Environment Agency

Bristol Avon Catchment Flood Management Plan

Summary Report June 2012

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Introduction

I am pleased to introduce our summary of the Bristol Avon Catchment Flood Management Plan (CFMP). This CFMP gives an overview of the flood risk in the Bristol Avon catchment and sets out our preferred plan for sustainable flood risk management over the next 50 to 100 years.

The Bristol Avon CFMP is one of 77 CFMPs for England and Wales. Through the CFMPs, we have assessed inland flood risk across all of England and Wales for the first time. The CFMP considers all types of inland flooding, from rivers, ground water, surface water and tidal flooding, but not flooding directly from the sea (coastal flooding), which is covered by Shoreline Management Plans (SMPs). Our coverage of surface and ground water is however limited due to a lack of available information.

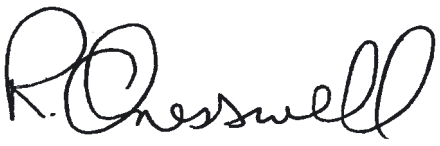
The role of CFMPs is to establish flood risk management policies which will deliver sustainable flood risk management for the long term. This is essential if we are to make the right investment decisions for the future and to help prepare ourselves effectively for the impact of climate change. We will use CFMPs to help us target our limited resources where the risks are greatest.

This CFMP identifies flood risk management policies to assist all key decision makers in the catchment. It was produced through a wide consultation and appraisal process, however it is only the first step towards an integrated approach to Flood Risk Management. As we all work together to achieve our objectives, we must monitor and listen to each others progress, discuss what has been achieved and consider where we may need to review parts of the CFMP.

The Bristol Avon catchment has a history of flood risk, and over the last 60 years numerous engineering schemes have been implemented to reduce flood risk in the catchment. At present 7,000 properties are at risk in the catchment in a 1% event. This is likely to increase to over 20,000 properties in the future.

We cannot reduce flood risk on our own, we will therefore work closely with all our partners to improve the co-ordination of flood risk activities and agree the most effective way to manage flood risk in the future. We have worked with others including: Bristol City Council, Natural England, Wessex Water and the National Farmers Union to develop this plan.

This is a summary of the main CFMP document, if you need to see the full document an electronic version can be obtained by emailing enquiries@environment-agency.gov.uk or alternatively paper copies can be viewed at any of our offices in South West Region.



Richard Cresswell
South West Regional Director

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The purpose of a CFMP in managing flood risk

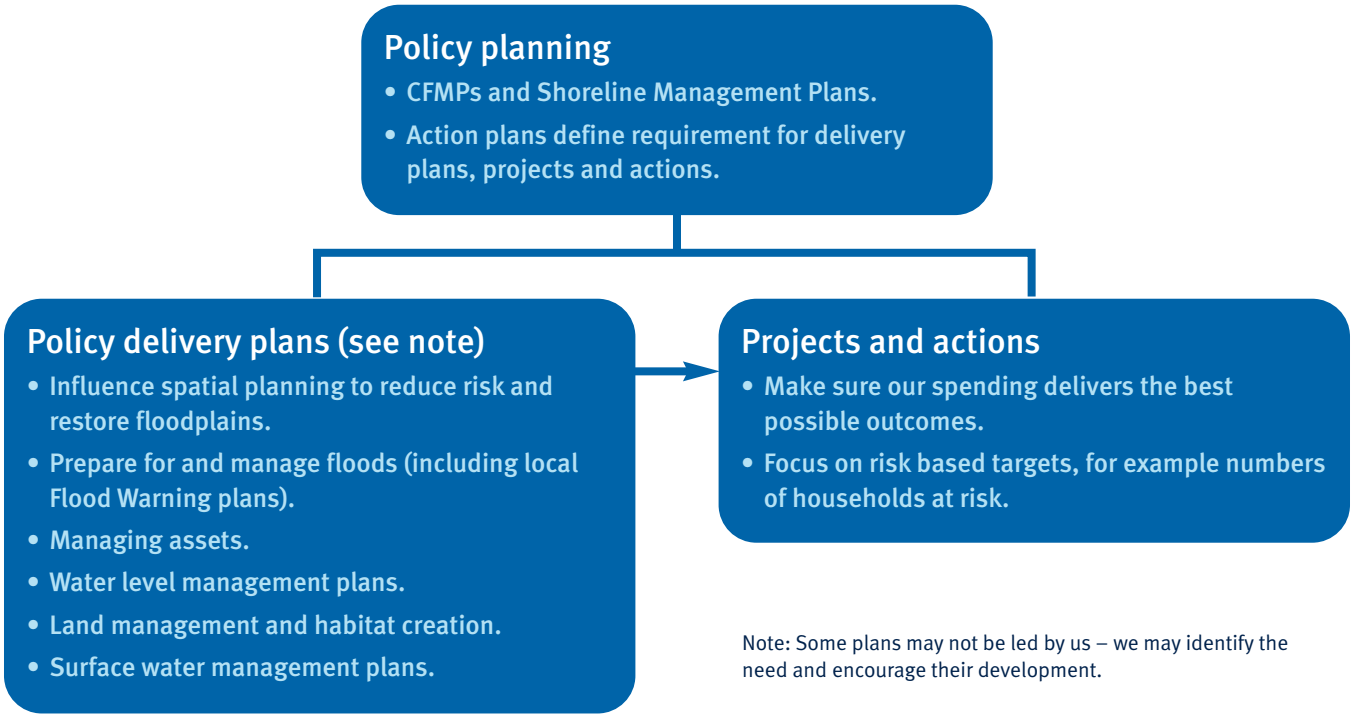
CFMPs help us to understand the scale and extent of flooding now and in the future, and set policies for managing flood risk within the catchment. CFMPs should be used to inform planning and decision making by key stakeholders such as:

- the Environment Agency, who will use the plan to guide decisions on investment in further plans, projects or actions;
- Regional Assemblies and local authorities who can use the plan to inform spatial planning activities and emergency planning;
- Internal Drainage Boards (IDB), water companies and other utilities to help plan their activities in the wider context of the catchment;
- transportation planners;
- land owners, farmers and land managers that manage and operate land for agriculture, conservation and amenity purposes;
- the public and businesses to enhance their understanding of flood risk and how it will be managed.

CFMPs aim to promote more sustainable approaches to managing flood risk. The policies identified in the CFMP will be delivered through a combination of different approaches. Together with our partners, we will implement these approaches through a range of delivery plans, projects and actions.

The relationship between the CFMP, delivery plans, strategies, projects and actions is shown in Figure 1.

Figure 1. The relationship between CFMPs, delivery plans, projects and actions



Note: Some plans may not be led by us – we may identify the need and encourage their development.

Catchment overview

The Bristol Avon catchment is located in the west of England. It drains parts of Gloucestershire, Wiltshire and Somerset and flows through the major cities of Bristol and Bath to the Severn Estuary at Avonmouth.

Map 1 shows the location and extent of the River Avon CFMP area. It includes the Somerset Frome and the Bristol Frome, plus a number of other tributaries including Semington Brook, the River Chew and Midford Brook. The downstream limit of the CFMP area overlaps with the upstream boundary of the Severn Estuary Shoreline Management Plan (SMP).

The Severn Estuary SMP deals with coastal flood management, while the CFMP considers tidal flood risk along the River Avon upstream of Netham Weir to the tidal limit at Keynsham.

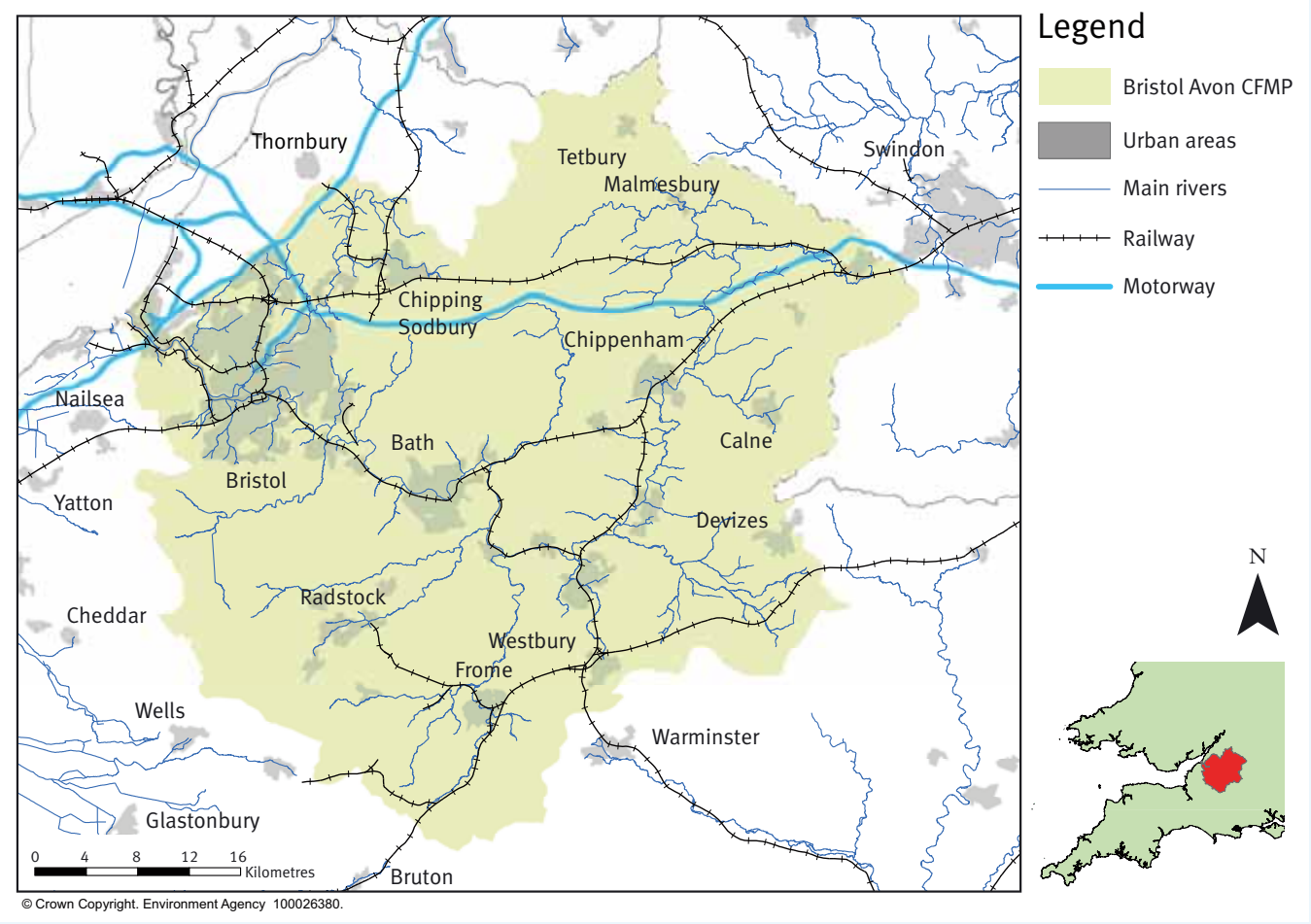
The overall catchment area is about 2,221 square kilometres, and has a population of around 1,050,000. Ten per cent of the catchment is urbanised. As well as Bristol and Bath, its main urban areas include Chippenham, Frome, Trowbridge, Devizes, Melksham, Malmesbury, Calne, Keynsham, Westbury, Midsomer Norton and Radstock, Yate and Chipping Sodbury, Bradford-on-Avon and Corsham.

The Bristol Avon catchment is delineated by the Mendip Hills to the south, the Cotswold Hills to the north, the Marlborough Downs and Salisbury Plain to the east and the Severn Estuary to the west. The River Avon's direction and path is dictated by the catchment's topography and results in the river following a crescent shape, initially flowing south from the Cotswolds before bending west through Bath and Bristol.

The main geological features of the catchment are the limestone Mendip Hills, the oolitic limestone Cotswolds and the chalk downs in the east, all of which are major aquifers affecting the hydrology of the catchment. Impermeable clays lie between the west-sloping strata of the limestone and the chalk, while sandstone and mudstone are exposed in the west of the catchment.

Within the River Avon catchment there are a number of sites designated for their environmental importance including Special Areas of Conservation (SAC), Special Protection Areas (SPA) and Ramsar sites. Important environmental sites in the catchment include four Areas of Outstanding Natural Beauty (AONB) including the Cotswolds and the Mendip Hills, five SACs, 23 SPAs, 98 Sites of Special Scientific Interest (SSSIs) and 299 Scheduled Monuments.

Map 1. Location and extent of the Bristol Avon CFMP area



↑ High water levels on the Avon at Old Bridge – since replaced by Churchill Bridge – in Bath in 1960

Current and future flood risk

Overview of the current flood risk

Flood risk has two components: the chance (probability) of a particular flood and the impact (or consequence) that the flood would have if it happened. The probability of a flood relates to the likelihood of a flood of that size occurring within a one year period. It is expressed as a percentage. For example, a 1% flood has a 1% chance or 0.01 probability of occurring in any one year, and a 0.5% flood has a 0.5% chance or 0.005 probability of occurring in any one year. The flood risks quoted in this report are those that take account of flood defences already in place.

This catchment has a long history of flooding, which resulted in many flood defence schemes being built, particularly in the period 1935 to 2000. Since then, high flows on the River Avon in 2000 and 2008 which would have caused widespread flooding resulted in little damage.

Currently the main sources of flood risk for people, property, infrastructure and the land are:

- river flooding from the River Avon and its tributaries, particularly in Bristol, Bath, Malmesbury, Chippenham, Chew Magna, Frome, Melksham, Bradford-on-Avon and Midsomer Norton;
- tidal flooding from the River Avon between Avonmouth and Bristol, where tidal water could result in tidelocking on tributaries draining to the river;
- surface water drainage and sewer flooding, which has occurred in parts of Bristol, Bath, Midsomer Norton, Chipping Sodbury and Corsham. Several other towns have the potential to be at risk from surface water flooding.

What is at risk?

At present there are around 17,000 people and 7,000 commercial and residential properties at risk in the whole catchment from a 1% annual probability river flood. This means that 1.6% of the total population living in the catchment are currently at risk from flooding.

It is difficult to assess the current impact of flooding to environmental features. Many designated sites at risk from flooding would not actually be damaged by the inundation.

43 Scheduled Monuments are at risk of flooding, but again, the actual risk of damage from flooding is limited.

Sluice gates built on the River Avon at Twerton as part of the Bath Flood Alleviation Scheme. They are vital for maintaining the river level in Bath and open automatically to let flood flows through. ➜

Map 2. Flood risk to property in a 1% annual probability river flood, taking into account current flood defences

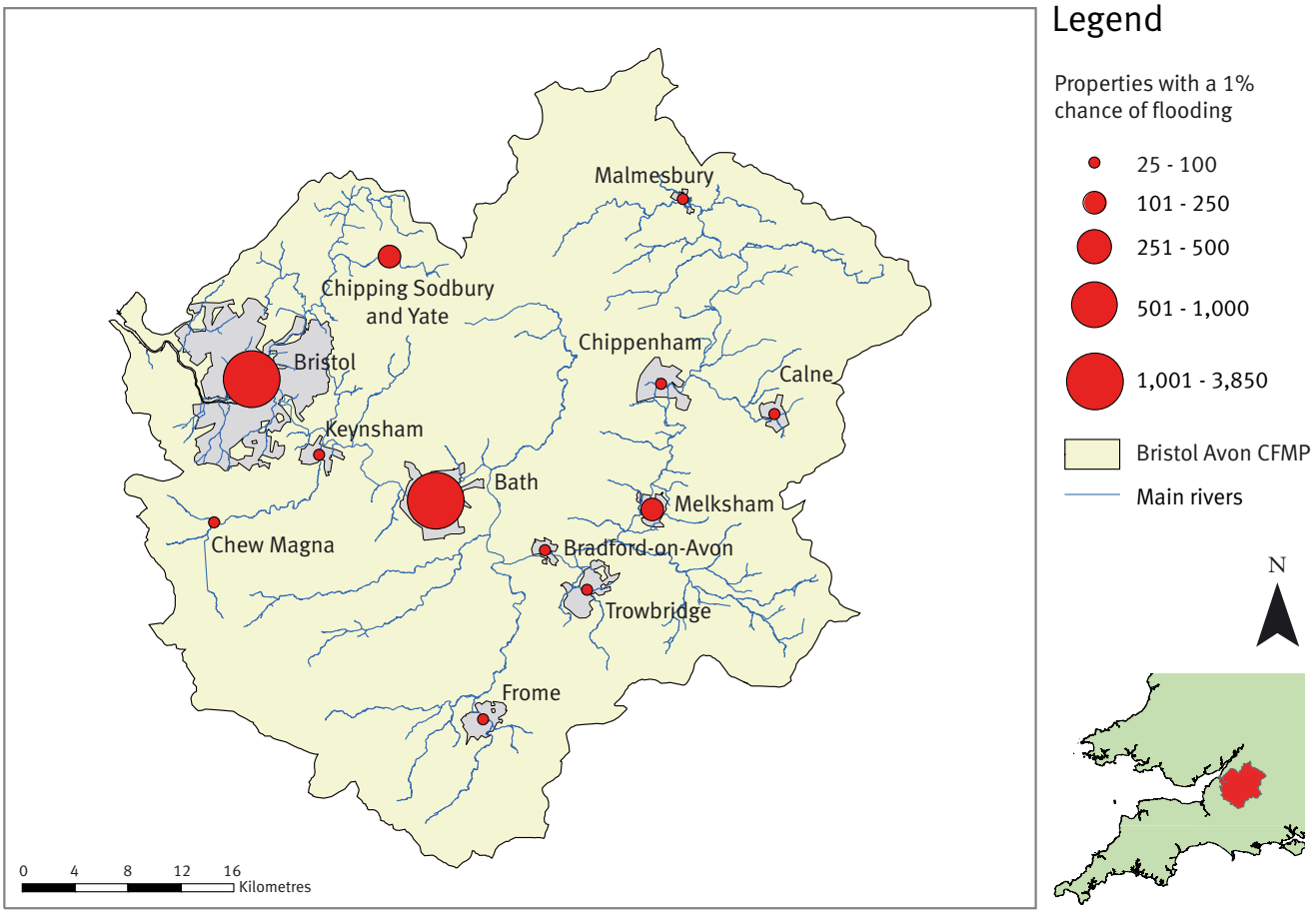


Table 1. Locations of towns and villages with 25 or more properties at risk in a 1% annual probability river flood

Number of properties at risk	Locations
›1,000	Bristol, Bath
500 to 1,000	None
100 to 500	Chipping Sodbury and Yate, Melksham
50 to 100	Trowbridge, Calne, Chew Magna, Keynsham, Bradford-on-Avon, Malmesbury
25 to 50	Chippenham, Frome

Table 2. Critical infrastructure at risk:

2 ambulance stations, 53 electricity sub-stations, 4 care homes

Where is the risk?

Around a third of the people and properties that are at risk within the catchment from a 1% annual probability river flood, are located in Bristol. A further 15% are located in Bath.

The distribution of properties at risk from a 1% annual probability river flood, is illustrated in Map 2. Table 1 summarises where there is flood risk to more than 25 properties. We recognise that there is also a potential risk from surface water and groundwater flooding. However, further studies following on from the CFMP are needed by us and our partners to quantify this potential risk.

How we currently manage the risk

The catchment has a history of flood risk, generally due to the high rainfall that can lead to extensive flooding of the river valleys.

Over 50 years at the end of the 20th Century, numerous engineering schemes were implemented to reduce flood risk in the catchment, including:

- widening and deepening of rivers and removal of obstructions in Bath, Chippenham, Frome, Trowbridge, Melksham, Malmesbury, Calne, Radstock, Keynsham, Castle Combe and Great Somerford. Protection varies from 4% annual probability in Malmesbury to 1% in Bath;
- building flood bypass tunnels: the bypass tunnel at Midsomer Norton which provides protection up to a 1% annual probability river flood, while at Ashton Vale in Bristol, this protection is reduced to 3% due to the risk of tidelocking of the tunnel outfall. The Northern Stormwater Interceptor at Eastville diverts flood flows from the centre of Bristol directly to the River Avon;
- constructing reservoirs. The flood storage reservoir at Iron Acton reduces flood risk downstream on the Bristol Frome through Frampton Cotterell to Eastville. Other reservoirs at Wootton Bassett and Emerson's Green have similar impacts on the Hancock's Water and Folly Brook respectively.

These measures have all reduced flood risk.

In addition to these engineering schemes other flood risk management activities are carried out in the catchment. These include activities which help to reduce the probability of flooding and those that address the consequences of flooding.

Activities that reduce the probability of flooding include:

- maintaining and improving existing flood defences and structures;
- maintaining river channels;
- maintenance of road drainage and sewers;
- working with local authorities to influence the location, layout and design of new and redeveloped property and ensuring that only appropriate development is allowed on the floodplain through the application of Planning Policy Statement 25 (PPS25).

Activities that reduce the consequences of flooding include:

- understanding where flooding is likely by using flood risk mapping;
- providing flood forecasting and warning services;
- promoting awareness of flooding so that organisations, communities and individuals are aware of the risk and are prepared in case they need to take action in time of flood;
- promoting resilience and resistance measures for those properties already in the floodplain.

The impact of climate change and future flood risk

In the future, flooding will be influenced by climate change, changes in land use (for example urban development) and rural land management. In the Bristol Avon catchment, climate change will have the greatest impact on flood risk, with urban development being a further impact on the Bristol Frome. The following future scenario for climate change was used in the CFMP:

- 20% increase in peak flow in all watercourses. This will increase the probability of large-scale flood events;
- a total sea level rise of 1,000 mm by the year 2100. This will increase the probability of tidal flooding on the lower reaches from Avonmouth to Keynsham and increase the length of time watercourses will be tide locked.

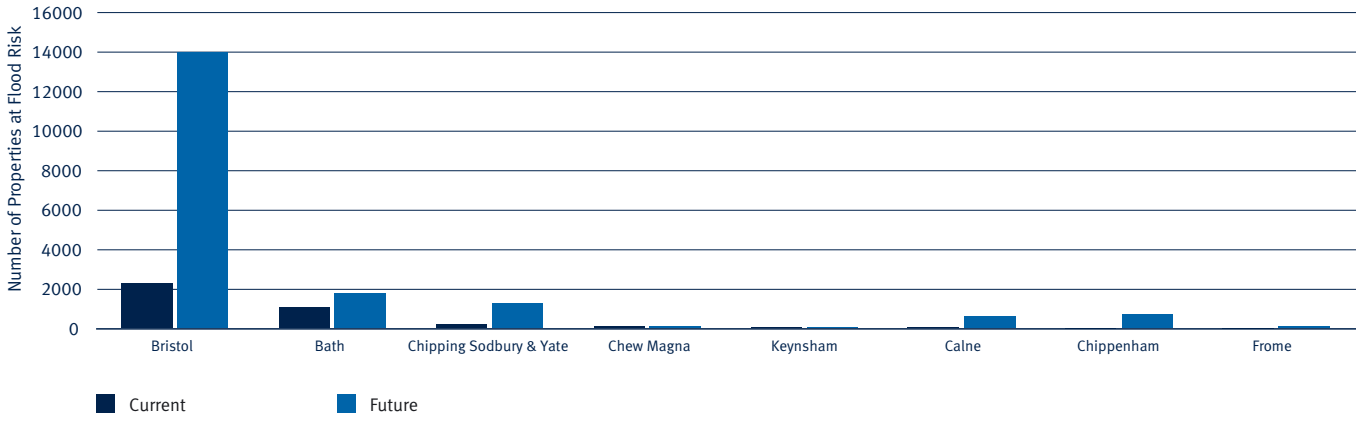
Using river models we estimate that by 2100, around 50,000 people and 20,000 properties across the catchment may be at risk from a 1% annual probability flood. Flood risk from rivers increases mainly in the Bristol and the Bristol Frome catchment, but significant increases also occur in the Wiltshire towns of Chippenham, Trowbridge and Calne.

The sensitivity testing undertaken has shown that the main drivers of change to flood risk in the Bristol Avon catchment to be climate change and in some locations, urban development.

Figure 2 shows the difference between current and future flood risks from a 1% annual probability river flood at key locations in the catchment. Following on from the CFMP, organisations need to work together to investigate flood risk from other sources (e.g. surface water and ground water flooding) in more detail.

In general, it is unlikely that the impact of flooding on environmental sites will change significantly in the future.

Figure 2. Current and future (2100) flood risk to property from a 1% annual probability river flood, taking into account current flood defences



Future direction for flood risk management

Approaches in each sub-area

We have divided the Bristol Avon catchment into nine distinct sub-areas which have similar physical characteristics, sources of flooding and level of risk. We have identified the most appropriate approach to managing flood risk for each of the sub-areas and allocated one of six generic flood risk management policies, shown in Table 3.

To select the most appropriate policy, the plan has considered how social, economic and environmental objectives are affected by flood risk management activities under each policy option.

↑ River Chew at the village of Pensford after floods of July 1968

Map 3. Bristol Avon sub-areas

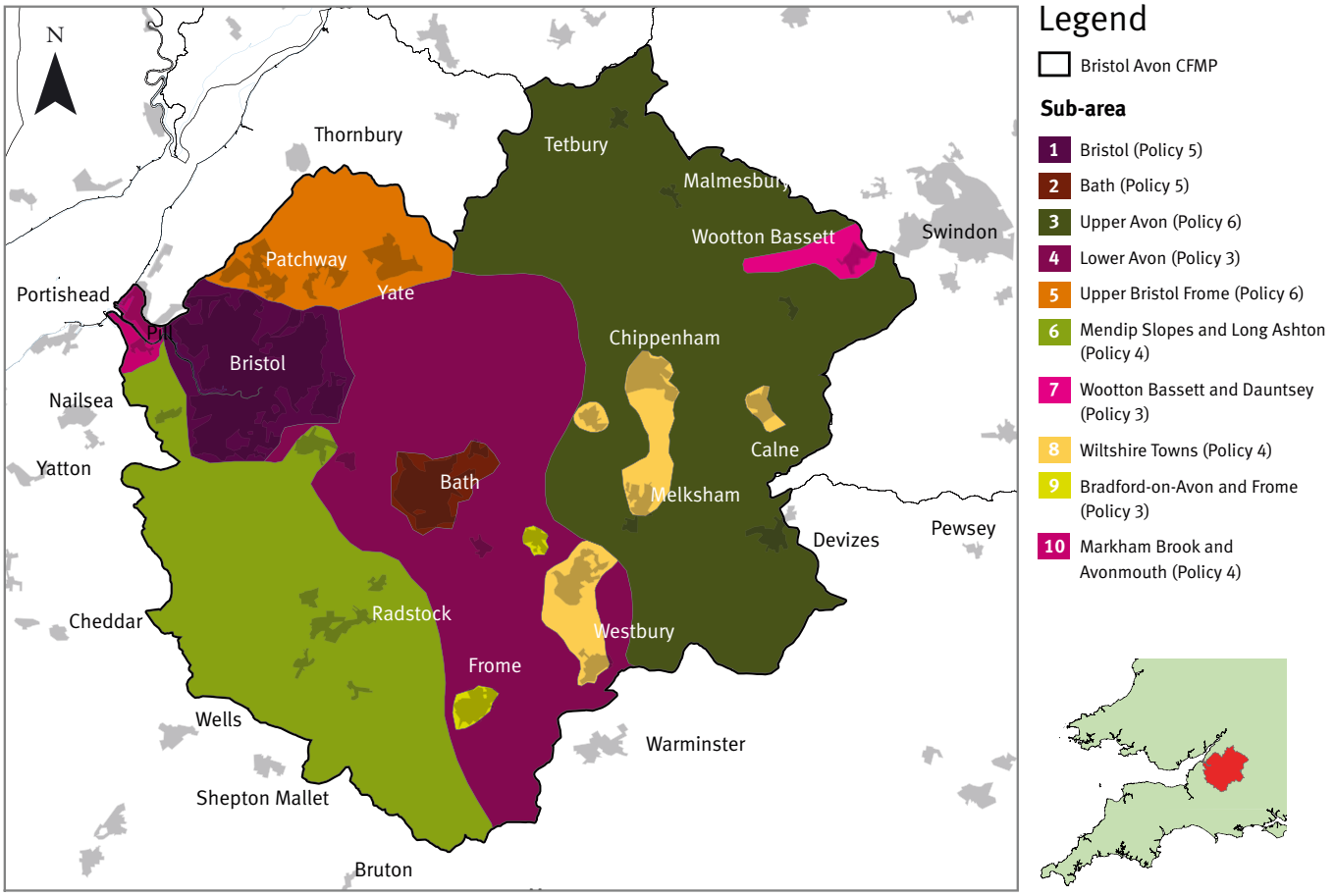


Table 3. Policy options

Policy 1

Areas of little or no flood risk where we will continue to monitor and advise

This policy will tend to be applied in those areas where there are very few properties at risk of flooding. It reflects a commitment to work with the natural flood processes as far as possible.

Policy 2

Areas of low to moderate flood risk where we can generally reduce existing flood risk management actions

This policy will tend to be applied where the overall level of risk to people and property is low to moderate. It may no longer be value for money to focus on continuing current levels of maintenance of existing defences if we can use resources to reduce risk where there are more people at higher risk. We would therefore review the flood risk management actions being taken so that they are proportionate to the level of risk.

Policy 3

Areas of low to moderate flood risk where we are generally managing existing flood risk effectively

This policy will tend to be applied where the risks are currently appropriately managed and where the risk of flooding is not expected to increase significantly in the future. However, we keep our approach under review, looking for improvements and responding to new challenges or information as they emerge. We may review our approach to managing flood defences and other flood risk management actions, to ensure that we are managing efficiently and taking the best approach to managing flood risk in the longer term.

Policy 4

Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change

This policy will tend to be applied where the risks are currently deemed to be appropriately-managed, but where the risk of flooding is expected to significantly rise in the future. In this case we would need to do more in the future to contain what would otherwise be increasing risk. Taking further action to reduce risk will require further appraisal to assess whether there are socially and environmentally sustainable, technically viable and economically justified options.

Policy 5

Areas of moderate to high flood risk where we can generally take further action to reduce flood risk

This policy will tend to be applied to those areas where the case for further action to reduce flood risk is most compelling, for example where there are many people at high risk, or where changes in the environment have already increased risk. Taking further action to reduce risk will require additional appraisal to assess whether there are socially and environmentally sustainable, technically viable and economically justified options.

Policy 6

Areas of low to moderate flood risk where we will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits

This policy will tend to be applied where there may be opportunities in some locations to reduce flood risk locally or more widely in a catchment by storing water or managing run-off. The policy has been applied to an area (where the potential to apply the policy exists), but would only be implemented in specific locations within the area, after more detailed appraisal and consultation.

Bristol

Our key partners are:

City of Bristol Unitary Authority

South Gloucestershire Unitary Authority

North Somerset Unitary Authority

Wessex Water

Met Office

The issues in this sub-area

This sub-area is a mostly urban area, covering the city of Bristol and its suburbs.

The defences through Bristol include the Northern Storm Water Interceptor (NSWI), diverting flood flows from the Bristol Frome away from the city into the tidal Avon. There are also smaller diversion channels on the Ashton, Longmoor and Colliters Brooks and the Brislington Brook. The Floating Harbour in the centre of the city has a vital role in protecting the city from combined tidal and fluvial flooding, effectively acting as a large storage area.

It is estimated that approximately 2,200 properties lie within the current 1% annual probability flood extent. Many of these properties are protected by defences. Within the future 1% annual probability flood extent the number of properties is expected to increase to 14,000.

There are a number of environmental designations at risk of flooding including the Horseshoe Bend (Shirehampton), Avon Gorge and three Scheduled Monuments.

Flooding affects a significant amount of critical infrastructure in Bristol. This includes hospitals, police stations, and fire stations. Numerous roads are at risk of flooding including the M4 and M32 motorways. The increase in future flood risk will mainly be driven by climate change.

Climate change and increasing development pressures have been identified as the main drivers for increase in flood risk.

The vision and preferred policy

Policy Option 5 - We can generally take further action to reduce flood risk.

Taking further action to reduce the flood risk will ensure that the standard of protection through Bristol is improved where required. This will ensure that the effects of increased flows as a result of climate change and future development do not result in an increase in the level of flood risk in vulnerable areas.

Proposed actions to implement the preferred policy

- We will carry out a study to determine the combined fluvial / tidal flood risk to Bristol from the tide, the River Avon and the Bristol Frome in order to reduce uncertainty relating to the level of risk this poses.
- This information will then be used to inform and further develop our flood risk management strategy for Bristol.
- We will identify if there are other specific areas where tide-locking of tributaries (for example the Malago Stream flowing into the River Avon from the South) are causing flooding problems, and look at ways of mitigating this risk.
- Carry out integrated urban drainage studies to identify current and future risks, and propose mitigation.
- We will investigate the benefits of improved flood forecasting and flood warning using improved meteorological technology.

Bath

Our key partners are:

Bath & North East Somerset Unitary Authority

The issues in this sub-area

This sub-area covers the urban area of Bath and includes a large number of designated sites. Bath is a World Heritage Site.

Approximately 1,100 properties are within the current 1% annual probability flood extent. This figure increases to an estimated 1,800 properties for the future 1% annual probability flood extent.

Although the majority of the properties and people are at risk of flooding from the River Avon, a significant number are at risk from tributaries, in particular those flowing into the River Avon from the north (right bank). Bath has a formal defence scheme to protect the city from the River Avon.

Flooding significantly affects critical infrastructure in Bath. Ambulance stations, health surgeries and a police station are at risk. Transport networks are also at risk.

Two Scheduled Monuments, including the Roman Baths and part of the World Heritage Site, are at risk of flooding.

The increase in future flood risk will mainly be driven by climate change, which is predicted to result in increases to peak river flows.

The vision and preferred policy

Policy Option 5 - We can generally take further action to reduce flood risk.

The current level of flood risk in Bath is considered unacceptable and under the chosen policy this risk would be reduced. Future increases in flood risk due to climate change could be balanced by reducing flows through increasing storage in the Upper Avon sub-area.

Proposed actions to implement the preferred policy

- Carry out improvements to existing assets through development opportunities on those lengths identified as below standard, and identify an overall strategy for the future protection of Bath and for its existing defences.
- We will increase awareness of risk and response to flood warnings, and discourage inappropriate development.

Flooded streets at Southgate in Bath in December 1960 ➜

Upper Avon

Our key partners are:

- Wiltshire Unitary Authority
- South Gloucester Unitary Authority
- Cotswold District Council
- Natural England
- Wessex Water
- National Farmers Union
- Farming and Wildlife Advisory Group
- Local farmers and landowners

The issues in this sub-area

This sub-area covers the predominantly rural area of the Upper Avon catchment and includes the Semington Brook. The main flood risk comes from the River Avon, though there is also a flood risk associated with the tributaries. Overall, there are no particularly large concentrations of people or properties at risk within the sub-area.

There are very few formal defences within the sub-area and most of the watercourses remain in a natural state. Malmesbury is the main settlement, but generally across the sub-area most properties at risk are isolated. There are a number of old river control structures that have been replaced with flood defence control structures on the River Avon and tributaries. Within the sub-area, approximately 400 properties are at risk of flooding during the current 1% annual probability flood event. These numbers increase to approximately 600 properties for the future 1% annual probability event. The floodplain of the River Avon covers a wide extent and flooding of the agricultural land is a significant factor.

An AONB, three SSSI and four Scheduled Monuments are at risk of flooding. A school, health centre, electricity sub-station, a sewage treatment works, a water treatment works and a fire and ambulance station are at risk. Railway lines and roads, including the M4 motorway, are also at risk. The increase in future flood risk will mainly be driven by climate change, with future land use changes and land management practices unlikely to have a major effect on future flood risk.

The vision and preferred policy

Policy Option 6 - We will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits.

This policy offers the potential for considerable environmental benefits. The floodplain of the River Avon is quite wide for much of this sub-area, meaning that there is potential for significant floodplain storage. This will have the effect of attenuating flows and retaining floodwater, thereby reducing the flood risk to areas at risk downstream, and locally.

Proposed actions to implement the preferred policy

- We will carry out a detailed study to determine specific areas where storage of floodwater may be feasible. This is likely to include a detailed topographic study (e.g. upstream of Malmesbury), and will propose the implementation of feasible schemes. This work will also identify urban areas and smaller settlements within the sub-area at risk of flooding so that the risk to these would not be increased by adopting this policy.
- We will identify areas which could benefit from increased flooding, for example suitable areas in which to develop water meadows, wet woodland and other wetland habitat, or opportunities to convert arable land to permanent pasture that may also allow flooding. We will identify opportunities to create recreational public amenities or water resources benefits through such storage options. We will propose a schedule of schemes for suitable sites.
- We will carry out pilot studies on the Semington Brook, Brinkworth Brook and at Little Somerford into the benefits of planting wet woodlands in floodplain.
- We will monitor the effects of upland storage on flows through Bradford-on-Avon and Bath.

↑ The confluence of the River Avon and the Brinkworth Brook at Great Somerford during flooding

Lower Avon

Our key partners are:

Bath and North East Somerset Unitary Authority

South Gloucestershire Unitary Authority

Mendip District Council

The issues in this sub-area

This sub-area covers much of the rural area of the lower Bristol Avon catchment and includes the By Brook, River Boyd and the lower sections of the Somerset Frome and Midford Brook. This sub-area covers a large proportion of the Bristol Avon CFMP.

There are very few formal defences within the sub-area with mainly isolated properties at flood risk. A limited flood warning service is offered to the main areas at risk.

Approximately 200 properties are within the current 1% annual probability flood extent, most of which are well dispersed across the sub-area.

This figure is expected to increase to an estimated 340 properties within the future 1% annual probability flood extent.

Numerous features have designations, including 15 Sites of Special Scientific Interest, 11 Scheduled Monuments, two Areas of Outstanding Natural Beauty and the Salisbury Plain and Mells Valley Special Areas of Conservation.

Three electricity sub-stations and three water treatment works are at risk of flooding, along with railways and major roads, including the M4 and A36.

The increase in future flood risk will be driven mainly by climate change which is predicted to result in increases to fluvial flows. Neither land use or land management changes are expected to have a significant influence on future flood risk in the sub-area.

The vision and preferred policy

Policy Option 3 - We are generally managing existing flood risk effectively.

Flood risk is predicted to increase in the future through climate change but the effective decrease in the standard of protection that this will bring is not expected to have significant social or economic implications and this policy therefore represents the best balance of costs and benefits, socially, economically and environmentally.

The increased frequency of flooding will bring a limited opportunity to increase the area of water meadows, wetland and/or wet woodland, including around Bradford-on-Avon and Newton St Loe.

Proposed actions to implement the preferred policy

- Through the development of a System Asset Management Plan, study the cost-efficiency of existing asset maintenance in relation to flood risks at sites such as Bathford, Swineford, Batheaston etc and implement any recommended improvements.

Upper Bristol Frome

Our key partners are:

South Gloucestershire Unitary Authority

The issues in this sub-area

This sub-area covers the upper Bristol Frome catchment and includes the towns of Frampton Cotterell, Chipping Sodbury and Yate. The main flood risk comes from the Bristol Frome, although a few minor tributaries contribute to the flood risk.

The majority of properties at risk are in Chipping Sodbury and Yate, but isolated properties at Frampton Cotterell and on the Stockwell Watercourse, Bradley Brook and Folly Brook are also at risk. Tubbs Bottom detention dam was constructed to reduce the risk of flooding to areas downstream.

Around 300 properties are within the current 1% annual probability flood extent. This figure is expected to increase significantly to 1,600 properties in the future. An electricity sub-station, a care home, a fire station, schools and health centres are at risk from flooding. Part of the M4 motorway and the A432 road are also at risk.

The vision and preferred policy

Policy Option 6 - We will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits.

Increasing storage through this approach, including increasing the efficiency of Tubbs Bottom detention reservoir, has the potential to reduce the flood risk in the urban areas of the sub-area through increased floodplain storage upstream. This would bring an associated reduction in the severity and frequency of flooding to people and properties. The flood risk to the health centres, school, care homes and the fire station will be reduced, as will the flood risk to the roads within the urban areas.

Proposed actions to implement the preferred policy

- We will carry out a detailed study to consider, firstly, the operation of Tubbs Bottom detention reservoir to further benefit downstream, and secondly, the opportunities for further floodplain storage on the Ladden Brook and tributaries.
- We will discourage inappropriate development in flood risk locations, especially critical infrastructure.

↑ Construction work at Tubbs Bottom

Mendip Slopes and Long Ashton

Our key partners are:

Mendip District Council

Bath and North East Somerset Unitary Authority

North Somerset Unitary Authority

Met Office

The issues in this sub-area

This sub-area covers the slopes of the Mendips and the upper reaches of the Midford Brook, Somerset Frome and River Chew. An area to the west of Bristol around Long Ashton is also included. It is a predominantly rural area, but does contain the towns of Midsomer Norton, Chew Magna, Keynsham and Radstock.

The flood risk mainly arises from the relatively fast response of the watercourses due to their location on the slopes of the Mendip Hills and from direct surface run-off. Notable areas at risk of flooding include Chew Stoke, Hallatrow, Nunney, Witham Friary, Mells, Pensford, Chilcompton, Compton Dando and Vobster. Approximately 580 properties (of which 470 are residential) are at risk of flooding currently, rising to 790 (600 residential) in the future.

Within the current 1% annual probability flood extent there are various environmental designations. These include nine SSSIs, two AONB, two SAC and 15 Scheduled Monuments.

Seven electricity sub-stations are also at risk along with health centres, schools, a sewage treatment works, railways and major roads.

The increase in future flood risk will mainly be driven by climate change with future changes in land use and land management practices unlikely to have much of an effect on future flood risk. The steeper nature of the watercourses combined with the increased flows predicted under climate change may lead to a larger increase in flood risk compared to some of the other sub-areas in the Bristol Avon CFMP.

The vision and preferred policy

Policy Option 4 - We are already managing the flood risk effectively but we may need to take further actions to keep pace with climate change.

This policy will require us to do more in the future to contain what would otherwise be increasing risk. There should be no increase in flood risk to the schools, health centres, sewage treatment works or industrial units currently at risk of flooding.

Proposed actions to implement the preferred policy

- We will review emergency contingency planning, especially in the light of climate change, increase awareness of risk and response to flood warnings, and discourage inappropriate development.
- We will investigate the benefits of improved flood forecasting and flood warning using improved meteorological technology.

Wootton Bassett and Dauntsey

Our key partners are:

Wiltshire Unitary Authority

Highways Agency

Network Rail

The issues in this sub-area

This sub-area includes the towns of Wootton Bassett and Dauntsey, both of which are located in the upper reaches of the catchment

Whilst this sub-area is predominantly rural, at Wootton Bassett significant development is predicted. The main flood risk is to 40 residential properties at Dauntsey, rising to 60 with climate change increases. There is a flood detention reservoir in Wootton Bassett. This was primarily installed to ensure that increased run-off from development upstream did not increase flooding to agricultural land.

There is one Scheduled Monument at risk of flooding within the current 1% annual probability flood extent. Also at risk are roads, including part of the M4 motorway and the railway line from Bristol to Swindon. A school in Dauntsey is also at risk.

The increase in future flood risk will mainly be driven by climate change, which is predicted to result in increases to river flows and surface run-off.

The vision and preferred policy

Policy Option 3 - We are generally managing existing flood risk effectively.

Although this approach may lead to a slight increase in the frequency of flooding in the future and to the level of disruption, this is not deemed significant enough to increase the level of flood risk management. Policy 3 represents the best balance of costs and benefits, socially, economically and environmentally.

Proposed actions to implement the preferred policy

- Undertake integrated urban drainage studies, in particular for main line railway and M4 motorway flood risks, and implement any recommended improvements.
- Through the development of a System Asset Management Plan, study the cost-efficiency of existing channel maintenance in relation to Dauntsey Green, and implement any recommended improvements.

Sub-area 8

Wiltshire Towns

Our key partners are:

Wiltshire Unitary Authority

Met Office

The issues in this sub-area

This sub-area covers the towns of Chippenham, Melksham, Corsham, Calne, Westbury and Trowbridge. The main flood risk to Chippenham comes from the River Avon, though several small tributaries flow through the town and increase the risk.

None of these towns have significant flood risk, and, except for Corsham, are protected to a reasonable level by past schemes. Development pressures affect all the towns and climate change will increase properties at risk dramatically. It is estimated that approximately 400 properties lie within the current 1% annual probability extent. Within the future 1% annual probability flood extent the number of properties is expected to increase to 2,600. Major infrastructure including main line rail, roads and an electricity sub station will be at increased risk.

The vision and preferred policy

Policy Option 4 - We are already managing the flood risk effectively but we may need to take further actions to keep pace with climate change.

Under this approach, further action will be taken to sustain the current level of flood risk into the future. The majority of the 2,600 properties at risk in the future would see the risk remain similar to that at present.

Proposed actions to implement the preferred policy

- We will develop a prioritised programme of strategies for maintaining the level of risk into the future. As well as benefiting from upstream storage, we would look to include the possible future modification of existing assets, including utilising development opportunities for the removal or replacement of sluice structures at Chippenham and Melksham. We would look at options to make channel improvements and undertake bank raising in Trowbridge and Westbury. We would also look at options to make improvements to channels, culverts and their screening, and storage in Corsham and Calne.
- Improve flood forecasting and flood warning using improved meteorological technology and improve response through raising awareness.
- Undertake integrated urban drainage studies, in particular for main line rail flood risks, and implement any recommended improvements at Corsham.
- Discourage inappropriate development in Corsham, Calne, Trowbridge and Westbury.
- Reinforce contingency planning and self-help in Corsham and Calne.

Bradford-on-Avon and Frome

Our key partners are:

Wiltshire Unitary Authority

Mendip District Council

The issues in this sub-area

This sub-area covers the towns of Bradford-on-Avon and Frome.

Both towns would be cut in half if major flooding takes place. Unlike Bradford-on-Avon, Frome already has some protection afforded by an earlier scheme. Both towns suffer from the impracticality of future improvements to channels and bridges in the town.

There are currently 75 properties with the current 1% annual probability flood extent and this is expected to rise to around 190 in the future.

Three Scheduled Monuments in Bradford-on-Avon are at risk of flooding. Also at risk in the town are an electricity sub-station, a fire station and a police station. The A363 road and the railway line through the town are also at risk.

There are no environmental designations at risk of flooding in Frome. The A361 and A362 roads, along with the railway, are also at risk. Flooding could also affect an electricity sub-station and two health centres in the town.

The vision and preferred policy

Policy Option 3 - We are generally managing existing flood risk effectively.

The overall increase in the level of flood risk is likely to be small.

Proposed actions to implement the preferred policy

- We will reinforce contingency planning and self-help, increase awareness of risk and response to flood warnings, and discourage inappropriate development.
- Through the development of the System Asset Management Plan, study the cost-efficiency of existing maintenance of the two town centre's bridges, channels and culverts and implement any recommended improvements.

Markham Brook and Avonmouth

Our key partners are:

City of Bristol Unitary Authority

North Somerset Unitary Authority

Port of Bristol Authority

Wessex Water

The issues in this sub-area

This sub-area covers both banks of the tidal River Avon below Shirehampton including the Markham Brook and Chapel Pill. This includes the urban areas of Shirehampton, Pill and Easton-in-Gordano and a small area of Avonmouth including Portbury and Avonmouth Docks. Most of Avonmouth is covered by the Severn Tidal Tributaries CFMP.

The over-riding flood risk in this sub-area is from tidal flooding and both banks of the Avon have raised tidal defences.

Behind the defences, the main risk of flooding is from surface water exacerbated by tide-locking.

Around 60 properties, mainly residential, are at risk of flooding from the current 1% annual probability flood event, though these are protected from flooding by the existing defences. The number of properties at risk during the future 1% event increases to an estimated 120.

The Severn Estuary Special Protection Area, and Ramsar are not affected by fluvial and surface water flooding in this sub-area.

An electricity substation, a fire station and 10 sheltered houses are at risk from the current 1% annual probability flood event. A main road is also at risk.

The vision and preferred policy

Policy Option 4 - we are already managing the flood risk effectively, but we may need to take further actions to keep pace with climate change.

Increased river flows, surface run-off and sea level rise as a result of climate change are likely to be the three main drivers of future flood risk within this sub-area.

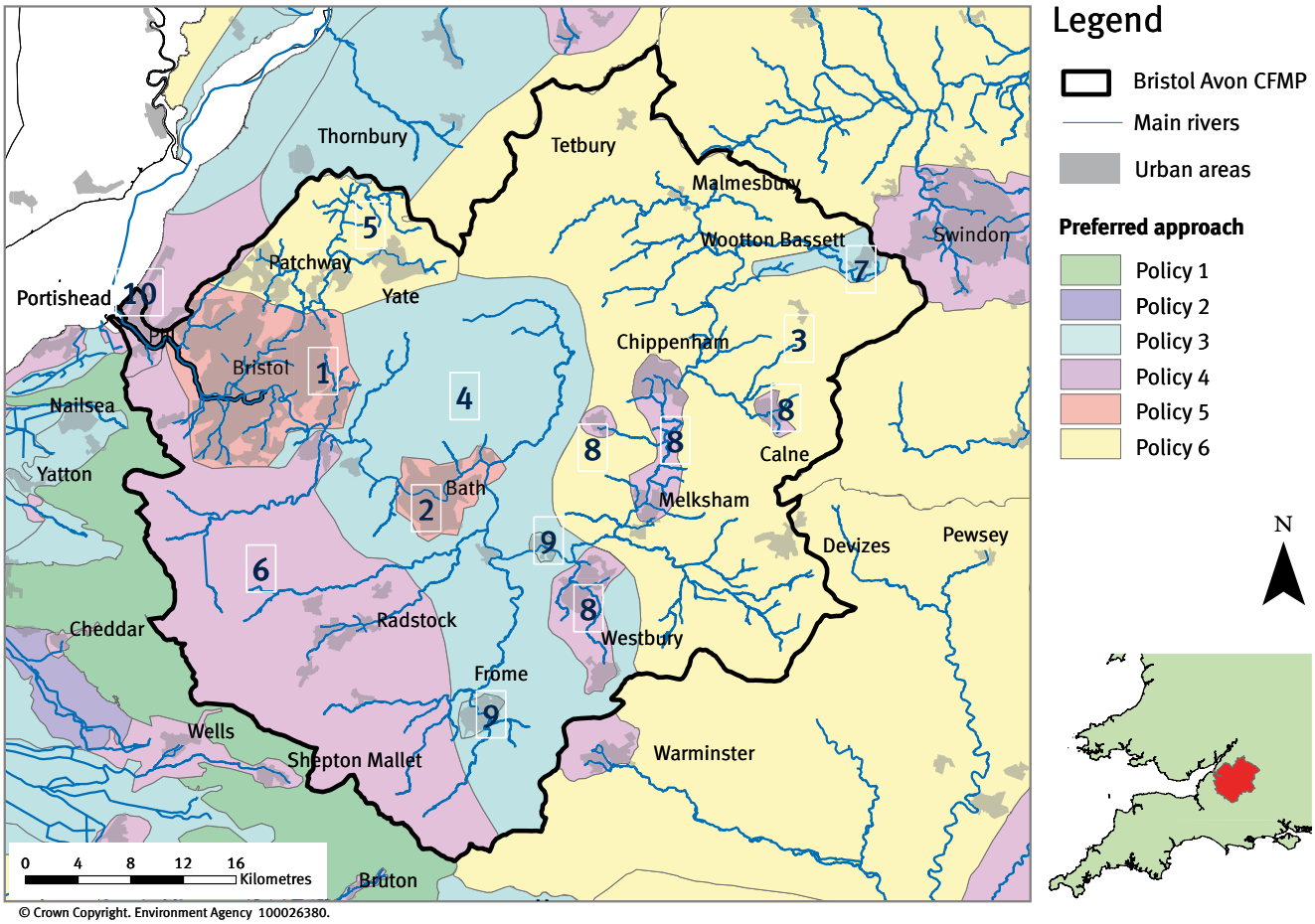
Under this approach, further action will be taken to sustain the current level of flood risk into the future. The estimated 120 properties at risk of flooding would see the risk remain similar to that at present.

Proposed actions to implement the preferred policy

- Review emergency contingency planning, especially in the light of climate change
- Increase awareness of risk and response to flood warnings.
- Discourage inappropriate development.
- Encourage the production of surface water management plans for Pill and Shirehampton
- Consider future improvements for the Pill pumping station.

Map of CFMP policies

Map of the policies in the Bristol Avon catchment



The sub-areas

1 Bristol
2 Bath
3 Upper Avon
4 Lower Avon
5 Upper Bristol Frome
6 Mendip Slopes and Long Ashton
7 Wootton Bassett and Dauntsey
8 Wiltshire Towns
9 Bradford-on-Avon and Frome
10 Markham Brook and Avonmouth

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