



Droitwich surface water flooding

Worcestershire

Local Flood Risk Management Strategy 2015 – 2021

Adopted March 2016

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www.worcestershire.gov.uk



Reedbed and pools, Forest of Feckenham

Foreword

The Flood and Water Management Act 2010 placed a number of statutory duties on Worcestershire County Council in its new role as a Lead Local Flood Authority. One of these duties is to produce a Local Flood Risk Management Strategy.

In producing our Strategy, we have worked closely with partners, local communities, residents and interested parties to help understand the broad nature and extent of flood risk across the county, and the interactions between the different types of flood risk. This has helped us to improve our own knowledge and understanding of flood risk which is reflected in this Strategy, and something which we will continue to build on over time.

The Strategy is the overarching document on flood risk in the county. It sets the scene for understanding flood risk, and the issues and challenges which the county faces. It draws together information from a number of sources and partners and outlines how we will incorporate environmental and sustainability objectives into our flood risk work.

The evidence and information in the Strategy is being used to inform our actions, to develop projects and to bid for future funding from central Government and other agencies to address flood issues across the county.

The Strategy is one of a number of documents being produced to develop our understanding of flooding issues including Surface Water Management Plans, asset register and procedure for investigating flood incidents.

The Strategy will be reviewed every 5 years to ensure that it continues to provide the strategic direction for flood risk management in the county.



Councillor Anthony Blagg

Deputy Leader and Cabinet Member
with Responsibility for Environment
Worcestershire County Council



Surface water flood alleviation scheme – Avon Meadows, Pershore –

Executive Summary

The Flood and Water Management Act (2010) gave Worcestershire County Council a new role as Lead Local Flood Authority (LLFA) for Worcestershire. As such the Council is required to publish a Local Flood Risk Management Strategy to set out how local flood risk will be managed in the county.

Worcestershire County Council has adopted this Local Flood Risk Management Strategy to guide the development of policy and programmes across its operations and in its work with other organisations, communities and stakeholders. Partnership working will be central to delivering this Strategy and as such it has been produced in collaboration with the Environment Agency, district and borough councils, Severn Trent Water Ltd and other bodies.

The Strategy highlights the steps that are to be taken to ensure this happens and it is supported by seven high level aims as outlined below:

1. Understand and appropriately prioritise flood risk
2. Manage and minimise the likely impact of flooding
3. Develop and manage effective partnerships
4. Inform, develop and implement relevant plans, policies and strategies
5. Secure, maximise and prioritise the appropriate allocation of funding and other resources
6. Deliver sustainable environmental and economic benefits and contribute to the well being of Worcestershire's communities and residents
7. Develop, maintain and implement the LFRMS action plan

The Local Flood Risk Management Strategy is accompanied by an action plan that identifies a programme of work for reducing local flood risk within Worcestershire. The Strategy and future updates will be informed by ongoing programme reviews, flood risk assessments, information from flooding events and the latest technical guidance.

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Glossary

Term/Word	Definition
Act	A Bill approved by both the House of Commons and the House of Lords and formally agreed to by the reigning monarch (known as Royal Assent).
Catchment	An area that serves a river with rainwater. Every part of land where the rainfall drains to a single watercourse is in the same catchment.
Catchment Flood Management Plan (CFMP)	A strategic planning tool through which the Environment Agency works with other key decision-makers within a river catchment to identify and agree policies for sustainable flood risk management.
Climate change	The change in average conditions of the atmosphere near the earth's surface over a long period of time.
Defence	A structure that is used to reduce the probability of floodwater or coastal erosion affecting a particular area (for example a raised embankment).
Drainage authorities	Organisations involved in water level management, including IDBs, the Environment Agency, and RFCCs.
Flood	The temporary covering by water of land not normally covered with water.
Flood Plain	A flood plain is an area of flat land near a river, stream, lake or other open waterway that is subject to flooding when there is significant rainfall. [2] A flood zone is a commonly used term in floodplain management. Flood zones are areas identified by the Environment Agency (EA) and refer to the probability of river and sea flooding, ignoring the presence of defences. [8] Flood zones are divided into Flood Zone 1 (Low Probability flooding events), Flood Zone 2 (Medium probability), Flood Zone 3a (High Probability) and Flood Zone 3b (the Functional Floodplain).
Flood Risk Management	The introduction of mitigation measures (or options) to reduce the risk posed to property and life as a result of flooding. It is not just the application of physical flood defence measures.
Flood Risk Regulations	Legislation, which transposed the European Floods Directive in 2009.
Fluvial flooding	Flooding caused by the over-topping of river or stream banks.
Groundwater flooding	Occurs when water levels in the ground rise above the natural surface. Low-lying areas underlain by permeable strata are particularly susceptible.
Internal Drainage Board (IDB)	A statutory body that provides storm water management by operating and maintaining an artificial surface water drainage system.
Lead Local Flood Authority	Upper tier authorities with responsibility to coordinate the management of local flood risk from surface water, ground water and ordinary watercourses.
Local Flood Risk	Local Flood risk includes surface water, ordinary watercourse and groundwater flooding.

Glossary

Term/Word	Definition
Main River	A watercourse shown as such on the Main River Map, and for which the Environment Agency has responsibilities and powers. Main rivers are usually larger streams and rivers (like the River Severn or the River Teme), but also include smaller watercourses of strategic drainage importance (like the Battlefield Brook in Bromsgrove). A main river is defined as a watercourse shown as such on a main river map and can include any structure or appliance for controlling or regulating the flow of water along its course in or out of a main river. The Environment Agency has powers to carry out flood defence works applying to main rivers only.
Mitigation	The management (reduction) of flood risk.
Ordinary watercourses	A watercourse that is not part of a main river including (amongst others) ditches, drains, cuts, culverts, dikes, sluices and passages, through which water flows.
Recovery	The process of rebuilding, restoring and rehabilitating the community following an emergency.
Reservoir	A natural or artificial lake where water is collected and stored until needed. Reservoirs can be used for irrigation, recreation providing water supply for municipal needs, hydroelectric power or controlling water flow.
Resilience	The ability of the community, services, area or infrastructure to avoid being flooded or lost to erosion, or to withstand the consequences of flooding or erosion taking place.
Risk	The significance of a potential event in terms of likelihood and impact.
Risk assessment	A structured and auditable process of identifying potentially significant events, assessing their likelihood and impacts, and then combining these to provide an overall assessment of risk, as a basis for further decisions and action.
Risk Management Authority (RMA)	Organisations that have a key role in flood and coastal erosion risk management as defined by the Flood and Water Management Act (2010). These are the Environment Agency, lead local flood authorities, district councils where there is no unitary authority, internal drainage boards, water companies, and highways authorities.
River flooding	Occurs when water levels in a channel overwhelms the capacity of the channel.
Strategic Environmental Assessment	Arising from an EU directive and consistent with Government policies on the environment and sustainable development, with the objective of providing high level of protection for the environment and to contribute to the integration of environmental considerations into the preparation and adoptions of plans and programmes with a view to promoting sustainable development.

Term/Word	Definition
Sewer Flooding	<p>Sewer flooding occurs when sewers are overwhelmed by heavy, rainfall or when they become blocked. The likelihood of flooding depends on the capacity of the local sewerage system. Land, property and rivers can be flooded with water contaminated with sewage as a result.</p> <p>During heavy rainfall, combined sewer overflows (CSOs) can operate which discharge dilute sewage to watercourses. These are consented by the EA. Also during heavy rainfall, sewer flooding can occur which can result in this flood water discharging to a river or mixing with river flooding.</p>
Strategic Flood Risk Assessment	The assessment of flood risk on a catchment-wide basis for proposed development in a District.
Sustainable drainage systems (SuDS)	Current best practice for new development that seeks to minimise the impact upon the localised drainage regime, e.g. through the use of pervious areas within a development to reduce the quantity of runoff from the development.
Surface water flooding	Flooding from rainwater (including snow and other precipitation), which: is on the surface of the ground and has not entered a watercourse, drainage system or public sewer.
Site of Special Scientific Interest (SSSI)	Wildlife and geological sites, which are protected under the Wildlife and Countryside Act 1981, as amended by the CROW Act and NERC Act 2006.
Surface Water Management Plan (SWMP)	A study undertaken in a specified area, which looks at, the risk associated with local flood risk, resulting in an action plan for managing future risk and resource allocation.
Voluntary organisations/groups	Self-governing organisations, some being registered charities, some incorporated non-profit organisations. They deliver work for the public benefit using volunteers.
Watercourse	A channel (natural or artificial) along which water flows.

Abbreviations

Abbreviation	Definition
CFMP	Catchment Flood Management Plan
Defra	Department for Environment, Food and Rural Affairs
EU	European Union
FMfSW	Flood Map for Surface Water (3rd generation Environment Agency surface water mapping)
FRM	Flood Risk Management
FRMSCG	Flood Risk Management Strategic Co-ordinating Group
FWMA	Flood and Water Management Act 2010
GI	Green Infrastructure
IDB	Internal Drainage Board
LDF	Local Development Framework
LFMRS	Local Flood Risk Management Strategy
LLFA	Lead Local Flood Authority
LNP	Local Nature Partnership
LPA	Local Planning Authority
LRF	Local Resilience Forum
LSIDB	Lower Severn Internal Drainage Board
NFU	National Farmers' Union
NPPF	National Planning Policy Framework
PFRA	Preliminary Flood Risk Assessment
RBD	River Basin District
RFCC	Regional Flood and Coastal Committee
RMA	Risk Management Authority
SAB	SUDS Approving Body
SEA	Strategic Environmental Assessment
SFRA	Strategic Flood Risk Assessment
STW	Severn Trent Water
SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan
WCC	Worcestershire County Council
WLDG	Worcestershire Land Drainage Group
WLEP	Worcestershire Local Enterprise Partnership



Surface water flooding

1. Background

Section 1: The following section outlines the purpose of the Strategy and the guiding principles.

Introduction

- 1.1 The Worcestershire Local Flood Risk Management Strategy (The Strategy) has been produced to assist in the understanding and management of flood risk in the county. The Strategy is one of a number of policies, plans and proposals being developed as part of a more integrated approach to flood risk, which includes the different responsible organisations working better together to manage flood risk for the benefit of communities and businesses in the county.
- 1.2 Worcestershire County Council, as the Lead Local Flood Authority (LLFA), is only responsible for the management of local flood risk. Local flood risk is defined as surface water, ordinary watercourse and groundwater flooding, as defined within the Flood and Water Management Act. Therefore, this Local Flood Risk Management Strategy only addresses local flood risk and the interactions it might have with other forms of flood risk. Flooding in Worcestershire may be strongly influenced by management in upstream catchments. Actions within the Strategy will, therefore, need to integrate closely with catchment wide strategies led by the Environment Agency (see table 4). Reference will, however, be made to national strategies, policies and approaches where relevant and beneficial to the understanding of local flood risk issues.

Guiding Principles

- 1.3 The Local Flood Risk Management Strategy will play an important role in formalising an integrated approach to local flood risk management in Worcestershire by setting out short, medium and long-term goals and aspirations, which will build on existing knowledge, experience and procedures.
- 1.4 The Strategy has been designed to ensure that it is accessible for use by both public and private sector organisations as well as the general public.
- 1.5 This Strategy for Worcestershire sits in the overarching framework of the National Flood and Coastal Erosion Risk Management Strategy (National Strategy), which has been prepared by the Environment Agency with input from the Department for Environment, Food and Rural Affairs (Defra) to reflect government policy. Localism is at the heart of the National Strategy, recognising that there is a limit to what government and national bodies can achieve alone, and that national priorities are only part of the picture.

- 1.6 The National Strategy encourages more effective risk management by enabling people, communities, businesses, infrastructure operators and the public sector to work together.
- 1.7 The following diagram, taken from the National Strategy, demonstrates how the Environment Agency intends to work with individuals, communities and organisations to reduce the risk of flooding. This approach applies to all flood risk mitigation, large or small, and is reflected in the approach taken by the Local Strategy.

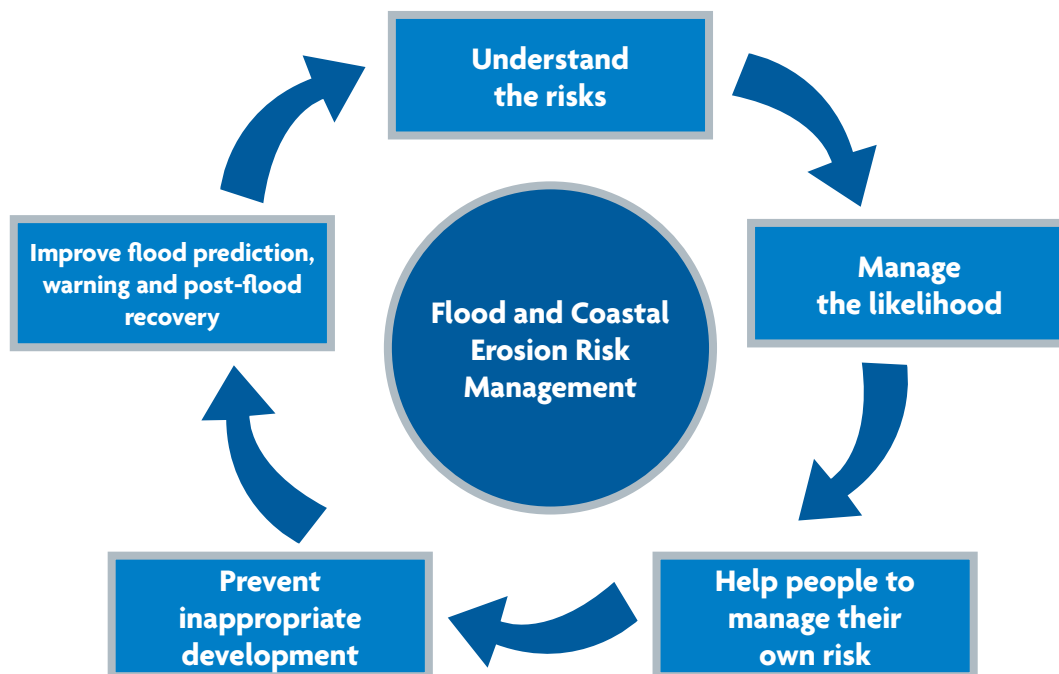


Figure 1 Managing flood risk¹

- 1.8 The LLFA will work in partnership with the other risk management authorities (RMAs), the Worcestershire Local Enterprise Partnership (WLEP), the Worcestershire Local Nature Partnership (LNP), local communities, district councils, neighbouring LLFAs and other stakeholders to build an evidence base for local flood risk management in Worcestershire.
- 1.9 Flood risk management can reduce both the risk and impact of flooding and improve our response to flooding for future occupiers and/or the area in the vicinity of development as an enabler to economic growth. Strategic development should integrate consideration of flood risk and sustainable drainage to avoid inappropriate development that could increase the risk of flooding.
- 1.10 The Strategy will provide the evidence base to target future capital and operational investment to manage flood risk in Worcestershire. The Strategy is designed to complement other works undertaken by the County Council and by our partners.

Defining Flood Risk

- 1.11 Local flood risk is defined by the Flood and Water Management Act as meaning flood risk derived from surface runoff, groundwater and ordinary watercourses.
- 1.12 Ordinary watercourses are defined as those which do not form part of a main river. Main rivers themselves being defined by the Water Resources Act 1991 as being a watercourse shown as such on a main river map and this includes any structure or appliance for controlling or regulating the flow of water into in or out of the channel.

¹ National Flood and Coastal Erosion Risk Management Strategy for England, May 2011.

1.13 Flood risk from the sea, main rivers and reservoirs is not defined as local flood risk and is the concern of the Environment Agency. Such sources of flood risk do, however, need to be considered, as their potential interaction with those flood risks defined as local to ensure that all joint risks of flooding are assessed at the local scale.

Structure of the Strategy

Section number	Title	Summary of Context
1.0	Background	Purpose of the document, background information.
2.0	Legislative and Policy Context	National legislation and strategy.
3.0	Worcestershire Flood Risk.	Local content.
4.0	Organisational Responsibilities	Organisations responsible for flood risk and their respective roles.
5.0	Worcestershire Partnerships	How Worcestershire County Council will work in Partnership.
6.0	Communities	How Worcestershire County Council and partners will work to support community resilience.
7.0	Planning	The role of the planning system and emergency planning.
8.0	Actions to Manage Flood Risk	Details of actions that Worcestershire County Council and its partners are taking to reduce flood risk.
9.0	Flood Risk Management	Details of how actions can be implemented and available funding sources.
10.0	Environmental Objectives	Details of how the Local Strategy can be used to achieve wider environmental benefits.
11.0	Next steps	Summary of actions and planned review dates.

Table 1 Structure of the Strategy

Review of the Strategy

1.14 This Strategy has been produced to reflect current legislation and our current understanding of the management of local flood risk. It will require periodic review to reflect any changes to legislation, increases in data and understanding and the completion of actions. We propose to review the Strategy every five years.



Crophorne emergency road scheme

2. Legislative and Policy Context

Section 2: The following section provides an overview of key legislation, plans and strategies with regard to flood risk management.

National Legislation

2.1 Flood risk management is governed in England and Wales through a series of different pieces of legislation, including Acts of Parliament and other regulations. The principal legislative and policy documents are outlined below with full details in Appendix 1.

Flood and Water Management Act (2010)

2.2 The Flood and Water Management Act 2010 (the Act) designated upper tier / unitary local authorities as Lead Local Flood Authorities (LLFA) and gave them and other risk management authorities (RMAs) a number of duties and powers.

LLFA Role	Summary of requirements
Duty to publish a Local Flood Risk Management Strategy	Develop, maintain, apply and monitor a strategy for local flood risk management of the area.
Duty to investigate flooding	Co-ordinate the investigation of significant flood events.
Duty to produce an asset register	Maintain a register and record of structures and features which have a significant impact on flood risk.
Power to designate flood risk assets	Designate structures and features that affect flooding in order to safeguard them.
Power to carry out works	Undertake works to manage flood risk from surface runoff and groundwater.
Duty to administer and enforce the Land Drainage Act with regard to Ordinary Watercourses	Discharge consent applications for significant changes to ordinary watercourses and take enforcement action under the provisions of the act as required.

Table 2 LLFA Roles and Responsibilities

Other Acts, Regulations and Policy

2.3 Alongside the Flood and Water Management Act there is other legislation which gives a range of duties and powers to the various risk management authorities for flooding.

Legislation	Derivation	Role
Flood Risk Regulations 2014	Translates EU Flood Directive into UK law.	Environment Agency to prepare, collate and publish flood risk maps, hazard maps, Preliminary Flood Risk Assessments and flood management plans for flooding arising from sea, main rivers and reservoirs. LLFA to undertake this for other sources of flooding.
Land Drainage Act, 1991	Outlines the duties and powers to manage land drainage for a number of bodies including the LLFA, Environment Agency, Internal Drainage Boards (IDB's).	This legislation has been updated in part by the Flood and Water Management Act.
National Planning Policy Framework	National planning policy.	Aims to avoid inappropriate development in areas at risk of flooding, and reinforce the requirement for sustainable surface water management in new development.

Table 3 Other Legislation and Policy

2.4 Flood risk management is influenced by a range of other national legislation and policies, the most significant of which are listed below.

- The Climate Change Act (2008)
- The Conservation of Habitats and Species Regulations (2010)
- The Civil Contingencies Act (2004)
- The Environmental Assessment of Plans and Programmes Regulations (2004)
- The Land Drainage Act (1991)
- The Water Framework Directive (2007)
- The Countryside and Rights of Way Act (2000)
- The Wildlife and Countryside Act (1981)
- The Public Health Act (1936)
- Highways Act (1980)
- Reservoirs Act (1975)
- Water Resources Act (1991)
- Water Industry Act (1991)

Flooding Plans and Strategies

2.5 Alongside the legislation, there are also a series of plans and strategies relating to flood risk management and water quality. The most significant of these are outlined below

Name	Geographical Area	Role
National Strategy for Flood and Coastal Erosion Management	National	Produced by Environment Agency, to reduce the threat of flooding and coastal erosion.
River Basin Management Plans	Regional	Delivery of Water Framework Directive by improving ecological status of water bodies.
Catchment Flood Management Plans	Catchment / Region	Produced by Environment Agency to identify and agree policies for sustainable flood risk management.
Surface Water Management Plans	County and District	Assessment of local flood risk.
Multi Agency Flood Plans	County and District	Emergency response plan for incidents of flooding.
Strategic Flood Risk Assessments	District Planning Authority	Provides information on areas at risk from all sources of flooding and form the basis from which to apply the Sequential Test and Exception Test (as defined in NPPF) in development allocation and development management process.

Table 4 Flooding Plans and Strategies

Other Related Plans and Strategies

2.6 Flood risk management and water quality will also relate to a series of other strategies produced at the local level which can assist with a partnership approach, and bring additional benefits. These strategies are listed below.

Name	Geographical Area	Role
Worcestershire Green Infrastructure Strategy	County	Need for and delivery of green infrastructure of which sustainable drainage can be part.
Worcestershire Local Transport Plan	County	Delivery of transport infrastructure and requirements for highways and sustainable transport design and drainage.
Worcestershire Climate Change Strategy	County	Carbon reduction and resilience strategy for the likely impact of climate change, which includes flooding.
Worcestershire Strategic Economic Plan	County	Overarching framework for investment in Worcestershire's economy through WLEP. Resilience to flooding events is recognised in this.
Worcestershire County Council Corporate Plan	County	Sets 4 key areas of focus for the County Council: Open for Business, the Environment, Health and Wellbeing and Children and Families.

Table 5 Worcestershire Plans and Strategies

2.7 The Strategy is influenced by and influences a range of other plans, policies and legislation. The links between other plans, policies and legislation must be considered to ensure consistency whilst avoiding duplication. Figure 2 (below) illustrates where the Strategy sits in relation to other relevant plans, policies and legislation.

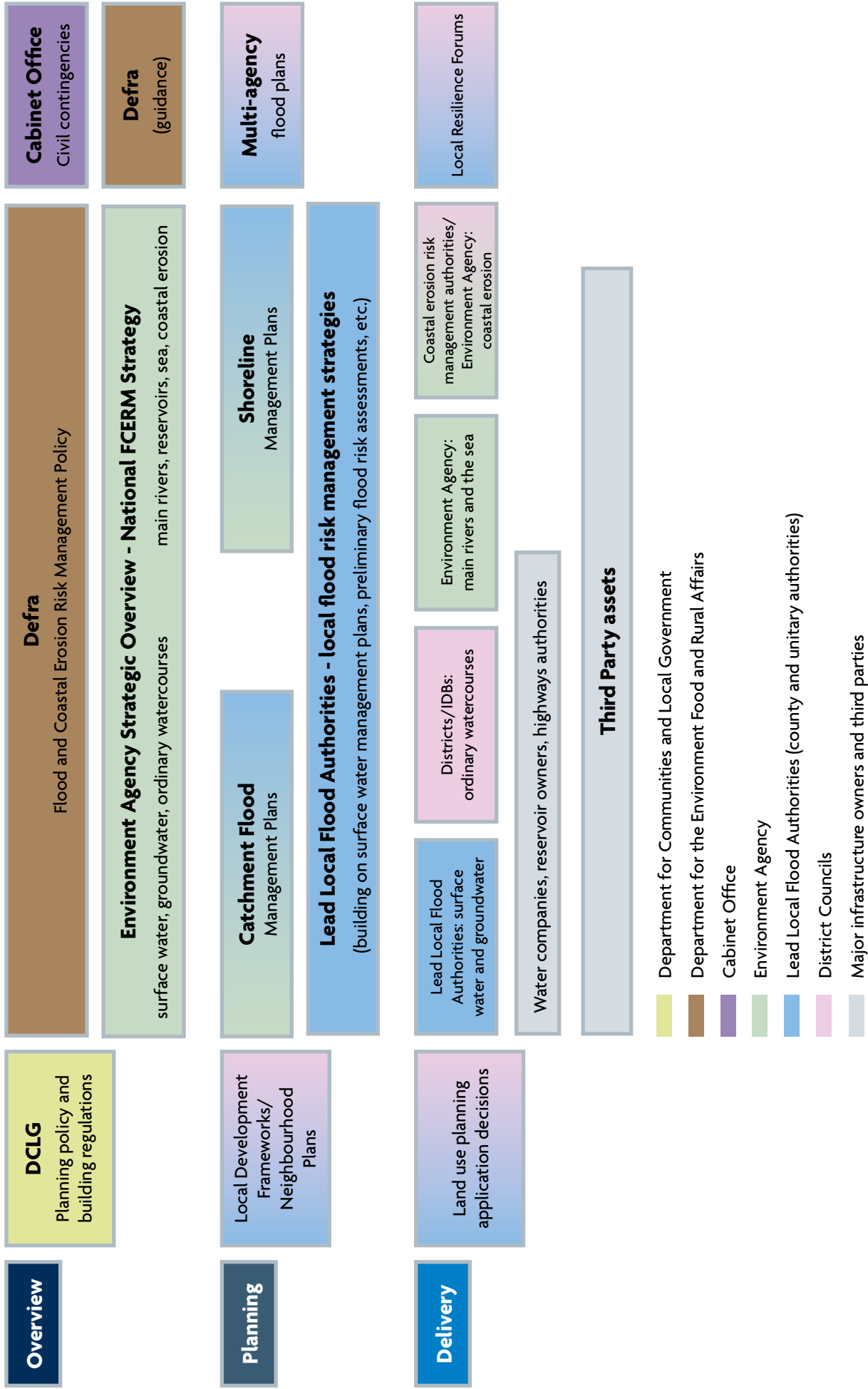


Figure 2 Flood and coastal erosion risk management overview



3. Worcestershire Flood Risk

Section 3: The following section summarises the types of flood risk and describes the flood characteristics and historic flood impacts in Worcestershire.

Types of Flood Risk

- 3.1 Flood risk is varied in nature and extent throughout the county. The county includes the catchments of important rivers, numerous small streams and minor rivers, plus a network of canals, meaning that flooding can come from a range of sources.
- 3.2 The main sources of flooding within Worcestershire are:
 - Surface water flooding is also known as pluvial flooding and it occurs when rainfall flows across the surface of the land, and ponds in low lying areas. It is more commonly associated with high intensity rainfall (typically greater than 30mm/hr) but is also associated with very prolonged rainfall. It is unpredictable in both location and severity.
 - Highways flooding can be defined as flooding on or from the highway which results from rainfall falling on the surface of the highway.
 - Ordinary watercourse flooding arises from any watercourse not designated as a main river. There is a large network of small watercourses, streams, brooks and small rivers in the county, both mapped and unmapped. This type of flooding occurs when the watercourse cannot accommodate the volume of water resulting in it coming out of its banks. All flooding from rivers is known as fluvial flooding.
 - Main river flooding is also known as fluvial flooding and occurs when main rivers are overwhelmed and flow outside of their banks. Main rivers are normally the large river systems, but can also include smaller watercourses of strategic drainage importance. Main rivers in Worcestershire include the Rivers Severn, Teme, Avon, Stour and Salwarpe and the Bow, Spadesbourne, Battlefield and Sugar Brooks.
 - Groundwater flooding occurs when the water table rises above the surface of the ground. Flooding of this type tends to arise after periods of sustained rainfall and can last for long periods of time. The areas most at risk from groundwater flooding are low-lying areas where the water table is naturally near the surface, or water raising up from an underlying aquifer or through springs.

- Reservoir flooding results from a complete or partial failure of a reservoir structure or overtopping. It may be caused by erosion due to seepage, overtopping the dam, or through damage to the structure itself. This form of flooding is extremely rare.
- Sewer flooding occurs when the sewer network cannot cope with the volume of water entering it. It is often experienced during times of heavy rainfall, when large amounts of surface water overwhelm the sewer network causing flooding. This may have a negative impact on water quality.

3.3 The responsibility for managing the different types of flood risk sits with a number of organisations as outlined in the chart below:

Flooding source	Responsible organisation
Surface water	Lead Local Flood Authority
Ordinary Watercourse	Lead Local Flood Authority Internal Drainage Board
Highway	Highways England Highways Authority
Groundwater	Lead Local Flood Authority
Main river	Environment Agency
Reservoir	Environment Agency
Sewer	Water and Sewerage Company

Table 6 Flood Responsibilities



Upton upon Severn main river flood defence



Sewer Flooding © Severn Trent Water

Flooding Characteristics of Worcestershire

- 3.4 Fluvial flooding from the main rivers in the county generates the most media interest with a focus on the River Severn through Bewdley, Upton-upon-Severn, Stourport-on-Severn, and Worcester City, the River Avon through Evesham and the River Teme through Tenbury. However, the majority of flood events in recent years have been caused by intense rainfall leading to surface water and ordinary watercourse flooding.
- 3.5 The most significant events in living memory are those that occurred in June and July of 2007 when there were a large number of incidents recorded throughout the county from a range of flooding sources. The flooding event in 2007 was particularly significant in terms of its impact on people, properties, businesses, infrastructure and the environment in Worcestershire with over 4,700 properties being internally flooded. It is estimated that this flooding had an overall cost to Worcestershire of around £6.4 million per week.
- 3.6 Major surface water and main river flooding has occurred again as recently as February 2014 with further surface water flooding being experienced in February 2016.
- 3.7 These events demonstrate the complexity and integrated nature of flooding in the county and expose the susceptibility to flood risk from many sources. Whilst the events of 2007 were exceptional, they gave insight into the scale of risk that might be presented as a result of climate change and demonstrate that the strategic management of flood risk is central to the economic prosperity and longevity of Worcestershire as a place for people to live, work and visit.

North Worcestershire (Bromsgrove District, Redditch Borough and Wyre Forest District Councils)

Bromsgrove District

- 3.8 Bromsgrove District contains the headwaters of a number of main rivers which rise in the North Worcestershire Hills
- The River Salwarpe which flows from Bromsgrove towards Droitwich
 - The Gallows Brook, which flows through West Hagley to its confluence with the River Stour in Kidderminster.
 - The River Arrow, which becomes a main river east of Alvechurch and then flows south, towards Redditch, then to its confluence with the River Alne.
 - The River Cole and
 - The River Rea

- 3.9 The district is also drained by numerous ordinary watercourses, most notably to the north, on the Birmingham Plateau.
- 3.10 Bromsgrove also contains sections of two canals: the Worcester and Birmingham Canal which bisects the district from the north east to the southwest; and the Stratford-upon-Avon Canal of which approximately 700m cuts across the very north eastern corner of the district.
- 3.11 Although there are no reports of flooding from the Stratford-upon-Avon Canal, overtopping of the Worcester and Birmingham Canal has been blamed for flooding in Stoke Prior, near Bromsgrove, most notably in 2007.
- 3.12 In addition, there are numerous pools and reservoirs within the district. The largest are the Upper and Lower Bittel and Tardebigge Reservoirs, both of which are canal feeder reservoirs.
- 3.13 Due to its headwater location Bromsgrove district has not suffered from the severe fluvial flooding experienced further downstream in Worcestershire during June and July 2007. However, due to the number of watercourses present there have been numerous occurrences of smaller-scale flooding, most notably flash flooding from rapid catchment response. In many cases this has resulted in flooding of properties and overwhelming of the road, rail and canal networks and their associated drains and outflows.
- 3.14 Bromsgrove town has suffered primarily from surface water flooding but the village of Catshill in particular has flooded from the Marl Brook and Battlefield Brook. There are also multiple occurrences of sewer flooding within the district. In recent years flood alleviation schemes have been built along the Marl Brook and Callow Brook.



Redditch Borough

- 3.15 The River Arrow bisects the northern half of the borough from north to south with numerous ordinary watercourses draining into it. Most of these smaller watercourses have their headwaters located on the southern extent of the Birmingham Plateau.
- 3.16 The southern, more rural, half of Redditch borough is drained by two main river channels, which flow from north to south. The western branch is referred to as Swans, or Elcocks Brook. The eastern branch is referred to as The Wharrage / Wixon Brook. Downstream of their confluence, the watercourse is referred to as Swans Brook and, finally as the Bow Brook. Although there are numerous balancing ponds located within the borough, the only notable still-water body is Arrow Valley Lake.
- 3.17 As Redditch is located at the base of the incline of the Birmingham plateau and is on relatively flat land, it can suffer from rapid flash flooding.
- 3.18 Multiple accounts of sewer flooding have also been reported within the borough, although largely limited to Redditch town, Astwood Bank and the village of Feckenham.



Sewer Flood © Severn Trent Water

Wyre Forest District

- 3.19 The principal town of Kidderminster is located on the River Stour, which flows through the main town centre. The Staffordshire and Worcestershire Canal follows approximately the same route as the River Stour and both have a long history of flooding. However, the town benefits from a major upstream attenuation area which controls flow rates and flood heights.
- 3.20 Stourport-on-Severn, the second largest settlement, is located on a number of watercourses. Most notable is the River Severn, which flows to the south of the main town. The River Stour, one of the River Severn's tributaries, joins the Severn at Stourport. Additionally, the Staffordshire and Worcestershire Canal terminates in Stourport and consequently there are a number of canal basins located near to the town centre.
- 3.21 Bewdley, the third main settlement, has historically suffered from large flooding events as it sits in the valley of the River Severn. The west bank of the river has benefited from multi-million pound flood defences along Severnside North and South. The eastside benefits from temporary defences managed by the Environment Agency.



- 3.22 The district also has a network of streams, pools and smaller watercourses which all have the potential to cause flooding and there is a large water supply reservoir at Trimpley, to the north of Bewdley and in close proximity to the River Severn.
- 3.23 The main tributaries of the River Severn within the Wyre Forest district are Dick Brook, Dowles Brook, Gladder Brook, Hoo Brook, Snuffmill Brook, Riddings Brook, and the River Stour.

South Worcestershire (Worcester City, Malvern Hills and Wychavon Districts)

- 3.24 The main causes of flooding in south Worcestershire are the main rivers and surface water (either overland or from sewers). Main river flooding has occurred many times with significant events occurring in 1998, 2000, 2007 and 2014 when several hundred properties flooded on each occasion.
- 3.25 The floods in 1998 were attributed to a large storm event whilst the November and December 2000 events were the largest flood events since 1947. In 2007, there were over 1600 recorded incidents of flooding in Wychavon alone and nearly 200 properties flooded in Worcester. This particular event was a combination of main river and surface water flooding.
- 3.26 The main causes of flooding within the villages are the smaller watercourses and surface water flooding from sewers and overland flow.

Worcester City

- 3.27 Significant watercourses within Worcester City include the River Severn, River Teme and Barbourne Brook. Flooding can be caused by any of these rivers singly or in combination plus interaction with several smaller watercourses and surface water. Canal flooding has also been recorded in the past, which has been attributed to vandalism of the lock gates.

Wychavon

- 3.28 Significant watercourses within the area include the River Avon, River Salwarpe, Badsey, Merry and Carrant Brooks and River Isbourne.
- 3.29 The main causes of flooding within Evesham are the River Avon, River Isbourne, Battleton Brook, Carrant Brook, several smaller watercourses and surface water.
- 3.30 The main causes of flooding within Pershore are the River Avon, several smaller watercourses and surface water flooding from sewers and overland flow.
- 3.31 The main causes of flooding within Droitwich are the River Salwarpe, Elmbridge Brook and surface water flooding from sewers and overland flow. In addition, the Droitwich Canal interacts with the River Salwarpe in several locations.
- 3.32 While the impact of flooding from the Carrant Brook is largely felt in Tewkesbury (Gloucestershire) it also has a significant impact upstream in Worcestershire (e.g. in Beckford). The catchment of this brook is the subject of an enhancement project involving a number of partners including the Kemerton Conservation Trust, Buglife, the Environment Agency and the Overbury Estate. Flood alleviation through reintroducing meanders is part of this project and the Environment Agency has already carried out some work on the Kemerton Estate below Aston on Carrant.

Malvern Hills

- 3.33 Significant watercourses within the Malvern Hills District include the River Severn, River Teme, Kyre Brook, Dick Brook, River Rea, Hatfield Brook and Pool Brook.
- 3.34 The main cause of flooding within Malvern is surface water.
- 3.35 The main causes of flooding within Tenbury Wells are the River Teme, Kyre Brook and surface water. In addition, a culverted section of an un-named watercourse causes flooding at Bog Lane.
- 3.36 The main causes of flooding within Upton-upon-Severn are the River Severn, Pool Brook, and surface water flooding. There is an important flood flow route to west of the town during extreme flood events on the River Severn, which essentially isolates the town. In 2012 a new permanent flood defence designed to protect 64 properties from a 1 in 150 chance of flooding was completed.
- 3.37 A small area in the south of Malvern Hills District is included within boundaries of the Lower Severn Internal Drainage Board. Their responsibilities include leading on local flood and surface water management within this area.

Rapid Response Catchments

- 3.38 The Environment Agency has, at a national level, identified Rapid Response Catchments. These catchments are areas that include rivers or streams (including smaller tributaries and ordinary watercourses) where flooding can occur without a significant period of warning time. There are three such catchments in Worcestershire:
- Dick Brook,
 - Badsey Brook
 - Merry Brook.
- 3.39 The Environment Agency is the lead for managing flood risk in these catchments and the LLFA and other partners are working in close partnership with them.



Upton-upon-Severn, river Severn in flood



Highway drainage gully

4. Organisational Responsibilities

Section 4: The following section summarises the roles of organisations responsible for managing flood risk in Worcestershire.

Lead Local Flood Authority

4.1 The Flood and Water Management Act 2010 introduced a range of roles and responsibilities for flood risk management, which are summarised below. Full details of the responsibilities of the LLFA are described in Appendix 2.

LLFA responsibilities:

- Duty to produce a Local Flood Risk Management Strategy
- Duty to investigate flooding
- Duty to produce a record and register of structures and features
- Power to designate structures and features
- Power to carry out works
- Duty to administer applications for consent to work on an ordinary watercourse
- Power to enforce the Land Drainage Act with regard to ordinary watercourses
- Duty to respond to consultation on major planning applications with regard to surface water

Risk Management Authorities

4.2 A number of public bodies and private undertakers have responsibilities for flood risk and they are required to work in partnership together to manage flood risk and help communities become more resilient to flooding. Full details of the responsibilities of the risk management authorities are described in Appendix 3.

4.3 The risk management authorities in Worcestershire are

- Worcestershire County Council
(as both the Highways Authority and the LLFA)
- The Environment Agency
- Bromsgrove District Council

- Malvern Hills District Council
- Redditch Borough Council
- Worcester City Council
- Wychavon District Council
- Wyre Forest District Council
- Lower Severn Internal Drainage Board (IDB)
- Severn Trent Water Limited
- South Staffordshire Water Plc

Highway Authority

- 4.4 As the Highway Authority, the County Council is responsible for the local road network. Highways England is responsible for the strategic or trunk road network.
- 4.5 The Highway Authority has a duty to manage flooding caused by rain falling on the surface of the highway.
- 4.6 The Highway Authority is also responsible for the management and maintenance of structures on and underneath the highway. This involves the clearance of watercourses and culverts to ensure the structural integrity of structures such as bridges and culverts.
- 4.7 The Highway Authority has the power to carry out works considered necessary to protect the highway from flooding. These can be on the highway or on land which has been acquired by the Highway Authority for that purpose. Subject to consent, the Authority may divert parts of a watercourse or carry out any other works on any form of watercourse if it is necessary for the construction, improvement or alteration of the highway or provides a new means of access to any premises from a highway. It is also able to adopt SuDS that serve the highway.

Environment Agency

- 4.8 The Environment Agency has significant responsibilities, including leading on flood risk management on Main Rivers. In carrying out its duties, the Environment Agency must have regard to the Local Flood Risk Management Strategy produced by the LLFA and, like other RMAs, it must also contribute to sustainable development, co-operate with other RMAs and provide them with information.
- 4.9 The Environment Agency also has a duty to produce and maintain a National Strategy for Flood and Coastal Erosion Risk Management and to regulate flooding from reservoirs.

District, City and Borough Councils

- 4.10 District, city and borough councils have responsibilities which are:
- The power to designate structures and features that affect flooding or coastal erosion
 - A duty to exercise their flood risk management functions in a manner consistent with local and national strategies and to have regard to those strategies in their other functions
 - A duty to respond to requests from other RMAs for information
 - A duty to co-operate with investigations and scrutiny

Water and Sewerage Companies

- 4.11 The majority of Worcestershire is covered by Severn Trent Water Limited although South-Staffordshire Water Plc serves a small area of Bromsgrove district. Their responsibilities include:
- A duty to act consistently with the National and Local Strategies and to have regard to them when carrying out their flood risk management functions
 - A duty to co-operate with investigations and scrutiny
 - A duty to co-operate with and share information with other RMAs with regard to flood risk management functions

Internal Drainage Boards

4.12 Internal Drainage Boards (IDBs) are independent statutory bodies responsible for drainage in areas of special drainage need. Traditionally their main focus has been drainage of agricultural land. However they have evolved to play a much wider role, contributing to flood risk management in both urban and rural areas. Much of their work involves the improvement and maintenance of rivers, drainage channels and pumping stations; managing water levels; and protecting and enhancing wildlife and biodiversity.

4.13 The Lower Severn Internal Drainage Board (LSIDB) serves a relatively small area of South Worcestershire. The Flood and Water Management Act adds a number of new powers and responsibilities to the IDBs' existing role, which are:

- The power to designate structures and features that affect flooding or coastal erosion
- The power to cause flooding and erosion for nature conservation and cultural heritage reasons, and people's enjoyment of these
- A duty to exercise their functions in a manner consistent with the Local and National Strategies
- A duty to co-operate with investigations and scrutiny
- The power to carry out enforcement and works on ordinary watercourses within their boundaries

Neighbouring LLFAs

4.14 The LLFAs that adjoin Worcestershire include:

- Herefordshire Council
- Warwickshire County Council
- Gloucestershire County Council
- Staffordshire County Council
- Shropshire Council
- Birmingham City Council
- Solihull Metropolitan Borough Council
- Dudley Metropolitan Borough Council





Ordinary watercourse flooding

5. Worcestershire Partnerships

Section 5: The following section summarises the importance of partnership working in managing flood risk and the structures in place to facilitate this going forward.

Partnership Working

- 5.1 A partnership approach is the most efficient to co-ordinate local flood risk management activities. Strong local partnerships enable effective, efficient and integrated flood risk management activities and will enable co-ordinated investments. Local flood risks can be complex in nature i.e. multiple sources and pathways managed by multiple organisations. Working in partnership is therefore essential to achieving optimum understanding of the risks, as well as integrated and efficient mitigation measures where multiple organisations are involved. By working collaboratively WCC and its partners gain a better understanding of local flood risks and can collectively identify and assess the most suitable risk management measures.
- 5.2 Given the limited capacity within the LLFA this collaborative approach is already being taken forward with a working agreement between the LLFA, South Worcestershire Land Drainage Partnership (a collaboration between Worcester City Council, Wychavon District Council and Malvern Hills District Council) and North Worcestershire Water Management (a collaboration between Wyre Forest District Council, Bromsgrove District Council and Redditch Borough Council) which provides the opportunity to maximise resources. This includes the regulation of ordinary watercourses and the use of Geographical Information Systems (GIS) to record flood risk information from all sources and to inform the development of Surface Water Management Plans and projects.

Regional Flood and Coastal Committees

- 5.3 Regional Flood and Coastal Committees (RFCCs) are committees established under the Flood and Water Management Act. Worcestershire falls under The English River Severn and Wye RFCC and is represented on the Committee by an elected member of WCC's Cabinet. A small part of north Worcestershire falls under the Trent RFCC. RFCCs meet on a quarterly basis and bring together members appointed by the LLFAs, officers from the EA and independent members invited to share particular areas of expertise. They play an increasingly important role overseeing local flood risk management and providing a key link to Government Departments. Their role is to:
- Ensure there are coherent plans for identifying, communicating and managing flood and coastal erosion risks across catchments and shorelines

- Promote efficient, targeted and risk based investment in flood and coastal erosion risk management that optimises value for money and benefits for local communities
- Provide a link between the Environment Agency, Lead Local Flood Authorities, other risk management authorities, and relevant bodies to promote a mutual understanding of flood and coastal erosion risks in its area.

The Worcestershire Flood Risk Management Strategic Co-ordinating Group

5.4 In 2010 the Worcestershire Flood Risk Management Strategic Co-ordinating Group (FRMSCG) was established to focus on more strategic flood risk management issues within the county. The group comprises officers and elected members from:

- Worcestershire County Council
- District Councils
- Environment Agency
- Severn Trent Water Ltd
- West Mercia Local Resilience Forum
- Worcestershire Local Nature Partnership
- Lower Severn Internal Drainage Board
- Worcestershire Land Drainage Group
- Worcestershire Planning Officers’ Group

The Worcestershire Land Drainage Group

5.5 The Worcestershire Land Drainage Group (WLDG) was established in the wake of the 2007 floods and includes officers from County and District Council functions such as highways, emergency planning, strategic planning and land drainage, Environment Agency, Severn Trent Water Limited, the National Farmers Union and the LSIDB. This group focuses on an increasingly wide range of tactical and operational flood risk management issues.

5.6 The work of the WLDG and the FRMSCG is informed by community groups and individuals and Parish Councils, whose input into historic flood-spot records and the development of resilience plans has been invaluable.

Main Flood Risk Management Governance Groups

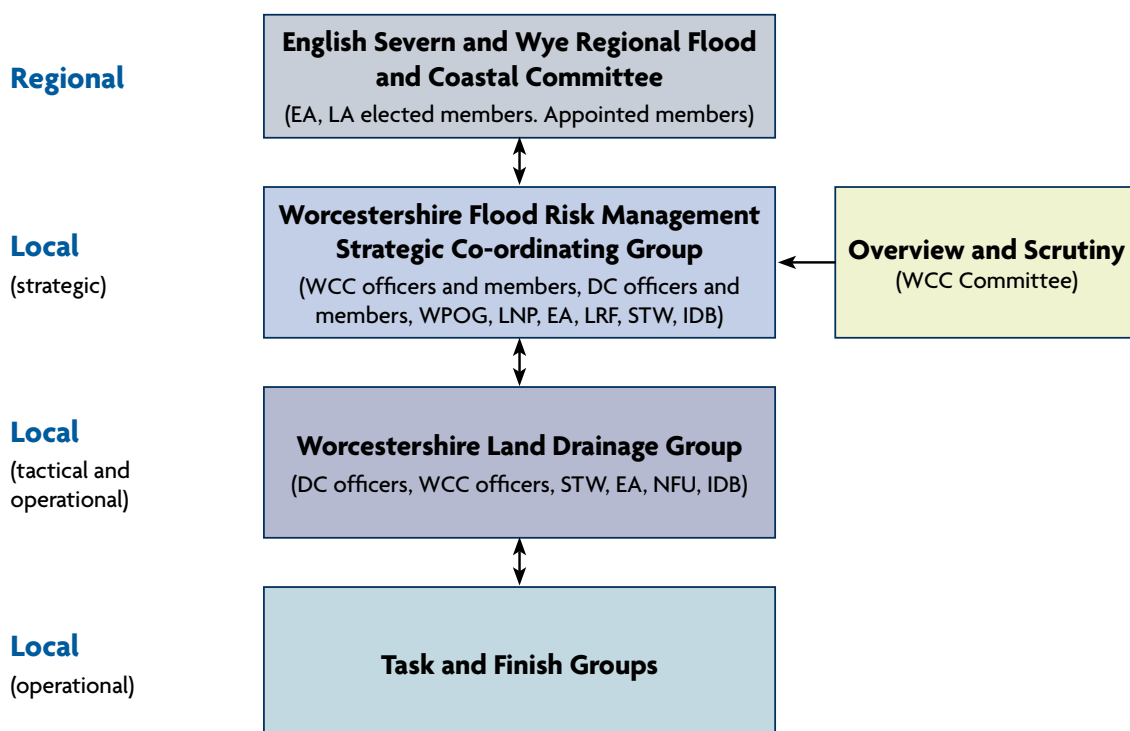


Figure 3 Worcestershire Flood Risk Management Governance



6. Communities

Section 6: The following section summarises the role of Worcestershire's communities and individuals in managing flood risk.

The Role of Communities and Individuals

- 6.1 Primary responsibility for protecting a property from flooding lies with the property owner. However, unless people have suffered flooding or have had a near miss they are unlikely to consider taking measures to improve flood resilience and may, incorrectly, see it as the responsibility of others. In addition residents may not have experienced flooding whilst they have lived in a property or are unaware of the future risk presented by climate change.
- 6.2 Stakeholders at all levels have a role to play in managing flood risk. Individuals, communities and businesses can all assist by taking action to protect themselves and their properties, and getting involved in local flood risk management activities. The Strategy aims to promote personal responsibility by raising awareness of flood risk and supporting community-based actions.
- 6.3 RMAs and partner organisations have an important role to play in awareness raising with affected property owners to give them the knowledge and tools so that they are empowered to take responsibility for managing their own flood risk. However, a balance will need to be struck between awareness-raising and causing undue concern/potential property blight, especially given the uncertainties associated with predicting surface water flood risk.
- 6.4 Nationally, the government and the insurance industry have developed a new home insurance scheme called Flood-Re which will provide flood insurance for at risk homes. Householders benefiting from Flood-Re will also be encouraged to take action to reduce their flood risk through, for example, property level protection and increasing reliance.
- 6.5 Town and parish councils can also play an important role in managing flood risk at the community level by helping to gather information on areas at risk of flooding, preparing community flood plans and encouraging residents to develop and become involved with parish council flood warden schemes. Communities can be crucial in raising and accessing additional funding for flood resilience and flood defence measures. In addition the LLFA and partners will continue to engage with the range of local community flood groups.

- 6.6 Voluntary organisations, such as the National Flood Forum, have proven to play an important role in giving advice to individuals as well as supporting communities in setting up flood action groups. Many members of the National Flood Forum have been affected by flooding themselves and, therefore, have first-hand experience of the traumas and challenges faced by flood victims.
- 6.7 The National Flood Forum has produced the Blue Pages Directory,² which provides a list of products and services associated with flood protection measures for homes and businesses.
- 6.8 The County Council will use a range of different techniques to engage with local communities including social media, meetings, local press and the County Council's website.³ This will enable flood risk messages to reach a wider audience and increase the understanding of the local flood risk.

² National Flood Forum <http://www.nationalfloodforum.org.uk/bluepages/>

³ Worcestershire County Council, Flood Risk Management http://www.worcestershire.gov.uk/info/20236/flood_risk_management

7. Planning

Section 7: This section summarises the role of land use planning and the planning system in mitigating flood risk.

Land Use Planning

- 7.1 The land use planning system aims to provide residential and non-residential development in a timely, affordable and sustainable manner. With respect to flood risk, the system seeks to ensure that development is safe from flooding and does not increase flood risk elsewhere.
- 7.2 National planning policy is provided by the NPPF, which sets out a series of steps with regard to the development of local planning policy for flooding and development and the determination of applications.
- 7.3 Without effective planning policy there is a risk that the increase in hard standing and impermeable surfaces associated with development will increase surface water runoff and hence the risk of flooding. However, individual planning applications can make a contribution to reducing flood risk on and off site through a range of techniques collectively known as sustainable drainage. This needs to be fully assessed as part of the development of local planning documents and in determining planning applications.
- 7.4 This Strategy does not duplicate the existing work completed by local planning authorities in preparation of their core strategies / local plans (most notably Strategic Flood Risk Assessments). Rather, it focuses on where we can provide additional evidence to support effective spatial planning, and consideration of local flood risk in planning policy and development control decisions.
- 7.5 Flood risk management should be taken into consideration at the earliest possible stage to ensure that it is integrated into designs from the outset. The LLFA strongly encourages early discussion of flood risk management prior to formal planning application stages.
- 7.6 The Government has made Lead Local Flood Authorities a statutory consultee on development for major applications in relation to surface water drainage from April 2015.

- 7.7 Planning boundaries do not usually coincide with catchment boundaries. Local authorities need to take this into account and understand the potential impacts of flood risk in their respective districts or boroughs, policies and decision making, considering the potential for all types of flood risk. They must also be made with due consideration to the potential impact that future development may have upon known existing flooding problems if not carefully managed.
- 7.8 Under the Localism Act, communities have the right to draw up Neighbourhood Plans. These plans allow communities to say where they want new houses, businesses and shops to go, and what they should look like. This is achieved through establishing general planning policies for the development and use of land in their neighbourhood. Although county councils have no statutory duty in terms of the preparation of neighbourhood plans, it does hold information on surface water flood risk as well as highways and ecology which may be of assistance to communities when preparing their plans.

Strategic Flood Risk Assessments

- 7.9 Planning authorities undertake Strategic Flood Risk Assessments as a requirement of the NPPF to assess the effect of proposed developments on flood risk. These policies should promote the strategic allocation of land and of buildings within the development boundary to reduce flood risk, promote sustainable drainage and improve water quality.
- 7.10 All district and borough councils in Worcestershire have undertaken SFRA's to inform the preparation of their Local Plans. SFRA's should be live documents that identify and analyse current and future flooding issues and include detailed mapping and analysis of flood risk to inform the land allocation process.
- 7.11 The LLFA and partners have engaged with the local planning authorities to provide evidence to support the development of emerging local plans. Whilst the delivery times and schedules vary from one planning authority to another the LLFA and partners are working in close liaison to promote consistency in approach and decision-making with respect to the effective management of flood risk throughout the county.
- 7.12 The LLFA is already working with the development management services across the county to provide drainage and flood risk comments on major planning applications. The LLFA is also seeking earlier engagement with developers through the development management services to maximise the opportunities to influence the location and design of drainage in new development and encourages pre-application engagement with developers and local planning authorities.

The Minerals Local Plan

- 7.13 Worcestershire County Council is the planning authority for minerals and waste development. The Council has a statutory duty to produce a Minerals Local Plan (MLP) to manage sustainable minerals development and ensure there is an adequate supply of minerals.
- 7.14 It is national planning policy that planning authorities must take account of flood risk and protect water quality when allocating land for development and in developing their policies and plans. The winning and working of minerals can worsen flooding or water quality problems, if not managed properly. Surface water run-off from workings can, for example, lead to the pollution and eutrophication of water bodies or contribute to the loss of protected habitats or impede flow. The Minerals Local Plan will include policies that ensure that these matters are properly addressed before and during operations and monitored following restoration.
- 7.15 There are, however, many options during and after the course of mineral working operations and in the ways that sites are restored which have the potential to provide flood benefits. Significant possibilities include the creation of temporary and permanent flood storage capacity by restoring riparian corridors, creating flood retention or attenuation features or reservoirs. Such areas can be designed to hold floodwater by storing runoff during the peak flow and releasing it at a controlled rate during and after the peak flow has passed.



Kemerton Lake Nature Reserve

Emergency Planning

- 7.16 Emergency planning focuses on the response to and recovery from emergency incidents (including flooding). The Local Resilience Forum (including Emergency Services, Local Authorities, Environment Agency and Health Authorities), are responsible for working in partnership to plan for and respond to flooding emergencies. Local Authorities are responsible for leading the recovery from flooding incidents. Worcestershire County Council's Emergency Planning team works with other agencies (including district/borough councils) to coordinate the preparation of Multi-Agency Flood Plans and a Local Authorities' Recovery Plan to identify the response to, and recovery from, flooding incidents.
- 7.17 Emergency planning is therefore a critical element of any sustainable flood risk management solution and strong liaison between RMAs and the emergency services is essential.
- 7.18 The Environment Agency monitors river levels within the main rivers affecting Worcestershire. Using computer forecast models the Environment Agency makes an assessment of the anticipated maximum water level that is likely to be reached within the proceeding hours (and/or days). Where these predicted water levels are expected to result in the inundation of populated areas, the Environment Agency will issue a series of flood warnings to both the public and professional partners within defined flood warning areas, encouraging residents to take action to avoid damage to property in the first instance. In addition the District authorities have a number of monitoring stations on ordinary watercourses.
- 7.19 An essential component of increasing the safety and resilience of Worcestershire's residents will be to integrate the Strategy with those of the emergency services and partners. This will help to ensure that responses to emergency situations are integrated with the way in which partners manage longer-term strategic thinking.
- 7.20 The Civil Contingencies Act 2004 is of particular relevance to emergency planning for flooding. It formalises a number of duties on local authorities, the emergency services and other organisations involved (including the Environment Agency) in responding to any emergency.
- 7.21 The County Council is designated as a Category 1 Responder under the Civil Contingencies Act 2004. As such, the Council has defined responsibilities to assess risk and respond appropriately in case of an emergency, including a major flooding event. Duties that fall on the County Council and District Authorities as Category 1 responders are:

- Risk assessment
- Business continuity management
- Emergency planning
- Maintaining public awareness and arrangements to warn, inform and advise the public
- Provision of advice and assistance to the commercial sector and voluntary organisations
- Co-operation and information sharing

7.22 The West Mercia Local Resilience Forum (WMLRF) is a multi-agency group comprising bodies such as local authorities, national and local health agencies, the three emergency services and the Environment Agency. It addresses, through planning and risk management, the consequences of any emergency (including flooding) that may occur within the county.

Multi Agency Flood Plans

7.23 Multi Agency Flood Plans (MAFPs) have been developed for each district in Worcestershire in accordance with the framework provided by the Civil Contingencies Act 2004. They provide an overview of the flood risk areas to be found in each district and what actions will be taken during the time of activation. The MAFP details the roles, responsibilities and actions to be taken by partners during a flooding incident.



Emergency evacuation

7.24 These plans have all been tested through a variety of flood events of different character and scale and have been found to be working successfully. Currently, the plans are being reviewed and refined to reflect that the nature and complexities of incidents can be hugely different and allow for a more flexible approach based on the needs of each incident and its level.

Case Study

7.25 Pershore Town Council has worked with Wychavon District Council and Worcestershire County Council as well as the Environment Agency and Severn Trent Water to develop the Pershore MAFP. The plan forms a vital part of the town's flood defence including the monitoring of surface water levels. The plan has been put into action on two occasions in the past 5 years since the town's flood defences were constructed.

Communication and Engagement

7.26 Good internal and external communications are essential to successful flood risk management. The LFRMS action plan reflects the importance of good communication, which should be embedded in everything the LLFA and its partners do. Whilst all partners and Flood Risk Management officers have a key role to play in this, the LLFA has designated a lead FRM officer with responsibility for this role.

7.27 A communications plan has been developed, which is now being implemented alongside the Strategy to facilitate community engagement in different aspects of flood risk management. The communications plan will in future be available on the County Council website under the flood risk management pages.⁴

7.28 A community forum will commence as part of a community engagement project run jointly by the LLFA and the National Flood Forum (with a joint officer) and a community liaison group will be established to work alongside the Worcestershire Land Drainage Group.

⁴ Worcestershire County Council, Flood Risk Management http://www.worcestershire.gov.uk/info/20236/flood_risk_management



Retreat Farm Quarry - Grimley, restored minerals quarry

8. Actions to Manage Flood Risk

Section 8: The following section summarises the aims, objectives and protocols which have been established to guide flood risk management in Worcestershire.

National Objectives

8.1 The overall aim of the National Strategy is to “ensure that the risk of flooding and coastal erosion is properly managed by using the full range of options in a co-ordinated way.” The risk management authorities and other organisations involved in flood and coastal erosion risk management will together take forward the objectives set out below:

- Understanding and working together; understanding the risks of flooding and coastal erosion, working together to put in place long term plans to manage these risks and make sure that other plans take them into account.
- Development control; avoiding inappropriate development in areas of flood and coastal erosion risk and being careful to manage land to avoid increasing flood risk.
- Reducing risk; maintaining and improving systems to reduce the likelihood of harm to people and damage to the economy, environment and society.
- Improve public awareness; building 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.
- Improved emergency planning and recovery; improving the detection, forecasting and issue of warnings of flooding, co-ordination of rapid response to flood emergencies and promoting faster recovery and flooding.

Strategic Aims of the Strategy

8.2 The aim of the Local Flood Risk Management Strategy is to establish a series of local objectives, aligned to the national objectives, as outlined below.

Number	Local Strategy Aim	National Strategy Objectives				
		Understanding and working together	Development control	Reducing risk	Improving public awareness	Improving emergency planning and recovery
1	Understand and appropriately prioritise flood risk	✓		✓	✓	✓
2	Manage and minimise the likely impact of flooding	✓	✓	✓	✓	
3	Develop and manage effective partnership	✓		✓		✓
4	Inform, develop and implement relevant plans, policies and strategies	✓	✓	✓		✓
5	Secure, maximise and prioritise the appropriate allocation of funding and other resources	✓		✓	✓	
6	Deliver sustainable environmental and economic benefits and contribute to the well being of Worcestershire's communities and residents	✓	✓	✓	✓	
7	Develop, maintain and implement the LFRMS action plan	✓		✓	✓	✓

Table 7 Local Aims and Relationship with National Strategy.

8.3 Each strategic aim has been broken down into a series of objectives. These objectives are made more specific, measurable and timetabled in the LFRMS Action Plan in Appendix 4.

1. Understand and appropriately prioritise flood risk

1.1	Develop a county wide flood risk management strategy.
1.2	Develop a county wide surface water management plan.
1.3	Review and record relevant Risk Management Authority data in a register and make available to the public and partners subject to data sharing and confidentiality agreements.
1.4	Develop a county wide protocol and on-going performance milestones to populate the register and record of flood assets.
1.5	Develop a protocol for undertaking the Duty to Investigate.
1.6	Develop a county wide protocol and implementation plan for the designation of flood risk assets.

2. Manage and minimise the likelihood and impact of flooding

2.1	Ensure that FRM is fully integrated into the design and planning of new infrastructure and developments at the earliest possible stage.
2.2	Develop flood alleviation schemes.
2.3	Work with partners, residents and businesses to install appropriate property level protection measures.
2.4	Work with landowners, NGOs and other public bodies to reduce surface water run-off and to prioritise a green infrastructure approach.
2.5	Monitor ordinary watercourses and encourage appropriate maintenance.

3. Develop and manage effective partnerships

3.1	Identify and communicate FRM roles and responsibilities to stakeholders.
3.2	Work in partnership with the other RMAs in Worcestershire.
3.3	Work in partnership with neighbouring and other LLFAs.
3.4	Engage and work in partnership with Worcestershire’s communities.
3.5	Develop local partnership groups around priority flood locations to develop and co-ordinate joint working.

4. Inform, develop and implement relevant plans, policies and strategies

4.1	Take into consideration relevant legislation and policies in the development of the LFRMS.
4.2	Work with Local Planning Authorities and local communities to ensure surface water flooding is taken into account in Local Plans, Neighbourhood Plans, and supporting evidence.
4.3	Influence other plans, policies and strategies, through partnership working where appropriate, to ensure the consideration of FRM.

5. Secure, maximise and prioritise the appropriate allocation of funding and other resources

5.1	Identify and maintain awareness of potential sources of FRM funding.
5.2	Maximise opportunities for funding.
5.3	Utilise the Defra capacity grant to deliver the LFRMS and other statutory responsibilities.
5.4	Undertake a review of the structure and deployment of FRM resources and identify potential efficiencies.
5.5	Review and appropriately develop skills and knowledge amongst FRM staff.

6. Deliver sustainable environmental and economic benefits and contribute to the wellbeing of Worcestershire’s communities and residents

6.1	Protect, enhance and conserve Worcestershire’s built and natural environment. ⁵
6.2	Adapt to future projected climate change.
6.3	Work with the Worcestershire and Greater Birmingham and Solihull LEP to maximise the benefits to Worcestershire’s economy and infrastructure from FRM.
6.4	Reduce the negative impact of flooding on health and wellbeing.

7. Develop, maintain and implement the LFRMS action plan

7.1	Ensure that all owners of actions within the plan and listed partners are aware of their role in delivery of the LFRMS.
7.2	Regularly monitor progress with delivery of the action plan and update the status column accordingly.
7.3	Review and update the action plan every 12 months.

8.4 Protocols have been established to guide delivery of some of the key LLFA duties and powers defined by the Flood & Water Management Act (2010) as follows:

⁵ The conservation of Worcestershire’s natural environment is achieved by use of our environmental due diligence mechanism to identify and help avoid adverse impacts to our network of designated and non-designated sites of nature conservation importance (including Worcestershire’s Special Areas of Conservation and SSSI’s) and also, wherever possible, opportunities to create, restore, enhance and defragment our priority habitats are also realised.

Designation of Structures and Features

- 8.5 The LLFA has the power to formally designate man-made structures and natural features, which it considers, have a significant impact on flooding.
- 8.6 Once designated, any alteration to or removal of a structure or feature by existing or future owners will require formal consent.

Schedule 1 of the Flood and Water Management Act 2010, which includes:

Subject to conditions, a designating authority may designate a structure or a natural or man-made feature of the environment where it thinks the existence or location of the structure or features affects flood risk.

A person may not alter, remove or replace a designated structure or feature without the consent of the responsible authority.

- 8.7 A county-wide protocol and implementation plan for the designation of flood risk assets will be developed and decisions to designate will be made on a case-by-case basis. Subject to designation these assets will then be included on the Asset Register (see section 8.13) and will be available for the public to view.

Duty to Investigate Flooding

- 8.8 The LLFA has a duty to investigate flood events it deems to be 'significant'. Significance is to be determined by the LLFA and its partners based on local criteria.
- 8.9 The LLFA has adopted the following approach to how and when a formal flood investigation under the FWMA will be carried out, how the various stakeholders and relevant parties will be contacted and involved and also how this information will be used and communicated to relevant parties.
- 8.10 All flood events will be investigated informally but flood events resulting in one or more of the following impacts will normally be formally investigated under the FWMA:
- Danger to life
 - 10 or more properties internally flooded
 - 10 or more businesses severely disrupted
 - 1 or more pieces of critical infrastructure severely impacted
- 8.11 A formal investigation under the FWMA may also be triggered if there is one or more of the following:
- Very frequent flooding
 - Impact on particularly vulnerable people
 - Severe economic disruption
 - Significant environmental impact
 - Requests of a significant weight

Section 19

1. On becoming aware of a flood in its area Lead Local Flood Authority must, to the extent that it considers it necessary or appropriate, investigate –
 - (a) Which risk management authorities have relevant flood risk management functions, and
 - (b) Whether each of those risk management authorities has exercised, or is proposing to exercise, those functions in response to the flood.
2. Where an authority carries out an investigation under subsection 1) it must –
 - (a) Publish the results of its investigations; and
 - (b) Notify any relevant risk management authorities.

- 8.12 Flood events not meeting the criteria for a formal investigation may be investigated informally, depending on their frequency and impact.

Register and Record of Structures and Features

- 8.13 The LLFA has a duty to establish and maintain a record of assets, which have a significant impact on flood risk and establish, maintain and make publicly available a simple register.

Under Section 21 of the Flood and Water Management Act, each Lead Local Flood Authority (LLFA) will have to establish and maintain:

- a. A register of structures or features which, in the opinion of the authority, are likely to have a significant effect on a flood risk in its area, and
- b. A record of information about each of those structures or features, including information about ownership and state of repair.

LLFAs also have a duty to arrange for the register to be available for inspection at all reasonable times. This includes inspection by the public. The record does not need to be made available to the public.

- 8.14 The Record and Register for Worcestershire is established and available to the public on request. This will be updated on an on-going basis.
- 8.15 Assets to be entered onto the Register and Record can include any man-made structures e.g. culverts, weirs, walls etc or natural features e.g. banks, mounds, ditches, etc.
- 8.16 Structures and features will be deemed to be having a ‘significant impact’ when their absence, amendment or dis-repair could contribute to potential impacts of flooding including one or more of the following:
- Danger to life
 - 10 or more properties internally flooded
 - 10 or more businesses severely disrupted
 - 1 or more pieces of critical infrastructure severely impacted
 - Structures and features might also be deemed to be ‘significant’ when there is:
 - Very frequent flooding
 - Impact on particularly vulnerable people
 - Severe economic disruption
 - Significant environmental impact

Worcestershire Preliminary Flood Risk Assessment

- 8.17 The Flood Risk Regulations (2009) required Worcestershire County Council (WCC) to undertake a Preliminary Flood Risk Assessment (PFRA). The primary purpose of the PFRA is to report ‘Nationally Significant Areas of Flood Risk’ to the EU.
- 8.18 The PFRA has been produced alongside the developing Surface Water Management Plan (SWMP). These two documents will then make a significant contribution to the Local Flood Risk Management Strategy.
- 8.19 There are no “Nationally Significant Areas of Flood Risk” in Worcestershire⁶ and neither have there been any single flood locations in Worcestershire where the criteria defined for ‘Locally Significant Flood Risk’ i.e. those which affect at least 3,000 people in a small geographical area, have been met.

⁶ Despite the map of ‘Nationally Significant Areas of Flood Risk’ indicating that a small part of the Midlands risk area crosses the Worcestershire border, a closer assessment of flood risk in this part of the county demonstrates that this is simply an anomaly caused by methodology used by the Department for Environment, Food and Rural Affairs (Defra). It has, therefore, been agreed with the Environment Agency and Birmingham City Council that in reality there are no areas of ‘Nationally Significant Areas of Flood Risk’ within Worcestershire.

Worcestershire Surface Water Management Plan

- 8.20 Surface Water Management Plans are a tool to manage flood risk on a local basis by improving and optimising coordination between relevant stakeholders. They arose from the Flood and Water Management Act, 2010. The goal of a SWMP is to establish a long term action plan setting out priorities for action and to influence future strategy for flood risk management including development, maintenance, investment, planning and engagement linked to local development frameworks and emergency plans.
- 8.21 Work on Worcestershire’s SWMP commenced in 2011 with the aim of producing a SWMP by working closely with colleagues from the district councils and other key partners including the Environment Agency, Severn Trent Water Ltd and Lower Severn Internal Drainage Board.
- 8.22 The Defra guidance defines a standard process via which a SWMP should be undertaken and this is articulated in a wheel diagram (figure 4). There are four steps involved in the process: Preparation; Risk Assessment; Options; and Implementation and Review. The first three phases are about the SWMP study and gathering the information. The final phase is producing the action plan from the evidence gathered, implementing the plan and then reviewing the response.



Figure 4 The SWMP Wheel.

8.23 Initial stages of work on the SWMP have focussed on a high-level overview of flooding in Worcestershire using existing data to identify sites which could benefit from ‘quick win’ solutions and identify locations where further investigation is required. This has enabled the LLFA and partners to arrive at a list of historical and potential future flooding locations. The stages in the development and analysis of the SWMP are outlined below.

8.24 Stage 1 - established the need for the SWMP, developed existing partnerships, scoped the SWMP study, data gathering of flood locations.

8.25 Stage 2 - county-wide strategic risk assessment – an early decision was made to carry out a county-wide assessment of all past and future potential flooding, from all sources, in order to:

- Form a thorough and robust flood risk evidence base
- Identify locations which require attention
- Prioritise the locations which require attention
- Record locations which have already received attention

This exercise, with the addition of new locations emerging from flood events that occurred during the assessment period, has produced approximately 1,700 past ‘Floodspots’.

8.26 Stage 3 – An extensive series of workshops, interviews and desk top assessments has led to the collation of attribute data for almost every floodspot, including:

- Flooding source
- Number of impacted properties
- Number of impacted businesses
- Number of impacted pieces of critical infrastructure
- Status of mitigation work
- Lead risk management authority

8.27 Stage 4 - The Environment Agency’s surface water map, ‘Flood Map for Surface Water’, was overlaid onto the National Receptor Database in order to identify potential future flood locations. This resulted in a final list of future potential floodspots ready for further investigation and potential mitigation.

8.28 More recently the Environment Agency has developed its ‘Communities at Risk’ approach which duplicates the stage 4 exercise using the ‘updated flood map for surface water’ modelling and with the addition of more refined property threshold data. The future potential floodspots which emerge from this exercise will replace those produced previously in stage 4.

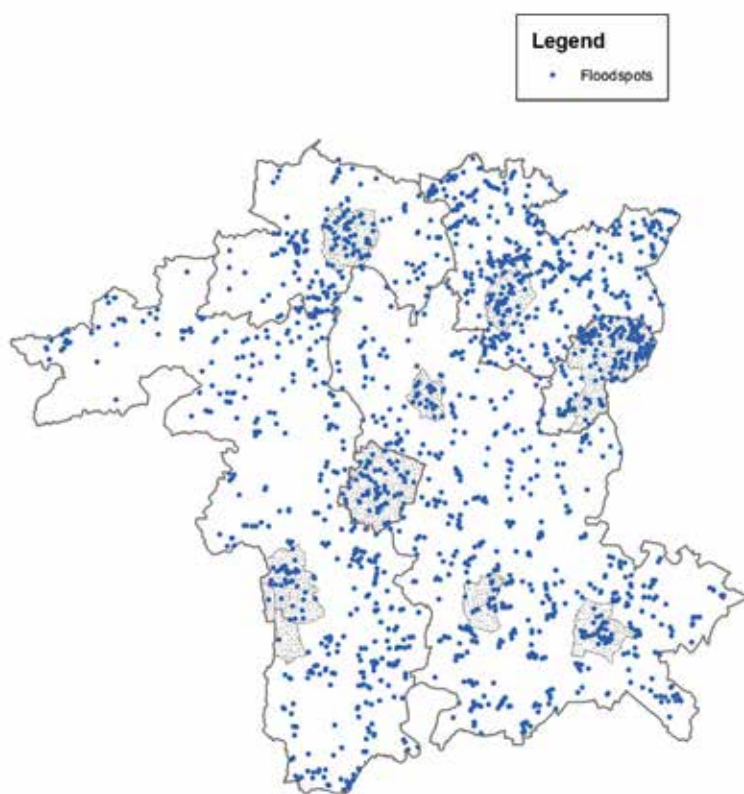


Figure 5 Worcestershire Floodspots.



Upton upon Severn; construction of a flood alleviation scheme

- 8.29 Stage 5 – Historic floodspots have been prioritised according to the extent of impact and grouped into bands. Within each priority band, floodspots are ordered according to the number of properties affected, the number of pieces of critical infrastructure affected and the number of businesses affected. These floodspots have been allocated to the identified lead risk management authority in order that they can be investigated and mitigation proposed.
- 8.30 It is likely that some floodspots will be moved into a different band once initial investigation gets underway. For example if a floodspot is known to be impacted very frequently it might be moved to a higher band or if the critical infrastructure is discovered to be less important it might be moved to a lower band.
- 8.31 In addition, when a floodspot is being investigated it will be sensible to look at other floodspots in close proximity, regardless of their priority band, in order to establish if there is a relationship between them and / or an opportunity exists to address them together. This might be particularly relevant where a broad catchment based approach is appropriate.
- 8.32 The future potential floodspots emerging from the ‘Communities at Risk’ exercise will be fed into the appropriate priority bands and allocated to the identified lead RMA for further investigation and mitigation.

Early / Quick Win Schemes

8.33 A number of individual floodspots have been investigated and appropriate mitigation works carried out during the SWMP strategic assessment stage and schemes which have been either completed or started include:

- Tibberton
- Green Lane, Catshill
- Callow Brook, Rubery
- Lower Moor
- Bransford
- Harvington (Wychavon)



Construction of a flood alleviation scheme

Localised SWMPs

- 8.34 Locally focused SWMPs are being produced for locations which have a high concentration of floodpots and / or complex flooding issues.
- Droitwich Town SWMP
 - Bromsgrove Town SWMP

Bromsgrove Town Centre SWMP

- 8.35 Following investigations into a number of flood incidents and as part of the Worcestershire Surface Water Management Plan process it has been decided that a SWMP specific to Bromsgrove Town Centre will be produced, with particular focus on the Spadesbourne and Battlefield Brooks, surface water flooding and capacity issues within the highway drainage and sewer networks.
- 8.36 Initial investigations suggest that around 252 residential properties and 44 non-residential properties are at risk of flooding in a 1:100 event in the 14km² study area. This includes important infrastructure such as the A38 and South Bromsgrove High School. There are also seven major areas marked for development proposed to contain a total of up to 2,675 dwellings which will be assessed individually in terms of flood risk.
- 8.37 It is currently envisaged, following investigations into the brooks, that around 700m of watercourse can be improved or naturalised immediately, and 820m² of water dependent habitat can be created. This will help to meet requirements set out in the European Water Framework Directive and will improve the habitats for the remaining colonies of water voles in Bromsgrove – which are thought to be the last remaining stable population in Worcestershire.

Droitwich Town Centre SWMP

- 8.38 Droitwich has long suffered from flooding issues and it was very severely impacted in 2007. Accordingly the emerging county-wide SWMP has identified a cluster of floodspots in the town centre leading to the intention to produce a focused local SWMP to address them.

Prioritising Investment in Sewer Flooding

- 8.39 Severn Trent Water Ltd target is to reduce incidents of internal sewer flooding by 13% and external sewer flooding by 6% and has set out the following priorities for investment:
- Focus on managing low severity sewer flooding through property level protection, whilst also increasing investment in schemes to increase the capacity of the network.
 - Continue to invest in repairing, replacing and rehabilitating assets, as well as undertaking proactive and reactive maintenance of networks.
 - Increase emphasis on changing customer behaviours to reduce sewer blockages, which can lead to flooding.
 - Deliver more sustainable solutions to flooding and work in partnership with other RMAs to deliver integrated flood risk management schemes.
 - Significantly increase the amount of real time monitoring and telemetry on the network to better understand and manage flood risk.⁷

⁷ Full details of Severn Trent Water objectives can be found at <http://www.stwater.co.uk/2020-plan>



Upton upon Severn, flood defence

9. Flood Risk Management

Section 9: The following section summarises the key principles behind and approaches to flood risk management in Worcestershire.

- 9.1 Flood risk management needs to be planned effectively both for the short and long term and set out how the risks will be managed and by whom. This section sets out how the process of delivering flood risk management schemes in Worcestershire will be managed to ensure that the best outcomes are achieved including:
- Identifying and managing existing flood risk management assets in the county.
 - Working with landowners to review land management methods.
 - Identifying funding sources and working with partners to secure funding.
 - Adopting sustainable approaches to surface water management.
 - Working with communities to improve resilience.
 - Improving the skills and capacity of those working in flood risk management.

The Source-Pathway-Receptor model

- 9.2 Flood risk management schemes, infrastructure or improvement works used to reduce flood risk, offer opportunities to deliver more benefits than simply protection from flooding.
- 9.3 In managing flood risk we should seek to deliver broader benefits by working with natural processes where possible and seeking to provide environmental benefit as required by the Habitats, Birds and Water Framework Directives. Measures such as the use of Sustainable Drainage Systems (SuDS) to manage risk should be considered as they can also deliver benefits for amenity, recreation, pollution reduction and water quality.
- 9.4 The source – pathway – receptor model provides a useful basis for considering the assessment and management of local flood risk, although sometimes it may be more difficult to apply in practice.

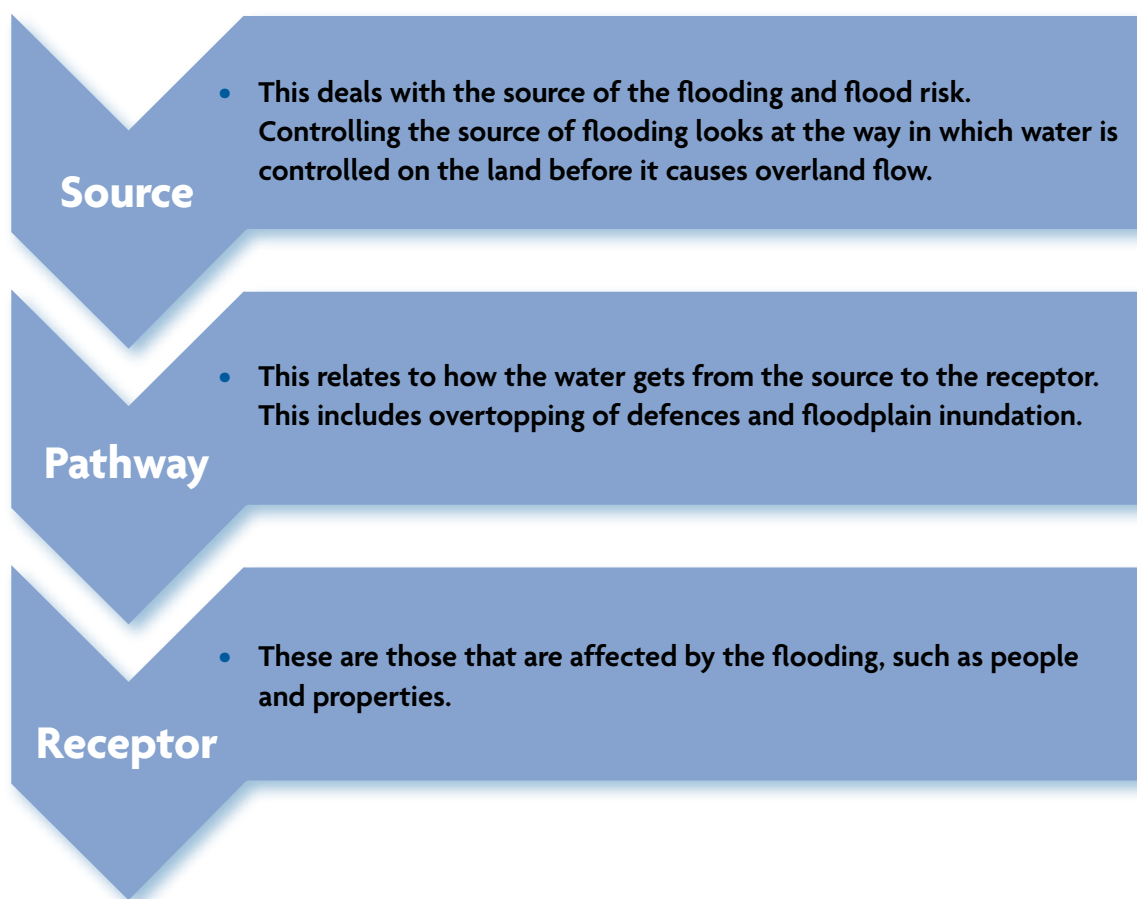


Figure 6 Source, Pathway, Receptor model.

- 9.5 Sources are the physical conditions (such as rainfall, river and coastal water levels) that create the risk.
- 9.6 Pathways provide the routes for flood water to pass to receptors and are divided here into three key groups:
- Above ground/major system (surface topography, watercourses and drainage channels);
 - Below ground/minor system (sewer networks and highway drains);
 - “Interface” assets that control transfers of flow between the two systems.
- 9.7 Receptors are the properties, people, infrastructure assets and environmentally or culturally significant sites in the floodplain that are at risk of flooding. Part of the risk is related to the consequences receptors suffer. The consequences of flooding are the economic, social, environmental or cultural impacts that may result from a flood. Consequences can be expressed in monetary terms or using other metrics such as counts, lengths or areas of features affected by flooding.
- 9.8 In reality there are often multiple sources, pathways and receptors of local flood risk in any one area. This can add significant complexity when the pathways interact. For example, if the performance of a below ground drainage system depends on the above ground system or the state of intervening assets (such as highway drainage grilles).
- 9.9 Whilst there is still a significant amount of work to be done to understand this risk, the LLFA working with partners, is currently gathering evidence to better understand the risk of surface water flooding in Worcestershire.



Attenuation catchment management natural solution

Urban Creep

- 9.10 There has been a trend in recent years for the incremental conversion of permeable surfaces to impermeable (e.g. hard surfacing of front gardens to provide parking spaces, creation of large patio areas). This is termed as 'urban creep'. This increase in impermeable areas has consequently led to greater runoff volumes, premature surcharging of the drainage network, and subsequent flooding. These flashy flows from urban runoff may also have a detrimental impact downstream on rural landowners and communities. Urban creep can also impact on water quality, as deposited pollutants are washed off during rainfall events.
- 9.11 The consideration of urban creep should be assessed on a site-by-site basis and an appropriate allowance for the increase of impermeable area from urban creep should be included in the design of the drainage system over the lifetime of the proposed development. Reference should be made to local planning authorities' advice and the allowances that should be applied to the impermeable areas.

Upstream Catchment Management

- 9.12 Holding back and slowing down water in upper catchments before it reaches potential receptors downstream is being trialled in a number of areas as a method of flood reduction, particularly in smaller upland catchments.
- 9.13 For this approach to be expanded into larger and more complex catchments will require a greater and more widespread understanding of relevant techniques, engagement with and co-operation from landowners and co-ordination of RMA efforts and those of other relevant organisations. However, this approach should be considered as part of a cohesive package of measures to manage flood risk. This may include upstream attenuation, de-silting or maintaining downstream conveyance measures. The development of upstream catchment management schemes will require consideration of the following:
- The need to actively and fully consult, engage and seek agreement with land managers and farmers.
 - Careful site analysis of the benefits, dis-benefits and risks, with special attention given to local catchment knowledge. Defra's Working with Natural Processes is a programme of research into sustainable flood and coastal erosion risk management. The programme is modelling a range of weather and flood events on the catchment to analyse the full spectrum of flood flows, catchment conditions and scales. Poorly located schemes can have the inadvertent effect of increasing the frequency or extent of flood inundation.

- Assessment of maintenance requirements in the short and long term to ensure the continued effectiveness of any scheme.
- Impact on the agricultural economy of any schemes, both directly and indirectly.

9.14 A project has been initiated by the WCC to investigate opportunities to apply this in Worcestershire learning from experiences elsewhere in the country and then translating these into local plans, strategies and actions. The project will undertake a feasibility and options appraisal of incorporating this approach into on-going schemes, including the potential to undertake a pilot project in the county.

Sustainable Drainage Systems (SuDS)

9.15 Approaches to manage surface water in a sustainable way which mimics natural processes, doesn't place additional burden on the existing drainage network and which takes account of water quantity, water quality and amenity issues are collectively referred to as SuDS. Examples of this include open ponds that capture rainwater and allow it to slowly dissipate into the ground rather than directing it to the sewers. There are technically complex versions of this approach including underground storage and various ways to control or hold back water flow but in essence it is about reducing run off from new developments and reducing flood risk to homes, businesses, roads and land.

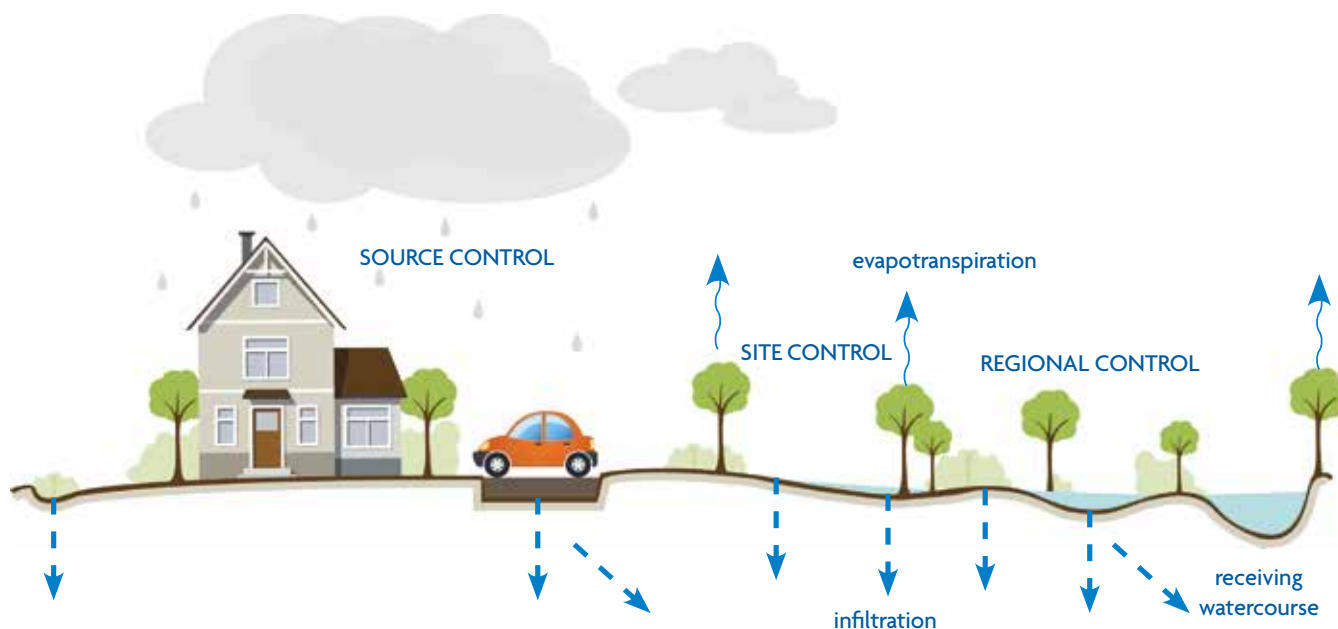


Figure 7 SuDS mimicking nature – Susdrain.

9.16 The application of a SuDS scheme to a specific development is heavily dependent upon the topography and geology of the site (and its surrounds). For example, areas overlaying clay geology are likely to be unsuitable for infiltration techniques including soakaways. Similarly, steep slopes are generally unsuitable for SuDS techniques that rely upon flow storage, e.g. ponds and wetlands. Careful consideration of the site characteristics must be assured to ensure the future sustainability of the adopted drainage system. There are numerous different ways that SuDS can be incorporated into a development and the most commonly found components of a SuDS scheme are described in the following table:

Pervious surfaces	Surfaces that allow inflow of rainwater into the underlying construction or soil.
Green roofs	Vegetated roofs that reduce the volume and rate of runoff and remove pollution.
Filter drain	Linear drain consisting of trenches filled with a permeable material, often with a perforated pipe in the base of the trench to assist drainage, to store and conduct water; they may also permit infiltration.
Filter strips	Vegetated areas of gently sloping ground designed to drain water evenly off impermeable areas and to filter out silt and other particulates.
Swales	Shallow vegetated channels that conduct and retain water, and may also permit infiltration; the vegetation filters particulate matter.
Basins, Ponds and Wetlands	Areas that may be utilised for surface runoff storage.
Infiltration Devices	Sub-surface structures to promote the infiltration of surface water to ground. They can be trenches, basins or soakaways.
Bio-retention areas	Vegetated areas designed to collect and treat water before discharge via a piped system or infiltration to the ground.
Pipes and accessories	A series of conduits and their accessories normally laid underground that convey surface water to a suitable location for treatment and/or disposal. (Although sustainable, these techniques should only be considered where other SuDS techniques are not).

Table 8 SuDS Typology

The LLFA's Role in SuDS

- 9.17 Following the 2007 floods the Pitt Review made a number of recommendations that were translated into the Flood and Water Management Act 2010. One such recommendation was the introduction of a requirement for sustainable drainage on new developments.
- 9.18 This requirement was included in the planning system in April 2015, via a change to the National Planning Policy Guidance. Subsequently all major developments are expected to include sustainable drainage systems and for these to be given increased weight in the determination of planning applications.
- 9.19 Planning applications that fail to meet a policy requirement to normally deliver SuDS instead of conventional drainage could be refused.
- 9.20 The Government made Lead Local Flood Authorities a statutory consultee on development for major applications⁸ in relation to surface water drainage in April 2015.
- 9.21 Planning guidance explains that local planning authorities should ensure local plan policies are compatible with this Strategy. The guidance also suggests that local planning authorities and the LLFA should agree the circumstances and locations where LLFA advice should be sought on a planning application for development that raises surface water or other local flood risk issues. The LLFA is working with LPAs and partner risk management authorities to implement these proposals.
- 9.22 Flood risk management should be taken into consideration at the earliest possible stage, to ensure that it is integrated into designs from the outset. The LLFA strongly encourages early discussion of flood risk management prior to formal planning application stages.

8 (e.g. developments of ten dwellings or more and equivalent non-residential schemes)

- 9.23 The design of SuDS needs to comply with new national standards brought forward via the planning system and planning guidance. The national standards for SuDS set general principles and good practice. More specific guidance for the local area will need to be provided through county or district level guidance or supplementary planning documents. The LLFA is exploring this.

Review of Land Management Methods

- 9.24 Riparian landowners (householders, business owners or other landowners of land adjacent to a watercourse) are responsible for the maintenance of watercourses which flow through or adjacent to their land and for ensuring the normal flow of water. Lead Local Flood Authorities and the Environment Agency have permissive powers to require riparian landowners to carry out maintenance work where flood risk is a concern. Where a watercourse forms the boundary between two properties, responsibility is deemed to be up to the centreline of the watercourse.
- 9.25 Typical maintenance activities include:
- Removal of blockages and obstructions.
 - Managing vegetation.
 - Accepting the natural flow from upstream and transferring it downstream without obstruction, pollution or diversion.
 - Maintaining any structures, including culverts, weirs and sluice gates.
- 9.26 Riparian landowners have a right to protect their property from flooding and erosion, but they should discuss proposals with the Lead Local Flood Authority (LLFA), the Environment Agency or the Internal Drainage Board (IDB) as certain types of work require prior consent. Further information can be found in the Environment Agency’s document ‘Living on the Edge’.⁹
- 9.27 Changes in land use management practices can increase rates of surface water runoff. Typical issues that can have a significant impact include crop selection, removal of hedges and ditches (the removal of ditches requires consent) and soil compaction from grazing. The LLFA is working with landowners, parish councils, the National Farmers Union, Country Land and Business Association and other organisations to promote changes in land management practices which can reduce the impact of flooding, siltation of watercourses and provide opportunities to incorporate ecological benefits.

Case Study

The Woodland Trust has worked with farmers at Pontbren in Wales to understand the benefits of changes in land management and how this can benefit the water environment. Key lessons show that hedgerow restoration, new hedgerows and shelter belts have created a financially and biologically more sustainable farmed landscape.

Studies at Pontbren show that planting tree belts across slopes has led to increased infiltration of water into the soil. When modelled across the catchment the result was a potential reduction in peak flows of as much as 40%. This is clear evidence that integrating trees into farms can play a part in reducing flood risk downstream.

This farmer led initiative also showed the importance of an intimate knowledge of the land in designing and siting tree belts. The farmers knew where shelter was needed, but they also knew where runoff was a problem, where land lay wet for much of the year and those areas prone to erosion. They have managed simultaneously to improve the resilience and sustainability of their farms whilst delivering public benefits of improved water quality, flood mitigation and biodiversity gain.

⁹ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/403435/LIT_7114.pdf

Asset Management

- 9.28 Assets (e.g. watercourses, control structures, pumping stations, culverts, trash screens, gullies) that are not adequately maintained may not function appropriately during times of rainfall and could, therefore, exacerbate the consequences of flooding. In addition, over time, the performance of assets may be reduced due to deterioration.
- 9.29 The Environment Agency uses an asset management system (AIMS - Asset Information Management System) to manage the maintenance and condition of assets related to main rivers.
- 9.30 Severn Trent Water has an asset management system for its public sewerage network.

Worcestershire Asset Register (Register and Record of Structures and Features)

- 9.31 WCC and its partners have, in accordance with Section 21 of the Flood and Water Management Act, created and been gradually populating a simple register and more detailed record of assets (structures and features) which make a significant contribution to local flood risk management.
- 9.32 Additional data will be gathered for the register and record using a risk-based approach, focusing on the most vulnerable communities identified in the LFRMS and SWMP.
- 9.33 Asset maintenance programmes will need to be prioritised due to the availability of funding. Furthermore, because many assets are on third party land it will be necessary to work with landowners to ensure they maintain their assets appropriately. The RMAs will work closely with each other and riparian owners to ensure that the maintenance regime is targeted and cost-effective.
- 9.34 The asset register will be used to develop a risk-based approach for maintaining assets which have a critical effect on local flood risk by identifying assets whose performance will most significantly affect flood risk (e.g. where blockages to a culvert would cause property flooding).

Flood Resilience and Property Level Protection

- 9.35 In addition to the risk management authorities there is an important role to play for individuals, communities and businesses in managing flood risk. There are a number of measures that can be taken to reduce the risk and consequences of flooding including:
- Taking property-level resilience and resistance measures;
 - Bagging and binning leaves rather than allowing them to block drains;
 - Getting involved in local flood risk resilience groups;
 - Riparian owners taking responsibility for maintaining a proper flow of water in any watercourse that drains through their property.¹⁰
- 9.36 Successful local flood risk management will require local communities, businesses and riparian owners to work in partnership with risk management authorities and to take personal actions. Furthermore, local match funding contributions are increasingly required to secure Government capital so the RMAs will need to work with individuals, communities and businesses to identify potential sources.

¹⁰ Further advice available here: <http://www.gloucestershire.gov.uk/CHttpHandler.ashx?id=26530&p=0>

Preventing Sewer Blockages – Severn Trent Water

Surface water flooding, flooding of homes and pollution of rivers and streams can occur when sewers get blocked by unwanted items. Severn Trent Water clears over 55,000 sewer blockages every year and 75% of them are caused by putting the wrong items down the sink or toilet. They spend over £10 million each year regularly clearing over 700 kilometres of sewers of nearly 22,000 sewer blockages, a cost which is passed on to their customers.

Severn Trent Water works with communities to encourage small changes in behaviour and to promote the correct disposal of items such as fats, oils and greases which can solidify when they meet the cold sewer walls. These fats stick to the side of the sewer forming a concrete-like solid that attracts other debris, eventually causing a blockage.

For further advice visit: <http://www.stwater.co.uk/sewer/>

Funding and Implementation

- 9.37 To date the Government and Defra has committed funding annually to support LLFAs in their flood risk management roles and which to 2015 has been based on the level of risk each local authority faces. However, in the long term funding commitments are unclear and given the significant challenges faced by the public sector resource pressures are likely to remain. It will therefore be essential that partners work together collaboratively to maximise efficiency of resources.
- 9.38 A key principle of the Strategy is that actions and investment will be prioritised, where the consequences of flooding are greatest. The decision to invest in flood risk management will be a balance of social, economic and environmental factors. Therefore, funding may sometimes be invested in less vulnerable areas where economically viable 'quick wins' can be delivered.
- 9.39 The Strategy and SWMP in combination will provide a rolling programme of affordable, costed schemes and initiatives that will help to reduce flood risk. Prioritisation will be based on the evidence of the Worcestershire Surface Water Management Plan or where other information becomes available and partners will ensure that the limited financial resources are directed to the highest demonstrable areas of risk and impact. This prioritisation will be revisited and adjusted accordingly as our understanding of local flood risk improves over time and as new information becomes available.
- 9.40 Much has been achieved since the floods of 2007, in reducing the impacts of flooding in both larger scale projects such as Upton upon Severn and also in delivering the vital smaller projects that have reduced flood impacts for both residents and businesses in local communities across the county.
- 9.41 Worcestershire County Council has over the last seven years provided in excess of £14 million of capital investment for flooding and drainage projects across the county. This investment has importantly, levered in over £16m of additional partnership funding from a variety of sources including our district council partners, Severn Trent Water, parish councils and the Environment Agency.
- 9.42 The LFRMS is required to set out how the proposed actions and measures will be funded and resourced. A key factor will be to identify what funding mechanisms are available to pay for the flood risk management measures that are set out in the Strategy. This will include establishing the costs and benefits of individual proposed projects and consideration of local contributions and beneficiaries where appropriate. Implementation of flood policy objectives will require adequate resources for management and response activities as well as for capital projects.

- 9.43 The Environment Agency is responsible for allocating central government funding to manage flood and coastal erosion risk in England. Nationally, Defra spending on flood and coastal erosion risk management reduced by 8% from 2011 to 2015.
- 9.44 A new funding arrangement has been introduced by Defra, which encourages community and business contributions to the funding of schemes, which improves their chance of being supported through the national funding allocation. National funds for works, known as ‘Flood Defence Grant in Aid’, is allocated according to a national formula that uses a range of different criteria to establish the relative priority of schemes, and thereby to establish how much national funding each scheme can attract.
- 9.45 The likelihood of success of an FRM funding proposal will be improved if the cost burden is shared amongst as many contributors as possible, the share from the national allocation is as low as possible and the outcomes from the proposal are evidenced as clearly as possible. The new national funding scheme has also been extended to include proposals that address risk from surface water flooding as well as from main river-related fluvial flooding.
- 9.46 However, it also means that fewer schemes will be fully funded from this source, with some schemes receiving a proportion of the overall cost or no funding at all. Any shortfall will need to be made up at the local level. There are a number of other potential sources of funding, including:
- The local levy which is funded by LLFAs and administered by the Regional Flood and Coastal Committee
 - Local Enterprise Partnership funds including regional growth funds and EUSIF
 - Planning contributions including S106, CIL and in-kind contributions
 - Water Framework Directive funds
 - Direct funding from RMA budgets
 - Community contributions including from parish councils
 - Private sector funding contributions from developers and businesses including BIDs (Business Investment Districts)

Local Levy Funding

- 9.47 All LLFAs contribute annually to the Local Levy Fund, which is administered and allocated by the RFCC.
- 9.48 The level of contribution is calculated by a formula based on the number of ‘Band D’ council tax properties within the LLFA boundary. The total levy pot is then distributed to a number of flood alleviation schemes proposed by the LLFAs in collaboration with the Environment Agency.
- 9.49 Each year the RFCC votes on the level of levy to be set for the following financial year and also which of the submitted schemes will receive funding and be slotted into the rolling programme. This is strongly guided by the Environment Agency’s national scoring system. The RFCC, LLFA and partners will need to continue to work in partnership to explore opportunities to co-ordinate funding including maximising the leverage of commercial contributions.
- 9.50 Worcestershire has benefited from RFCC funding as illustrated in the table below. The majority of this spend has been from FDGiA and Local Levy allocation, drawn down as a result of the Local Levy contribution. However, WCC has also contributed a proportion of the total spend each year from the capital highways budget including, for example, £1m to the Upton-upon-Severn scheme in 2012/13.

Year	WCC Local Levy Contribution	Spend on FRM schemes in Worcestershire (approx)
2004/05	£197,501	£535,000
2005/06	£206,288	£690,000
2006/07	£218,221	£400,000
2007/08	£252,164	£0
2008/09	£215,124	£644,000
2009/10	£220,095	£4,900,000
2010/11	£216,382	£845,000
2011/12	£220,000	£773,000
2012/13	£220,000	£6,100,000
2013/14	£220,000	£589,000
2014/15	£220,000	£610,500
2015/16	£220,000	£599,500
2016/17	£220,000	£716,000
Total	£2,845,775	£17,402,000

Table 9 RFCC expenditure Worcestershire 2004–2017

- 9.51 Severn Trent Water and South Staffs Water plan their investment strategies through five yearly Asset Management Plans (AMPs), which are fundamental to the management of the public sewerage, water treatment and supply systems and adapting to future climate change. AMP6¹¹ contains 10 key outcomes / objectives with 45 associated measures of success / performance commitments. These reflect Severn Trent Water Ltd statutory duties, priorities and income.
- 9.52 The County Council and LLFA have already contributed to the development of AMP6. The LFRMS should play an important role in influencing the development of future business plans and, in particular, the formulation of the next five-yearly cycle, this will include the development of the plan for 2020 to 2025 (AMP 7).

Flood Risk Management Funding Plan

- 9.53 In 2011 WCC received a grant of £140,000 to enable it to begin delivering its new statutory responsibilities within the Flood & Water Management Act (2010). In 2012 this grant rose to £250,000 in recognition of the additional capacity needed to implement the new responsibilities.
- 9.54 However, in 2013 the grant was cut by £135,000 (54%). The responsibilities have remained the same and the reduction was compensated by WCC from its own budget in order that the essential work could continue. In 2015 the grant was reduced by a further £40,000 (33%) with no lessening of responsibilities. Again WCC is set to compensate from its own budget.
- 9.55 WCC is also committed to spending a further £1.5m on flood alleviation schemes and this will continue to draw down significant additional external funding into the county.
- 9.56 WCC has dedicated staff capacity in its Flood Risk Management Team for the production and implementation of a Flood Risk Management Funding Plan. The Plan will guide the procurement of local, regional and national funding to support implementation of the LFRMS. This capacity will also provide support, particularly to local authority partners, for the development and management of future funding applications and bids.

¹¹ AMP6 plans are summarised in our business plan on the website. <http://www.stwater.co.uk/2020-plan>.

- 9.57 However, it should be recognised that the funding available for flood risk management is never going to be sufficient to address all existing flood risks and the increasing future risk brought about by a changing climate. The approach to flood risk management will need to be supplemented by the efforts of partners and communities and by those at risk taking responsibility and making the most of opportunities to help themselves.

Case Study – Peopleton flood defence scheme

There are already a number of examples of this partnership approach to funding flood defence measures in Worcestershire.

The village of Peopleton in Worcestershire helped to fund its own flood defences in 2010. The village was severely affected in 2007 where flooding saw 45 homes inundated in the village. The project involved the digging of a ditch, the installation of a road culvert and the laying of huge pipes beneath the village's surrounding fields, a process which had estimated costs of £150,000.

The funding was found through a mixture of revenues raised from the parish council/local residents (£25,000), a Government loan (£50,000) and contributions from both the District Council and the County Council.

Highways Schemes

- 9.58 Since the major floods of 2007, Worcestershire County Council has invested in excess of £14m into capital flood alleviation and drainage projects across the county. This investment has, importantly, levered in over £16m of additional partnership funding from a variety of sources including national and local government and the Environment Agency. Flood risk management and highway drainage are now part of the same team which will assist in integrating these two operations.
- 9.59 This overall investment has resulted in over 860 schemes from relatively small highway drainage improvements to medium sized village schemes at places such as Powick, Harvington and Wolverley to large-scale schemes such as those at Upton upon Severn, Bewdley and Hylton Road in Worcester.
- 9.60 In addition to this capital investment, there has been a significant revenue investment in the cyclical maintenance of highways drainage assets accompanied by dramatically improved methodologies and partnership working arrangements with the district council land drainage teams and other organisations such as the Environment Agency, Severn Trent Water Ltd and the Canal & Rivers Trust.
- 9.61 Each severe weather event results in the need for additional schemes. For example 770 highway drainage issues were reported between January and June 2014 resulting in the need for an additional 105 schemes to help protect properties, businesses and critical infrastructure.
- 9.62 Despite the excellent progress that has been made there is still a significant programme of outstanding schemes and climate change projections suggest more will inevitably be added to the programme in the future. Therefore, there is a clear need for continued investment and the procurement of funding from a range of sources.
- 9.63 For example, New Homes Bonus and Local Growth Fund from the Local Enterprise Partnership have been secured to combine with core WCC capital and revenue funding to enable:
- The implementation of a number of major highway flood adaptation schemes
 - The completion of the outstanding programme of high priority smaller scale highway drainage improvement schemes and continued maintenance of highway drainage infrastructure
- 9.64 This funding will also be used to contribute to other major flood alleviation schemes, such as the Badsey Brook Flood Alleviation Scheme in Broadway, thus helping to draw down further inward investment such as Local Levy and Flood Defence Grant in Aid.

Highway Drainage Capital Scheme Programme

- 2015-16

A44 Evesham major highway adaptation scheme

- 2016-17

A4104 Upton and A44 New Road, Worcester major highway adaptation schemes

- 2017-18

B4084 Pershore and Powick Roundabout major highway adaptation schemes

9.65 Future LLFA investment will be based on a number of criteria which will be identified in the Flood Risk Funding Management Plan (see paragraph 9.54) including:

- The development of a criteria based policy that facilitates and considers economic, social and environmental benefits that reflect Worcestershire priorities.
- Floodspot prioritisation within the Worcestershire SWMP, which will facilitate targeted corresponding resource allocation and fundraising efforts.
- Potential schemes will be appropriately introduced to the RFCC and its 6 year programme in order that potential Local Levy and FDGiA contributions can be maximised.
- However, it will be essential to secure other local match funding such as contributions from local authorities, local beneficiaries and funding streams such as the SEP Local Growth Fund, New Homes Bonus, developer contributions.



Drainage scheme, Littleworth

Skills and Capacity

9.66 Central to delivering the Strategy and the new statutory roles and functions will be the ability for RMAs to have the requisite skills and to be capable of challenging expert external advice, commissioning work or producing it in house. Local Authority officers will need to understand both the technical and local issues under consideration.

9.67 Once these skills, capabilities and knowledge have been acquired it is also essential that they are maintained. This will need to include the on-going maintenance of professional codes and standards and will be essential where assets and systems are in place and where their potential failure could result in damage to property, infrastructure, businesses, the environment or even the loss of life.

9.68 Defra and the Environment Agency are working to build the knowledge and skills that will help flood risk authorities to carry out their roles and responsibilities. Locally county and district officers have attended regional training workshops run by Defra as part of their capacity building strategy.

9.69 It is clear that the responsibilities (such as the new statutory consultation role) placed on upper tier authorities as LLFAs will require additional resources. In order to enable the resilience of the LLFA to deliver the new roles and responsibilities, there will be a need to ensure longevity in budgets and funding to facilitate future proofing and enable the retention and building of both skills and capacity.

9.70 The LLFA has worked with the North Worcestershire Water Management and South Worcestershire Land Drainage Partnership shared services and implemented joint working arrangements that have enabled capacity building and increased resilience. In addition working with partners has enabled the placement in Worcestershire of several students through the Environment Agency Foundation degree course.

9.71 Other actions to build capacity include:

- Attendance of Defra and Environment Agency workshops to support the delivery of the LLFA role; Worcestershire County Council ecologists provided biodiversity training for officers of the LLFA, NWWM and SWLDP. These officers have also attended workshops on environmental compliance and ecology.
- Land Drainage Law training – officers of the LLFA, NWWM and SWLDP attended CPD hosted by Wychavon District Council on Land Drainage Law.
- Attendance at regional working groups and workshops.



Ordinary watercourse

10. Environmental Objectives

Section 10: The following section outlines how the Strategy will support sustainable development and the use of natural processes to mitigate flood risk and improve the resilience of Worcestershire’s natural environment and economy.

The Natural Environment

- 10.1 The LLFA recognises the role of the natural environment and land management in managing flood risk. The likelihood of negative effects can be reduced through the use of natural flood risk management, working through a green infrastructure approach. In developing and delivering the Strategy, Worcestershire County Council is working with partners to develop an understanding of where land management changes could help manage flood risk.
- 10.2 The implementation of flood risk management measures provides a significant opportunity to improve the natural and built environment across Worcestershire. This includes providing better environments for residents and businesses as well as improving biodiversity and local habitats for wildlife. The Flood and Water Management Act states that: “*the local strategy must specify how it will contribute to the achievement of wider environmental objectives and sustainable development*”.
- 10.3 The Act lists “maintaining or restoring natural processes” as a way of managing flood risk, and provides powers for the Environment Agency, local authorities and Internal Drainage Boards to manage flooding in the interests of nature conservation (including the conservation of the landscape), preservation of cultural heritage, and people’s enjoyment of the environment generally. This Strategy will contribute to the achievement of wider environmental objectives in the following ways:
 - Encouraging upstream catchment management measures where appropriate.
 - Encouraging the use of source control measures (such as sustainable drainage), which can help improve water quality through reducing runoff and therefore reducing diffuse pollution entering watercourses and drainage systems.
 - Promoting Water Framework Directive targets and River Basin Management Plan actions, to ensure no deterioration of surface water and groundwater and the protection of water bodies and communities as new flood risk management schemes are implemented.
 - Seek to ensure that opportunities from new development and redevelopment are planned in accordance with green and blue infrastructure principles.

- Enhance biodiversity and habitat creation within any future capital schemes, such as SuDS or flood storage areas.
 - Assess the positive, neutral and negative impacts of flooding on historic and environmental assets. This will allow for potential improvements to be identified for these assets in relation to flood risk management works.
- 10.4 Man-made flood defences will continue to play a role in flood risk mitigation. However, there is increasing recognition of the importance of natural processes not only in flood defence but also in helping communities and businesses adapt to climate change. This includes mitigating the impacts of urban heat island effect and improving the energy efficiency of buildings for example the installation of green roofs or retrofitting of SuDs.
- 10.5 Farmers and land owners in Worcestershire can make a positive contribution to the environment and are involved in a range of different schemes which are contributing positively to flood risk management and environmental quality. Changes in land management practices will need to be undertaken in consultation with land- owners. The LLFA and partners recognise the importance of this partnership approach and works with farmers and land-owners in a range of and hope to continue this into the future.

Strategic Environmental Assessment

- 10.6 The FWMA requires RMAs to aim to make a contribution towards the achievement of sustainable development when exercising their flood and coastal erosion risk management functions. To ensure the Strategy contributes to the achievement of wider environmental objectives it is important that it is subject to Strategic Environmental Assessment (SEA).
- 10.7 The objective of the SEA directive is “to provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view to promoting sustainable development.” It requires certain plans and programmes to have an environmental assessment, known in the UK as an SEA.
- 10.8 In addition to an SEA the County Council is also required to undertake a Habitats Regulations Assessment (HRA). The purpose of the HRA is to determine whether any of the measures in the emerging LFRMS are likely to have a significant effect on any Special Areas of Conservation (SAC), Special Protection Areas (SPA) or Ramsar sites, and thus if a full Appropriate Assessment under the Habitats Regulations is required.
- 10.9 The Strategy has been updated to reflect recommendations arising from the Draft LFRMS HRA Screening report, to ensure that there are no adverse impacts on the relevant (Natura 2000) sites and that relevant enhancements are delivered.
- 10.10 While a Strategic Environmental Assessment is being undertaken as part of the Local Flood Risk Management Strategy there is considerable uncertainty involved in strategic assessments at this level. It is therefore important that before the development of any measures and actions undertaken as part of the Strategy that further more detailed studies are undertaken at a project level. This will help to assess the potential environmental and social impacts (including to internationally important sites) and identify any mitigation or enhancement opportunities. This may include the need to carry out specific Habitats Regulations Assessments to assess adverse impacts to the designated Natura 2000 sites and to ensure that proposals include appropriate design.

The Water Framework Directive

- 10.11 The Water Framework Directive (WFD) is EU legislation that requires member states to make plans to protect and improve the water environment. The aim of the WFD is to protect and improve the aquatic environment and it does this by requiring the assessment of the status of many components of aquatic ecosystems.
- 10.12 The WFD was transposed into law in the UK by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003. There are 4 main aims of the Water Framework Directive. These are:
- Create a better quality of life for everyone
 - To improve and protect inland and coastal waters
 - Drive wiser, sustainable use of water as a natural resource
 - Create better habitats for wildlife that lives in and around water.

- 10.13 It is a requirement under the WFD for water bodies to meet ‘good ecological status’. There are different timescales for these targets dependent on the classification of the watercourse and its current condition. River Basin Management Plans have been written to implement the Water Framework Directive in England.
- 10.14 River Basin Management Plans establish objectives and are developing a programme of measures to meet those objectives. The WFD has set a target that all surface and ground waters should aim to reach ‘good status’ by 2015. Any surface water body which has had substantial changes to its physical character as a result of physical alterations caused by human use, otherwise known as ‘heavily modified’ watercourses, need to reach ‘good ecological potential’ by 2015. All water bodies must reach ‘good’ or ‘high’ status by 2027 (heavily modified need to reach their maximum potential, known as ‘good potential’ by this timeframe).
- 10.15 Local authorities and partner risk management authorities play a significant role in identifying and addressing synergies and tensions between management of flood risk, development and river basin management. The LLFA and partners will work with the Environment Agency to identify circumstances where water body status is likely to be a significant issue and schemes can contribute to water quality improvement and sustainable growth.
- 10.16 Worcestershire County Council and Wyre Forest District Council have worked in partnership with the Environment Agency and Sustainability West Midlands to prepare an advice note on the WFD for local authorities across the Midlands.

Sustainable Development

- 10.17 Mitigation measures have the potential to reduce a developments environmental impact and enhancement measures could see environmental improvements through the provision of habitat and the enhancement of amenity. There is also a risk that poorly conceived mitigation measures could negatively impact on other features through construction activities or by disturbing the natural flow of water.
- 10.18 Opportunities to enhance the environment and provide habitat and amenity will be sought where possible in the delivery of flood risk management schemes, especially if they could help to achieve other partners’ aims, such as providing public health benefits or contributing to the delivery of the Worcestershire Green Infrastructure Strategy.
- 10.19 Altering the flow of water may have an impact on sites downstream that rely on water. There are many designated sites for biodiversity, habitats and species in Worcestershire and many of these are water sensitive. The impact of flood risk management schemes needs to be assessed thoroughly if there is any potential impact downstream or if cross boundary measures will be required. The mitigation for any such impact may be incorporated into the design of the schemes themselves.
- 10.20 Environmental impacts should be assessed at an early stage of the design of schemes and appropriate consultation should be undertaken with relevant stakeholders to scope any potential effects.
- 10.21 A key tenet of this Strategy is sustainable development in the delivery of the local flood risk management. Some of these opportunities are identified in the Strategic Environmental Assessment.
- 10.22 Defra has developed a document named the ‘Guidance for risk management authorities on sustainable development in relation to their flood and coastal erosion risk management functions’ that defines the contribution that all flood risk management authorities must make towards the achievement of sustainable development.
- 10.23 A common approach of mitigating or adapting to the risk of flood is the use of more sustainable ‘softer’ approaches. This is reflected in the government strategy for flood and coastal risk management ‘Making Space for Water’, which states that the concept of sustainable development should be firmly rooted in all flood risk management decisions and operations. This will manifest itself on the ground in the form of more flood solutions working with natural processes.

- 10.24 Working more with natural processes can also realise a wide range of other benefits, from creating new habitats and enhancing biodiversity to providing large expanses of green space for recreation and amenity. This multifunctional approach is a key driver behind the emphasis placed within the FWMA on the use of SuDS to manage surface water.

Climate Change

- 10.25 There is consensus amongst climate model projections presented in the IPCC fourth assessment report for northern Europe suggesting that in winter high extremes of precipitation are very likely to increase in magnitude and frequency. These models project drier summers with increased chance of intense precipitation — intense heavy downpours interspersed with longer, relatively dry periods (Solomon et al., 2007).
- 10.26 The UK data produced under the UKCP09 project highlight some of the possible changes in climate we could see over the coming years. If emissions follow a medium future scenario the UKCP09 projected changes by the 2050s relative to the recent past are:
- Winter precipitation increases of around 12% (very likely to be between 2 and 26%).
 - Precipitation on the wettest day in winter to increase by around 9% (very unlikely to be more than 22%).
 - Peak river flows in a typical catchment likely to increase between 9 and 18%.
- 10.27 Climate changes can affect local flood risk in several ways. Impacts will depend on local conditions and vulnerability. Wetter winters and more of this rain falling in wet spells may increase river flooding along the main rivers and their tributaries. More intense rainfall causes more surface runoff, increasing localised flooding and erosion. In turn, this may increase pressure on drains, sewers and be detrimental to water quality. Rainfall intensity in summer could be higher, increasing the need to be prepared for localised storms.
- 10.28 National policy on climate change highlights some of the risks and opportunities a changing climate could bring. The UK Climate Change Risk Assessment 2012 sets out the key risks to sectors such as health and wellbeing and infrastructure. This is reviewed every 5 years. As a result of the risk assessment, the government has produced a National Adaptation Programme, which identifies actions to increase resilience in each sector.
- 10.29 The Worcestershire Climate Change Strategy provides a local response to tackling climate change. The vision of the Worcestershire Climate Change Strategy is for:
- A county resilient to volatile costs of fossil fuels and severe weather.
 - A county with businesses and residents empowered to take action themselves.
- 10.30 The specific impact of climate change on local flood risk in Worcestershire is poorly understood. Projections suggest an increased intensity of rainfall the implication of which is that excess water will need managing.
- 10.31 Several national flood maps have informed the development of the Preliminary Flood Risk Assessment report and the Surface Water Management Plan- specifically the Flood Map for Surface Water, Areas Susceptible to Surface Water Flooding, Areas Susceptible to Groundwater Flooding and Flood Map (ordinary watercourses). However, these do not specifically show the impact of climate change on local flood risk.
- 10.32 Some drainage systems across the county have however been modified to help improve the management of water levels and could help in adapting locally to some impacts of future climate change on flooding.
- 10.33 Over recent years there have been a number of studies in to the impacts of climate change including planning for climate resilient infrastructure and the Local Climate Impacts Profile (LCLIP), which records impacts of each severe weather event in Worcestershire. The Worcestershire LCLIP records impacts from a number of major flooding events that have affected services and residents. This record is updated following each severe weather event.
- 10.34 Where appropriate, further studies will be required to better understand climate impacts in detail, including effects from other factors such as land use changes. However, sustainable development, the use of SuDS and other land management measures will help us adapt to climate change and manage the risk of damaging floods in future.

- 10.35 Worcestershire County Council is supporting Cranfield University on a research project to better understand the potential future impacts of soil moisture deficits on infrastructure (including water infrastructure) as a result of climate change.

Green Infrastructure

What is Green Infrastructure?

Green infrastructure (GI) is the planned and managed network of green spaces and natural elements that intersperse and connect our cities, towns and villages.

GI comprises many different elements including biodiversity, the landscape, the historic environment, the water environment (also known as blue infrastructure) and publicly accessible green spaces and informal recreation sites.

Traditionally the focus has been on the environmental benefits of these green spaces, but the underlying principle of GI is that the same area of land can frequently offer multiple benefits. The green infrastructure approach therefore integrates consideration of economic, health and social benefits to ensure that delivery against both environmental and socio-economic objectives is central to the planning, management and delivery of these spaces.

Green spaces and natural elements do not exist in isolation. Considering networks in an integrated way also achieves benefits that are far greater than when individual components are considered separately.

- 10.36 Worcestershire has a high-quality natural environment and numerous green infrastructure assets, which contribute to the unique character of the county. The landscapes and habitats of the Malvern Hills and the Wyre Forest are nationally recognised. Recreational resources ranging from the Droitwich Canals to the Lickey Hills are widely appreciated by local communities and visitors alike, making valuable contributions to Worcestershire's economy.
- 10.37 Green infrastructure can offer practical and viable solutions, providing environmental services to support and enhance new and existing developments, contributing to the economic success of the county.
- 10.38 The Worcestershire Green Infrastructure Strategy, produced by the Worcestershire Green Infrastructure Partnership, describes the need for green infrastructure in the county and sets a vision for the delivery of green infrastructure. Integrating surface water management into green infrastructure can bring a wide range of benefits.
- 10.39 A major benefit can come from trees and other green spaces, which intercept rain, reducing the volume and rate of runoff. Interception by trees increases the volume of water that infiltrates into soil and the rate of evapotranspiration. Slowing the speed at which rainwater reaches the watercourses or drainage features reduces the risk of surface water flooding and the likelihood of pollutants harming water quality¹² whereas an increase in paved areas can accelerate runoff rates and increase volume.
- 10.40 Planting trees and woodland will not stop all flooding. Engineered flood defences will continue to be needed to prevent inundation of many places. But it is clear that strategically located trees and woodland, in both urban and rural environments can play an important part in reducing flood risk, whilst also improving water quality, contributing to biodiversity conservation.
- 10.41 The Strategy will reduce the risk of surface water flooding by identifying opportunities to work with natural processes and protecting, restoring and emulating the natural function of catchments. A more natural approach to risk management may take a number of forms across a range of spatial scales and in different parts of catchments including:

¹² Trees in our towns - The role of trees and woodland in managing urban water quality and quantity. The Woodland Trust.

Planting trees to protect water: The role of trees and woods on farms in managing water quality and quantity – The Woodland Trust

- Replacing the use of hard materials such as concrete with sustainable drainage systems (SuDS) in urban areas
 - Restoring floodplains to store more water in rural areas
 - Creating managed flood storage areas by rivers or watercourses
 - Creation of green infrastructure and encourage appropriate planting of trees.
- 10.42 Through integrated planning at the catchment scale the Strategy will help to align the LFRMS, surface water management plans, river basin management plans and catchment flood management plans, to achieve a catchment-based approach. This single joined-up planning approach will help meet the requirements of the Water Framework Directive, Habitats Directive and Floods Directive, as well as more sustainable flood risk management.
- 10.43 The LLFA will work with the Worcestershire Green Infrastructure Partnership to develop a comprehensive and prioritised programme of actions and interventions to inform the LFRMS implementation plan and Worcestershire Green Infrastructure Implementation Plan.

The Historic Environment

- 10.44 Flooding can shape and has shaped the historic environment. Insensitively designed flood mitigation works can impact on historic environment character and individual heritage assets. Alleviation works can also push floodwaters elsewhere downstream and could impact on heritage assets not previously subject to flooding.
- 10.45 Preventative measures and repairs/restoration following flooding need to be designed to take account of the historic environment to prevent harm to the fabric of individual buildings, but also the county's distinctive and valued character, impacting on tourism and the environment. Appropriate consideration of the historic environment within flood risk planning and management can present a number of opportunities, ranging from the re-use of historic water-management systems, to garnering a greater understanding of modern flooding through research into historic events. Works associated with flooding can also provide opportunities for archaeological research through mitigation, as happened during the construction of the Kempsey flood alleviation scheme, which unearthed Anglo-Saxon burials.
- 10.46 When flood risk management schemes are planned it is important that the potential impact on the historic environment is fully considered and any unavoidable damage is minimised. This is best secured by early consideration of the local historic environment following consultation with the Worcestershire Historic Environment Record.
- 10.47 Worcestershire Archive and Archaeology Service (WAAS) has been commissioned by Historic England to undertake a project aimed at appraising the impact of flooding and flood mitigation on the county's distinctive and rich historic environment and landscape character.
- 10.48 The project involves cross-referencing Environment Agency and WCC flood mapping (including hotspots) against the 40,000 Historic Environment Record entries, to identify assets potentially at risk from fluvial and pluvial flooding, and also assets that could play a role in flood management (such as historic leats, mills, etc.). This has led to around 15,000 assets being identified for consideration.
- 10.49 This will form a valuable evidence base to inform the subsequent appraisal of sites. The catalogue will also be used to inform SuDs schemes, flood alleviation works and the SWMP.
- 10.50 In detail the project aims to:
- Understand immediate threats to Worcestershire's historic environment through flood events and consequent mitigation, adaptation, response and recovery.
 - Identify which parts of Worcestershire's heritage are at greatest risk from these threats.
 - Where possible reduce the impact of these threats on heritage.
 - Provide guidance to make heritage more resilient to these threats through mitigation and adaption before flood events.

- Develop effective counter-disaster responses for heritage.
- Inform and influence third party bodies' responses to these threats to reduce further negative impacts on heritage and provide inter-agency/inter-disciplinary working.
- Produce guidance for other local authorities and heritage practitioners on the opportunities offered by the historic environment for sustainable flood management, and effective methodologies for incorporating the historic environment into flood management plans.
- Inform public perception and understanding of flooding in both the present and the historical past, which might provide platforms for community engagement and community mitigation of flood risk.

10.51 The aim is to provide an accessible and easy-to-use dataset that can be interrogated by developers, planners, and communities, to improve awareness of the risks to and opportunities from the historic environment. The second stage of the project will analyse these datasets in more detail alongside studying recent academic work and flooding-related projects, with the third stage assessing and improving community awareness and engagement (including through case studies involving Neighbourhood Plans, Flood Action Groups, etc.).

Appendix 1

Principal Flood Risk Legislation and Policy

The Flood and Water Management Act 2010

The Flood & Water Management Act (FWMA) gained royal assent on the 8th April 2010 and provides legislation for the management of risks associated with flooding and coastal erosion. Many of the recommendations contained in the Pitt Review have been enacted through the Flood and Water Management Act.

The Act reinforces the need to manage flooding holistically and in a sustainable manner and places a number of roles and responsibilities on upper tier authorities such as Worcestershire County Council, which is designated a Lead Local Flood Authority. The preparation of this Local Flood Risk Management Strategy is just one of the duties placed upon the County Council under this piece of legislation.

The Act defines various bodies which are ‘risk management authorities’ and lists them as the following:

- Lead Local Flood Authority
- The Environment Agency
- district council
- internal drainage board
- water company
- highway authority

The Land Drainage Act 1991

The Land Drainage Act 1991 outlines the duties and powers to manage land drainage for a number of bodies including the Environment Agency, Internal Drainage Boards (IDB), local authorities, navigation authorities and riparian landowners. The Flood and Water Management Act 2010 has updated many parts of this legislation to integrate the role of LLFAs. The powers and duties under this act can be summarised as:

- A duty on a drainage board to exercise a general supervision over all matters relating to the drainage of land
- A general duty to the environment when exercising powers
- Powers to maintain, improve and build new works required for drainage
- Consenting and enforcement powers for ordinary watercourses
- Powers to make byelaws
- General powers of entry onto land for water level management so that statutory authorities can exercise flood risk management functions for the common good.

Flood Risk Regulations (2009)

The Flood Risk Regulations (2009) bring the EU Floods Directive into UK law. The Regulations give responsibility to:

The Environment Agency to prepare, collate and publish Directive deliverables: preliminary assessment report, flood risk maps and hazard maps, Preliminary Flood Risk Assessments (PFRA) and flood risk management plans - for flood risk from the sea, main rivers and reservoirs

LLFAs to do the same for all other forms of flooding (excluding sewer flooding).

The National Strategy for Flood and Coastal Erosion Risk Management

The Flood and Water Management Act 2010 requires the Environment Agency to develop, maintain, apply and monitor a strategy for flood and coastal erosion risk management in England. It can be found here: <http://publications.environment-agency.gov.uk/dispay.php?name=GEHO0711BTZE-E-E>

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 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 six 'guiding principles' of the National Strategy are:

- Community focus and partnership working
- A catchment and coastal 'cell' based approach
- Sustainability
- Proportionate, risk-based approaches
- Multiple benefits
- Beneficiaries should be allowed and encouraged to invest in local risk management

National Planning Policy Framework

The Government published the National Planning Policy Framework (NPPF) in March 2012 and has been designed to streamline previous planning policy. The NPPF is accompanied by technical guidance on flood risk management, which retains much of the guidance that was contained in the previous Planning Policy Statement 25 (PPS25). The aim is to reduce development in flood risk areas and reinforces the requirement for sustainable surface water management in new developments.

Making Space for Water

Making Space for Water states that Government will, over the 20-year lifetime of the National Strategy, implement a more holistic approach to managing flood and coastal erosion risks in England. The approach involves taking account of all sources of flooding, embedding flood and coastal risk management across a range of Government policies. The aim is to manage risks by employing integrated approaches that reflect both national and local priorities. This will reduce the threat to people and their property and deliver the greatest environmental, social and economic benefit, consistent with the Government's sustainable development principles.

The development and implementation of the Strategy will be influenced by and build upon a number of other plans, strategies and reports at the regional, sub-regional and local level.

Appendix 2

LLFA Roles and Responsibilities

Duty to investigate flooding - LLFAs have a duty to co-ordinate the investigation and recording of flood events within their area that they deem to be significant. This duty includes identifying which authorities have flood risk management functions and what they have done or intend to do with respect to the incident, notifying RMAs where necessary and publishing the results of any investigations carried out.

Duty to produce an Asset Register - LLFAs have a duty to maintain a register and record of structures or features that are considered to have a significant effect on flood risk, including details of ownership and condition. The register must be available to the public on request.

Power to designate flood risk management structures - LLFAs have powers to designate structures and features that affect flooding or coastal erosion in order to safeguard them.

Duty to approve, adopt and maintain Sustainable Drainage Systems - LLFAs were due to be designated as SuDS Approving Bodies (SABs) with a duty to approve, adopt and then maintain sustainable drainage systems in new developments of more than one property.

However, this section of the Act was never commenced and it has been replaced by an expectation that Local Planning Authorities (LPAs) will ensure the installation and maintenance of SuDS via the existing planning process. In order to help LPAs assess SuDS proposals, LLFAs have been designated as statutory consultees.

Power to carry out works - LLFAs have powers to undertake works to manage flood risk from surface runoff and groundwater, consistent with the local flood risk management strategy for the area.

Duty to administer and enforce the Land Drainage Act with regard to Ordinary Watercourses – LLFAs must administer requests for consent to make significant changes to a watercourse. They also have the power to carry out enforcement action if works are carried out without consent, or if a riparian owner fails to carry out their own responsibilities.

Local Flood Risk Management Strategy

The Strategy must be consistent with the National Flood and Coastal Erosion Risk Management Strategy for England. It should also be developed and maintained in consultation with stakeholders such as the other RMAs and the public. Local Flood Risk Management Strategies must specify:

- The risk management authorities in the authority's area
- The flood and coastal erosion risk management functions that may be exercised by those authorities in relation to the area
- The objectives for managing local flood risk (including any objectives included in the authority's flood risk management plan prepared in accordance with the Flood Risk Regulations 2009)
- The measures proposed to achieve those objectives
- How and when the measure are expected to be implemented
- The costs and benefits of those measures and how they are to be paid for
- The assessment of local flood risk for the purpose of the strategy
- How and when the strategy is to be reviewed
- How the strategy contributes to the achievement of wider environmental objectives

Local Flood Risk Management Strategies are statutory documents and relevant organisations must act consistently with and have due regard for them.

Appendix 3

Risk Management Authorities' Roles and Responsibilities

The risk management authorities have:

- a duty to act consistently with the national and local flood risk management strategies (water and sewerage companies must have regard to local strategies) when exercising flood risk management functions:
- a duty to be subject to scrutiny by the LLFA's democratic processes
- a duty to co-operate with other RMAs in the exercise of their flood and coastal erosion risk management functions, including sharing flood risk management data
- a duty to contribute towards the achievement of sustainable development in the exercise of flood or coastal erosion risk management functions and to have regard to any appropriate ministerial guidance
- power to designate structures and features that affect flooding or coastal erosion (not water and sewerage companies)
- power to take on flood and coastal erosion functions from another RMA when agreed.

Environment Agency

Responsibilities for the Environment Agency include:

- a national strategic overview role for all forms of flooding, and a duty to develop a National Strategy for Flood and Coastal Erosion Risk Management to cover all forms of flooding
- to report to Ministers about flood and coastal erosion risk management including application of the national strategies for England and Wales and management of flood risk by all risk management authorities
- powers to request information in connection with the Environment Agency's flood and coastal erosion risk management functions.
- power to designate structures and features that affect flooding or coastal erosion
- powers to cause flooding and erosion for nature conservation and cultural heritage reasons, and people's enjoyment of these.
- regulating flood risk from reservoirs

Appendix 4

Action Plan

The Local Flood Risk Management Strategy Action Plan is a dynamic document which is updated annually.

The latest version can be found at: http://www.worcestershire.gov.uk/info/20236/flood_risk_management.

Please contact us if you need this document in another format, or if you have any questions.

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