifetime of 60 years is appropriate for other non-residential developments. Developers are welcome to suggest an alternative design life for their development where this is considered appropriate, for example agricultural facilities or temporary developments. Table 6.5.5 summarises peak rainfall intensity allowances.

Table 6.5.2 Peak rainfall intensity allowance[25]

Allowance Category	Total potential change anticipated for 2010 to 2039	Total potential change anticipated for 2040 to 2059	Total potential change anticipated for 2060 to 2115
Upper End	10%	20%	40%
Central	5%	10%	20%

[25] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

DESIGN OF DRAINAGE SYSTEMS

Herefordshire Council expect surface water drainage systems for all new development to be designed for the Central allowance category, but the resilience of the design tested for the Upper End allowance category.

In practical terms, this means that the development should still not pose risk to users of the development or to people and property elsewhere up to the 1 in 100 (1%) annual probability event, but that flood waters may be allowed to exceed the capacity of the drainage system if the developer can demonstrate that this water can still be safely controlled and managed within the site boundary. This could also be achieved, for example, by demonstrating that the design freeboard provided within attenuation systems such as ponds is sufficient to cater for events more extreme that the design storm without overtopping and increasing risk elsewhere.

ASSESSMENT OF FLUVIAL FLOOD RISK FOR SMALL CATCHMENTS

As discussed above, the use of the Environment Agency's climate change recommendations for peak rainfall intensity is considered appropriate for the assessment of future fluvial flood extents associated with rivers with a catchment of less than 3km^2.

The allowance category that is considered most applicable to a development will depend on the vulnerability of the development to flood risk. The recommendations that will be adopted in Herefordshire are summarised in Table 6.5.6 below.

Table 6.5.6 Allowance categories for different development types when assessing fluvial flood risk for small catchments

Development type	Design allowance category	Test allowance category
Essential Infrastructure	Upper End	-
Highly Vulnerable or More Vulnerable development	Upper End	-
Water Compatible or Less Vulnerable development	Central	Upper End

6.6 RESISTANCE AND RESILIENCE MEASURES

For development within areas identified to be at risk of flooding, the developer will need to demonstrate that appropriate resistance and resilience measures have been incorporated to adequately protect the development from flooding. A range of possible measures is provided below.

The need for site-specific resistance and resilience measures for all developments will need to be agreed in consultation with the relevant authorities and tailored to site-specific conditions. For those developments that require Environment Agency statutory consultation, these measures should be agreed to meet Environment Agency requirements. For those developments for which Environment Agency Standing Advice applies, measures should be discussed and agreed with Herefordshire Council as LLFA.

For development proposed within areas that benefit from flood defences, the same requirements as discussed below should apply assuming overtopping, breach or failure of the flood defences.

RAISED FLOOR LEVELS (FREEBOARD)

The raising of floor levels within areas identified to be at risk of flooding from any source (i.e. including surface water and other local sources) can ensure that the risk to life and damage to property is minimised.

Typically floor levels within new development should be situated a minimum of 0.6m above the predicted 1 in 100 (1%) annual probability fluvial flood level and including an allowance for climate change as calculated for the 'design' scenario. The height that the floor level is raised above the flood level is referred to as the 'freeboard' and is determined as a measure of the residual risks, confidence in flood data and vulnerability of development.

All new development should strive to remain resilient to flood water ingress during the 'test' scenario and during the 1 in 1000 (0.1%) annual probability event that may require a higher floor level than discussed above.

In areas at risk of surface water flooding, it is recommended that floor levels within new development should be situated 0.15m above the estimated flood depth, taking the potential effects of climate change into account, or a minimum of 0.15m above existing ground levels if this is more appropriate.

If it is not possible to locate ground floor levels above the estimated flood level, resistance and resilience measures as discussed below should be considered. Ground floor sleeping accommodation would not be considered appropriate if floor levels could not be raised to an appropriate height. An appropriate flood evacuation plan would also be required.

Important Note

Herefordshire Council require that the need to raise floor levels is also applied to surface water flood risk as well as fluvial flood risk.

The freeboard that is considered appropriate for Water-Compatible Development and Essential Infrastructure will be dependent on the operational requirements of the development and subsequent risks in the event of flooding.

FLOOD RESILIENCE

If it is not possible to raise ground floor levels above the estimated flood level for the site, the following recommendations are included within Environment Agency Standing Advice:

→ Water depth up to 0.3m:

- Design the proposed building or development to keep water out as much as possible. Do this by using materials that have low permeability (i.e. materials that water cannot pass through such as impermeable concrete).

→ Water depth from 0.3m to 0.6m:

- Design the proposed building or development to keep water out (unless there are structural concerns) by using materials with low permeability to at least 0.3m; using flood resilient materials (e.g. lime plaster) and design (raised electrical sockets); and making sure there's access to all spaces to enable drying and cleaning.

- Water depth above 0.6m:
  - Design the proposed building or development to allow water to pass through the property to avoid structural damage by using materials with low permeability to at least 0.3m; making it easy for water to drain away after flooding; and making sure there's access to all spaces to enable drying and cleaning.

Development located within the defended Flood Zone 3a may be at risk from sudden inundation following a breach of the flood defences. If it is not possible to locate the ground floor level of the development above the predicted flood level, it is recommended that the developer strives to reduce the rate of inundation (i.e. through raising ground levels as high as practicable without increasing flood risk elsewhere) to provide sufficient time to facilitate evacuation of the site. Access and evacuation is discussed in greater detail below.

Ground floor sleeping accommodation would not be considered appropriate if floor levels could not be raised to an appropriate height.

Where development is located in an area of flood risk, the developer should look to include flood resistant and flood resilient design measures as set out within 'Improving the Flood Performance of New Buildings (Flood Resilient Construction), CLG (2007)'. Further guidance is also provided by the National Flood Forum, www.nationalfloodforum.org.uk.

6.7 BASEMENTS

Basements are not considered appropriate within Flood Zone 3b.

Within the undefended Flood Zone 3a, basements with a proposed use classified as More Vulnerable and/or to be used as habitable areas and living accommodation (classified as Highly Vulnerable) are not considered appropriate. Basements with a proposed use classified as Less Vulnerable within the undefended Flood Zone 3a or within the defended Flood Zone 3a are considered acceptable, but must have a point of access that is situated 0.6m above the 1 in 100 (1%) annual probability fluvial flood level plus climate change allowance for the 'design' scenario, and above the 1 in 100 (1%) annual probability 'test' scenario and 1 in 1000 (0.1%) annual probability event flood level.

Within the medium risk Flood Zone 2, basements are considered appropriate, but must have a point of access that is situated 0.6m above the 1 in 100 (1%) annual probability fluvial flood level plus climate change allowance for the 'design' scenario, and above the 1 in 100 (1%) annual probability 'test' scenario and 1 in 1000 (0.1%) annual probability event flood level.

It is particularly important to ensure that basements within areas benefitting from flood defences are provided within a 'continuous secondary fixed flood defence'. In practical terms, this may be a raised wall incorporated into the landscaping that will withstand the ponding of water (i.e. following a breach failure), and will prevent water surging into the basement area with little or no warning.

There are no restrictions on basements in Flood Zone 1, however the risk of flooding from other sources must be considered along with the impacts that the structure could have on flood risk elsewhere (for example by restricting groundwater movements). Where possible, the overland flow of water entering the basement structure up to and including the 1 in 100 (1%) annual probability surface water flood event should be prevented from entering the basement structure.

6.8 ACCESS AND EVACUATION

For developments located within Flood Zone 3 or areas at significant risk of flooding from other sources, developers will need to provide details of emergency escape plans for any parts of a building that are below the estimated flood level during the 1 in 100 (1%) annual probability event and allowing for climate change. This requirement also applies to any development located within

a lower flood zone where vehicular access (particularly to enable access to emergence services and other key infrastructure) requires passage through an area at higher risk. The creation of 'dry islands' is of particular importance.

Important Note

Consideration needs to be given to safe access and egress for all types of development located in any Flood Zone, including consideration of risk given to other sources of flooding – particularly surface water flooding and in the event of a flood defence breach.

The definition of 'safe' access and egress is somewhat defined by the vulnerability of the proposed development and the ability of the users of that development to escape the identified risks. 'Flood hazard', as described in Section 6.4, is an important consideration in the assessment of risk.

For More Vulnerable development located in the defended or undefended high risk Flood Zone 3, or in an area at high risk of surface water flooding, or if the access route passes through these areas, it is recommended that dry vehicular access is provided above the 1 in 100 (1%) annual probability fluvial or surface water flood level and allowing for the potential effects of climate change for the 'design' scenario. Where this is not possible, it may be acceptable to demonstrate that a suitable access and egress routes subject to 'very low' flood hazard is available. At minimum, safe access with 'very low' flood hazard should be available up to the 1 in 1000 (0.1%) annual probability event.

For Less Vulnerable development located in the defended or undefended high risk Flood Zone 3, or in an area at high risk of surface water flooding, or if the access route passes through these areas, it is also recommended that dry vehicular access is provided above the 1 in 100 (1%) annual probability fluvial or surface water flood level and allowing for the potential effects of climate change for the 'design' scenario. However, where this is not possible, a viable access and egress route that is subject to 'moderate' flood hazard may be considered acceptable. At minimum, safe access with 'moderate' flood hazard should be available up to the 1 in 1000 (0.1%) annual probability event.

Within the defended Flood Zone 3a it may not always be possible to evacuate the site following a breach in the flood defences. Where safe vehicular access cannot be provided, an alternative strategy must be agreed with the Herefordshire Council Emergency Planning Team. This is likely to comprise a sheltered communal space within the building, accessed via internal stairs. It will be necessary to ensure the safe haven is sufficient in size to safely house all residents/users of the building and consideration must be given to the needs of vulnerable and disabled users of the development. At minimum, it is recommended that a safe haven is located a minimum of 0.6m above the 1 in 1000 (0.1%) annual probability fluvial flood level and allowing for the potential effects of climate change.

Consultation with the Environment Agency should be undertaken for all developments in Flood Zone 3a and 3b.

6.9 SUMMARY OF DEVELOPMENT CONTROL RECOMMENDATIONS

This section of the SFRA provides further clarification of how flood risk should be taken into account in the spatial planning and development control process, setting out the minimum required flood management measures and supporting studies that are expected to support planning applications.

It is also essential that all development within Herefordshire takes into account other information provided within this SFRA, particularly the requirements of policy and legislation as summarised in Section 2, the assessment of flood risks as summarised in Section 5, and the recommendations for climate change as summarised in Section 6.5.

The Herefordshire SFRA should be used by both the Council and prospective developers to meet their obligations under the NPPF throughout the planning cycle.

Table 6.9.1 provides a summary of key development control recommendations. These recommendations are discussed in greater detail in the subsequent sections of this report.

Table 6.9.1 Spatial Planning and Development Control Recommendations

Policy Response	NPPF Flood Zone					Surface Water Flood Risk	Other Sources of Flood Risk
	Zone 3b Functional Floodplain	Zone 3a High Probability		Zone 2 Medium Probability	Zone 1 Low Probability		
		Undefended Fluvial Flooding	Defended Fluvial Flooding				
SPATIAL PLANNING RECOMMENDATIONS							
Land Use	Future development within Zone 3b should only be considered following application of the Sequential Test. Within a development site, a sequential approach should be adopted.	Future development within the undefended Zone 3a should only be considered following application of the Sequential Test. Within a development site, a sequential approach should be adopted.	Future development within the defended Zone 3a should only be considered following application of the Sequential Test. Within a development site, a sequential approach should be adopted.	Future development within the defended or undefended Zone 2 should only be considered following application of the Sequential Test. Within a development site, a sequential approach should be adopted.	A sequential approach should be adopted to direct development away from areas at risk of flooding.	The risk of flooding from minor watercourses must be considered. A sequential approach should be adopted for all sites to direct development away from areas at risk of surface water flooding.	A sequential approach should be adopted to direct development away from areas at risk of flooding.
	Only development classified as water compatible and certain essential infrastructure that has to be located in Flood Zone 3b is considered acceptable. Essential infrastructure will be required to pass the Exception Test.	Only development classified as water compatible and less vulnerable is considered acceptable in the undefended Flood Zone 3a. Essential infrastructure and development classified as more vulnerable may be accepted if it can successfully pass the Exception Test. Development classified as highly vulnerable should not be permitted.	Only development classified as water compatible and less vulnerable is considered acceptable in the defended Flood Zone 3a. Essential infrastructure and development classified as more vulnerable may be accepted if it can successfully pass the Exception Test. Development classified as highly vulnerable should not be permitted.	All types of development, with the exception of highly vulnerable development, are considered acceptable in the defended or undefended Flood Zone 2. Development classified as highly vulnerable may be accepted if it can successfully pass the Exception Test.	All types of development are considered acceptable in Flood Zone 1, although consideration should still be given to other sources of flooding.	Areas at risk of flooding from watercourses may be considered as per the fluvial Flood Zones if the risk to the site is substantial. All types of development are considered acceptable for sites that are at risk from surface water flooding that is not attributable to a watercourse flood flow path.	All types of development are considered acceptable subject to appropriate flood mitigation.
Important Considerations	Seek to relocate existing development to land with a lower probability of flooding. Do not impede flood flows and seek opportunities to reduce the overall level of flood risk in the area.	Seek to relocate existing development to land with a lower probability of flooding. Create space for flooding and seek opportunities to reduce the overall level of flood risk in the area.	Seek to relocate existing development to land with a lower probability of flooding. Seek opportunities to reduce the overall level of flood risk in the area and seek opportunities to improve existing flood defence.	Seek opportunities to reduce the overall level of flood risk in the area. Consider risks to access and egress for sites that are surrounded by the defended or undefended Flood Zone 3a or 3b.	Seek opportunities to reduce the overall level of flood risk in the area. Consider risks to access and egress for sites that are surrounded by the defended or undefended Flood Zone 2, 3a or 3b.	Consider natural overland flow paths. Create space for flooding and seek opportunities to reduce the overall level of flood risk in the area. Consider risks to access and egress for sites that are surrounded by the defended or undefended Flood Zone 2, 3a or 3b.	Consider natural overland flow paths. Consider risks to access and egress for sites that are surrounded by the defended or undefended Flood Zone 2, 3a or 3b.
DEVELOPMENT CONTROL RECOMMENDATIONS							
Detailed Flood Risk Assessment	Required for all development.	Required for all development.	Required for all development. The assessment of flood risk in areas that benefit from flood defences should include an assessment of risk following a breach or failure in the flood defences.	Required for all development.	Required for all sites one hectare or greater.	Required for all development that is at risk of flooding from fluvial sources. Required for all sites where relatively large areas are at high or medium risk of surface water flooding.	Required for all sites in an area at risk of flooding from reservoirs.
Environment Agency Consultation	Required for all development.	Required for all development, excluding minor development and some change of use proposals unless these are within 20m of a main river.	Required for all development, excluding minor development and some change of use proposals unless these are within 20m of a main river.	Required for all development greater than 1 hectare or if the development is classified as essential infrastructure, highly vulnerable, a caravan site, is within 20m of a main river, or poses pollution risk.	Required for development located within 20m of a main river.	Consultation not required.	Consultation not required.
Floor Level	Ground floor levels are to be situated a minimum of 0.6m above the 1 in 100 annual probability fluvial flood level, including allowance for climate change.	Ground floor levels are to be situated a minimum of 0.6m above the 1 in 100 annual probability fluvial flood level, including allowance for climate change, and above the 1 in 1000 annual probability fluvial flood level.	Typically, ground floor levels are to be situated a minimum of 0.6m above the 1 in 100 annual probability fluvial flood level following a breach in the defences and including allowance for climate change, and above the 1 in 1000 annual probability fluvial flood level.	Ground floor levels are to be situated a minimum of 0.6m above the 1 in 100 annual probability fluvial flood level, including allowance for climate change, and above the 1 in 1000 annual probability fluvial flood level.	No minimum level required, although recommend ground floor levels are situated 150mm above adjacent ground level and consider other sources of flooding.	Ground floor levels are to be situated a minimum of 0.15m above the estimated 1 in 100 annual probability flood level, including allowance for climate change, or set a minimum of 0.15m above adjacent ground level.	Recommend ground floor levels are situated 0.15m above adjacent ground level, or above the estimated flood depth. Location-specific advice required for sites located in the overland flow path of reservoir flooding.

Policy Response		NPPF Flood Zone					Surface Water Flood Risk	Other Sources of Flood Risk
		Zone 3b Functional Floodplain	Zone 3a High Probability		Zone 2 Medium Probability	Zone 1 Low Probability		
			Undefended Fluvial Flooding	Defended Fluvial Flooding				
DEVELOPMENT CONTROL RECOMMENDATIONS								
Site Access & Egress	Highly Vulnerable	N/A	N/A	N/A	Dry vehicular access should be provided above the 1 in 100 annual probability fluvial flood level (including allowance for climate change) to a place of safety or the wider road network. Where this is not possible, safe access with 'very low' flood hazard should be demonstrated.	Dry vehicular access should be provided above the 1 in 100 annual probability fluvial flood level (including allowance for climate change) to a place of safety or the wider road network. Where this is not possible, safe access with 'very low' flood hazard should be demonstrated.	Dry vehicular access should be provided above the estimated 1 in 100 annual probability surface water flood level (including allowance for climate change) to a place of safety or the wider road network. Where this is not possible, safe access with 'very low' flood hazard should be demonstrated.	Consideration should be given to the impact of flooding from other sources to the ability to provide safe access and egress, similar to those recommendations made for sites at risk from fluvial and surface water flooding.
	More Vulnerable	N/A	Dry vehicular access should be provided up to the 1 in 100 annual probability fluvial flood level (including allowance for climate change) to a place of safety or the wider road network. Where this is not possible, safe access with 'very low' flood hazard should be demonstrated up to the 1 in 1000 annual probability event.	Dry vehicular access should be provided above the 1 in 100 annual probability fluvial flood level (including allowance for climate change) to a place of safety or the wider road network. Where this is not possible, safe access with 'very low' flood hazard should be demonstrated up to the 1 in 1000 annual probability event. Only where neither of these is feasible, a dedicated 'safe haven' should be provided as agreed in consultation with the Herefordshire Council Emergency Planning Team.	Dry vehicular access should be provided above the 1 in 100 annual probability fluvial flood level (including allowance for climate change) to a place of safety or the wider road network. Where this is not possible, safe access with 'very low' flood hazard should be demonstrated up to the 1 in 1000 annual probability event.	Dry vehicular access should be provided above the 1 in 100 annual probability fluvial flood level (including allowance for climate change) to a place of safety or the wider road network. Where this is not possible, safe access with 'very low' flood hazard should be demonstrated up to the 1 in 1000 annual probability event.	Dry vehicular access should be provided above the estimated 1 in 100 annual probability surface water flood level (including allowance for climate change) to a place of safety or the wider road network. Where this is not possible, safe access with 'very low' flood hazard should be demonstrated up to the 1 in 1000 annual probability event.	
	Less Vulnerable	For water compatible and essential infrastructure only: Where access is required during a flooding event, dry vehicular access should be provided above the 1 in 100 annual probability fluvial flood level (including allowance for climate change) to a place of safety or the wider road network. Where this is not possible, safe access with no greater than 'moderate' flood hazard should be demonstrated up to the 1 in 1000 annual probability event.	Dry vehicular access should be provided above the 1 in 100 annual probability fluvial flood level (including allowance for climate change) to a place of safety or the wider road network. Where this is not possible, safe access with no greater than 'moderate' flood hazard should be demonstrated up to the 1 in 1000 annual probability event.	Dry vehicular access should be provided above the 1 in 100 annual probability fluvial flood level (including allowance for climate change). Where this is not possible, safe access with no greater than 'moderate' flood hazard should be demonstrated up to the 1 in 1000 annual probability event. Only where neither of these is feasible, a dedicated 'safe haven' should be provided as agreed in consultation with the Herefordshire Council Emergency Planning Team.	Dry vehicular access should be provided above the 1 in 100 annual probability fluvial flood level (including allowance for climate change) to a place of safety or the wider road network. Where this is not possible, safe access with no greater than 'moderate' flood hazard should be demonstrated up to the 1 in 1000 annual probability event.	Dry vehicular access should be provided above the 1 in 100 annual probability fluvial flood level (including allowance for climate change) to a place of safety or the wider road network. Where this is not possible, safe access with no greater than 'moderate' flood hazard should be demonstrated up to the 1 in 1000 annual probability event.	Dry vehicular access should be provided above the estimated 1 in 100 annual probability surface water flood level (including allowance for climate change) to a place of safety or the wider road network. Where this is not possible, safe access with 'moderate' flood hazard should be demonstrated up to the 1 in 1000 annual probability event.	
Site Specific Emerg-ency Response Plan	Highly Vulnerable	N/A	N/A	N/A	Required to support all developments.	Not required.	Not required.	Not required.
	More Vulnerable	N/A	Required to support all developments.	Required to support all developments and must consider the needs of vulnerable and disabled users of the development.	Unlikely to be required to support development.	Not required.	Not required.	Not required.
	Less Vulnerable	For water compatible and essential infrastructure only: Required to support all developments.	Required to support all developments.	Likely to be required to support all habitable buildings and manned sites and must consider the needs of vulnerable and disabled users of the development.	Unlikely to be required to support development.	Not required.	Not required.	Not required.

Policy Response		NPPF Flood Zone					Surface Water Flood Risk	Other Sources of Flood Risk
		Zone 3b Functional Floodplain	Zone 3a High Probability		Zone 2 Medium Probability	Zone 1 Low Probability		
			Undefended Fluvial Flooding	Defended Fluvial Flooding				
DEVELOPMENT CONTROL RECOMMENDATIONS								
Evacuation by Emergency Services (All Flood Risk Vulnerabilities)		Site specific emergency evacuation procedures must be in place to ensure that the risk to life is minimised should a flood event occur. Coordination with the emergency services will be required in the event of a flooding emergency.			Site specific emergency evacuation procedures likely to be only required for highly vulnerable development in Flood Zone 2.	Unlikely to be required, unless at significant risk from other sources such as reservoir failure.	Unlikely to be required, unless at significant risk from other sources such as reservoir failure.	Unlikely to be required, unless at significant risk from other sources such as reservoir failure.
Basement structures	Highly Vulnerable	N/A	N/A	N/A	Basements should be flood resistant, and must have an internal access to a higher floor situated a minimum of 0.6m above the 1 in 100 annual probability fluvial flood level with an allowance for climate change, and above the 1 in 1000 annual probability fluvial flood level. Flood resilient design techniques should be adopted for all basement uses.	No restrictions, unless identified as at risk of flooding from other sources of flooding.	Basements must prevent the overland flow of water entering the basement structure up to and including the 1 in 100 annual probability event.	Where possible, prevent the overland flow of water entering the basement structure. Consideration should be given to the impact of flooding from other sources to the ability to provide safe access and egress, similar to those recommendations made for sites at risk from fluvial flooding. Consider the potential impact of the structure on flood risk elsewhere, e.g. changes to groundwater flow regimes. Other sources of flooding such as foul water, leakage though dilapidated surface water drainage or groundwater ingress should also be considered.
	More Vulnerable	N/A	Basements used as habitable areas and living accommodation are not considered appropriate in the undefended Flood Zone 3a.	Basements used as habitable areas and living accommodation are not considered appropriate in the defended Flood Zone 3a.				
	Less Vulnerable	For water compatible and essential infrastructure only: No basements are considered appropriate within Zone 3b Functional Floodplain.	Safe internal access must be provided to a level 0.6m above the 1 in 100 annual probability fluvial flood level with an allowance for climate change, and above the 1 in 1000 annual probability fluvial flood level. Flood resilient design techniques must be used for all basements.	Basements should be protected with a continuous secondary fixed flood defence and must have internal access to a level 0.3m above the 1 in 100 annual probability fluvial flood level with an allowance for climate change, and above the 1 in 1000 annual probability fluvial flood level. Flood resilient design techniques should be adopted for all basement uses.				
Site Runoff		Development should result in no increase in the rate or volume of runoff when compared to the existing situation. Where possible, betterment should be provided. Runoff should be infiltrated to ground where site conditions permit. If this is not possible, consideration should first be given to discharging to a watercourse before consideration is given to discharging to the sewerage network. SUDS features should be used where feasible to promote water quality, amenity and biodiversity benefits. Proposed adoption and maintenance arrangements for all proposed drainage systems must be clarified.						
Buffer Zone		A 4m buffer from the top of bank or foot of a flood defence to the proposed development will be sought for all watercourses. A Flood Risk Activities Permit is likely to be required from the EA for any works within 8m of a main river (or flood defence structure). Ordinary Watercourse Flood Defence Consent is likely to be required for any works within 8m of an ordinary watercourse (or flood defence structure). Buffer zones should be naturalised wherever possible.						
Flood Resilience/Resistance		For development within areas identified to be at risk of flooding, appropriate resistance and resilience measures should be incorporated to adequately protect the development from flooding. Essential infrastructure and critical infrastructure should remain operational during flooding events.						
Flood storage compensation		Compensation for any loss of Zone 3b should be provided on a like-for-like basis, taking climate change into account.	Compensation for any loss of undefended Zone 3a should be provided on a like-for-like basis, taking climate change into account	Compensation is generally not required in areas that are defended from fluvial flooding unless the works will significantly increase flood risk elsewhere in the event of breach/overtopping/failure.	Compensation is not required, unless the effects of climate change result in the development to be located within the 1 in 100 year plus climate change event. In this case, compensation is required.	Compensation is not required.	Compensation is not required.	Compensation is not required.

6.10 DETAILED FLOOD RISK ASSESSMENT

As discussed in Section 6.3, local planning authorities should only consider development in flood risk areas where informed by a site-specific flood risk assessment. The general requirements of a site-specific flood risk assessment have been clarified by the Environment Agency and are explained in detail on the www.gov.uk website. A summary of the requirements of a site-specific flood risk assessment and development control policies for each identified Flood Zone is provided below.

SCOPE OF THE DETAILED FLOOD RISK ASSESSMENT

As discussed in earlier sections of this report, the SFRA is a strategic document that provides an overview of flood risk throughout the area for the purpose of informing the Sequential Test, Exception Test and site-specific flood risk assessments.

A site-specific flood risk assessment is required to support any planning application that is located within:

- The medium risk Flood Zone 2 or high risk Flood Zone 3 taking the potential effects of climate change into account, and excluding benefits that may be offered by flood defences;
- The low risk Flood Zone 1 where the development is 1 hectare or greater in area; or
- The low risk Flood Zone 1 where the development is at risk of flooding from other sources of flooding (i.e. surface water, sewerage systems or reservoirs), including a change of use in development type to a more vulnerable class (e g. from commercial to residential).

The site-specific flood risk assessment should identify and assess the risks of all forms of flooding to and from the development and demonstrate how these flood risks will be managed so that the development remains safe throughout its lifetime, taking climate change into account. Those proposing developments in areas identified to be at risk of flooding should take advice from the local emergency planning department and emergency services when producing an evacuation plan for the development as part of the flood risk assessment.

Site-specific flood risk assessments for sites greater than 1 hectare in Flood Zone 1 and with no identified risks from other sources should focus on the sustainable management of surface water runoff generated by the proposed development and opportunities to reduce risk elsewhere.

Although the statutory requirement to complete a site-specific flood risk assessment is defined by the location of development in areas identified to be at risk and/or the size of the proposed development, the developer should demonstrate for all types of development that consideration has been given to all sources of flood risk including overland flow, groundwater, surcharging of sewers and other artificial sources. This may include consideration of runoff from areas of higher ground or from minor watercourses that may not be illustrated on published flood maps. It is recommended that the developer consults with Herefordshire Council to discuss any known local sources of flood risk, including that derived from anecdotal evidence that may require further investigation.

Important Note

Developers should give consideration to all sources of flooding regardless of Flood Zone. For developments located in the fluvial Flood Zone 1 after climate change effects have been considered, consideration should still be given to flood risk from ordinary watercourses that may not have a mapped Flood Zone, surface water flooding, overland flow, groundwater, surcharging of sewers and other artificial sources.

For all proposed developments in Flood Zone 2 and Flood Zone 3 and taking the potential effects of climate change into account and ignoring the presence of flood defences, the site-specific flood risk assessment should demonstrate the application of the Sequential Test and, if required, the Exception Test. It is important to note that prior to investing resources into carrying out a detailed flood risk assessment (in particular for major developments) developers should first contact the Council to discuss the Sequential Test. It is possible that the development may be inappropriate and be refused planning permission irrespective of any flood risk assessment.

For all proposed developments located in areas benefitting from raised flood defences, the assessment of flood risk must include an assessment of risk following a breach of overtopping of the flood defences. For proposed developments that benefit from other flood alleviation schemes such as those present in Hereford (associated with the Yazor Brook Flood Alleviation Scheme) and in Ross-on-Wye, the assessment of flood risk must consider the full or partial blockage of these schemes, with the scope of the assessments agreed with the Environment Agency and Herefordshire Council on a case-by-case basis following a review of the likely flood risk and consequences of flooding.

Within all site-specific flood risk assessments, the development should demonstrate that a sequential approach has been taken that aims to steer the most vulnerable types of development to those areas within the site that are at least flood risk.

The site-specific flood risk assessment should be commensurate with the risk of flooding to the proposed development and the potential effects of the development on flood risk to others. For example, where the risk of fluvial flooding to the site is negligible (e.g. Flood Zone 1) and it is not indicated as being at risk of flooding from other sources or likely to impact on any known problem area off-site, there is little benefit to be gained in assessing the potential risk to life and/or property as a result of flooding. Rather, emphasis should be placed on ensuring that runoff from the site does not exacerbate flooding lower in the catchment. The particular requirements for flood risk assessments within each delineated flood zone are outlined below.

The assessment of flood risk must take into consideration historic flooding events in locations that could be affected by the development. This is particularly important for the management of surface water runoff, and may highlight the need to provide betterment over current conditions even if the site is currently undeveloped. Information regarding historic flooding events is presented in Appendix D and more detailed information can be requested from the Council.

6.11 PROPOSED DEVELOPMENT WITHIN FLOOD ZONE 3B – THE FUNCTIONAL FLOODPLAIN

Only development classified as Water Compatible and certain essential infrastructure as defined by the NPPF that has to be located in these areas should be permitted in Flood Zone 3b. A site-specific flood risk assessment will be required to support the planning application and this should demonstrate that the development will be designed and constructed to:

- remain operational and safe for users in times of flood;
- result in no net loss of floodplain storage;

- not impede water flows; and
- not increase flood risk elsewhere.

For development proposed to be located within Flood Zone 3b, developers should seek opportunities to:

- reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems;
- relocate existing development to land with a lower probability of flooding.

Essential infrastructure in this zone will be required to pass the Exception Test and this should also be demonstrated within the site-specific flood risk assessment.

6.12 PROPOSED DEVELOPMENT WITHIN FLOOD ZONE 3A – HIGH PROBABILITY

Where previous development has depleted flood plain storage, it is considered preferable to recover the land from previous uses and return it to natural flood plain. Active flood pathways should be identified and respected.

Only development classified as Water Compatible and Less Vulnerable as defined by the NPPF are considered appropriate in the defended and undefended Flood Zone 3a, although development classified as Essential Infrastructure and More Vulnerable is also considered acceptable subject to the successful application of the Exception Test. The redevelopment of brownfield land will be of key importance when demonstrating the wider sustainability benefits of development in Flood Zone 3a.

Development classified as Highly Vulnerable is not considered appropriate in the defended or undefended Flood Zone 3a.

A site-specific flood risk assessment will be required to support the planning application for any development in the defended and undefended Flood Zone 3a. This should clearly summarise:

- the predicted fluvial flood risk within the development site, including the estimated flood levels, existing site topography and proposed development levels;
- the predicted duration, rate and order of inundation, hazard and consequences of flood risk;
- predicted flood risks from other sources of flooding, including surface water, overland flow, groundwater, surcharging of sewers, reservoirs and other artificial sources;
- assessment of residual risk, including failure of flood defences or blockage of culverts;
- information of any known past flood events that effected the site;
- an assessment of the potential impacts of climate change over the lifetime of the development on all sources of identified flood risk;
- consideration of site access and egress routes and the risk of flooding to these routes during a flood event up to the 1 in 1000 (0.1%) annual probability fluvial plus climate change event, taking into consideration the risk of the site within a ‘dry island’. Specifically:
  - Dry vehicular access should be provided up to the 1 in 100 (1%) annual probability event taking the effects of climate change into account;
  - Safe vehicular access should be provided up to the 1 in 1000 (0.1%) annual probability event, determined through consideration of hazard and development vulnerability.

- an assessment of the impact of the development on flood risk elsewhere, including that associated with loss of flood plain storage (where appropriate) and site generated surface water runoff;
- proposed resistance and resilience measures that will be incorporated into the development to address identified flood risks and an assessment of any residual risks;
- application of the Sequential Test and, where appropriate, successful application of the Exception Test.

It should be noted that any loss of flood plain storage within the undefended fluvial Flood Zone 3a and Flood Zone 3b up to the 1 in 100 (1%) probability annual year plus climate change event for the 'design' scenario will need to be compensated for on a like-for-like basis to ensure no increased flood risk elsewhere as a result of development. This should be discussed with the Council and Environment Agency during the preparation of the flood risk assessment.

The assessment of flood risk in areas that benefit from flood defences should include an assessment of risk following a breach or overtopping of raised flood defences. Developers should discuss the assessment of breach scenarios with the Environment Agency and refer to the Environment Agency's guidance document Flood Risk Assessment Guidance for New Development[26]. The assessment of flood risk in areas that benefit from flood alleviation schemes (such as the Yazor Brook or Ross-on-Wye schemes) should include an assessment of risk assuming the failure (or blockage) of these schemes.

It is unlikely that compensation will be needed for the loss of flood plain storage within the defended fluvial Flood Zone 3a and Flood Zone 3b up to the 1 in 100 (1%) probability annual year plus climate change event unless the loss of this area will significantly increase flood risk elsewhere in the event of breach, overtopping or failure of raised defences. It is likely that the need for compensatory flood plain storage in those areas that benefit from flood alleviation schemes (such as the Yazor Brook or Ross-on-Wye schemes) will need to be considered assuming a failure of these schemes. The approach should be discussed and agreed with the Council and Environment Agency during the preparation of the flood risk assessment.

Fluvial flood risks associated with minor watercourses not mapped on the Environment Agency's Flood Map for Planning should be considered and managed using the same approach and guidance provided for larger watercourses. Refer to Section 6 for more information.

Development proposed within Flood Zone 3a, including that within areas identified to benefit from flood defences, is likely to need to be supported by a flood evacuation plan and/or emergency response plan prepared in consultation with the Herefordshire Emergency Planning Team. This should be determined within the site-specific flood risk assessment in consultation with the Council and Environment Agency.

Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in times of flood.

For development proposed to be located within Flood Zone 3a, developers should seek opportunities to:

- reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems;

[26] http://evidence.environment-agency.gov.uk/FCERM/Libraries/FCERM_Project_Documents/FD2320_3364_TRP_pdf.sflb.ashx

- relocate existing development to land with a lower probability of flooding;
- create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage.

6.13 PROPOSED DEVELOPMENT WITHIN ZONE 2 - MEDIUM PROBABILITY

The majority of development is considered appropriate in the defended and undefended Flood Zone 2. Only development classified as Highly Vulnerable as defined by the NPPF is not considered appropriate in this flood zone unless subject to the successful application of the Exception Test. The redevelopment of brownfield land will be of key importance when demonstrating the wider sustainability benefits of development in Flood Zone 2.

A site-specific flood risk assessment will be required to support the planning application for any development in the defended and undefended Flood Zone 2. This should clearly summarise:

- the predicted fluvial flood risk within the development site, including the estimated flood levels, existing site topography and proposed development levels;
- predicted flood risks from other sources of flooding, including surface water, overland flow, groundwater, surcharging of sewers, reservoirs and other artificial sources;
- assessment of residual risk, including failure of flood defences or blockage of culverts;
- information of any known past flood events that effected the site;
- consideration of site access and egress routes and the risk of flooding to these routes during a flood event up to the 1 in 1000 (0.1%) annual probability fluvial plus climate change event, taking into consideration the risk of the site within a 'dry island'. Specifically:
  - Dry vehicular access should be provided up to the 1 in 100 (1%) annual probability event taking the effects of climate change into account;
  - Safe vehicular access should be provided up to the 1 in 1000 (0.1%) annual probability event, determined through consideration of hazard and development vulnerability.
- an assessment of the potential impacts of climate change over the life time of the development on all sources of identified flood risk;
- an assessment of the impact of the development on flood risk elsewhere, including that associated with site generated surface water runoff;
- proposed resistance and resilience measures that will be incorporated into the development to address identified flood risks and an assessment of any residual risks;
- application of the Sequential Test and, where appropriate, successful application of the Exception Test.

Fluvial flood risks associated with minor watercourses not mapped on the Environment Agency's Flood Map for Planning should be considered and managed using the same approach and guidance provided for larger watercourses.

It is unlikely that development (other than Highly Vulnerable development) proposed within Flood Zone 2, including that within areas identified to benefit from flood defences, will need to be supported by a flood evacuation plan and/or emergency response plan prepared in consultation with the Herefordshire Emergency Planning Team. However, the need for a flood evacuation plan and/or emergency response plan should be determined within the site-specific flood risk assessment in consultation with the Council and Environment Agency. Highly Vulnerable development proposed within Flood Zone 2 is more likely to need to be supported by a flood evacuation plan and/or emergency response plan.

For development proposed to be located within Flood Zone 2, developers should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems.

6.14 PROPOSED DEVELOPMENT WITHIN ZONE 1 - LOW PROBABILITY

In accordance with NPPF, all types of development are considered appropriate in Flood Zone 1. However, consideration should be given to fluvial flood risks associated with minor watercourses that are not illustrated in the Environment Agency's Flood Map for Planning as these areas should be considered and managed using the same approach and guidance provided for larger watercourses.

For sites located in Flood Zone 1, a site-specific flood risk assessment must be prepared to accompany the planning application for any development that is:

- greater than 1ha in area;
- indicated to be at fluvial flood risk from a watercourse not mapped on the EA's Flood Map for Planning;
- indicated to be at risk of flooding from surface water sources up to and including the 1 in 100 (1%) annual probability event;
- indicated to be at risk of flooding from reservoirs.

The need and scope of a site-specific flood risk assessment in Flood Zone 1 should be discussed and agreed with the Council as part of the pre-application and planning process.

If deemed required, the site-specific flood risk assessment should clearly summarise:

- predicted flood risks from all sources of flooding, including surface water, overland flow, groundwater, surcharging of sewers, reservoirs and other artificial sources;
- assessment of residual risk, including blockage of culverts;
- information of any known past flood events that affected the site;
- consideration of site access and egress routes and, in particular, that safe access and egress (including consideration of 'dry islands') is available up to the 1 in 1000 (1%) annual probability plus climate change fluvial event;
- an assessment of the potential impacts of climate change over the life time of the development on all sources of identified flood risk;
- an assessment of the impact of the development on flood risk elsewhere, principally that associated with site generated surface water runoff;
- if appropriate, application of a sequential approach to development layout.

Information regarding the depth and velocity of predicted surface water flooding is available within the detailed view of the Environment Agency's online Risk of Flooding from Surface Water map[27].

A development site may be located in Flood Zone 1 but may be at risk of flooding from fluvial sources associated with a watercourse that has a catchment of less than 3km^2 and that is therefore not shown to be at risk in the Environment Agency's Flood Map for Planning. If the site is at risk of fluvial flooding from this minor watercourse, it is expected that a flood risk assessment

[27] https://flood-warning-information.service.gov.uk/long-term-flood-risk/map

is prepared that meets the requirements of sites located within Flood Zone 2, 3a and 3b as informed by the equivalent annual probability of flooding associated with the minor watercourse.

For development proposed to be located within Flood Zone 1, developers should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems.

6.15 LIAISON WITH THE ENVIRONMENT AGENCY AND HEREFORDSHIRE COUNCIL

The Environment Agency is a statutory consultee for many developments located within areas potentially at flood risk and developers are advised to consult with the Environment Agency during the planning application process for the following developments:

- all development located within the high risk Flood Zone 3 (excluding minor extensions and some change of use proposals);
- all development of greater than 1ha in size and located within Flood Zone 2;
- development in Flood Zone 2 that is classified as:
  - essential infrastructure;
  - highly vulnerable;
  - more vulnerable and is a landfill or waste facility or is a caravan site;
  - less vulnerable and is one of the following: land or building used for agriculture or forestry; a waste treatment site; a mineral processing site, a water treatment plant; or a sewage treatment plant;
- all development within 20m of a main river.

A full explanation of when the Environment Agency must be consulted is provided on the Government website www.gov.uk[28].

To assist local planning authorities and developers, the Environment Agency has produced Standing Advice to inform on their requirements for developments not included within the list above. Full details of their Flood Risk Standing Advice can be found at www.gov.uk[28]

The Environment Agency (West Midlands) have prepared a Flood Risk Assessment Guidance Note and also a Flood Risk Standing Advice note. These documents are available by contacting the Environment Agency's area Sustainable Places team in Shrewsbury.

The Environment Agency is an excellent source of information to inform the development of the detailed flood risk assessments. The Customers and Engagement Team should be contacted as early as possible to source information relating to (for example) up to date mapped outputs, historical flooding, hydraulic modelling and topography (LiDAR). It is emphasised that the information provided within the SFRA is the best available at the time of writing. More up to date information may be available and contact should always be made with the Environment Agency at an early stage to ensure that the detailed site based flood risk assessment is using the most current datasets, avoiding unnecessary re-work.

It is recommended that developers consult with Herefordshire Council as LLFA at an early stage of the planning application process to discuss any known flood risk issues at the proposed

[28] https://www.gov.uk/flood-risk-assessment-local-planning-authorities

development site, the need and scope of a site-specific flood risk assessment and opportunities to reduce the overall flood risk in the area, including the sustainable management of surface water runoff.

Consultation with the Council is also recommended for any development within close proximity (recommended 8m from top of bank) of an ordinary watercourse. Consent for works within close proximity of an ordinary watercourse may require consent from the Council in accordance with the Land Drainage Act 1991.

For all development in areas identified to be at flood risk for which the Environment Agency are not a statutory consultee, consultation with the Council should be undertaken to agree site-specific flood resilience and resistance measures in accordance with Environment Agency Standing Advice.

6.16 CONSENTS AND BUFFER ZONES

In accordance with the Environmental Permitting Regulations, a Flood Risk Activities Permit is likely to be required from the Environment Agency for any works within 8m of the top of bank of a main river or 8m from the foot of an Environment Agency maintained flood defence structure. For all criteria related to Flood Risk Activities Permits, refer to www.gov.uk[28]

In accordance with the Land Drainage Act, Ordinary Watercourse Consent is likely to be required for any works within 8m of a Herefordshire Council or IDB maintained ordinary watercourse that could impede the flow of water or increase flood risk associated with that watercourse. Information on how to apply for Ordinary Watercourse Consent can be found on Herefordshire Council's website.

Herefordshire Council also request that a minimum 4m buffer is maintained between the extent of development and from the top of bank of a watercourse or foot of a flood defence structure to enable future maintenance access. These buffer zones should be naturalised wherever possible for ecological benefit.

6.17 SUSTAINABLE DRAINAGE SYSTEMS (SUDS)

Sustainable drainage systems, commonly referred to as SuDS, promote an improved approach to the management of surface water runoff that maximises the additional benefits that can be achieved when compared to traditional piped systems.

SuDS can comprise a wide range of drainage features that aim to mimic natural drainage systems more closely than traditional drainage systems whilst also improving the quality of our natural and surrounding environment.

The Herefordshire Council SuDS Handbook provides detailed guidance on the expectations and use of SuDS within Herefordshire. Checklists showing the information that developers are expected to submit as part of their planning applications are included on the Council website. A brief summary of key design considerations and expectations is provided below. These apply to developments of all sizes.

The requirement to consider SuDS in all new and redeveloped sites in Herefordshire is being driven by existing and increased local flooding, increased pollution of rivers, poor natural landscapes, declining biodiversity and uncertainty regarding the impact of climate change. In particular, traditional piped systems that collect runoff from hard paved surfaces such as roofs, roads and car parks can contribute to increased flood risk and pollution by:

- Increasing the volume and rate at which surface water is discharged to a receiving watercourse and therefore increasing fluvial flood risk;

- Surcharging during larger rainfall events, with water unable to discharge to the system or emerging through manholes and gullies in areas at lower elevation hence causing localised flooding;
- Partial or full blockage caused by sediment, debris or pipe collapse which can often go unnoticed until a large rainfall event causes flooding in upstream areas;
- Little to no treatment of surface water runoff, especially from vehicular areas, thereby conveying all pollutants to the natural environment;
- Increased discharge of surface water runoff to combined sewers or wastewater treatment works, resulting in more regular discharge of wastewater to the water environment via combined sewer overflows (CSOs) or insufficient capacity at the wastewater treatment works.

Increasing urban development is exacerbating existing issues. It is therefore essential that any new development in Herefordshire looks to incorporate the principles of SuDS as much as practical to prevent further deterioration and help reverse this increasing trend.

Important Note

SuDS are expected to be provided for all developments as far as reasonable practicable. Developers are expected to demonstrate that consideration has been given to each of the points below and to the requirements of the Herefordshire SuDS Handbook.

SUDS HIERARCHY

The Planning Practice Guidance to NPPF sets out the requirement to consider sustainable drainage systems (SuDS) within all new development where appropriate and states that developments should aim to discharge surface runoff as high up the following hierarchy of drainage options as reasonably practicable:

1. Into the ground (infiltration);
2. To a surface water body;
3. To a surface water sewer, highway drain, or another drainage system;
4. To a combined sewer.

Developers will be expected to demonstrate how the above hierarchy has been considered within their proposed development.

CONTROLLING RATE AND VOLUME OF RUNOFF

In accordance with the Non-Statutory Technical Standards for Sustainable Drainage Systems published by Defra in March 2015, the following design standards are expected:

- Post-developed runoff rates for previously undeveloped (greenfield) sites are limited to the existing runoff rates for all events between the 1 in 1 (100%) and the 1 in 100 (1%) annual probability rainfall events.
- Post-developed runoff rates for previously developed (brownfield) sites are limited as far as practical to the equivalent greenfield runoff rates for all events between the 1 in 1 (100%) and the 1 in 100 (1%) annual probability rainfall events and should never exceed the rate of discharge from the development prior to redevelopment. Within Herefordshire, a minimum 20% betterment is expected for all return period events, noting that this may be higher for development located in catchments that contribute to significant downstream surface water flooding.

- For previously undeveloped (greenfield) sites, the volume of runoff in the 1 in 100 (1%) annual probability, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event.
- For previously developed (brownfield) sites, the volume of runoff in the 1 in 100 (1%) annual probability, 6 hour rainfall event should be restricted as far as practical to the greenfield runoff volume for the same event and should never exceed the runoff volume from the development prior to redevelopment. Within Herefordshire, a minimum 20% betterment is expected, noting that this may be higher for development located in catchments that contribute to significant downstream surface water flooding.

Methods for calculating runoff must be in accordance with the methods promoted within the CIRIA SuDS Manual (C753, published in 2015). It is expected that FEH methods and 2013 rainfall data are used in the calculation of existing and post-development scenarios. The calculation of pre-development runoff rates and volumes should not take the potential effects of climate change into account.

If a developer is not discharging runoff at the rates and volumes as recommended by the Non-Statutory Technical Standards for Sustainable Drainage Systems, it is expected that measures to encourage infiltration and evapotranspiration are incorporated into the design where practicable to reduce runoff during smaller rainfall events. These measures are also applicable in less permeable soils.

Within Herefordshire, it is expected that drainage systems serving developments must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30 (3.33%) annual probability rainfall event. This includes on-ground conveyance structures as well as below ground piped systems. This means that overland flow structures such as swales should also be designed for a 1 in 30 (3.33%) annual probability rainfall event.

Flooding from the drainage system may be permitted during events greater than the 1 in 30 (3.33%) annual probability rainfall event. However, flood waters that leave the drainage system must be controlled and must not pose risk to any part of a building or other structure that would be damaged by flooding, for example a utility substation or pumping station, or flow off site at a rate or volume greater than the figures specified above. This means that water that leaves the drainage system during events greater than the 1 in 30 (3.33%) annual probability rainfall event can be managed on the ground's surface and directed to areas of low vulnerability that form part of the wider site drainage system.

Of key importance within Herefordshire is the management of runoff that temporarily exceeds the capacity of drainage systems. This is particularly important for piped systems that rely on structures such as gullies and channel drains to convey water to the below ground network. These structures are unlikely to have sufficient capacity to receive rainfall during intense rainfall events and, therefore, temporary ponding of water is likely to occur. On sloping sites, this water will follow the ground's topography and could pose flood risk elsewhere. It is therefore extremely important that developers consider this temporary exceedance of drainage systems and demonstrate how this water can be managed and retained to allow discharge to the drainage system once the intensity of the storm has reduced. On-ground conveyance and storage features are generally much better at managing these types of events.

Important Note

The management of surface water runoff that temporarily exceeds the capacity of the drainage system and inlet features is of key importance within Herefordshire, particularly on sloping sites. This water must be safely controlled within the site boundary and directed back into the drainage system as quickly as possible.

ADOPTION AND MAINTENANCE

The long term maintenance of surface water drainage systems is essential to their ability to manage flood risk and protect the natural water environment. Information regarding the proposed adoption and maintenance of surface water drainage systems must be submitted as part of the planning application. A copy of the proposed maintenance plan will be required for planning applications for all proposed drainage features that are not being adopted by a Water Company. Developers should also refer to the requirements of the Herefordshire SuDS Handbook.

Important Note

Proposals for surface water management must be accompanied by confirmation of the authority that will be responsible for the long term maintenance of the drainage system.

DEMONSTRATING BEST PRACTICE TECHNIQUES

The primary aims of SuDS are to reduce flood risks and improve the quality of water discharged to our rivers and aquifers, as well as enhance our open space to provide an improved environment for people and wildlife. On-ground conveyance and storage features are therefore likely to meet these objectives more so than traditional below ground conveyance and storage features. Whilst the provision of a below ground tank may offer some benefit in terms of reduced flood risk, it offers little to improve water quality or enhance our landscape.

On-ground conveyance and storage features are therefore promoted as far as practicable, particularly at the upstream end of drainage systems and for managing smaller rainfall events as this will offer the greater potential for improved water quality and reduced maintenance requirements in subsequent sections of the drainage system.

Important Note

Herefordshire Council promote the use of on-ground storage and conveyance features as far as practicable in preference for below ground storage tanks or oversized pipes.

6.18 EMERGENCY PLANNING

Developing in areas at known flood risk can pose risk to the users of those developments as well as risk to the emergency services who are tasked with evacuating at-risk developments. For the majority of proposed developments in areas identified to be at fluvial flood risk, and in some cases from other sources of flooding, consideration will need to be given to emergency planning.

Planning applications for developments located within the defended and undefended Flood Zone 3a and Flood Zone 3b are likely to be required to be supported by a site-specific flood evacuation plan or flood response plan. The nature of this plan should be commensurate with the

vulnerability and size of the proposed development. For example, for a single dwelling in Flood Zone 3a it may be appropriate to demonstrate that a safe haven has been provided at an appropriate level above the predicted floor level. However, for a larger development comprising of multiple dwellings, demonstration of safe evacuation routes within an appropriate timeframe is likely to be required.

It is also recommended that a site-specific flood evacuation plan or flood response plan is prepared for Highly Vulnerable development in Flood Zone 2, noting that this may also be required for sites within Flood Zone 1 if the site is at significant flood risk following reservoir failure or from other sources of flood risk.

Consultation with the Environment Agency should be undertaken for all developments in Flood Zone 3a and 3b, which may identify requirements for flood resilience measures. A site-specific flood evacuation plan or flood response plan should also be established in conjunction with Herefordshire Council Emergency Planning Team.

The Environment Agency advises that people and key infrastructure may be vulnerable at different stages of flooding and that a different set of actions will be required as summarised below:

- before – lack of preparedness – ensure people are aware (sign up to Flood Warnings Direct) infrastructure is protected or resilient;
- during – property and infrastructure is flood-resistant, escape and access is appropriate, refuge areas are provided;
- after – recovery is maximised - ensure emergency services can reach those most at risk/affected, no basement-only properties in areas if most flood risk, ensuring properties are properly flood-resilient.

For larger developments, vulnerable developments and/or developments in areas at high risk, the flood evacuation plan or flood response plan should include, but is not limited to, the following:

- Evacuation procedures or procedures for safe refuge;
- People responsible for evacuation and/or safe refuge;
- Evacuation and emergency refuge routes;
- Flood warning codes; and
- Local emergency services contact details.

7 CLOSING REMARKS

7.1 OVERVIEW OF THIS SFRA

This Level 1 SFRA has been prepared on behalf of Herefordshire Council to update the Level 1 SFRA published in 2009. Since 2009 new flood risk mapping has been published by the Environment Agency and prepared by Herefordshire Council. There have been a number of significant changes to legislation, national planning policies and guidance relevant to the local management of flood risk. This report updates the Level 1 SFRA to reflect these changes and forms part of the evidence base for the updated Herefordshire Local Plan that sets out the future planning in Herefordshire up to 2031.

This Level 1 SFRA has been developed in accordance with National Planning Policy Framework and in consultation with the Environment Agency. It assess the risk of flooding from all sources, now and in the future, taking into account the impacts of climate change, and assesses the impact that land use changes and development within Herefordshire could have on future flood risk.

Specifically the Level 1 SFRA will be used to:

- Determine the risk of flooding from all sources at a county level;
- Inform the sustainability appraisal of the Local Plan, so that flood risk is fully taken into account when considering allocation options and in the preparation of plan policies;
- Apply the Sequential Test and, where necessary, the Exception Test when determining land use allocations;
- Identify the requirements for site-specific Flood Risk Assessments (FRAs), including sites at risk of flooding from sources other than rivers;
- Set out the recommended approach to the management of flood risk that can be applied through the design and planning of development within the county;
- Determine the acceptability of flood risk in relation to emergency planning capability;
- Consider opportunities to reduce flood risk to existing communities and developments.

Of key importance within this SFRA is the recommended development control policies that all developments in Herefordshire are expected to consider.

7.2 UPDATING THE SFRA

This Level 1 SFRA has been developed using the latest guidance and information available in relation to flood risk assessment. The Environment Agency regularly update their flood mapping and these updates, along with other studies carried out within Herefordshire such as flood risk studies and observed flooding that may occur in the county including any consequent investigations, will improve the current level of knowledge of local flood risk in Herefordshire and may alter the predicted flood extents in the county.

A periodic review of this SFRA will be undertaken following the publication of any emerging policy directives, significant hydraulic modelling updates or flooding events to ensure that the SFRA is still relevant and updates should be made as necessary.