

# Bristol Local Flood Risk Management Strategy

May 2023

**Flood Risk Management Team**

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# Revision schedule

Local Flood Risk Management Strategy  
May 2023

Rev	Date	Details	Prepared by	Reviewed by	Approved by
04	Feb 2018	Four yearly formal update	<b>John Stevens</b> – Flood Risk Officer <b>Patrick Goodey</b> – Flood Risk Manager	<b>John Roy</b> – Group Manager, Transport Assets	<b>Adam Crowther</b> – Service Manager, Strategic City Transport
05	May 2023	Formal update	<b>John Stevens</b> – Flood Risk Officer	<b>Pete Woodhouse</b> – Group Manager, City Transport	<b>Adam Crowther</b> – Service Manager, City Transport

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# Foreword

Climate change and rising sea levels are increasing the risk of flooding in Bristol and across the West of England. Today, over 1,000 homes and businesses in central Bristol are at risk of a severe flood from the River Avon. Without action, up to 4,500 properties could be at risk by the end of the century.

While we cannot prevent floods from occurring altogether, the work we're doing in Bristol and beyond our boundaries with partners is a long-term plan to address what happens when they do, so that we can better protect the city with the right interventions in the right places.

Some of our most iconic landmarks are spread along the River Avon and it is a central part of life in the city. The Bristol Avon Flood Strategy seeks to enhance the river for all by creating a more resilient, active and sustainable city that can meet the future needs of its residents, businesses and visitors. Our vision is for change that works for the city all year round – not just when flooding is expected. By incorporating and improving active travel corridors and public spaces we can manage flood risk while also enhancing the city for everyone.

Investment is also committed to the west of Bristol for the Avonmouth and Severnside Ecology Mitigation and Flood Defence project, and we have recently been

awarded more than £6 million from the Department for Environment, Food and Rural Affairs (Defra) to unlock innovative and nature-based solutions in the River Frome catchment area. These projects will not only reduce the risk of flooding, but also deliver important ecological benefits such as new and enhanced habitats and improved water quality.

Our updated Local Flood Risk Management Strategy for Bristol is vital to supporting our ambitions to create a more resilient city and protect our densely populated areas. Across the city around 3,400 properties are at risk from surface water flooding. We will continue to take a whole system approach with a range of partners to manage flooding from local sources including surface water, groundwater and ordinary watercourses. This will help us to protect areas in the city currently at risk of flooding and will also help enable us to regenerate brownfield city centre land to safely build housing and new community spaces in the future.



**Nicola Beech**

Bristol City Council cabinet member with responsibility for flood resilience

# Glossary

Term	Definition
Active citizenship	People taking an active role in the community to help manage or reduce the risk of flooding, such as clearing leaves from highway drainage gullies.
Active management	Taking a proportionate and risk based approach to maintenance so that investment is directed at areas of highest risk, and deciding in advance if and when interventions are to be made.
Catchment	An area that serves a river with rainwater, i.e. every part of land that drains to a single watercourse is in the same catchment.
CIL	Community Infrastructure Levy.
Core Strategy	Sets out the overall approach for planning in Bristol. Part of the Local Plan.
Culvert	A pipe or other structure under a road or building etc. to direct the flow of water and sometimes replaces a natural watercourse.
Defra	Department for Environment, Food and Rural Affairs.
Flood risk	A combination of the likelihood and consequence of flooding.
Flood resilience	Designing or adapting a building or asset so that although it comes in to contact with floodwater, no permanent damage is caused.
Flood resistance	Measures to keep floodwater out of homes, buildings and infrastructure.
Fluvial flooding	Flooding from river flow.
Flood Risk Asset Register	A map that shows Bristol's main flood risk and drainage infrastructure assets and who is responsible for them.
FRMP	Flood Risk Management Plan.
Groundwater	Water held underground in soil or rock.



Term	Definition
IDB	Internal Drainage Board.
Inlet	The entrance to a culvert, sewer or other conduit to which water flows in.
JSP	Joint Spatial Plan.
LLFA	Lead Local Flood Authority. Created in 2010, a Unitary Authority or County Council responsible for co-ordinating flood risk management within its administrative boundary.
Local Flood Risk	Flood risk from surface water, groundwater and Ordinary Watercourses.
Local Plan	Includes policies that BCC use for deciding planning applications in Bristol. Made up of several documents.
Main river	A watercourse designated as such by the Environment Agency for which it has responsibilities and powers.
Ordinary watercourse	All watercourses that are not designated Main River and which are the responsibility of local authorities or Internal Drainage Boards.
Outlet	The exit of a culvert, sewer or other conduit from which water flows out of.
RMA	Risk Management Authority – an authority that has statutory responsibilities for managing flood risk.
SEA	Strategic Environmental Assessment.
Sewer	A pipe that conveys either storm water or waste water that is adopted by the local sewerage undertaker (in Bristol this is Wessex Water).
SFRA	Strategic Flood Risk Assessment.
Significant flood risk asset	Any asset located on the Significant Drainage Network. Any asset the Council builds as part of a flood mitigation scheme. Any other asset we believe performs an important flood risk management function.
Spring tide	A higher than average tide that occurs every two weeks, at the time of a full or new moon.

Term	Definition
SRBMP	Severn River Basin Management Plan.
Storm surge	Produced by stormy weather out to sea (for Bristol this is the Atlantic Ocean), creating a 'surge' of higher water levels that can travel inland, increasing the water level in the Severn Estuary and River Avon.
SuDS	Sustainable Drainage Systems are designed using a hierarchical approach to reduce the potential impact of new or existing developments with respect of surface water drainage discharges. They attempt to reduce the adverse impact that traditional drainage systems can create.
Surface water	Water that is unable to enter the ground or sewer system and therefore flows across the ground surface.
Tidal flooding	Flooding from the sea (for Bristol this is from the Severn Estuary). Flooding is made worse by 'storm surges'.
Trash screen	A structure installed at the entrance to a culvert to prevent the entry of debris that could cause a blockage.
Urban Creep	The loss of permeable areas in an urban environment and replacing them with impermeable surfaces. This often occurs 'little and often' but can have a significant cumulative impact.
Watercourse	Any channel, either natural or artificial, along which water flows.
West of England Sustainable Drainage Developers Guides	Guidance for designing sustainable drainage system strategies in preparation for submission of planning applications.

# Introduction

As we have all seen, flooding can have devastating effects on people and communities across the United Kingdom. In Bristol we have not had wide spread flooding since the great floods of 1968, but more recent events in nearby Gloucestershire and Somerset remind us of the extensive damage that can be caused.

Designated as Lead Local Flood Authority (LLFA) under the Flood and Water Management Act (2010) (the Act), Bristol City Council (BCC) are the authority responsible for managing the risk of flooding from local sources – that is surface water, groundwater and ordinary (smaller) watercourses in Bristol. BCC also sometimes lead on the co-ordination of flood risk management in Bristol where there is a benefit in doing so. This is conducted in partnership with other organisations involved in flood risk management activities.

An important duty we have under the Act is to produce and maintain a Local Flood Risk Management Strategy (LFRMS) which sets out our vision for managing the risk of flooding from local sources.

This document forms our revised strategy, an updated version following on from the 2014 original and subsequent revisions. This update reflects progress made, work undertaken and any necessary changes required for the BCC LFRMS. It has been produced in partnership with officers across BCC, the Environment Agency (EA), Wessex Water (WW) and the Lower Severn Internal Drainage Board (IDB). This newly revised strategy has gone through an internal approval process at BCC and has seen recommendations incorporated. This has included support and ratification from the Growth and Regeneration Scrutiny Commission.





## The purpose of the strategy is to:

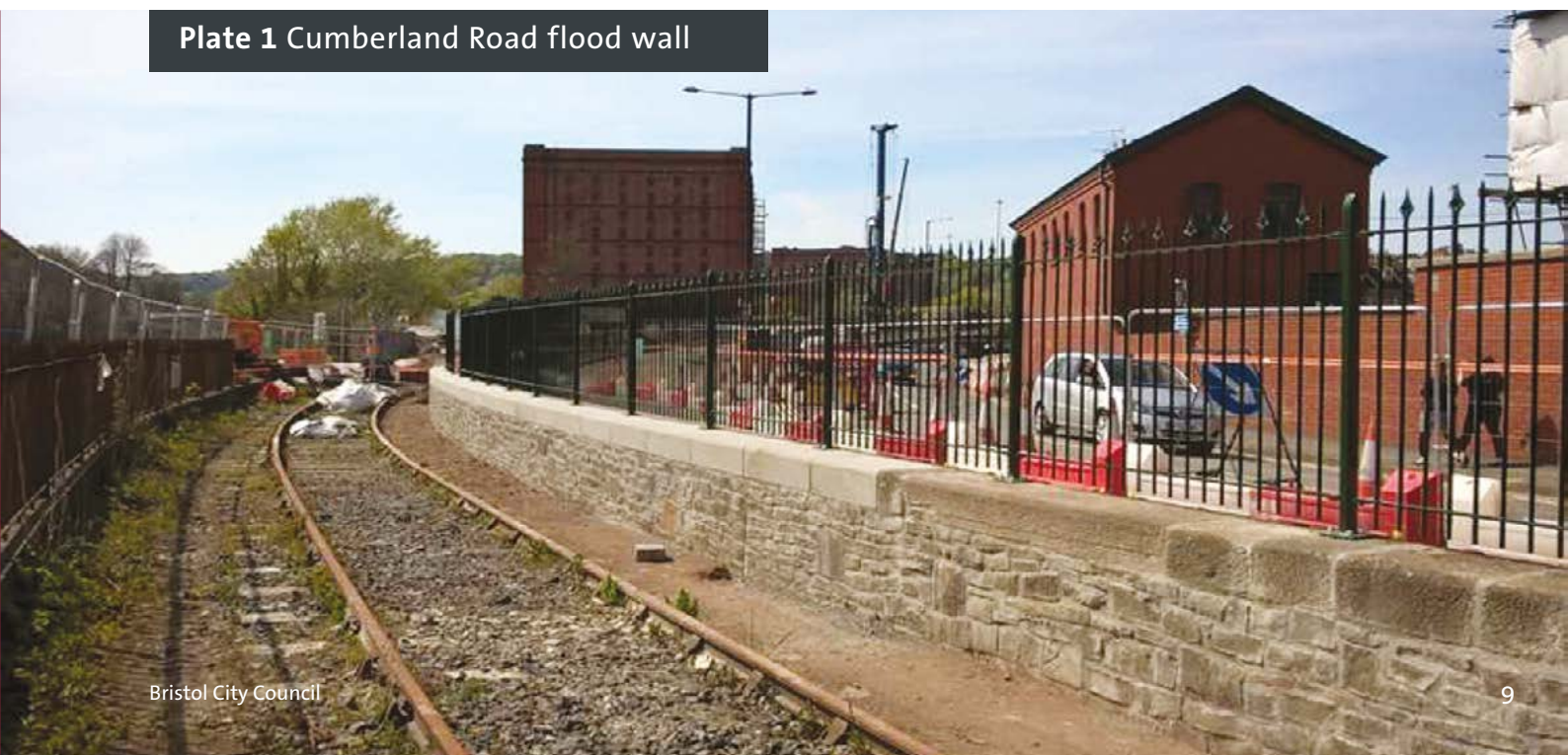
- Provide an overview of flood risk in Bristol
- Explain the role of organisations involved in flood risk management
- Set out the objectives for managing local flood risk
- Put in place measures to achieve the objectives
- Produce an action plan that explains how and when the measures are to be implemented
- Examine the costs and benefits of delivering the measures
- Demonstrate how the strategy contributes to the achievement of wider environmental objectives

The strategy is aligned with and based on the ambitions of the Environment Agency's national strategy. It reflects the needs of Bristol's declaration of a [Climate Emergency](#), [Ecological Emergency](#), the approach of the [One City Plan](#) and is linked to local development plans.

Our aim is to use both the local and national strategy to engage with our communities (those who live and / or work in Bristol) and communicate what we do and how the people of Bristol can work together to manage the risk of flooding in our city.

Since the inception of the LFRMS in November 2014 we have reduced the risk of flooding to an estimated 220 homes. The Cumberland Road flood wall (see Plate 1 below) has reduced the tidal flood risk to approximately 170 properties in and around the Floating Harbour, notably Avon Crescent. This was informed by our studies and made possible because of excellent partnership working with the MetroBus transport scheme and Environment Agency.

**Plate 1** Cumberland Road flood wall





**Plate 2** Flood proof fencing in south Bristol

Flood relief works at the base of Dundry Hills has alleviated the risk of surface water flooding in the southern most reaches of the city. The risk of flooding has lowered for approximately 20 properties in the Hartcliffe, Whitchurch Park, Bishopsworth, Stockwood, and Hengrove wards. See Plate 2 above of flood proof fencing introduced in south Bristol.

Other minor schemes across the city have reduced the risk to a further 30 properties. This has provided increased protection from sources of flooding, including fluvial, surface water and ordinary watercourses.

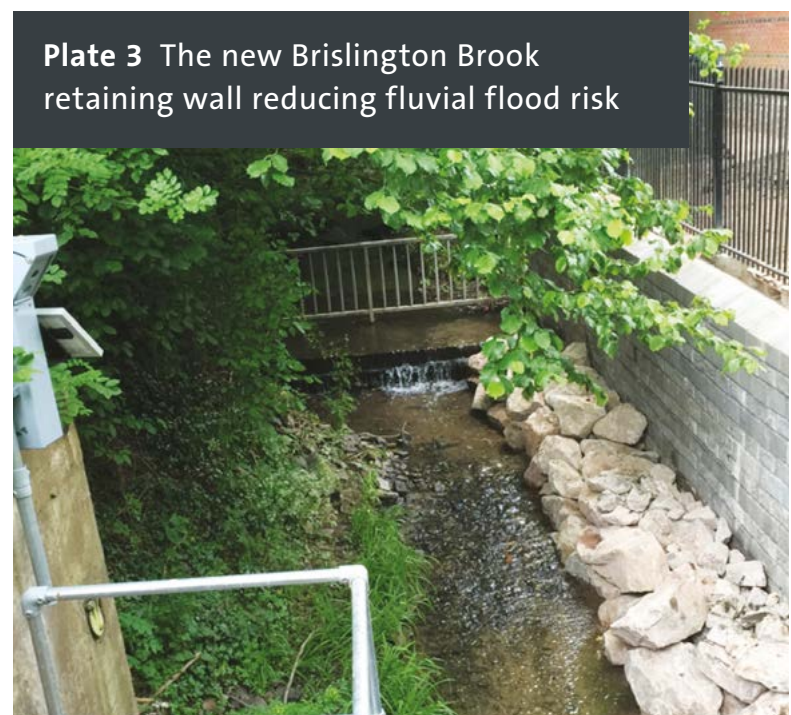
The repair of the Brislington Brook retaining wall and construction of a new flood defence retaining wall is an example of this, as shown in Plate 3.

Flood reduction schemes include Fonthill Park flood storage attenuation basin reducing flood risk to Stanton Road and Pigeonhouse Stream Leaky Dam (see Plate 4) reducing flood risk on Whitchurch Lane. An overall reduction to flood risk is achieved in a lot of the work we undertake, if not to particular properties specifically, such as through the Southmead SuDS scheme in 2022 (see Plate 5) for instance. West Town Lane basin was also introduced to reduce flooding to the adjacent footpath.

Ongoing actions in the revised LFRMS demonstrate many schemes currently underway or in the pipeline to protect many more properties in the Bristol region.

The progress made with the LFRMS for Bristol has been good so far but this further work must continue in order to properly manage flood risk in the city. In addition to the above schemes, we (along with our Risk Management Authority partners, notably the Environment Agency and South Gloucestershire Council [SGC]) have made significant progress on large-scale projects.

The Bedminster Green river restoration project, part of the wider regeneration of Bedminster Green, will not only reduce the flood risk to Bedminster but will also provide new and improved habitats to promote greater biodiversity, restore historic heritage features to preserve evidence of Bedminster's industrial past and create a new public space (amphitheatre seating area) for the public to reconnect with the newly emerged river.



**Plate 3** The new Brislington Brook retaining wall reducing fluvial flood risk



Public engagement (2020) has been undertaken on concept designs and public consultation (2021) has been undertaken on draft outline designs, with the public largely supportive of the scheme with benefits identified relating to biodiversity, flood risk and regeneration of the area. Detailed designs to restore and daylight a section of the River Malago have been produced. The planning application for the project was submitted in February 2023. Community Infrastructure Levy and other Bristol City Council funding sources have been secured to fund the project.

The Avonmouth and Severnside Ecology Mitigation and Flood Defence (ASEA) project will help protect communities from the increased risk of flooding from climate change and rising sea levels, in particular around Avonmouth Village and Chittening in Bristol and in other residential areas in South Gloucestershire. Construction is expected to be complete in 2024 and as well as flood defences, a minimum of 80 hectares (the equivalent of around 112 football pitches) of new wetland habitat will be created.

The Bristol Avon Flood Strategy (BAFS) Strategic Outline Case (SOC) is our long-term plan to better protect homes and businesses from flooding and enhance the River Avon for all. The SOC was approved in March 2021 and Outline Business Cases are in preparation, the first of which is expected to be complete by Autumn 2023. The proposals are adaptive, so that defences can be altered over time to respond to the increased risk of flooding due to climate change. The first phase is expected to commence construction in around 2026, and complete by around 2032. The second phase is anticipated to be required at around 2065.

The Resilient Frome Project (RFP) is a mix of flood resilience measures across the River Frome catchment area from the river's lower reaches in central Bristol right up to its headwaters in South Gloucestershire.



**Plate 4 Pigeonhouse Stream Leaky Dam**



**Plate 5 Southmead SuDS scheme**

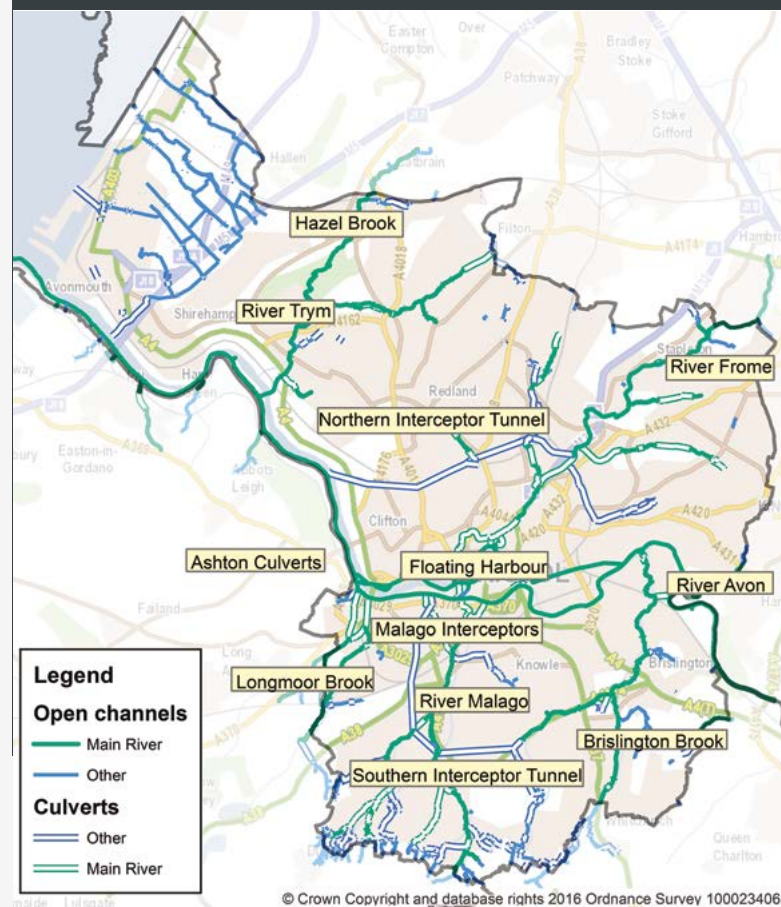
The Outline Business Case was approved in August 2022, which unlocked over £6m to enable the project partnership to deliver the programme over its five year duration up to 2027. We have six workstreams to improve flood resilience and provide multiple other benefits. By the end of the programme we aim to have completed a policy challenge review, installed new telemetry to inform operational procedures, delivered a river restoration scheme, installed natural flood management measures in the headwaters and constructed retrofit sustainable drainage systems (SuDS) in urban areas.

Our work has also influenced many planning applications across the city to ensure new developments are achieving a reduction in flood risk. By producing a revised Strategic Flood Risk Assessment (SFRA) for BCC in house we have strengthened the SuDS requirements to help manage this.

# Rivers in Bristol

Bristol is located in the south-west of England near to the Severn Estuary and Bristol Channel. There are two major rivers flowing through Bristol, the River Avon and the River Frome. Due to the proximity to the sea (Severn Estuary), the River Avon is influenced by the tide throughout Bristol.

**Figure 1** Rivers and water features in Bristol



Bristol has long had a close relationship with its rivers and waterways and owes much of its prosperity to living and trading within the tidal extent of the River Avon, which flows from east to west through the centre of the city. Managing the interaction with these rivers and the tide has often been at the forefront of the city's developers and engineers throughout the history of the city. The most significant evidence of this is the Floating Harbour, a unique inland harbour constructed in the early 19th century to provide a constant water level for mooring purposes and encourage the growth and prosperity of the city.

The flow of water through Bristol is heavily influenced by the topography of the city area. The northern and southern extents of the city are located on high ground that both slope down towards the city centre. Therefore the rivers in the north and south follow this topography and flow down to the River Avon, which defines the lowest lying areas of the city. The most northerly extent of Bristol, in the vicinity of Avonmouth, is also low lying as it is located on a coastal plain of the Severn Estuary.

**Figure 1** shows a map showing the location of all the major rivers and water features in the Bristol City Council area as well as giving an appreciation of the topography of the area.



# Flood risk in Bristol

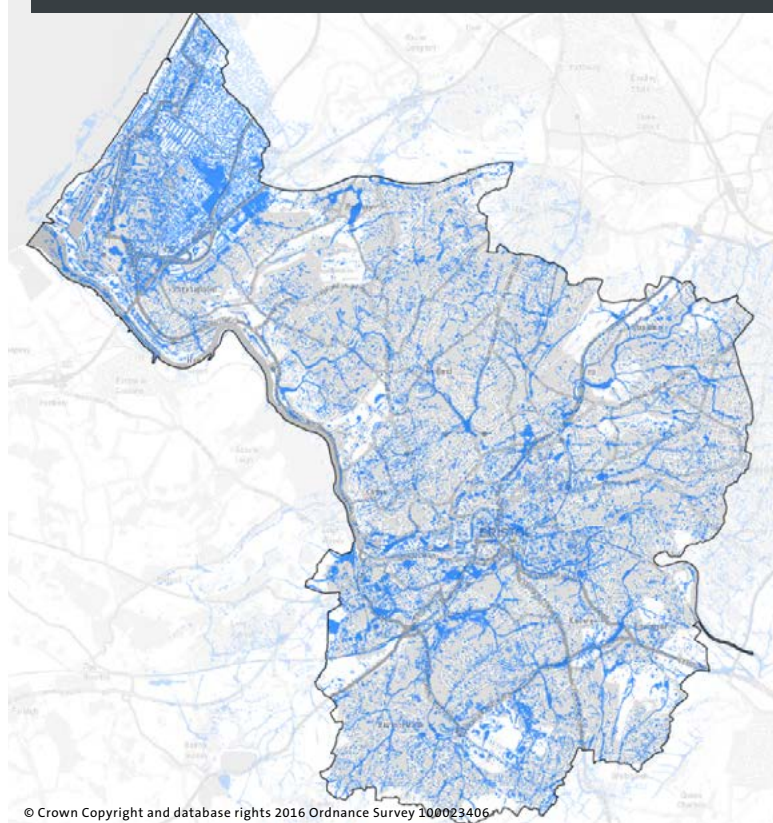
The flood risk in Bristol comes from a number of sources. Surface water, tidal flooding, flooding from rivers (fluvial flooding), groundwater, flooding from the underground surface water pipe network (sewers) and a combination of any of these sources all contribute towards the overall picture of flood risk. Climate change is expected to increase the frequency, severity and extent of flooding.

We, as LLFA, are responsible for managing local flood risks. In addition, our position as Harbour Authority, Highways Authority, Coast Protection Authority, Local Planning Authority and significant landowner, as well as being a key partner in the Local Enterprise Partnership and having the ability to apply for a variety of funding sources, Bristol City Council is well placed to take a lead role in managing flooding from other sources of flooding, where there is particular benefit in us doing so. It should be said that all flood management activities would be done so in partnership with the relevant Risk Management Authorities, stakeholders and community groups. A summary of the risk from all sources follows.

## Surface water and sewers

Our recently amended studies<sup>1</sup> predict that approximately 3,440 properties are at risk of surface water flooding across Bristol. This estimate is lower than previously thought based on different modelling assumptions. This strongly suggests that flooding during very heavy rainfall is likely to be significant and presents one of the biggest risks to the city.

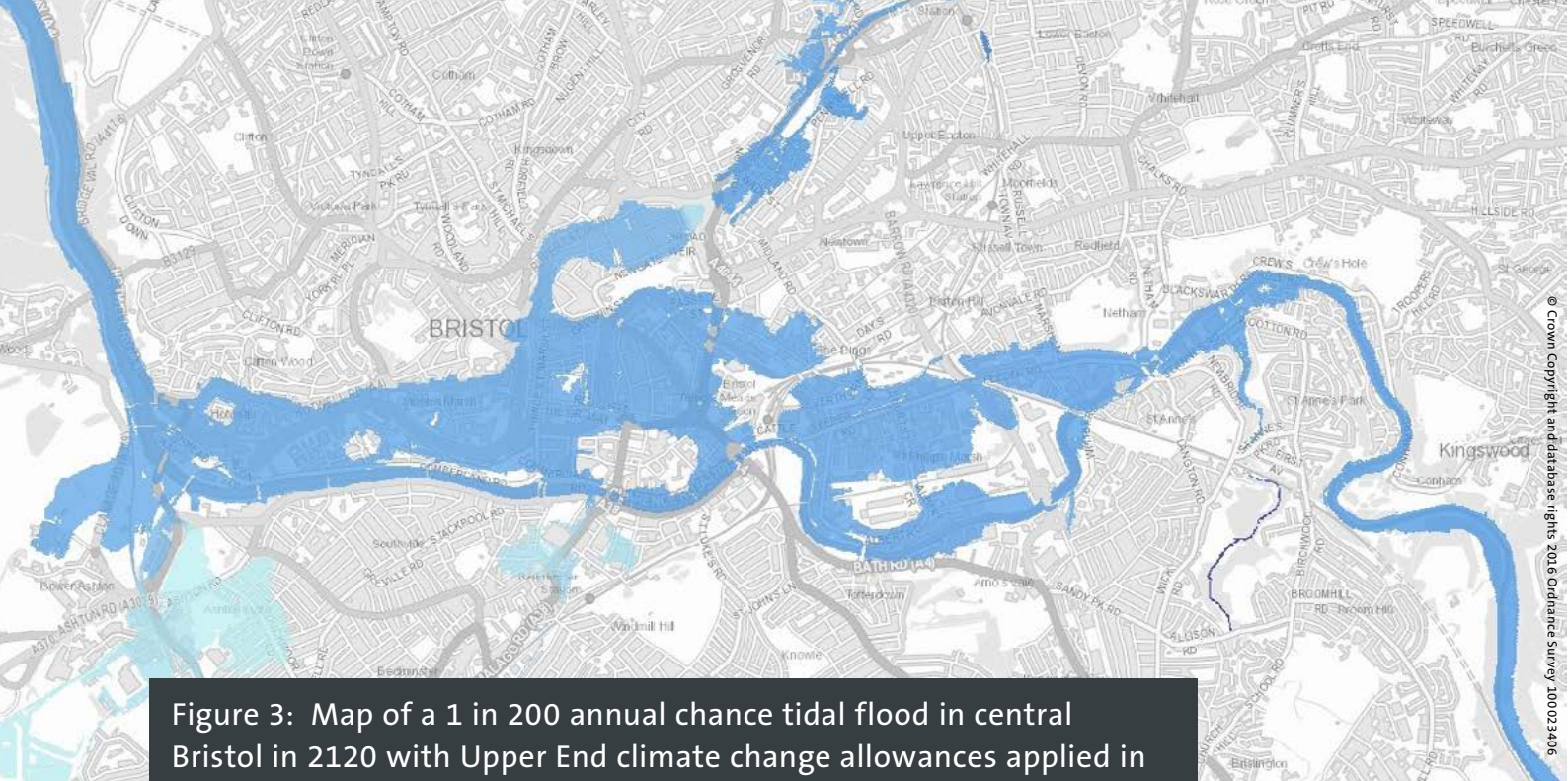
Figure 2: Map of a 1 in 100 annual chance surface water flood event in Bristol. See the [Bristol flood risk mapping](#).



The public surface water sewers only have capacity to accommodate a limited amount of rainfall. More intense storms beyond this are likely to overwhelm systems and lead to flooding. [The Wessex Water Drainage and wastewater management plan \(DWMP\)](#) considers the predicted future impacts on the sewer network and gives recommendations to help address this.

<sup>1</sup> [www.bristol.gov.uk/residents/planning-and-building-regulations/planning-policy-and-guidance/planning-evidence](http://www.bristol.gov.uk/residents/planning-and-building-regulations/planning-policy-and-guidance/planning-evidence)





We have identified a number of areas at particular high risk of flooding from surface water. The most notable of these are in Ashton and Southmead. The studies also confirmed that areas at the base of Dundry Hills (from Whitchurch to Withywood) are at high risk of flooding. Due to the importance of surface water flooding to Bristol, the surface water flood maps, as shown in Figure 2 have been designated as the Locally Agreed Surface Water information, which is represented in national surface water flood mapping.

## Tidal

Bristol lies adjacent to the River Severn Estuary, a tidal water body that has the second highest tidal range in the world. The River Avon that flows through Bristol discharges to the estuary and is therefore also tidal. The River Avon is tidal throughout the city and the influence of the tide extends upstream as far as Saltford near Bath. There are also several other rivers and surface water sewers in Bristol that discharge to the River Avon and because of this they too are affected by the tide in the low lying central areas of the city.

Several instances of tidal flooding have been experienced historically in Bristol including the flooding of 1981 when a storm surge caused a tide higher than predicted and resulted in flooding of approximately 12 properties. In addition, only proactive action by us and our partners avoided flooding impacts during storm surges early in 2014, where the tide reached a similar level to the event in 1981. Our studies indicate that tidal flood risk from the River Avon represents the most significant flood risk facing the city centre (the low lying parts of Bristol, located around the Floating Harbour) and predicts that approximately 1,200 properties (which include homes and businesses) are at risk from a high tide with a storm surge. The number of properties at risk has reduced following recent completion of a flood wall constructed in partnership between Bristol City Council and the Environment Agency as part of the MetroBus project. Due to the topography of Bristol, tidal flooding is contained mainly to the city centre and Avonmouth. Figure 3 shows the future risk of tidal flooding in central Bristol with the predicted impacts of climate change and Figure 4, the present day undefended risk at Avonmouth.

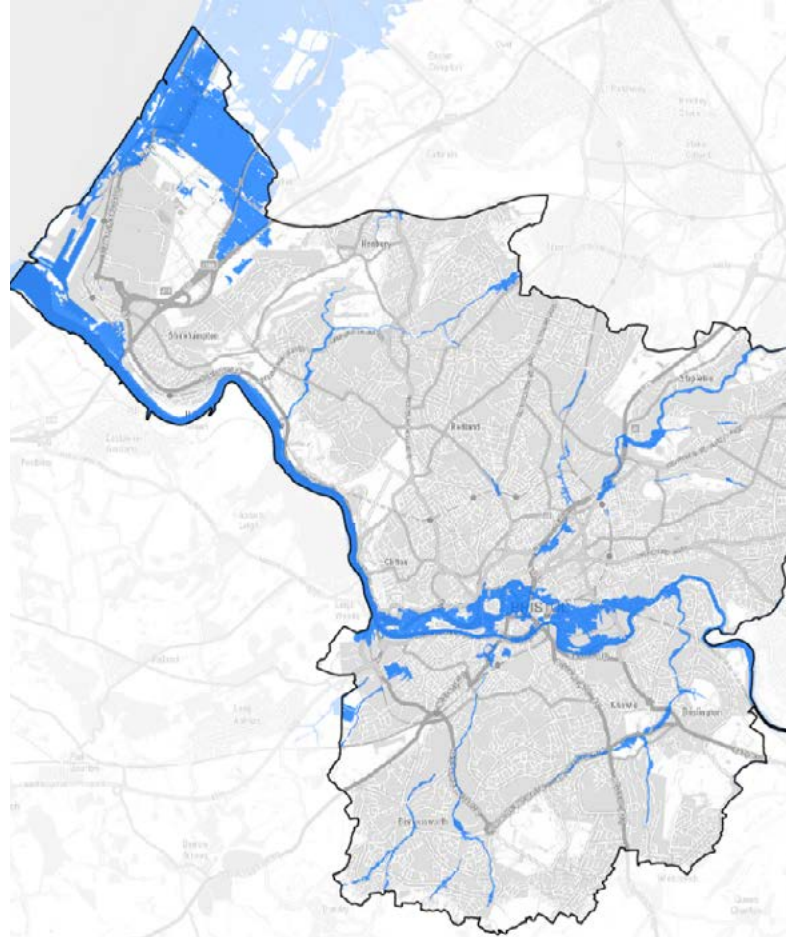
Online maps showing the approximate flood extents during extreme tidal events are available via [Bristol flood risk mapping](#).

## River (Fluvial)

There are several rivers (which are also known as Main Rivers) in Bristol and these have historically been known to cause significant flooding to the communities that surround them, most notably in 1968 (see below for more information). However since that time, large flood mitigation tunnels have been built that significantly reduce the actual flood risk to large parts of the city by diverting flood water into the River Avon.

We have been working with our risk management partners and adjacent developers, as part of a wider regeneration scheme to reduce flood risk to Bedminster from the River Malago. This river restoration scheme will reduce flood risk both in the present day and in the future with climate change, through the creation of a flood storage area to hold additional flood flows and the installation of a trash screen to prevent blockage to the culvert entrance, which has historically caused multiple flooding instances. Figure 4 shows the coverage of EA Flood Zone 3 across the city, representing areas of fluvial and tidal flood risk in the present day undefended scenario.

A number of smaller rivers, streams and ditches (which are also known as Ordinary Watercourses) also present a risk of flooding. These can often respond quickly to rainfall events and it is not always possible to accurately predict the extent of flooding that they may cause. Areas that are known to be at risk of such flooding are those at the base of the Dundry Hills in south Bristol and those around Henbury in the north of the city. Online maps showing the approximate flood extents during extreme fluvial events are available via [Bristol flood risk mapping](#).



**Figure 4: Map of EA Flood Zone 3 in Bristol.**  
See the [Bristol flood risk mapping](#).

## Groundwater

There have been very few instances of flooding from this source in Bristol. However it is recognised that the data used to assess this risk to date has been broad scale. The risk of groundwater flooding in Bristol is therefore not as well understood as the other risks at this time but is considered to be low in comparison to the risk of flooding from other sources.

We are aware that lower lying areas in Ashton in the south-west of the city and Avonmouth in the north, groundwater can get to within a few metres of the ground surface. Groundwater flooding has been reported at locations throughout the city but this has tended to be in basements, rather than groundwater rising above the ground surface. In addition, there are areas where springs can form, causing localised flooding. These areas are typically in Horfield, Redland and areas around Dundry Hills but these do not cause a significant risk to the city.



# Climate change

From rising sea levels to more intense rainfall, climate change is a threat that we need to address as part of the work we do.

## Tidal flooding

Figure 5 below show the potential impacts of climate change on tidal flooding in Bristol. Table 1 indicates the predicted impact of climate change on properties at risk from tidal flooding in the city centre, including the Temple Quarter Enterprise Zone.

**Table 1** Approximate number of properties (homes and businesses) at risk from tidal flooding in the city centre, including climate change.

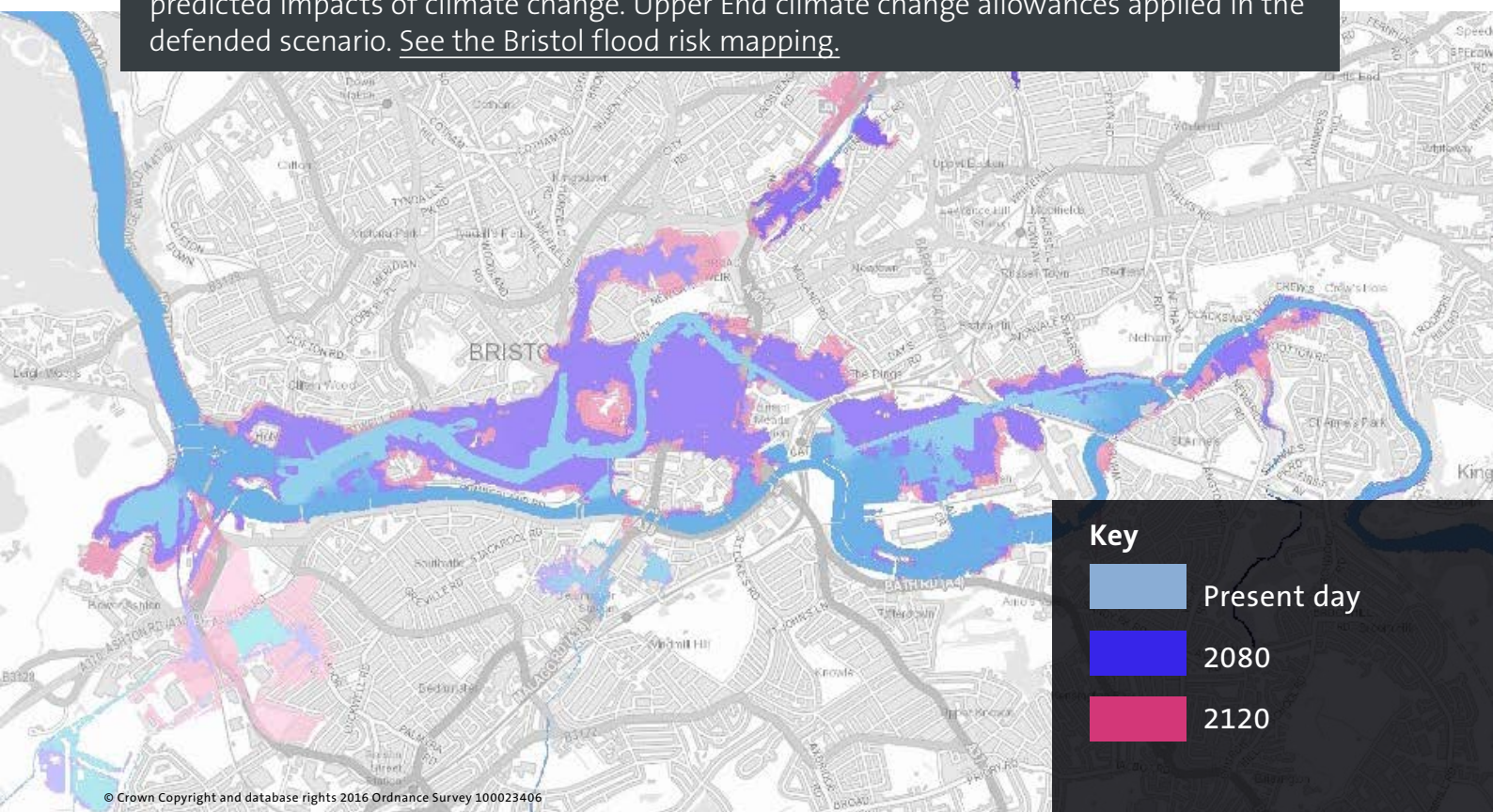
The threat from climate change is therefore likely to have a significant impact across the city, but notably in areas at risk of tidal flooding (city centre and Avonmouth). This would not only pose a threat to city life but also currently placing a constraint on future planning and regeneration in the city, in particular the two Enterprise Areas (Avonmouth and the Temple Quarter Enterprise Zone)<sup>3</sup>. It is therefore important that we work with our partners to help manage these constraints and encourage sustainable regeneration of the city.

	Present Day	Year 2125
Approximate Number of properties at risk <sup>2</sup>	1,200	4,500

<sup>2</sup> Taken from the 0.5% annual probability (1 in 200 annual chance) tidally-dominant event

<sup>3</sup> [www.westofenglandlep.co.uk/](http://www.westofenglandlep.co.uk/)

**Figure 5:** Map of a 1 in 200 annual chance tidal flood event in central Bristol with the predicted impacts of climate change. Upper End climate change allowances applied in the defended scenario. See the Bristol flood risk mapping.





## Surface water and sewer flooding

Our studies have predicted that the city faces a significantly increased risk of flooding from surface water and sewer flooding due to the likely impacts of climate change. It is likely that we will face heavy rainfall events on a more frequent basis in the future. In addition, given the potential strain that exists on the existing and therefore future drainage system of Bristol, urban creep is likely to be a significant issue in the future. As this will increase runoff into an already constrained sewer system.

## Fluvial flooding

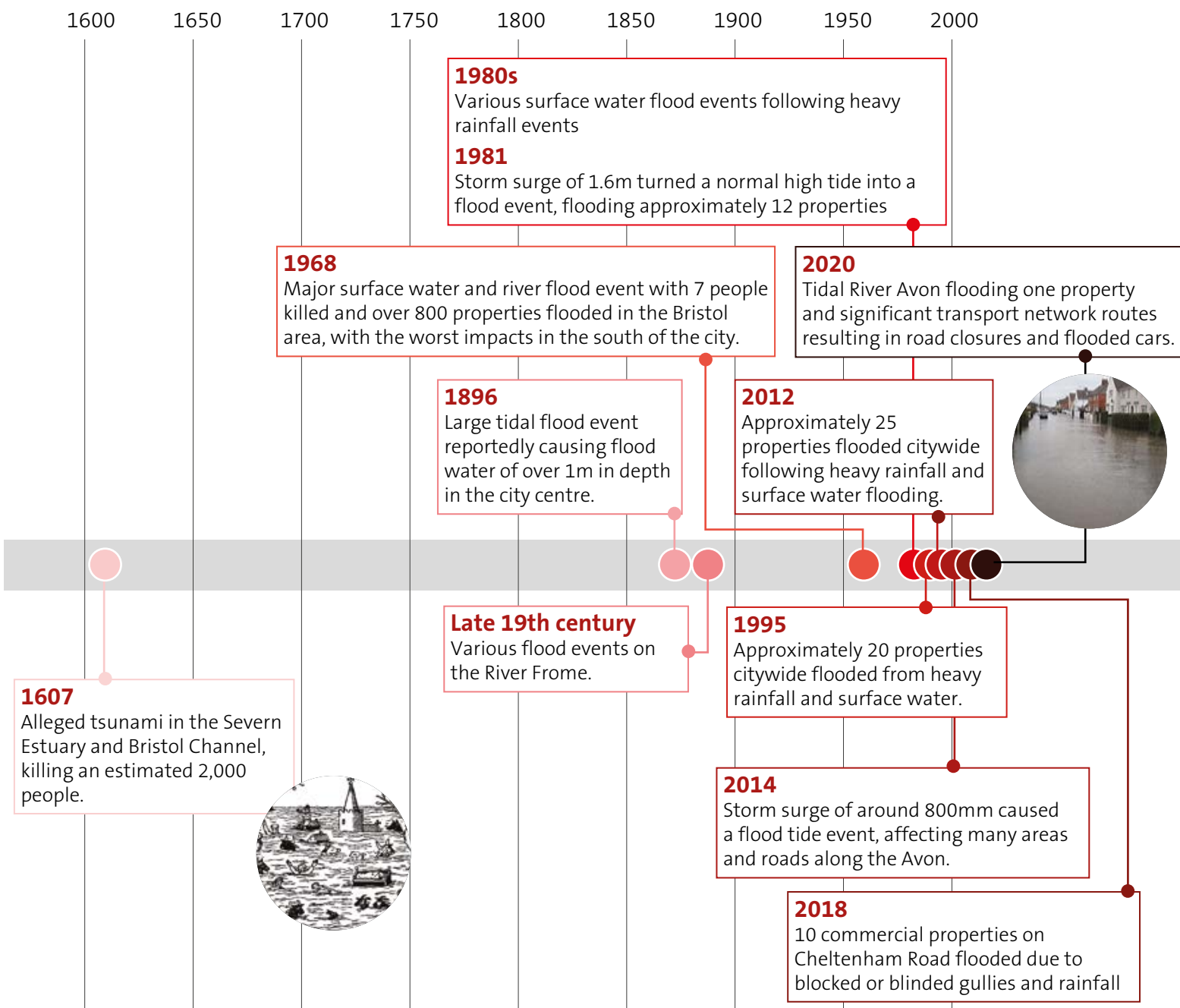
As identified above, the risk from climate change to fluvial flooding is predicted to be less severe than the tidal and surface water/sewer flooding, mainly on account of the existing flood mitigation tunnels. However, as these tunnels discharge into the tidal River Avon, sea level rise may limit their performance, increasing flood risks upstream.



# Historical flooding in Bristol

As with any city located around large rivers and the sea, Bristol has suffered from many flood events in the past. The timeline below summarises the more important events that have affected Bristol.

## Timeline





The rapid urban expansion of the city over the 19th and early 20th century, potentially contributed to more regular flooding events that affected the city at that time. The most significant flood event in recent history was in 1968. This was caused by approximately 13cm of rainfall falling in a 12 hour period in July 1968, resulting in both surface water and fluvial flooding. Over 800 properties were believed to have flooded, and seven people were killed. The flooding mostly affected areas in the south of the city (Ashton, Bedminster, Hartcliffe and Withywood) but it also caused flooding on the River Frome. In response to this major event, and previous events in the late 19th century, large tunnels were constructed to intercept flood water and reduce the risk to much of the city. These tunnels were the Airport Road Tunnel, Malago Interceptors and the Northern Storm Water Interceptor, which are shown in Figure 1 (page 12).

In addition to the event of 1968, the other event of particular significance is the tidal event in 1981. This is significant not because of the number of properties flooded but because of the nature of the event. On this day, the maximum tide level was predicted to be a normal spring tide. However, due to bad weather (a low pressure system) in the Atlantic Ocean and Severn Estuary, a storm surge of approximately 1.6m was experienced. This unexpected surge caused a normal tide to turn into a flood tide.

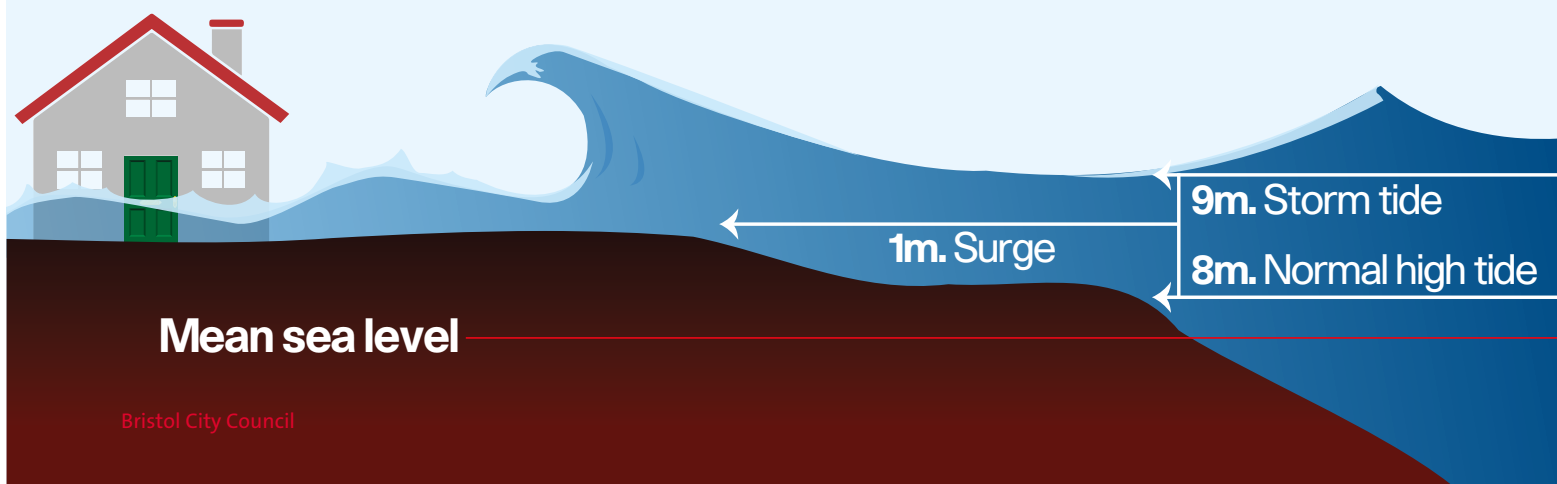
### Storm surge

The rise of water beyond what would be expected by the normal tide movement. These are typically associated with a low pressure weather system and strong winds.

### Spring high tide

Spring Tide, or Spring High Tide: a higher than average tide that occurs every two weeks, at the time of a full or a new moon. Some spring tides are higher than others.

**Figure 6** diagram indicating the effect of a tidal storm surge



# Recent events

Bristol has been relatively fortunate in recent years and has not experienced as much flooding as some of our neighbouring areas. In many instances, slightly different circumstances or a lack of actions that were conducted could have resulted in much more severe impacts to the city. The impact of the rainfall in 2000 and 2007 was not as significant in Bristol as other areas of the UK, resulting in only a few flooded properties across the city.

Across much of the UK, significant flooding was experienced in 2012, and again in the winter of 2013/14. This was due to some of the highest rainfall since records began, particularly from April 2012 until January 2013. In the Bristol area, most of the rainfall was persistent but not extreme.

The most notable single flood event was on 21 and 22 November 2012. During these two days, between 20 to 30 houses flooded internally across the city, with many more experiencing flooding of gardens, garages and roads. Property flooding was experienced in areas such as Highridge, Henbury, Brentry, Bishopsworth and Hengrove. The nature of the weather in 2012 meant that the areas experiencing flooding tended to be located adjacent to green spaces that were saturated from the prolonged rainfall over the preceding summer and autumn. As a result, the ground could not absorb much water and it flowed overland.

In an event similar to the 1981 event, on the 3 January 2014, we experienced a large storm surge in combination with a high spring tide. In 2020 this was encountered yet again with transport disruption and internal property flooding experienced. This resulted in flooding in many areas along the Avon, notably at Sea Mills, Cumberland Road and Avon Crescent, Cattle Market Road and Crew's Hole Road.

We have written a separate report to provide more information in the [Flood Investigation: March 2020 Tidal Flooding](#).

Thunderstorms in June 2016 resulted in surface water flooding of five properties around the Redland, Clifton and Cotham area (note: this was not classified as a significant event). Localised heavy downpours caused flash flooding, affecting mostly basement dwellings. The rainfall was highly isolated which was evident in the variation of measurements in rain gauges stationed throughout the city. The gauges recorded 25mm of rainfall in two hours in Clifton. In contrast only 1mm was registered in north and south Bristol. This highlights the risk during the summer months and demonstrates the rapid response of the urban drainage catchment, along with the limited capacities of the existing sewer network.

Intense rainfall in November 2016 caused flooding and disruption throughout Bristol. Seven properties suffered internal flooding and highway flooding damaged around a dozen cars in south Bristol. Blockages of gullies and trash screens were attributed the cause, from an accumulation of vegetation, debris and rapid leaf fall. This was combined with a month's worth of rainfall falling over only a few days, between 16 to the 22 November.

The consequences of which were made worse by infrastructure. This showed the increased flood risk during autumn time when the excess leaf fall and wetter seasonal conditions can have extremely detrimental affects. In 2018 a formal flood investigation was required under Section 19 of the Flood and Water Management Act 2010 into the internal flooding of 10 properties on Cheltenham Road. A sudden deluge of rainfall in combination with the autumnal fall impeding the highway drainage system resulted in flooding at this location due to several flow paths in the immediate surrounds all directed towards this point . A separate report on this flood event providing additional information is available via [Cheltenham Road flood: 27 November 2018](#).



# Flood risk management

## Formation of the Lead Local Flood Authority

In response to the major events of 2000 and 2007, the UK government established the formation of Lead Local Flood Authorities (LLFA) via the Flood and Water Management Act of 2010. LLFAs take a lead role in co-ordinating the approach to managing flood risk in their administrative areas. In 2010, Bristol City Council was identified as an LLFA.

This Local Flood Risk Management Strategy (Strategy) outlines how we (Bristol City Council) will manage flooding in our area now and in the future. The Strategy has been written for the people of Bristol, its authorities, agencies and partners.

We have a statutory requirement<sup>4</sup> to produce this Strategy and ensure that the Actions identified within it are monitored and achieved. The Strategy will be a vitally important document for us as the LLFA. Our aim, however, is to use the Strategy to engage with our communities (those who live and/or work in Bristol) and communicate what we do and how the people of Bristol can work together to reduce the risk of flooding in our city.

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<sup>4</sup> Under Section 10 of the Flood and Water Management Act, 2010

# Approach to the Strategy

## Definition of risk

A key aspect of our work is assessing the risk posed by flooding. For the Strategy, and therefore the work we do, risk is defined as:

$$\text{Risk} = \text{Probability} \times \text{Consequence}$$

The full definition of these terms is fundamental to our work and how we prioritise our work, however, it is a very technical subject and can be confusing. As a result, we have included in Appendix A an explanation of the terms for those who wish to learn more about this aspect.

## Definition of significance

Another important definition that forms the basis of all the work we do is the definition of significance. From the formal reporting of flood events<sup>5</sup> through to the identification of flood assets for the Asset Register<sup>6</sup>, most aspects of our work require a definition of a significant flood. Through our partnership working, notably the West of England Flood Risk Working Group, we have agreed the following definitions:

In order to provide a simple and proportionate method for identifying significant flood risk assets, we developed the Significant Drainage Network, which defines the key culverts and watercourses for drainage within the city. Any asset located on this network is considered significant.

**Significant Flood Risk Asset:** Any asset located on the Significant Drainage Network or any other asset we believe performs an important flood defence function.

## Significant flood event

Five or more properties within a defined area affected in an urban setting or two or more properties within a defined area affected in a rural setting.

## National Strategy

The Environment Agency is the national government agency who manages flood risk on a strategic (national) scale. The latest version of the [Environment Agency's National Flood and Coastal Erosion Risk Management Strategy \(NFCERMS\)](#) for England was published in July 2020. Its main ambitions over the next 10 to 30-year period are for:

- Climate resilient places
- Today's growth and infrastructure – resilient in tomorrow's climate
- A nation ready to respond and adapt to flooding and coastal change

<sup>5</sup> Under Section 19 of the Flood and Water Management Act, 2010

<sup>6</sup> Under Section 21 of the Flood and Water Management Act, 2010

## Local Strategy

Our Local Strategy reflects the national approach for consistency but is planned over shorter time periods. The Local Objectives align with National Ambitions but are made specific to Bristol. Figure 7 shows how the National Strategy Ambitions have been implemented as Local Objectives.

This Strategy is written in the form of an Action Plan that we can use to deliver improvements and monitor our progress in meeting the Local Objectives.

We will be using a number of Measures that describe how we aim to achieve the high-level Objectives. The Actions we will be using to deliver our Measures are based on a SMART approach (Specific, Measurable, Achievable, Realistic and Time-based) for ease of monitoring. In accordance with the SMART approach, the Strategy, and its Action Plan, is time based. The timeline for the Actions is based on short (two years, 2023–2025), medium (four to six years, 2023–2027) and long (more than six years, 2027 and beyond) term.

**Figure 7** National Strategy Ambitions and the relevant Bristol Strategy agreed Local Objectives

### National Strategy Ambitions

#### 1. Climate resilient places

#### 2. Today's growth and infrastructure – resilient in tomorrow's climate

#### 3. A nation ready to respond and adapt to flooding and coastal change

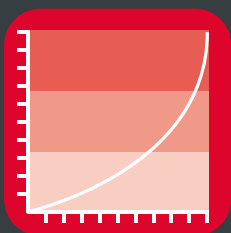
### Agreed Local Objectives

- Gain a greater understanding of the flood risks posed to Bristol and its people and places
- Promote sustainable development that seeks to reduce flood risk and includes consideration of climate change
- Actively manage flood risk infrastructure to reduce the likelihood of flooding causing harm to people and damage to society, the economy and the environment
- Increase public awareness and encourage communities to take action to manage the risks that they face
- Understand communities flooding concerns and priorities, and gather knowledge based on their perception of flooding
- Improve preparedness for flood events and post flood recovery



# Guiding principles

We have used the following six 'guiding principles' that comply with best practice approaches. We have ensured these principles are followed by using icons to categorise each guiding principle, the icons are shown below. For each Measure, we have identified which of the principles it helps to achieve by using the corresponding icon



## **Proportionate and risk based**

Flooding can never be prevented altogether. To try and do so would be technically infeasible, environmentally damaging and uneconomical. A risk based approach to managing flooding targets investment to areas where the risk is greatest by examining both the likelihood and consequences of a flood occurring. Flood risk management activities should be proportionate to the risk that is faced.

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## **A catchment based approach**

To manage flood risk effectively, it is important to understand the interactions with the wider area over the entire catchment. Activities must not adversely affect other areas and should consider how changes taking place around us impact the risk of flooding. A catchment based approach is how we ensure that activities are coordinated and involves working closely with neighbouring authorities.

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## **Community focus and partnership working**

Working closely with communities provides us with a clearer understanding of the issues and lets us appreciate the community perspective of flooding. Giving communities a greater say in what activities take place and helping them to manage their own risk will result in better decisions being made and allows greater flexibility in the activities that take place. It is also vital to work in partnership with other authorities so that a joined up way of working is achieved beyond the boundaries and responsibilities of individual authorities.



### **Beneficiaries encouraged to invest**

If funding for flood risk management activities relies on central and local government alone, then those activities will be significantly limited by the funds available. They will also be constrained by national controls and reduce the scope for local influence. Those that benefit should therefore be encouraged to invest in order to maximise flood risk management activity and allow innovative solutions to take place.

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### **Climate resilience and sustainability**

More sustainable approaches to flood risk management should be sought that include consideration of wider sustainability issues such as the environment, whole-life costs, and the impact of climate change. Wherever possible, solutions to flooding problems should work with natural processes and aim to enhance the environment.

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### **Multiple benefits**

Flood risk management solutions can often provide additional social, economic and environmental benefits. For example the use of sustainable drainage systems can reduce the pollution of watercourses by minimising urban storm water runoff. The potential to achieve multiple benefits should be considered in all of our flood risk management activities.

# Partnership working



**Figure 8** Risk Management Authorities in Bristol and the flooding sources they are responsible for managing

## Risk Management Authorities

Although Bristol as LLFA take a lead in co-ordinating flood risk management in our area, there are several authorities that have a role and responsibility for managing the risk of flooding from different sources, so working together is an essential part of this Strategy. Our partners that have formal or statutory responsibilities for managing flood risk are known as Risk Management Authorities (RMA). In Bristol, there are five Risk Management Authorities; **Figure 8** shows who they are and what they are responsible for.

**The Environment Agency** is the central government agency with the responsibility for a strategic overview of all sources of flooding and coastal erosion in the UK, in particular flooding from Main Rivers and the sea. It is also the enforcement authority for reservoirs.

**Bristol City Council** is the Lead Local Flood Authority in Bristol, and at times takes the lead on co-ordinating local flood risk activities within its administrative boundary. It is also responsible for flood risk management activities related to ordinary watercourses, surface water and groundwater.

**Bristol City Council** is also the Highway Authority in its area, and as such has the responsibility for providing and managing highway drainage and roadside ditches.

**Wessex Water** is responsible for managing the flood risk from all public sewers in Bristol and work closely with Bristol City Council and the Environment Agency to ensure a co-ordinated approach.

**The Lower Severn Internal Drainage Board** is responsible for managing water levels in the low-lying areas around the Severn Estuary, which in Bristol applies to the Avonmouth area.

The functions of the RMAs under the Flood and Water Management Act are provided in [Appendix B](#).

## Internal partners

As well as our Risk Management Authority partners, there are several service areas within BCC that have an important role to play in managing the causes and consequences of flooding. The Flood Risk Management Team (FRM) leads on co-ordinating the flood management activities between these teams. In the instance of receiving notification of a Flood Warning from the Environment Agency for example, the FRM Team will interpret this in terms of the local Bristol context and begin any necessary preparations. Proposing the appropriate actions to take and directing resources ahead of a potential flood event. Those colleagues involved that constitute the LLFA within BCC we refer to as our internal partners. They have the following roles and responsibilities in relation to flood risk management.

## Emergency Preparedness and Resilience Team (EPRT)

- Prepare and test emergency flood plans to ensure the city is prepared to respond to a major flood event.
- Ensure the council can care for the welfare and support of those affected during a flood.
- Provide expert advice to the emergency services during a flood.
- Assist the council in recovery of communities affected by a flood.

## Marine Services

- Operate and maintain the city docks flood defences.
- Work in partnership with the LLFA to increase understanding and improve future flood defences to manage the risk of climate change.

## Traffic and Highways Maintenance

- Maintain the highway drainage network and respond to blocked gullies that pose a flood risk to property.
- Maintain highway culverts, bridges and other structures.
- Work in partnership with the LLFA when delivering highway schemes to identify opportunities to reduce the risk of flooding.

## Strategic City Planning and Development Management

- Consider flood risk in Local Plans.
- Ensure development proposals are appropriate and do not increase flood risk to third parties. Seek opportunities to employ sustainable drainage approaches and incorporate biodiversity benefits where possible.

## **Parks and Estates**

- Maintain park areas and assist with clearing blockages from watercourses in public open space.
- Assist in emergency response during times of severe weather, including flooding.

## **Sustainable City and Climate Change**

- Achieve more effective flood risk management within the delivery of a wider climate change strategy
- Provide specialist environmental advice to council and partners

Residents and businesses of Bristol also have an important role to play in flood risk management. We encourage those who live and work in Bristol to:

- Report flooding incidents (see [Flooding and storms](#) and [Fix My Street](#))

Environment Agency Incident Hotline 0800 80 70 60 [Report an environmental incident](#) (www.gov.uk)

- Report blocked trash screens
- Take steps to protect their property and make it resilient to flooding
- Prepare their own emergency plans
- Volunteer to become flood wardens

Working with communities is an important part of this Strategy and is discussed in detail in later sections.



# Strategy Objectives, Measures and Actions

This section describes the Objectives, Measures and Actions that form the basis of our Strategy and provides the evidence as to how we are meeting the SMART approach. The summary Action Plan for each Objective has been provided within the main text of this document.

A full Action Plan is provided in [Appendix D](#), which provides additional information as to how the Actions are proposed to be funded, which Measures they help to achieve and which of the guiding principles they are aligned with.

# Climate resilient places

## Local Objective:

Gain a greater understanding of the flood risks posed to Bristol and its people and places

The flow and movement of water within and around Bristol is complex. From the tidal River Avon to surface water runoff from Dundry Hills, Bristol is at risk from almost all sources of flooding.

Since becoming a Lead Local Flood Authority (LLFA) in 2010, we have been working in collaboration with other Risk Management Authorities (RMAs) in the area (principally the Environment Agency and Wessex Water) to gain a greater understanding of the flood risks posed to Bristol. We have completed several studies to help us understand these risks. The key aspect in managing flood risk is first to understand and quantify the risk. As a result, understanding and quantifying the risk has been the first actions we have undertaken in our LLFA role. A summary of the various works undertaken by us is provided in [Appendix B](#).

Much of the work and studies we have completed to date has been associated with Main Rivers and the sea, which are both under the jurisdiction of the Environment Agency. However, we have led on these as they have been work required to support our emerging Local Development Framework or to support our other roles and responsibilities. In addition, we have taken the lead on studies to increase our knowledge and understanding of the role our assets (such as those in the Floating Harbour) has in flood risk management.

The Environment Agency and other RMAs have been key partners and stakeholders throughout the completion of all our studies to ensure consistency across the authorities.

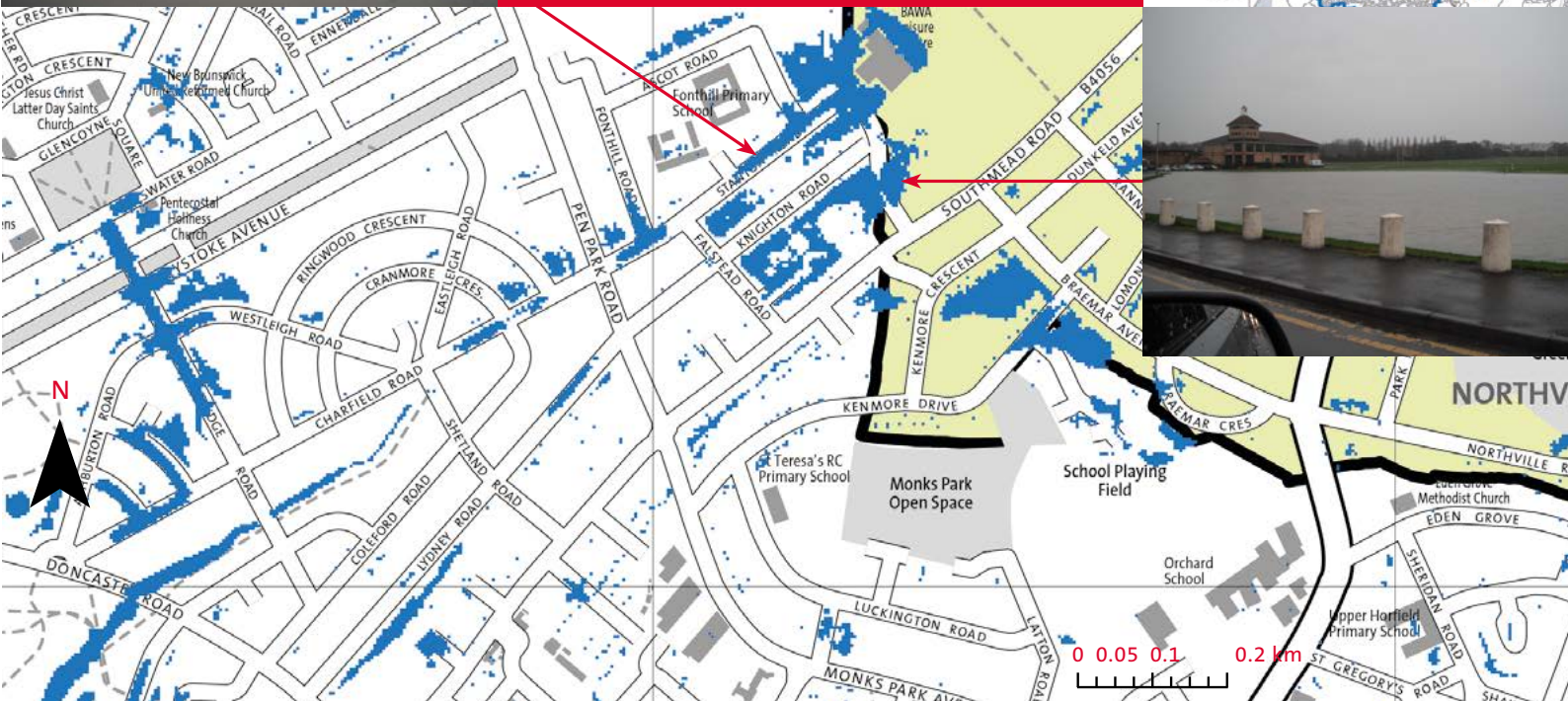
During and after the events in 2012, 2013, 2014, 2016, 2018 and 2020 we undertook many visits to the areas affected by flooding to gather data and information regarding the flooding. One way in which we used the data was to verify the results of our studies. The areas flooded in 2012 correlated well with our studies which give us a relatively high confidence in the predictions made by the studies.

**Figure 9** provides some evidence of the verification of study results.

Our studies have also provided potential options to reduce the risks, which are summarised in following sections.



Our study outputs predicted areas around Bristol that would be more susceptible and prone to flooding. During the November 2012 incident confirmation of this was gained by visiting the areas thought to be more vulnerable. These results correlated well, as shown.



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**Figure 9** Evidence of the verification of study results. See [maps.bristol.gov.uk/bfrm/](https://maps.bristol.gov.uk/bfrm/)

## Data led approach

We, like many LLFAs, are always looking to improve how we collect, manage, exploit and share information. Since the initial launch of this Strategy in 2014, we have embraced a data-led approach. As part of this, we record our actions, why we undertook them and the benefits they provide. We also seek to source information from other organisations and the public to support our activities. We then pass on the value of our information by sharing it with the public and our risk management partners. Such an approach shapes how we understand flood risk - now and in the future. It also ensures our activities are executed intelligently and transparently, founding our decisions upon sound information, and improves collaboration with our partners.

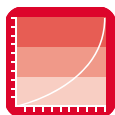
## Measures

- A.** Identify and prioritise local flood risks, taking climate change projections into account.
- B.** Work in partnership with the Risk Management Authorities to identify and prioritise other sources of flood risk.
- C.** Learn from real-life flooding by recording and investigating events.
- D.** Gather, manage and share high quality data to help understand the risk of flooding.
- E.** Create and maintain the Flood Risk Asset Register to identify key flood risk assets and who is responsible for their maintenance.

## A. Identify and prioritise local flood risks, taking climate change projections into account



Using the information gained from the studies summarised in [Appendix C](#), we have begun to identify a priority list of future actions, which has formed the basis of this Strategy.



For surface water and Ordinary Watercourses, we have used the studies and data collected from previous events (notably 2012) to identify a priority list for potential schemes or further works. In addition, we have used the outputs from our studies to identify a priority list for future work.

**Table 2** Priority list of areas requiring flood mitigation schemes

Flood source	Priority number	Area/location	Types of properties at risk
Tidal, fluvial	1	City Centre including Temple Quarter, Western Harbour and St Philips Marsh	Commercial, residential, infrastructure
Tidal, fluvial	2	Avonmouth	Commercial, residential, infrastructure
Tidal, fluvial	3	River Frome corridor	Commercial, residential, infrastructure
Tidal, fluvial	4	Bedminster Green	Commercial, residential, infrastructure
Surface water, tidal, fluvial, groundwater	5	Ashton	Residential, commercial and industrial
Surface water	6	Southmead	Mostly residential, some commercial

In addition to the larger high risk areas identified by the various studies and indicated in Table 2 above, areas of regeneration, where significant increases in the number of residents are proposed and flood risk measures have the potential to significantly reduce flood risk to the area, will be prioritised. The priority areas have also changed since the last Strategy update due to various schemes being implemented throughout the city in recent years. New flood modelling has also suggested a lesser risk in areas such as Bamfield that were previously on the list.

We have reviewed the computer simulation model that predicts surface water flooding in the city in 2018. Such a review was required given the age (completed in 2010) of the original model and the advances in simulation software since its completion. Through this update, we have also identified an opportunity to work closer with our partners Wessex Water and the Internal Drainage Board through the choice of simulation software to be used.



This allowed all partners to have a consistent baseline for analysing the risk of surface water flooding to Bristol.

Of the remaining local flood risks, the only risk that remains largely un-quantified is the risk posed by groundwater. Historically, groundwater has not been considered to pose a significant risk to Bristol, based largely on limited information. However, recent liaison with third parties has indicated high groundwater tables may exist beneath areas of Ashton and Avonmouth. The recent instances of groundwater flooding experienced at Avonmouth add validity to this. In addition, a number of springs have been identified in areas such as Horfield and Withywood. We propose to undertake future work to further understand the risk posed from groundwater sources.

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## **B. Work in partnership with the Risk Management Authorities to identify and prioritise other sources of flood risk**

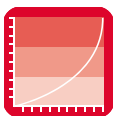


Due to the nature of flooding, categorising it into specific types or sources can sometimes be misleading. For example, flooding from surface water often combines, leads to or connects with, flooding from rivers. As a result, working in partnership with colleagues from other RMAs is crucial to help define and understand flooding mechanisms and prioritise potential interventions to where the risk is greatest.

Partnership working is a theme that runs through the Strategy and as such, many of the specific Actions we have identified are based on a partnership approach. As the Strategy monitoring process will be scrutinised by the main RMAs, we will be in a good position to ensure we identify the relevant partners for each piece of work we undertake.

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## **C. Learn from real-life flooding by recording and investigating events**



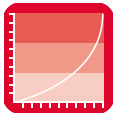
Knowing where and why flooding happens is vital for understanding and therefore managing flood risk. We will continue to investigate flood events in partnership with local residents, collecting information such as eye witness accounts, photos, questionnaires and meteorological data, to attempt to establish why the flooding occurred and potential solutions to reduce the risk.

To get the most out of this data we will further develop our flood events database to ensure the information is consistently recorded. As the record of flood events grows over time we will build an ever-more valuable picture of flooding in Bristol that will not only improve our understanding of flood risk, but also provide solid evidence to support decision-making, helping to ensure our activities are focused in the areas of greatest need. We are also committed to publishing as much data as we can (subject to licencing or confidentiality issues) on our public website to help inform the community.

Since the last Strategy refresh we have added more information to the council website on what to do in a flood situation and provided more background on known flooding issues. See for instance: [Flooding and storms](#) and [Flood Investigations](#).

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## **D. Gather, manage and share high quality data to help understand the risk of flooding**



Successful flood management is dependent on relevant, high-quality and reliable data. It is used to inform our knowledge of flood risk, support decision-making and measure the success of our actions.



We will continue to capture data, both as part of our routine work and through specific data collection exercises. This ensures that we don't waste time and resources collecting data without a worthy purpose and that its quality and format support the purpose for which it is collected.



As part of our flood investigation work, we record incidents in a central database shared with LLFAs, and other authorities across the region: Flood Online Reporting Tool ([FORT](#)). It is easy for officers and the public to fill in standard questionnaire forms, ensuring the Council and our partners get the information we need and in a format that allows us to easily analyse the results and help shape any potential interventions. The system can be accessed at:

[swim.geowessex.com/bristol](http://swim.geowessex.com/bristol)

We have installed several rain gauges and culvert inlet monitors (locations were decided using a risk-based approach), which provide high-quality, real-time data to help alert us to culvert blockages as well as improve our local understanding of catchment responses. The data is also available to the public via the Council's Open Data site: [opendata.bristol.gov.uk](http://opendata.bristol.gov.uk). Flood risk management is done in partnership with many organisations and our communities so it is important to make sure our data is easily accessible to anyone who needs it, ensuring, however, that any sensitive information is appropriately restricted and properly secured. Our online map is an easy access point for much of our data:

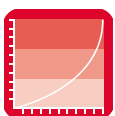
<http://maps.bristol.gov.uk/bfrm>

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## **E. Create and maintain the Flood Risk Asset Register to identify key flood risk assets and who is responsible for their maintenance**



Channels, drains, embankments, walls, water storage basins and many other types of infrastructure have a big influence on how water moves across the landscape. When these infrastructure assets are functioning well, they form a vital role in flood risk management.



To ensure flood risk infrastructure assets are maintained in a functioning state, we need to know where they are, what condition they're in and – critically – who's responsible for their maintenance.

To achieve this we have created and published the **Flood Risk Asset Register**. We have collated the data by establishing processes to integrate asset data held by partner authorities as well as carrying out our own data capture exercises. We will continue to improve the depth and quality of this information through further data capture projects. We will also adopt the use of an advanced database system to enhance the intelligence and efficiency of our asset management activities, ensuring our assets are sustainably managed, prioritising resources for assets in greatest need of repair in areas of greatest flood risk.

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## Local Objective 1 – Actions

### Actions completed

Undertake Avonmouth/Sevenside flood defence study.

Update and procure Flood Risk and Drainage Advice and Design Consultancy Framework.

Formulate methodology to identify significant flood risk assets for the Flood Risk Asset Register.

Install trash screen monitors and rain gauges.

Develop the flood events records database.

Complete SWMP update including Ashton surface water flood risk study.

Complete River Avon Tidal Flood Risk Management Strategy.

Complete Full Business Case for the Avonmouth/Sevenside Ecology Mitigation and Flood Defence Scheme.

Undertake vulnerability mapping exercise using study results and enhance infrastructure resilience.

Undertake comprehensive local flood-risk asset surveys.

Contribute towards the completion of the Horizon 2020 RESilience to cope with Climate Change in Urban arEas (RESCCUE) project with European partners.

Publish appropriate datasets such as the Flood Risk Asset Register on the council's website.

### Actions outstanding

Complete integrated Ashton flood risk study in partnership with EA and WW (continued by other RMAs).



Actions ongoing				
Action No.	Action Name	Short term 2023–2025	Medium term 2025–2029	Long term 2029 onward
1.0	Undertake citywide groundwater risk assessment.	✓	✓	✗
1.1	Update and procure the asset survey contract, ensuring national standards are met.	✓	✗	✗
1.2	Utilise Confirm asset management software and transference of applicable information. Including asset inspections, issuing of maintenance work, records of visits from contractors and developing forecast spend profiles.	✓	✓	✓
1.3	Improve the recording system of flood risk management activities undertaken. To demonstrate clearly to other RMAs and the public the progress made in completion of Strategy Actions and the status of work carried out.	✓	✓	✓
1.4	Continue to provide flood risk data to BCC Emergency Preparedness and Resilience Team to inform emergency management procedures.	✓	✓	✓

New Actions planned				
Action No.	Action Name	Short term 2023–2025	Medium term 2025–2029	Long term 2029 onward
1.5	Continue to lead the Resilient Frome project in partnership with the Environment Agency, South Gloucestershire Council, and Wessex Water, through regular project co-working, progress meetings and Director's boards.	✓	✓	✗
1.6	Deliver RFP policy challenge report to Defra in April 2023.	✓	✗	✗
1.7	Deliver RFP telemetry improvements as described in the OBC by Autumn 2023.	✓	✗	✗

## Local Objective:

Promote sustainable development that seeks to reduce flood risk and includes consideration of climate change

To ensure development is sustainable, the flood risk posed to and from a new development must be appropriately assessed and managed with allowance for climate change. The potential for increased flood risk caused from development must also be carefully considered. However, if properly managed new development can serve to reduce the existing risk of flooding. We are committed to actively encouraging such a reduction given the risk of surface water flooding posed to Bristol. National and local existing policies are in place to help achieve this<sup>7</sup>.

The technical review of proposed development plans for drainage is essential. Bristol City Council, like all Lead Local Flood Authorities, require all construction with drainage implications to seek our approval for drainage proposals to national standards and local requirements. As the LLFA, BCC is now a statutory consultee with regards to surface water drainage on all Major planning applications. However, to demonstrate our commitment to ensuring appropriate assessment of flood risk from development, we have agreed local standards to review planning applications using a risk-based approach.

Bristol City Council aims to facilitate real change in the way the drainage of new development is planned and implemented in Bristol. We are working to realise the opportunities of SuDS by promoting the approach and addressing the barriers to its use. We seek opportunities to employ the SuDS approach and incorporate biodiversity benefits where possible.

Scrutiny of new developments' drainage proposals will be subject to its own documentation and processes, hence we have not gone into detail within this Strategy, but introduced the salient points and our ambition.

Development in known flood risk areas must also be regulated and measures put in place to either restrict inappropriate development, or ensure that mitigation measures are put in place to make the development safe for the lifetime of its use.

### How we promote sustainable development

Promoting sustainable development involves assessing new development proposals on a flood risk basis by reviewing the nearby watercourses, flood risk assets, historical flooding records and drainage characteristics of the site. We assess development planning applications for compliance with the National Planning Policy Framework (NPPF), Planning Practice Guidance (PPG), our local West of England Sustainable Drainage Developers Guides, SFRA and our own Local Plan's policies. Best practice guidance, research and information are also referenced. As statutory consultee we review surface water drainage strategies for all Major planning applications. Our local agreement with Development Management colleagues in BCC is to also review certain minor applications on a risk based approach. From a Strategic Planning perspective we are involved in the [Local Plan](#), [SFRA](#) and subsequent Core Strategy update and will

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<sup>7</sup> National Planning Policy Framework, Bristol Local Plan's Core Strategy Policy BCS16

input on the [WECA Spatial Development Strategy](#) where required.

Our policy is that all development is required to incorporate water management measures to reduce surface water run-off and ensure that it does not increase flood risks elsewhere. Our policies make a presumption for the use of sustainable drainage. Reduced existing runoff rates and volumes from previously developed sites manage the existing flood risk to third parties downstream of the development.

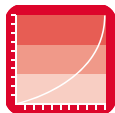
The approval of a site-specific flood risk assessment and drainage strategy is required including adherence to certain conditions to ensure development not only has protection from potential flooding issues itself but is also not increasing flood risk to third parties.

## Measures

- A.** Inform planning policy to ensure flood risk to new and existing developments is effectively identified and future land use is appropriately considered.
- B.** Ensure all new developments are drained sustainably.
- C.** Ensure new developments are better protected and able to withstand flooding where appropriate.
- D.** Work with new developments to reduce flood risk and incorporate Water Sensitive Urban Designs with nature based solutions and ecosystem services to provide multiple benefits.
- E.** Co-ordinate responses to planning applications in partnership with Risk Management Authorities to ensure new developments have an appropriate and consistent regard to flood risk.
- F.** Work in partnership to identify opportunities for contributions to flood mitigation schemes.



## A. Inform planning policy to ensure flood risk to new and existing developments is effectively identified and future land use is appropriately considered



Robust planning policy is essential to ensure appropriate consideration to flood risk is given by all new developments. We will ensure Bristol's Local Plan continues to include and gives due consideration to flooding. We will do this by maintaining our Strategic Flood Risk Assessments to ensure appropriate land allocation. In line with the NPPF, a sequential approach will be followed to steer new development to areas with the lowest probability of flooding. Through policies such as BCS16 of the Core Strategy we aim to reduce runoff rates and volumes from previously developed land to assist in lowering existing flood risk wherever possible. On greenfield land we will ensure that peak discharge and volume is not increased as a result of development.

### Strategy policy

All developments will be expected to incorporate SuDS, seeking opportunities for water sensitive urban design to reduce surface water runoff and ensure flood risk is not increased elsewhere.

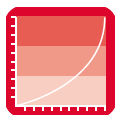
## B. Ensure all new developments are drained sustainably



Site-specific Flood Risk Assessments and drainage strategies in accordance with the West of England Sustainable Drainage Developers Guide and SFRA allow us to ascertain that the drainage for new developments will function adequately over its lifetime. We will assess against national standards and local requirements for sustainable drainage. We will ensure climate change is appropriately considered and ensure designing for exceedance is included as appropriate<sup>8</sup>. Ensuring SuDS are used in new developments is critical to managing existing surface water flooding across the city, but in particular in the defined higher risk areas. Water sensitive urban design that offers multiple benefits will be sought wherever practical and viable. We will provide case-by-case advice on development above minimum risk thresholds.

<sup>8</sup> Some areas of [Core Strategy policy](#), notably climate change, will be supported by future supplementary planning documents rather than by further detailed Development Management policies.

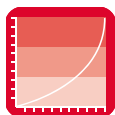
## **C. Ensure new developments have further protection and are able to withstand flooding where appropriate**



Incorporating flood resistance and / or flood resilience into developments involves adapting buildings and applying measures to avoid or reduce damage and disruption when flooding occurs. Examples of flood resistance measures include implementing raised thresholds or using flood barriers. Resilience measures may include property level protection techniques such as raised electrics or hard tile flooring. Good preparation for flood events by ensuring flood warning and evacuation procedures are devised and fully established can also increase resilience. We will encourage such techniques to be used where appropriate to ensure that new developments are better protected and able to withstand flooding. This is however a last resort following other flood mitigation measures that aim to prevent or avoid property flooding occurring in the first place. This is used as an extra precautionary measure to provide further protection from flooding.

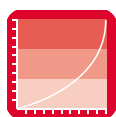
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## **D. Work with developers to reduce flood risk and incorporate Water Sensitive Urban Designs with nature based solutions and ecosystem services to provide multiple benefits**



Applying the principles of water sensitive urban design can serve to not only reduce flood risk but also to provide other benefits such as reduced water consumption, pollution control and increased biodiversity. We will work with both internal and external developers where we can to incorporate water sensitive urban designs in order to achieve multiple benefits and contribute towards wider environmental objectives. To encourage others to use these techniques, we have also produced the West of England Sustainable Drainage Developers Guides so that other people can easily and effectively apply the principles in new developments.

## **E. Co-ordinate responses to planning applications in partnership with Risk Management Authorities to ensure new developments have an appropriate and consistent regard to flood risk**



We will consult with the Environment Agency, Wessex Water, The Lower Severn Internal Drainage Board and the Highway Authority when required regarding new developments, enabling a consistency of approach in the advice and responses provided to developers. Early and effective communication with relevant authorities enhances the consultation process and ensures each authority's comments are considered and consistent. We have established, and follow, a formal approach with Risk Management Authorities for consultation on planning applications. Such an approach has reduced duplicated workloads and ensured a consistent regard to flood risk from all authorities.

BCC as the LLFA are a statutory consultee of the Local Planning Authority on Major planning applications, with respect to surface water drainage. It is therefore important for developers, the LLFA and the Local Planning Authority to work closely together from the outset as it is likely that drainage implications will have a bearing on site layout.

SuDS within adoptable highway pass to the Local Highway Authority for maintenance and will be adopted, along with the new highway. The Bristol-specific section of the West of England Sustainable Drainage Developer's Guide clarifies the highway SuDS adoption process.

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## **F. Work in partnership to identify opportunities for contributions to flood mitigation schemes**



When schemes and activities are funded by public finances alone, they will always be constrained by what central and local governments can provide. Projects must be subject to national controls to ensure the taxpayer receives value for money, which can result in a reduction in local benefits. However if those that benefit also invest in a scheme or activity, then there will be less constraints and more opportunities for flood risk management activity to take place.

We will therefore use working groups, strategic boards and other networks to identify funding opportunities from interested parties in order to maximise the flood risk management activity that can take place. We will also use the development management process to establish where potential contributions from developers are achievable and appropriate.

The Community Infrastructure Levy (CIL) is another potential funding source for contributions to flood risk management schemes. Flood risk mitigation measures are included on our adopted list of infrastructure to which CIL may be applied.



## Local Objective 2 – Actions

### Actions completed

Formalise process for reviewing planning applications following Development Management standards.

Formalise process for consultation with RMAs, City Docks and other relevant teams and authorities to seek consistency of approach and advice provided.

Update the SFRA (see [Appendix C](#)) with results from recent studies.

### Actions outstanding

Produce best practice guide to establish water sensitive urban design in Bristol (no longer pursued since existing guidance deemed satisfactory).

Develop risk based enforcement procedures for auditing approved applications (still planned but delayed due to resourcing).

### Actions on hold and to be reconfirmed (subject to further details on implementation of Schedule 3 of the Flood and Water Management Act 2010)

Establish the SAB (SuDS Approval Body) subject to enabling Government Legislation.

Implement an interim SAB approach including production of Local SuDS guidance, requirements and associated Planning Guidance Note. Implement drainage adoption on an optional basis with additional requirements, exclusions and charges to be determined.

When established, SAB to evaluate drainage applications. Adopt, charge for and maintain those SuDS which SAB has duty to adopt.

Actions ongoing				
Action No.	Action Name	Short term 2023– 2025	Medium term 2025–2029	Long term 2029 onward
2.0	Follow established process on consultation of planning applications from a flood risk perspective.	✓	✓	✓
2.1	Implement drainage adoption on an optional basis with additional requirements, exclusions and charges to be determined.	✓	✓	✓
2.2	Inform Local Plan preparation to ensure flood risk is appropriately considered.	✓	✓	✓
2.3	Ensure Flood Team involvement with, and inform distribution of CIL and other funding sources.	✓	✓	✓
2.4	Identify contributions to flood mitigation schemes through development management process.	✓	✓	✓
2.5	Submit comments in line with the agreed procedures and risk based approach on all Major planning applications with regards to surface water management and drainage. To fulfil the role of the LLFA as a statutory consultee.	✓	✓	✓
2.6	Develop risk based enforcement procedures for auditing approved applications.	✓	✓	✗

New Actions planned				
Action No.	Action Name	Short term 2023– 2025	Medium term 2025–2029	Long term 2029 onward
2.7	Comment on Bedminster Green regeneration planning applications in line with the BG masterplan.	✓	✗	✗

# Today's growth and infrastructure – resilient in tomorrow's climate

## Local Objective:

Actively manage flood risk infrastructure to reduce the likelihood of flooding causing harm to people and damage to society, the economy and the environment

Recognising the significant risk in Bristol we have set the Objective of reducing the likelihood of flooding causing damage to society, the economy and the environment. Existing measures are in place to manage the likelihood of flooding, but in order to achieve this Objective we must take further action to reduce the risk. This section focuses on the physical measures that we plan to implement in order to achieve this Objective.

## How we manage the likelihood

The likelihood of flooding occurring is highly dependent on rainfall and the tide, factors beyond our control. However we can manage the likelihood of an event resulting in flooding through ongoing maintenance, improvement and construction of flood risk management infrastructure as well as improving community resilience.

In terms of existing measures to manage the likelihood, we currently operate two maintenance programmes: one on watercourses and one on the highway network. As LLFA, we work in partnership with the Environment Agency to maintain watercourses by routinely clearing trash screens and cutting back

excess vegetation. This reduces the risk of blockages and allows watercourses to flow without obstruction.

We also regularly monitor our assets condition under T98 asset inspections. Since 2018 trash screen blockage clearance signs (**see Plate 6**) have been installed near to critical trash screens (such as Doncaster Road – **see Plate 7**) to enable the public to report a problem or blockage of the screen to the most appropriate team (either BCC or EA). To date we have nine screens across Bristol currently with signs in place and are aiming to roll out the scheme in the future. Where they are not installed [Fix My Street](#) or [Report an environmental incident](#) ([www.gov.uk](http://www.gov.uk)) can be used to report a blockage.

As the Highway Authority, we routinely clean highway drainage gullies to reduce the risk of blockages and allow the drainage network to operate effectively.

Silt clearances, such as that conducted on the Hazel Brook in 2021 (**see Plate 8 and 9**), is another watercourse maintenance function we may perform when necessary.

An important part of both of our maintenance programmes is to identify defects and potential problems with





**Plate 6** Doncaster Road trash screen blockage clearance sign



**Plate 7** Doncaster Road flooded



**Plate 8 and 9** - Hazel Brook silt clearance





existing infrastructure. We aim to take a pro-active approach to making repairs and improvements so that the work is completed before it causes a problem. Sometimes we may allow assets to reach the end of their operational lifetime without replacing or repairing them, we make this decision based on our understanding of the risk and the benefits of that particular asset. We call this approach to maintenance active management.

## **Active management**

**Taking a proportionate and risk based approach to maintenance so that investment is directed at areas of highest risk, and deciding in advance if and when interventions are to be made.**

Sometimes new infrastructure is required to further reduce the likelihood of flooding. We identify these situations through our plans and studies as well as through reports of flooding incidents. Constructing new infrastructure can often be an expensive solution, not just for construction costs but also to fund on-going maintenance and funding such schemes is a challenge. We use our own budgets as well as submitting bids for central government grants and working in partnership with Risk Management Authorities and the community in order to secure the necessary funding for such works. Indicative funding allocated by Defra forms our Capital Investment Programme.

One way to minimise costs of maintenance and operation of infrastructure is to remove infrastructure where it is not necessary, and return watercourses to a more natural state. We consider this to be the most sustainable form of maintenance and we will actively encourage and seek opportunities to achieve this where appropriate.

## **Management of tidal flooding**

Bristol is also at risk of tidal flooding, particularly around the Floating Harbour area and at Avonmouth. Although the Environment Agency have overall responsibility for managing tidal flood risk, we, as the LLFA and authority responsible for the management of the Floating Harbour, work in partnership with them to operate and maintain the Floating Harbour tidal flood defences. These are located at Junction Lock in the city centre and Netham Lock towards the east of the city. In the Avonmouth area flood defences are managed by the Environment Agency as well as local land owners.

It is also our responsibility for ensuring the sustainable regeneration and growth of the city, which includes managing flood risk and the impacts of climate change. Our studies have provided proposed methods for mitigating tidal flooding now and into the future. For the city centre, our studies and feasibility work suggests this is likely to involve raised flood defences. For Avonmouth it involves refurbishment and upgrade of the existing defences to account for sea level rise.

For the reasons outlined above, we will continue to take a lead on these projects but work in close partnership with the other RMAs and relevant interest groups and authorities.

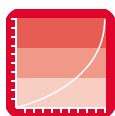
## **Strategy policy**

**Actively encourage the removal of built infrastructure where appropriate to encourage more natural management of watercourses and drainage channels.**

## Measures

- A.** Improve our flood risk management maintenance procedures
  - B.** Use our understanding of flood risk in Bristol to ensure limited resources are targeted at areas of highest risk
  - C.** Seek partnership working opportunities so that those that benefit from flood risk assets contribute towards their planning and management
  - D.** Encourage use of green areas and waterways to reduce the risk of flooding and contribute towards wider benefits. Using nature based solutions and ecosystem services to help achieve this.
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### A. Improve our flood risk management maintenance procedures

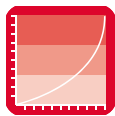


Effective maintenance of existing assets is a vital part of managing the likelihood of flooding. Clearing trash screens, keeping vegetation under control, cleaning highway gullies and removing silt and debris from culverts all reduce the likelihood of flooding. These are activities that we do now and will continue to do, but by reviewing our current procedures we can identify opportunities to improve. For example we may change the frequency of clearing trash screens or take an alternative approach to the maintenance of a particular asset.

Our watercourse maintenance contract was previously procured through a wider Highway Authority Framework, given we work closely with the Highways Authority who manage gully clearance and maintenance, however we have since procured a new contract outside of this framework, which ensured a specialist watercourse maintenance contractor could be procured, rather than more highway maintenance based contractors. We continue to work closely with colleagues in the Highways Authority to manage gully maintenance using a risk based approach to manage flood risk.

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## **B. Use our understanding of flood risk in Bristol to ensure limited resources are targeted at areas of highest risk**



Maintenance and capital improvements cost money, and resources will always be limited. We are committed to ensuring that the resources that are available are used in the best possible way. To do this we will take a risk based approach, using our understanding of flood risk across the city to balance investment with the risk that is faced. Sometimes this may mean that we cannot justify the construction of new or continued maintenance of existing infrastructure using public funds. However, if those that benefit contribute to such works, then we have more flexibility in how those funds are spent.



We have identified several schemes for inclusion in our Action Plan, all of which have been prioritised both on our understanding of flood risk and our responsibilities as the LLFA. We will take a similar risk based approach to improving our maintenance programmes.

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## **C. Seek partnership working opportunities so that those that benefit from flood risk assets contribute towards their planning and management**



Flood risk management activities are often localised and lead to personal or private benefits to specific individuals, communities and businesses. There can also be public benefits, for example by reducing the costs of incident recovery. Where private beneficiaries arise, the costs should not be restricted to the general taxpayer alone. Instead, we will encourage those that benefit to contribute towards the activity. Such contributions need not be financial, for example communities may take on the operation or maintenance of a structure or alert us to blockages.



Flood risk mitigation schemes can often also be designed to provide wider benefits such as environmental or amenity improvements. They may also contribute towards the delivery of other Risk Management Authority objectives. For example, by reducing surface water discharge to public sewers, Wessex Water benefits from increased capacity in the sewer network and may be able to contribute towards a scheme that achieves this. We will actively seek out such opportunities for partnership working and we will encourage contributions towards the delivery of the wider benefits.

## D. Encourage use of green areas and waterways to reduce the risk of flooding and contribute towards wider benefits. Using nature based solutions and ecosystem services to help achieve this.



Bristol is mainly an urban environment and as such large parts of the city are covered by impermeable areas such as roads, footways and buildings. Compared to the natural environment, these impermeable areas cause a significant increase in the rate and volume of water that runs off the surface of the ground following a rainfall event. This can overwhelm the sewer and river network and result in an increased risk of flooding.

By re-introducing green areas and waterways, we can reduce the amount of impermeable area and hence slow the rate of surface water runoff which in turn can lead to a reduction in flood risk. Each green area that we introduce may only be small, but over time the cumulative effect can be significant. The type of green areas that we will encourage include, for example; planters, swales, rain gardens, grassed verges and green roofs. We have already begun to implement such features and have completed a scheme on Embleton Road in Southmead in partnership with Sustrans, part funded by us, the Green Capital Partnership and Wessex Water.

In 2022 eight additional highways bioretention planters were installed across the wider Glencoyne Square and Arnside Road area of Southmead to complement the existing Embleton Road Scheme. These planters are designed to capture highways runoff and be attenuated within the planter before any remaining runoff is discharged slowly into the sewer network.

### Strategy policy

**Prevent the installation of impermeable surfaces unless using sustainable drainage techniques to manage runoff. Encourage the re-introduction of green areas.**

We are committed to trialling innovative techniques for managing flood risk because they can often contribute towards wider environmental benefits. Many of these techniques are proposed in the [Wessex Water Drainage and waste water management plan](#). For example a reduction in impermeable areas can improve habitats, reduce urban heat, be more visually appealing and improve water quality. Such benefits may be hard to quantify, hence we recognise that monitoring their effectiveness is key to learning for the future. These approaches can often attract the interest of other stakeholders and initiatives, such as the Bristol European Green Capital Partnership<sup>9</sup>. We will engage with stakeholders on such projects including local communities and other Risk Management Authorities to ensure maximum benefits are achieved.

<sup>9</sup> [bristolgreencapital.org](http://bristolgreencapital.org)



Many comments on the first Strategy in 2014 from the public consultation raised the importance of existing green spaces and parks in managing flood risk in the city. We have included an Action to investigate this and understand the role such green spaces have in managing flood risk in Bristol.

In December 2021 a wooden debris dam was installed along a section of the Pigeonhouse Stream (upstream from the Whitchurch Lane Trash Screen) using wood sourced from nearby trees as an outcome of the 2016 Whitchurch Lane Flood Investigation. The aim of this debris dam is to trap debris further upstream to avoid major blockages on the Whitchurch Lane Trash Screen that can cause flooding to nearby roads and properties. See [Plate 4](#) of the Pigeonhouse Stream Leaky Dam.

We have identified specific projects and processes through our Action Plan that will be promoted in the short and medium term to achieve this Measure and our aim is to also establish formal processes to ensure water sensitive designs are considered for all LLFA-led schemes.

## Local Objective 3 – Actions

Actions completed
Deliver Scotland Lane flood alleviation scheme.
Deliver Willway Street culvert tide flap replacement.
Formalise process for consulting on RMA led schemes to maximise inclusion of SuDS and green space.
Update and procure watercourse maintenance contract.
Identify and prioritise watercourse structural improvement requirements.
Deliver Dundry flood alleviation scheme.
Progress Sustainable Southmead water sensitive design feasibility work including Stanton Road and Trowbridge Road high risk areas.
Develop process for risk based approach to highway gully maintenance and leaf clearance.
Formalise process for consulting on RMA led schemes to maximise inclusion of SuDS and green space.
Actions outstanding
Deliver Sandburrows Road flood alleviation scheme. (TBC on site visit with private third party)

Actions ongoing				
Action No.	Action Name	Short term 2023–2025	Medium term 2025–2029	Long term 2029 onward
3.0	Continue maintenance of ordinary watercourses and associated structures.	✓	✓	✓
3.1	Implement minor land drainage works as appropriate.	✓	✓	✓
3.2	Identify and prioritise Floating Harbour flood risk asset improvement requirements.	✓	✓	✓
3.3	Utilise strategic board groups to identify opportunities for partnership working and funding contributions.	✓	✓	✓
3.4	Follow established process for consenting works to ordinary watercourses.	✓	✓	✓
3.5	Complete green spaces study to assess the importance of existing green spaces on flood risk management in the city.	✗	✓	✓
Actions removed (flood risk reduced based on new flood modelling)				
Deliver Bamfield flood alleviation scheme.				
Deliver Henbury flood alleviation schemes.				

New Actions planned				
Action No.	Action Name	Short term 2023–2025	Medium term 2025–2029	Long term 2029 onward
3.6	Deliver Bedminster Green river restoration scheme.	✓	✓	✗
3.7	Continue to support delivery of the ASEA project up to 2024 through the project delivery board.	✓	✗	✗
3.8	Continue to lead the BAFS project in partnership with the Environment Agency through regular project co-working, progress meetings and project boards.	✓	✓	✓
3.9	Complete BAFS OBC build stage one by autumn 2023.	✓	✗	✗
3.10	Commence BAFS OBC build stage two by early 2023.	✓	✗	✗
3.11	Aspire to commence construction for the BAFS in 2026.	✓	✓	✗
3.12	Finalise RFP SuDS detailed designs and Full Business Case by December 2023.	✓	✗	✗
3.13	Develop detailed designs for the RFP river restoration proposal by May 2024.	✓	✗	✗

# A nation ready to respond and adapt to flooding and coastal change

## Local Objective:

Increase public awareness and encourage communities to take action to manage the risks that they face

Understand communities flooding concerns and priorities, and gather knowledge based on their perception of flooding

Some people and communities are already deeply aware of the flood risk they face and have taken action in their own area; particularly those that have experienced flooding first hand. Others may not be aware of the risks in their area, are not sure how to find out about the risk, or what action they can take. There are a number of ways people can manage flood risk to their homes and businesses through active citizenship, without relying on the action of the authorities. One of our aims is to help people understand what they can do and what works effectively. We can also learn a lot from those communities that have first-hand experience of flooding and it is essential that we understand their concerns and priorities so that we can manage these appropriately and successfully.

### Active citizenship

People taking an active role in the community to help manage or reduce the risk of flooding, such as clearing leaves from highway drainage gullies.

It is important to remember that the risk of flooding can never be entirely eliminated, so helping people to manage their own risk forms a vital part of our strategy for managing flood risk.

### How we help people manage their own risk

Currently we engage with communities at risk of flooding through awareness raising events to discuss potential flood risk infrastructure improvements and we meet people that have been personally affected by



flooding. However, we are aware that to date our community engagement has been more sporadic, and often tailored to where we are investigating flooding or implementing some mitigation work, than it should.

However, with the formation of the LLFA for Bristol, we will be working to improve our community engagement through all the work we do.

We have formed a close working relationship with The Centre for Floods, Communities and Resilience (CFCR) that helps us to better engage with communities. One of the CFR's aims is to "Work with, and for, our local communities at risk of flooding in Bristol". The work that they do with communities provides us with opportunities to learn from our residents and share the work that we do with them.

We recognise that making information freely available is an important part of helping people to manage their own risk. With this in mind, we have published the various studies referred to throughout this report on our website, along with an interactive map of the study outputs. We also respond to queries from the public that are raised through our Customer Service Centre and provide information about flood risk to people and property.

The knowledge of people that have been personally affected by flooding is invaluable. We do our best to understand communities concerns and priorities, and learn from those with first-hand experience of living with flood risk. To do this, we issue questionnaires to those affected by flooding and listen to citizens at community meetings. We recognise that learning from people that have experienced flooding is an effective way of improving our flood risk management activities and we are committed to improving how we engage with those people in the future.

2018 marked 50 years since the great flood of 1968. With our partners at the EA and the Bristol Avon Rivers Trust we ran a community engagement campaign to reflect on this event. By recalling what had happened in the past we were able to raise awareness of what the present day risk is and the predicted future risk due to the effects of climate change. Through an exhibition (see Plate 10), library talks and a guided river walk we were able to communicate to a variety of community members to gain understanding of the flood risk in their city and how they can help manage that.

**Plate 10** 1968 flood exhibition



## Measures

- A.** Work with existing groups, networks and agencies to engage with communities at risk of flooding
  - B.** Involve local people in flood risk management activities taking place in their community
  - C.** Help communities understand the benefit of flood plans to improve community resilience and preparedness for flooding
  - D.** Use a range of communication techniques to effectively reach a diverse audience
- 

### **A. Work with existing groups, networks and agencies to engage with communities at risk of flooding**



Engaging with communities at risk of flooding is important not only to share our knowledge of flood risk, but also to enable us to learn from communities that have been affected by flooding. Engagement and consultation with the community took place on the concept and draft outline river restoration designs in Bedminster Green for example. There is a wide range of groups, networks and agencies that we can use to more effectively engage with a varied population. As mentioned above, historically, our engagement with communities at risk of flooding has not been as strong as we would like. Therefore before we agree a procedure for improving our community engagement, we must first identify suitable groups and form partnership working arrangements.

Community engagement and awareness raising was an issue raised by many people during the initial Strategy consultation process in 2014. Comments suggested that we should be making more information available to communities and engaging with them effectively. However, it is important that we engage with the correct people and groups to ensure that the information we disseminate is done so appropriately. By identifying relevant groups first, we can ensure information and actions are shared and agreed in the most effective way.

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### **B. Involve local people in flood risk management activities taking place in their community**



Giving communities a greater say in decision making is something we support. We believe that by engaging in two-way dialogue that recognises local people's views, more effective and considered flood risk management activities can be delivered. Involving local people in decision making will also encourage those people to take an active role in the on-going management of the infrastructure or activity that is put in place. Those that benefit from an activity or structure are therefore more likely to invest either financially or otherwise.



Meeting the first Measure (working with existing groups) will greatly assist with involving local people in flood risk management activities by identifying the various groups and techniques we can engage with. We will therefore establish a citywide communication programme but also engage with relevant groups on a site and project specific scale.

Comments from the public consultation of the draft Strategy indicated that many people across the city are concerned with the amount of debris (notably leaves) that can accumulate on highway drainage gullies. This can cause flooding issues by preventing water entering the drainage system. Therefore, we have completed an Action to address this issue.

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## **C. Help communities understand the benefit of flood plans to improve community resilience and preparedness for flooding**



If a significant flood event were to occur, Bristol City Council and other authorities have developed flood plans that allow all responding parties including the police and other agencies to work together on a co-ordinated response to flooding. However, individuals and businesses can also make their own arrangements to take action before, during and after a flood event. We call these arrangements community flood plans.



Having a community flood plan in place allows those at risk of flooding to monitor the risk and act together in advance of a flood event in order to reduce harm to people or damage to property. Flood plans can also improve community flood resilience, for example by making sure that those people most vulnerable to or at the highest risk of flooding are informed early so that they can move themselves and their possessions to a safe place of refuge. They might also include flood resistance measures to keep floodwater out of properties all together, for example by installing flood proof barriers.

We will work in partnership with communities and RMAs to identify areas that could benefit from flood plans and engage with communities to help people develop their own plans. We have committed to investing in water and rainfall monitoring equipment in areas at high risk of flooding across the city. We will ensure that relevant community groups have access to the data produced by the equipment to further benefit their response procedures.

### **Flood resilience**

Designing or adapting a building or asset so that although it comes in to contact with floodwater, no permanent damage is caused.

## D. Use a range of communication techniques to effectively reach a diverse audience



Bristol has a diverse population and no single method of communication can be effective at reaching everyone. Different groups and individuals can be engaged with in different ways and some ways will be more effective than others, but communicating effectively is critical to achieving our Objectives. It is also important we do this well to ensure our high standards of equalities are met.

In recognition of the diverse nature of Bristol, we will use a range of communication techniques so that we can reach a wide and varied group of people and communities. This will include new advances in technology, for example social media, but will also include more traditional approaches such as community meetings and written correspondence. Recognising the diverse population of those affected by flooding will inform how we choose to communicate with communities and help to achieve our Objectives.

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### Local Objective 4 – Actions

Actions completed
Identify existing groups, networks and agencies that we can use to engage with communities.
Produce programme of community engagement activities including flood plan development.
Produce and develop a community engagement activity to manage highway gullies and debris clearance.



Actions ongoing				
Action No.	Action Name	Short term 2023–2025	Medium term 2025–2029	Long term 2029 onward
4.0	Introduce proposed flood alleviation schemes to local communities.	✓	✓	✓
4.1	Ensure final version and future updates of local strategy are freely available to the public in a variety of formats.	✓	✓	✓

New Actions planned				
Action No.	Action Name	Short term 2023–2025	Medium term 2025–2029	Long term 2029 onward
4.2	Continue raising awareness of the risk of flooding to citizens of Bristol and the resources available to help manage this.	✓	✓	✓
4.3	Provide input on flood emergency plans with key responders.	✓	✓	✓

## Local Objective:

Improve preparedness for flood events and post flood recovery.

Flooding within Bristol can never be prevented entirely. An important part of dealing with the risk of flooding is making sure there is an effective response to incidents when they do happen. To recognise the importance of this we have set the Objective to put processes in place to improve our preparedness for flood events and post flood recovery. This section will focus on the Measures that we plan to implement in order to achieve this Objective.

### How we help improve preparedness for flood events and post flood recovery




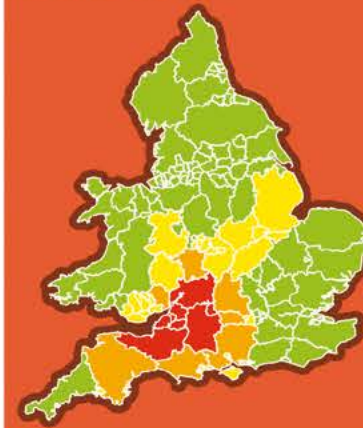



As a LLFA, we have a number of initiatives already in place to deal with flood emergencies. We receive Flood Guidance Statements and Severe Weather Warnings from the Flood Forecasting Centre about forthcoming rainfall and tidal events, derived from data collated by the Met Office and the Environment Agency; these warnings are cascaded to each LLFA team. The figure below is a diagram showing Activation Triggers from the BCC Flood Plan. It shows the link between each warning or reports of flooding and the different response levels.

On receiving Severe Weather Warnings or Flood Guidance Statements depending on the severity of the event, the Flood Risk Management Team within the LLFA will provide advice to relevant internal teams.

We have established procedures through strong partnership work with key internal partners. This includes clear lines of communication from the EPRT, Highways, Duty Officers, Communications Team, Parks and Estates and Marine Services in accordance with the Flood Plan.

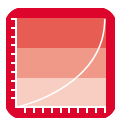
### Measures

- A.** Monitor and analyse warnings issued by the Environment Agency and Met Office to co-ordinate and prepare our response to extreme weather events.
- B.** Use our local knowledge and technical expertise to inform decisions made in advance of a potential flood incident.
- C.** Work with partners to support those who have been affected by flooding.
- D.** Review LLFA response to flood events and identify opportunities to improve community flood resilience.

<b>PROACTIVE TRIGGERS</b>	<b>Met Office issue severe weather warning(s)</b>	<b>GREEN</b> No severe weather forecast	<b>YELLOW</b> Be aware	<b>AMBER</b> Be prepared	<b>RED</b> Take action
	<b>Flood Forecast Centre issue Flood Guidance Statement(s)</b>  (A Flood Guidance Statement can be issued without a severe weather warning being in force)	<b>Very low Flood Risk</b> 	<b>Low Flood Risk</b> 	<b>Medium Flood Risk</b> 	<b>High Flood Risk</b> 
	<b>Environment Agency issue Flood Warning(s)</b> (for areas covered by the Flood Warning Service only)  (Flood Warnings can be issued without a Flood Guidance Statement being in force)	None	 Flood Alert	 Flood Warning	 Severe Flood Warning
<b>REACTIVE TRIGGERS</b>	<b>Reports of Flooding</b>	No reports of flooding	Reports of minor flooding	Reports of property flooding	Reports of significant or catastrophic flooding
<b>RESPONSE LEVEL</b>		<b>LEVEL 0</b> None	<b>LEVEL 1</b> Standby / Monitor (Pre-emptive actions)	<b>LEVEL 2</b> Monitor / Deploy	<b>LEVEL 3</b> Deploy / Escalate

**Figure 10** Showing Bristol City Council's corporate response to flood risk.

## **A. Monitor and analyse warnings issued by the Environment Agency and Met Office to co-ordinate and prepare our response to extreme weather events**

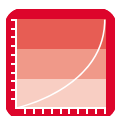


Monitoring and analysing warnings from the Environment Agency and Met Office is essential in helping us prepare a response to an extreme weather event. We will continue to receive automated emails from the Flood Forecasting Centre and Met Office, and liaise with relevant colleagues in BCC and our wider partners to co-ordinate and promote flood response and preparedness across key teams within the authority. For example, as the Flood Risk Management Team within the LLFA, we take a lead strategic role in responding to a flood event. We will help by providing advice to key teams within the LLFA or go out to effected areas to investigate the current situation. If the flood warning or event escalates, we will provide more of a supporting role in assisting other key teams direct resources more effectively and efficiently.



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## **B. Use our local knowledge and technical expertise to inform decisions made in advance of a potential flood incident**

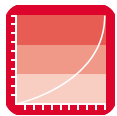


To be successful at managing flood risk we have to be pro-active in our approach. As a Flood Risk Management Team within the LLFA we can use our local knowledge and technical expertise to advise on decisions made, improving our prediction and response to a flood event. For example, we will set up procedures within BCC to use existing studies along with mapping and data management techniques to highlight high risk areas and help improve knowledge and flood prediction. In practice, whilst working in partnership with BCC EPRT, we can use this knowledge to help locate emergency centres and plan evacuation routes in locations least likely to be affected by flooding, leading to a more effective response, as stated in Bristol City Council's Multi-Agency Flood Plan.





## C. Work with partners to support those who have been affected by flooding



We will continue to work in partnership with key teams within the authority and wider stakeholders to carry out a strategic role in helping to provide knowledge and support to those who have been affected by flooding. As a LLFA we will undertake Section 19 of the Flood & Water Management Act 2010 (FWMA) and investigate flood incidents where appropriate or necessary. Further to this, as technical experts we can help explain to residents and communities how flooding occurred, what caused it and what potential actions can be put in place to help us and the residents of Bristol prevent it from happening in the future. We realise that community engagement is important in being able to provide sufficient support to the residents of Bristol, which is why earlier Objectives have been set to help people manage their own risk to address this.

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## D. Review LLFA response to flood events and identify opportunities to improve flood resilience



To be successful in managing flood risk, we have realised that as a LLFA we will need to continually review and test our current procedures to identify opportunities to improve our flood resilience.



We will continue to undertake specific training and learning within the team, for example we will attend Environment Agency Community Flood Plan meetings to improve knowledge and help improve community flood resilience. Helping those at risk by educating people will build resilience within communities, and allow people to become more prepared when a flood event occurs. Flood risk response can be improved by making information more freely available, such as rain gauge readings, which will allow residents to monitor current rainfall and allow them to take their own action against possible flood risks.

## Local Objective 5 – Actions

### Actions completed

Set up procedures with the BCC Working Group to use existing studies to help improve knowledge and flood prediction.

### Actions ongoing

Action No.	Action Name	Short term 2023–2025	Medium term 2025–2029	Long term 2029 onward
5.0	Continue to provide advice regarding warnings issued by the Flood Forecasting Centre to the wider authority and other stakeholders.	✓	✓	✓
5.1	Undertake functions from Section 19 of the FWMA, and endeavour to investigate smaller flood incidents where appropriate.	✓	✓	✓
5.2	Identify and undertake training to improve flood knowledge and preparedness of the LLFA team.	✓	✓	✓
5.3	Liaise and work in conjunction with colleagues in BCC who have a role to fulfil as the LLFA. To promote and co-ordinate flood response and preparedness across key teams within the authority.	✓	✓	✓
5.4	Develop and promote the use of flood data to inform emergency traffic management procedures.	✓	✓	✓
5.5	Attend Environment Agency community flood plan meeting(s) to improve knowledge and help improve community flood resilience.	✓	✓	✓

# Considerations for delivering the Strategy

The previous section introduced our Action Plan for delivering the Objectives of the Strategy. However, there are other factors that influence the delivery of the Strategy, such as environmental and funding considerations, which are discussed in the following section.

## Wider environmental objectives

Contribution towards the achievement of multiple benefits has guided the production of this Strategy; in particular we have tried to ensure our Measures help to deliver environmental benefits wherever possible. For example we have put in place a Measure to encourage the introduction of green areas not only to manage flood risk but also contribute towards the Bristol Green Capital programme to “make Bristol a more sustainable, healthier, greener city”. We are also committed to using sustainable drainage and water sensitive urban designs to reduce pollution of watercourses and help to improve the biological quality of rivers. This is an important environmental indicator in the Bristol Biodiversity Action Plan.

Biodiversity Net Gain (BNG) is an approach to be considered during flood risk management works to leave the environment in a measurable better state than it was beforehand through enhancing and/or creating new habitats. The Environment Act 2021 states that all planning permissions granted in England will have to deliver at least 10% BNG (expected to be mandatory from November 2023). BCC has declared an ecological emergency and therefore

we are striving to deliver a 10% BNG before it becomes mandatory. Bedminster Green river restoration planning application will provide a minimum 10% BNG, through removing channel walls and replacing with vegetated embankments, introducing channel bars and walls in-channel to support the formation of pool and riffle features and removing invasive non-native species from the site.

As well as Bristol’s own environmental objectives, we also have a statutory duty under the Water Framework Directive (England and Wales) Regulations 2017 (WFD) to deliver a better water environment. The Directive requires classification of water bodies and places a duty on local authorities and the Environment Agency to maintain or improve the classification. The aim of the WFD is for all inland waters to be in ‘good’ condition. We will be engaging with internal environmental specialists and the Environment Agency to ensure WFD requirements are included in our work and schemes. One area where we already have begun to address this is in Southmead, where we hope that our water sensitive design work will both significantly reduce flood risk and also help to improve the WFD classification.

## **Strategic Environmental Assessment**

The European Strategic Environmental Assessment (SEA) Directive sets out the legal requirements for the production of a SEA. This Strategy was deemed to require such an assessment and forms an important part of the Strategy as a whole. The objective of the directive is “to provide 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”. A separate SEA document has been produced to support our Strategy.



# Strategy governance, monitoring and review

## Governance

It is important that flood risk management activities are coordinated and decisions are made in an open, honest and accountable way. To achieve this several working groups, advisory boards and decision making groups have been set up to form a robust structure of governance. Authorities from across the West of England play an important part in these groups as it is essential to consider the entire catchment and recognise that activities of neighbouring authorities have an impact on each other. The structure of flood risk governance in Bristol is shown in Figure 11.

The structure of governance is set up so that the right people are working together at an appropriate level to ensure effective

working practices are technically robust and consistent with wider strategic plans and objectives. Technical groups are made up of flood risk practitioners who discuss best practice and provide potential solutions to problems. Partnership working opportunities are also identified in these groups.

Decision making groups consist of budget holders, senior management and political representatives who scrutinise the suggestions of working groups with due consideration to other West of England policies, aims and objectives. The groups facilitate linkages between operational activity and strategic policy decisions and are also responsible for ensuring democratic accountability and transparency.

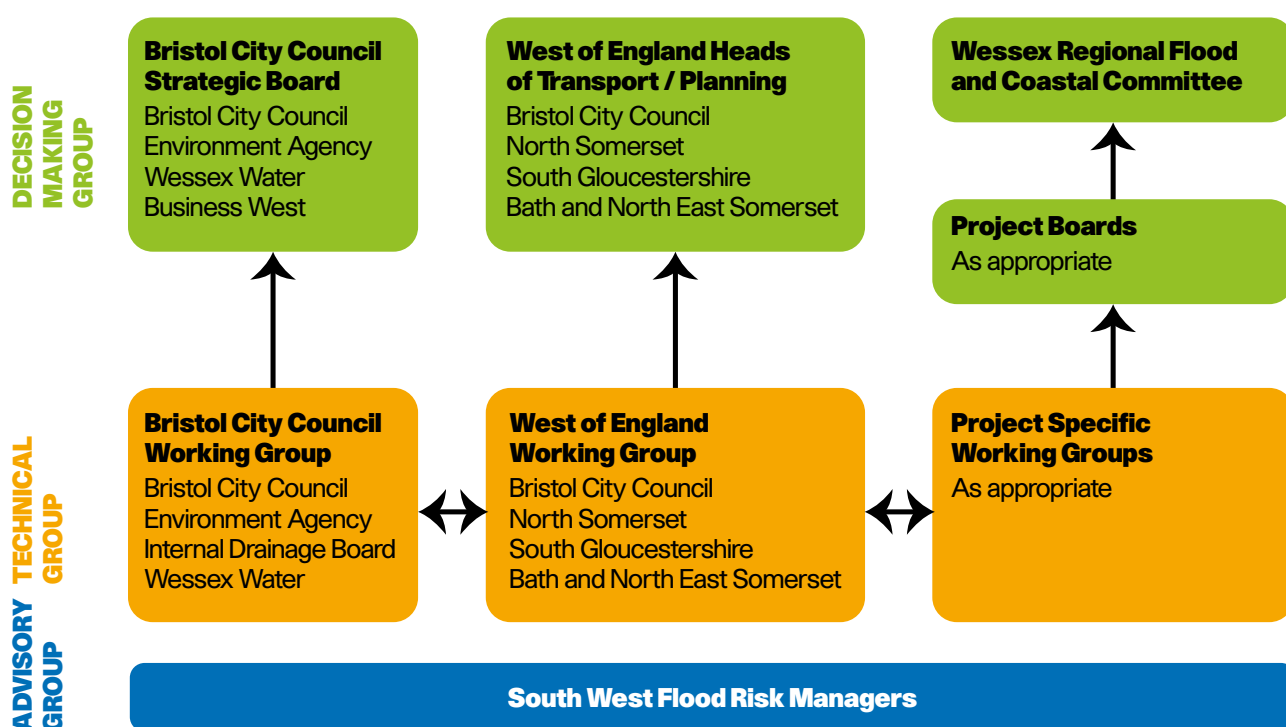


Figure 11 Flood risk governance in Bristol

The wider South West Flood Risk Managers group meets quarterly in order to share experiences and discuss nationally important flood risk management duties and responsibilities.

In addition to the above, the Strategy has been used as part of the evidence base for the Severn River Basin District Flood Risk Management Plan.

### **Monitoring and review**

It is essential that we monitor the delivery of this Strategy so that we can be sure that we are achieving the Objectives and to ensure that the Strategy itself is effective at doing so. To monitor progress, we will utilise the BCC Working Group. This group meets every two months so will enable us to effectively programme and resource our Actions at an appropriate time scale and ensure that the Strategy is embedded in every aspect of our work.

The Strategy will be reviewed annually at the BCC Strategic Board from the anniversary of its adoption. It will be formally updated every four years with official ratification obtained following review by the Scrutiny Commission. This relatively short timescale for formal review reflects the recognition of Bristol as a high risk area as well as the relatively dynamic landscape of national policy and guidance related to flood risk. It will also help to ensure that improved understanding of flood risk can be regularly incorporated in to the Strategy. For example if an area is affected by flooding it may be appropriate to develop solutions to mitigate against the risk of repeated flooding and therefore it is important that we can adjust and update the Strategy to accommodate future plans.

# Funding to manage flood risk

To implement this Strategy successfully, it is important to understand and plan how to fund its delivery. The majority of the work that we do is required by law, but there are many potential funding opportunities for all of our flood risk management activities including capital, revenue, national, local and private sources. By utilising a mixture of all of these sources, we can maximise the amount of flood risk management activity we can undertake and go above and beyond just that which is required by legislation.

The suitability of potential funding sources depends on a number of factors, but our general approach to funding is as follows.

- As the Lead Local Flood Authority, we receive national funding from the Department for Levelling Up Housing and Communities (DLUHC) (through a Revenue Support Grant) to deliver our statutory duties of the Flood and Water Management Act. We use this funding for staffing resources and professional services that are needed to ensure our responsibilities and duties of the Act are met.
- Bristol City Council capital and revenue funds are used to undertake maintenance and make essential capital infrastructure improvements. These funds are primarily used to undertake duties under the 1991 Land Drainage Act and are allocated locally.
- Flood Defence Grant in Aid is administered by Defra and we bid for these funds to improve the standard of protection to existing residential properties. In 2011, Defra introduced a new approach to allocating these funds, known as partnership funding. The key change was to replace 100% funding of fewer schemes to a situation where more schemes are partially funded with the shortfall in cost made up of third party contributions to individual schemes.
- The Local Levy is a levy that is on all councils that are administered by the Wessex Regional Flood and Coastal Committee that is similar to Flood Defence Grant in Aid but used to fund local projects that benefit the communities of the Wessex region.
- The Community Infrastructure Levy is allocated locally and we will bid for a share of these funds to deliver flood risk mitigation schemes as and when appropriate.

- Private beneficiary funding will become a more and more important part of our funding strategy as processes for securing such funds develop. The more those beneficiaries contribute towards flood risk management activities, the less restricted we are by standards and approvals and the more activity we can undertake.
- Heritage Lottery Funding (HLF) funds projects that connect people and communities to heritage. Bedminster Green River Restoration project will be aiming to submit a bid for funding from the HLF given the project will be restoring both natural heritage (River Malago) and built heritage structures (historic sluice gates).
- Since devolution in 2017, the West of England Combined Authority has access to more funding. The devolution deal brought £900 million of investment funding to the region. The Investment Fund is invested in regional priority schemes that support Local Industrial Strategy and the Regional Recovery Plan. Part of the original devolution deal, this brings £30m of new finance per annum to the West of England over a 30-year period. Bristol City Council has already accessed this fund to support the development of the Bristol Avon Flood Strategy.

**It is important to note that contributions from private beneficiaries are not restricted to members of the public. Water companies, electricity and other service providers, local businesses and land owners are all potential beneficiaries of flood risk management activity.**

We consider that the best approach to funding flood risk management activities is to secure a mix of funding sources that are appropriate to a particular activity. We use the funding matrix below to identify potential sources of funding that are suitable to utilise in order to deliver multiple flood risk activities.



**Figure 12** Flood risk funding sources matrix

## Primary Activity

Funding Source	Studies	Schemes	Maintenance	Community engagement	Promoting sustainability	Emergency response
DLUHC	Strong Potential	Medium Potential	Medium Potential	Strong Potential	Strong Potential	Strong Potential
BCC Capital	Medium Potential	Strong Potential	Medium Potential	Low Potential	Low Potential	Low Potential
BCC Revenue	Medium Potential	Medium Potential	Strong Potential	Medium Potential	Medium Potential	Medium Potential
FDGiA	Low Potential	Strong Potential	Low Potential	Low Potential	Low Potential	Low Potential
CIL	Low Potential	Medium Potential	Low Potential	Low Potential	Low Potential	Low Potential
Developer contributions	Low Potential	Medium Potential	Low Potential	Low Potential	Medium Potential	Low Potential
Private beneficiaries	Low Potential	Medium Potential	Medium Potential	Low Potential	Medium Potential	Low Potential
Regional Growth Fund	Low Potential	Medium Potential	Low Potential	Low Potential	Medium Potential	Low Potential
DEFRA Property Level Protection	Low Potential	Strong Potential	Low Potential	Low Potential	Low Potential	Low Potential
DEFRA one off grants and pilots	Medium Potential	Strong Potential	Low Potential	Medium Potential	Medium Potential	Medium Potential
Heritage Lottery Funding	Low Potential	Strong Potential	Low Potential	Strong Potential	Strong Potential	Low Potential
Local Levy	Strong Potential	Strong Potential	Low Potential	Medium Potential	Low Potential	Medium Potential
WECA sources	Medium Potential	Medium Potential	Low Potential	Medium Potential	Medium Potential	Low Potential

# Flood risk management costs and benefits

To make sure that the taxpayer receives value for money, it is important that the work we do is assessed to determine the costs and benefits of undertaking these activities. However, much of the flood risk management activities we undertake are statutory duties that we must deliver as the LLFA but do not have an obvious tangible benefit such as, for example, an increased height of flood defence. Examples of such duties include establishing and maintaining a register of flood risk assets, investigating significant flood incidents, and promoting sustainable development.

For this type of non-physical work, it is often difficult to estimate monetary benefits because it does not always directly reduce the likelihood of flooding causing harm to people or damage to property. The benefits of doing this type of work are however well known. An increased understanding of flood risk is for example a benefit of maintaining an asset register and investigating flood events. The costs of these relatively new duties are often hard to define, but are currently met through the local services support grant we receive as the LLFA.

A summary of benefits that will be achieved through the Actions proposed as part of this Strategy is provided in the Action Plan located in [Appendix D](#).

Physical works such as maintenance and infrastructure improvements have well defined costs and it is possible to estimate the benefits of this type of work using economic assessment tools.

The following is a simplified estimate of the costs and benefits of maintenance and capital schemes outlined in this Strategy.

## Maintenance

Bristol City Council currently spends £230,580 per year on highway drainage and watercourse maintenance combined. This work is vital to reduce the risk of blockages that could result in flooding to properties, highways, footpaths, cycleways, subways and more. It is assumed that was this maintenance not to take place, then the risk of flooding to properties would increase from “low” to “moderate”. Using the [Partnership Funding Calculator](#) (PF Calculator), this can be applied to all 3,440 properties identified at risk by our studies. The resulting costs and benefits are summarised in Table 3.

**Table 3** Maintenance costs benefit analysis

Annual maintenance costs (£)	Annual benefits (damages avoided) (£)	Benefit cost ratio
230,580	391,986	1.7

This shows that annually the effective benefit to the taxpayer of maintaining highway drainage and watercourse assets is approximately 2:1 and therefore represents good value for money. This estimation also does not include the annual damages in transport saved, for many forms of travel, representing even more benefit gained from this practice. It should be noted that this assessment is a coarse analysis but does provide good evidence to suggest that the maintenance work we do is financially beneficial to all the people of Bristol.

### Capital schemes

Flood alleviation schemes are assessed using the PF Calculator with the basis of our understanding of the flood risk in each area at the time of writing. See Table 4 below for the present value (PV) cost benefit analysis of our capital schemes.

**Table 4** Capital scheme cost benefit analysis

Scheme	PV costs £M	PV benefits £M	Benefit cost ratio	Confidence score
Avonmouth and Severnside Ecology Mitigation and Flood Defence project	71.7	561.1	7.8	High
Bristol Avon Flood Strategy	257	994	3.9	Medium
Bedminster Green trash screen	0.178	0.320	1.8	Medium
Resilient Frome project	7.1	19.1	2.7	Medium

# Strategy summary

- Bristol is at significant risk from surface water flooding, and our recent studies identify that approximately 3,440 properties are at risk
- The central area of Bristol is at risk of flooding from the tide, with approximately 1,200 properties at risk today
- Climate change presents a significant challenge to Bristol, from an increase in occurrence of heavy rainstorms to increased sea levels. Our studies show that approximately 4,500 properties are at risk from tidal flooding in the year 2125
- The Strategy is required by law and presents an Action Plan as to how we are going to manage and try to reduce flood risks to the people and places of Bristol
- In order to deliver the Action Plan, we need to work together to ensure that we all understand the risk and can help manage its likelihood, thus improving our response to flooding
- We will take an active role in promoting sustainable development and ensuring new development contributes to reducing flood risks, where appropriate



# Appendices

# Appendix A

## Definition of risk

For our Strategy, we define risk as:

$$\text{Risk} = \text{Probability} \times \text{Consequence}$$

As mentioned in the main body of the text, this definition is fundamental to the work that we do and how we prioritise our work as an LLFA. However, it is based on technical definitions that not everyone understands. In this Appendix, we have attempted to explain the risk calculation and its component parts, simply.

The probability is the chance of a flood event occurring, which we usually define as either the 'return period' or 'annual probability'. Return period is a statistical term. Using a hypothetical example, a flood of 1.5 metres in depth should statistically speaking occur once every 75 years. This does not mean it will only happen once every 75 years, it

could happen twice in one year then not again for 200 years. Return periods have been the traditional way to communicate flooding magnitude but for the above reason has led to some confusion. As a result, we tend to use annual probability, which is usually communicated as a percentage. For example, an annual probability of 1% means that a flood event of this magnitude has 1% chance of occurring in any given year. The consequence is the impact a particular flood event has, for example loss of life or damage to property or infrastructure. Using the above criteria, an extreme flood may have a low probability (chance) of occurring but very high consequences.

# Appendix B

## Risk Management Authorities duties and powers

### Risk Management Functions

The functions that each Risk Management Authority may undertake are known as duties and powers. Duties are actions that the authority must complete as specified by legislation, and powers are actions that an authority is able (but not obliged) to undertake or enforce others to undertake. The functions undertaken by each of the Risk Management Authorities follow.

### Lead Local Flood Authority (BCC)

As the Lead Local Flood Authority, BCC has the following functions:

A **duty** as a statutory consultee on planning applications in relation to surface water drainage

A **duty** to develop, maintain, apply and monitor a strategy (this Local Flood Risk Management Strategy) for local flood risk management in its area

A **duty** to co-operate with other Risk Management Authorities in the exercise of their flood risk management functions

A **power** to arrange for functions to be exercised on its behalf by another Risk Management Authority

A **power** to request a person to provide information in connection with its flood risk management functions

A **duty** to investigate flooding in its area and publish the results of the investigation

A **duty** to establish and maintain a register of structures that have a significant effect on flood risk in its area and a record of information about each of those structures, including ownership and state of repair

A **duty** to make a contribution towards the achievement of sustainable development

A **power** to designate structures or features that affects flood risk so that a person may not alter, remove or replace that structure or feature without prior consent

A **power** to carry out work that may cause flooding if the benefits of the work will outweigh the harmful consequences

A **power** to carry out flood risk management works that are considered desirable, having regard to the Local Flood Risk Management Strategy

A **power** to enforce land owners to undertake necessary maintenance works on ordinary watercourses

A **power** to consent or refuse works affecting the flow of ordinary watercourses

## Environment Agency

The Environment Agency has the following flood risk management functions:

A **duty** to develop, publish, maintain, apply and monitor a national strategy for flood and coastal erosion risk management

A **duty** to co-operate with other Risk Management Authorities in the exercise of their flood risk management functions

A **power** to arrange for certain functions to be exercised on its behalf by another Risk Management Authority

A **power** to designate structures or features as flood defence assets so that a person may not alter, remove or replace that structure or feature without prior consent

A **power** to grant or refuse an environmental permit for a flood risk activity to be carried out in, or adjacent to main rivers and coastal defences

A **power** to carry out flood risk management works that are considered desirable, having regard to the National Flood Risk Management Strategy

A **power** to require riparian owners to carry out works to maintain flow in main rivers

A **duty** to act as a statutory consultee on planning applications with regards to flood risk

A **duty** to act as the enforcement authority for reservoirs with a storage capacity of 10,000m<sup>3</sup> or greater

A **duty** to identify flood risk areas, publish hazard and risk maps and prepare flood risk management plans in co-operation with Lead Local Flood Authorities

## Wessex Water

Wessex Water has the following flood risk management functions:

A **duty** to co-operate with other Risk Management Authorities in the exercise of their flood risk management functions

A **duty** to provide, improve and extend a system of public sewers and to cleanse and maintain those sewers

A **power** to construct lateral drains following the provision of a public sewer

A **power** to adopt a sewer within its area that is constructed to suitable standards

A **power** to alter the drainage system of premises in its area that connects with a public sewer

A **power** to investigate defective sewers

A **power** to discontinue and prohibit the use of any public sewer in its area



## Internal Drainage Board

The Lower Severn Internal Drainage Board has the following flood risk management functions:

A **duty** to co-operate with other Risk Management Authorities in the exercise of their flood risk management functions

A **power** to undertake land drainage work in its area

A **power** to enforce land owners to undertake necessary maintenance works on ordinary watercourses within its area

A **power** to manage water levels within its area

A **power** to consent or refuse works carried out in, or within 8 metres of an ordinary watercourse within its area

A **power** to designate structures or features that affects flood risk so that a person may not alter, remove or replace that structure or feature without prior consent

## Highways Authority (BCC)

As the Highways Authority, BCC has the following flood risk management functions:

A **duty** to co-operate with other Risk Management Authorities in the exercise of their flood risk management functions

A **duty** and **power** to drain the highway

# Appendix C

## List of studies completed by Bristol City Council

Study Name	Date completed	Flood Source(s) Studied	Reason for Study	Study Objectives/ Methodology	Conclusions of Study	Link to Information
<b>Bristol Level 1 Strategic Flood Risk Assessment (SFRA)</b>	<b>2020</b>	All, including tidal, fluvial, surface water, sewer, groundwater, reservoir inclusive of climate change.	<ul style="list-style-type: none"> <li>Estimate the likely flood risk from rivers to development sites.</li> <li>Support emergency plans.</li> </ul>	<ul style="list-style-type: none"> <li>Review of historical events, studies and flood modelling to inform strategic planning and flood management plans.</li> </ul>	<ul style="list-style-type: none"> <li>Bristol is at significant risk from sources of tidal, fluvial and surface water flooding and this will increase in the future.</li> </ul>	<a href="http://www.bristol.gov.uk/residents/planning-and-building-regulations/planning-policy-and-guidance/planning-evidence">www.bristol.gov.uk/residents/planning-and-building-regulations/planning-policy-and-guidance/planning-evidence</a>
<b>Bristol Level 2 Strategic Flood Risk Assessment</b>	<b>Due in 2023</b>	Tidal, fluvial and surface water.	<ul style="list-style-type: none"> <li>To highlight those areas at most substantial risk of flooding and provide understanding of the flooding characteristics to manage this most effectively.</li> </ul>	<ul style="list-style-type: none"> <li>Focus on the main sources of flooding posing the greatest risk to the city and their mitigations.</li> </ul>	<ul style="list-style-type: none"> <li>Significant flood risk is posed to development behind existing or proposed defences that will need to be mitigated against.</li> </ul>	<a href="http://www.bristol.gov.uk/residents/planning-and-building-regulations/planning-policy-and-guidance/planning-evidence">www.bristol.gov.uk/residents/planning-and-building-regulations/planning-policy-and-guidance/planning-evidence</a>
<b>Surface Water Management Plan (SWMP)</b>	<b>2018</b>	Surface water, sewer and ordinary watercourses inclusive of climate change.	<ul style="list-style-type: none"> <li>To understand the risk of flooding to Bristol from heavy rainfall. Refine existing surface water models by including more of the underground pipe network.</li> </ul>	<ul style="list-style-type: none"> <li>Utilise computer simulation software to predict areas of flooding during heavy rainfall.</li> <li>Identify areas at high risk of flooding.</li> </ul>	<ul style="list-style-type: none"> <li>Around 3,440 properties in Bristol are at risk of surface water flooding. The risk will increase in the future.</li> </ul>	<a href="http://www.bristol.gov.uk/residents/planning-and-building-regulations/planning-policy-and-guidance/planning-evidence">www.bristol.gov.uk/residents/planning-and-building-regulations/planning-policy-and-guidance/planning-evidence</a>
<b>Proposed Surface Water Property Count Method for Bristol</b>	<b>2015</b>	Surface water	<ul style="list-style-type: none"> <li>Ensure national surface water flood property count methodology was suitable for use with Bristol's surface water modelling data, which differs from that done by the EA. The most important difference is that the Bristol modelling uses a 4, rather than 2, metre grid size.</li> </ul>	<ul style="list-style-type: none"> <li>Evaluate suitability of the national count method by comparing property count results in and out of Bristol.</li> <li>Review options to make the method suitable for use with Bristol's surface water modelling data by way of altering certain parameters.</li> </ul>	<ul style="list-style-type: none"> <li>The national count method using its standard parameters is not suitable for use with Bristol's surface water modelling data, but is if two parameters are altered to take account of the larger grid size.</li> </ul>	N/A

Study Name	Date completed	Flood Source(s) Studied	Reason for Study	Study Objectives/ Methodology	Conclusions of Study	Link to Information
<b>Dundry Hills Flood Risk Assessment</b>	<b>2012</b>	Surface water and Ordinary Watercourses in Dundry Hills	<ul style="list-style-type: none"> <li>● In response to local knowledge that the area is a known area of high flood risk</li> <li>● Build on the results of the SWMP</li> </ul>	<ul style="list-style-type: none"> <li>● Utilise site-specific version of the SWMP simulation model</li> <li>● Identify areas at highest risk and propose potential methods for mitigating such flooding</li> </ul>	<ul style="list-style-type: none"> <li>● Confirmation that flooding is from surface water runoff</li> <li>● Due to characteristics of the area (steep slopes with clay soils), flash flooding occurs</li> <li>● Two types of intervention are possible to reduce flood risk, named by the study as Tactical and Strategic Options</li> <li>● Tactical options include construction of flood mitigation measures (e.g. banks, ditches) to intercept and store flood water</li> <li>● Strategic options include encouraging better catchment management, improved rainfall and river flow monitoring and emergency response</li> </ul>	N/A

Study Name	Date completed	Flood Source(s) Studied	Reason for Study	Study Objectives/ Methodology	Conclusions of Study	Link to Information
<b>Central Area Flood Risk Assessment (CAFRA)</b>	<b>2013</b>	Tidal (River Avon) and river (Frome, Ashton watercourses, Malago)	<ul style="list-style-type: none"> <li>● Better understand the risk posed from tidal and river sources of flooding to the city centre</li> <li>● To refine the Bristol SFRA simulation modelling</li> <li>● Understand the role various assets have on flood risk management, notably the Floating Harbour assets</li> <li>● Answer an important question as to whether a moderate tide with moderate flow creates worse flooding than an extreme tide</li> </ul>	<ul style="list-style-type: none"> <li>● Utilise complex computer simulation software to predict areas of flooding during high flows and extreme tide levels</li> <li>● Undertake assessments and tests of the key assets in the central area that impact on flood risk management</li> <li>● Propose outline methods for mitigating flood risks from river and tidal sources</li> <li>● Establish a timeline of actions for progressing mitigation measures and management improvements</li> </ul>	<ul style="list-style-type: none"> <li>● Principal risk posed to central Bristol is from tidal flooding</li> <li>● The most dominant flood mechanism is an extreme tide, not a moderate tide in combination with a moderate flow</li> <li>● The Ashton area at risk from tidal and river flooding</li> <li>● The main route for flood water from the Avon is via three 'low spots' at Avon Crescent, Bathurst Basin and Albert Road</li> <li>● Climate change presents a significant risk due to rising sea levels</li> <li>● Over 600 properties are at risk in a present day 1 in 200 year return period event, rising to over 2,500 properties in the year 2110</li> <li>● The Floating Harbour plays a crucial role in flood risk management</li> <li>● Options to mitigate flood risk are proposed in the short term, medium term and long term</li> <li>● Short term options include raising the three 'low spots'</li> <li>● Medium term actions include establishing a Harbour asset management plan and improving flood response</li> <li>● Over the long term, a strategic solution to manage flood risk is required</li> </ul>	<a href="http://www.bristol.gov.uk/files/documents/2757-cafra-summary-final/file">www.bristol.gov.uk/files/documents/2757-cafra-summary-final/file</a>

Study Name	Date completed	Flood Source(s) Studied	Reason for Study	Study Objectives/ Methodology	Conclusions of Study	Link to Information
<b>River Avon Strategic Flood Defence Feasibility</b>	<b>2013</b>	Tidal (River Avon) and river (Frome, Ashton watercourses, Malago)	<ul style="list-style-type: none"> <li>• Undertake a due diligence assessment to select the most appropriate flood mitigation options for the central area</li> <li>• Utilise the results from previous studies (notably CAFRA) to inform future management and mitigation options</li> </ul>	<ul style="list-style-type: none"> <li>• Utilise the CAFRA results to propose flood mitigation interventions for the short, medium and long term</li> <li>• Undertake an optioneering assessment of potential options</li> <li>• Identify the potential opportunities and constraints on the various options</li> <li>• Utilise the constraints and opportunities assessment to propose preferred interventions</li> <li>• Generate a 'roadmap' for delivery of flood defence options</li> <li>• Consider the damages to Bristol's property and future development potential</li> </ul>	<ul style="list-style-type: none"> <li>• The roadmap concurs with the short, medium and long-term options proposed in the CAFRA</li> <li>• The preferred long term (i.e. climate change) strategic defence option would be a rising barrier in the River Avon</li> <li>• The options are in outline form only at present and need significant additional works and studies to prove their deliverability</li> <li>• The roadmap provides advice on the required future works and processes that need to be completed to enable delivery</li> </ul>	N/A
<b>Avonmouth/ Severnside Flood Defence Optioneering</b>	<b>2013</b>	Tidal (Severn Estuary) and river (various rhynes)	<ul style="list-style-type: none"> <li>• Required to facilitate the Avonmouth Severnside Economic Development Strategy</li> <li>• Develop the outline flood mitigation proposals identified by previous studies in the area</li> <li>• Utilise the results from previous studies (notably SFRA) to inform future management and mitigation options</li> </ul>	<ul style="list-style-type: none"> <li>• Utilise existing study results to propose flood mitigation interventions for the short, medium and long term</li> <li>• Undertake an optioneering assessment of potential options</li> <li>• Identify the potential opportunities and constraints on the various options</li> <li>• Utilise the constraints and opportunities assessment to propose preferred interventions</li> <li>• Consider the damages to existing property and future development potential</li> </ul>	<ul style="list-style-type: none"> <li>• The preferred options in the short to medium term include ground raising of key development sites</li> <li>• The preferred long term option is improve and upgrade existing flood defences</li> <li>• The report provides advice on the required future works and processes that need to be completed to enable delivery</li> </ul>	N/A



# Appendix D Strategy Action Plan

## Climate resilient places

**Local Objective:** Gain a greater understanding of the flood risks posed to Bristol and its people and places.

### Benefits key

- 1 Reduce flood risk
- 2 Increase understanding
- 3 Environmental
- 4 Resilient communities
- 5 Partnership working and efficiencies
- 6 Sustainability

Action No.	Action Name	Short term 2023–2025	Medium term 2025–2029	Long term 2029 onward	Funding Source	Cost Estimate	Stakeholder Involvement	Benefits
1.0	Undertake citywide groundwater risk assessment.	✓	✓	✗	DLUHC (LLFA)	15–25k	BCC, EA, WW	5
1.1	Update and procure the asset survey contract, ensuring national standards are met.	✓	✗	✗	DLUHC (LLFA)	Staff time	BCC	2
1.2	Utilise Confirm asset management software and transference of applicable information. Including asset inspections, issuing of maintenance work, records of visits from contractors and developing forecast spend profiles.	✓	✓	✓	DLUHC (LLFA)	Staff time	BCC	2,4
1.3	Improve the recording system of flood risk management activities undertaken. To demonstrate clearly to other RMAs and the public the progress made in completion of Strategy Actions and the status of work carried out.	✓	✓	✓	DLUHC (LLFA)	Staff time	BCC, EA, WW, LSIDB	2, 5
1.4	Continue to provide flood risk data to BCC Emergency Preparedness and Resilience Team to inform emergency management procedures.	✓	✓	✓	DLUHC (LLFA)	Staff time	BCC	1, 2, 4, 5
1.5	Continue to lead the Resilient Frome project in partnership with the Environment Agency, South Gloucestershire Council, and Wessex Water, through regular project co-working, progress meetings and Director's boards.	✓	✓	✗	Flood & Coastal Resilience Innovation Programme	£430k	BCC, EA, SGC, WW	1, 2, 3, 4, 5, 6
1.6	Deliver RFP policy challenge report to Defra in April 2023.	✓	✗	✗	Flood & Coastal Resilience Innovation Programme	£50k	BCC, EA	4, 5
1.7	Deliver RFP telemetry improvements as described in the OBC by Autumn 2023.	✓	✗	✗	Flood & Coastal Resilience Innovation Programme	£160k	BCC, EA	2, 5

## Climate resilient places

**Local Objective:** Promote sustainable development that seeks to reduce flood risk and includes consideration of climate change.

### Benefits key

- 1 Reduce flood risk
- 2 Increase understanding
- 3 Environmental
- 4 Resilient communities
- 5 Partnership working and efficiencies
- 6 Sustainability

Action No.	Action Name	Short term 2023–2025	Medium term 2025–2029	Long term 2029 onward	Funding Source	Cost Estimate	Stakeholder Involvement	Benefits
2.0	Follow established process on consultation of planning applications from a flood risk perspective.	✓	✓	✓	DLUHC (LLFA)	Staff time	BCC, EA, WW	1, 5, 6
2.1	Implement drainage adoption on an optional basis with additional requirements, exclusions and charges to be determined.	✓	✓	✓	TBC	TBC/Staff time	BCC, WW	1, 3, 4, 5, 6
2.2	Inform Local Plan preparation to ensure flood risk is appropriately considered.	✓	✓	✓	DLUHC (LLFA)	Staff time	BCC, EA, WW, LSIDB	1, 2, 5
2.3	Ensure Flood Team involvement with, and inform distribution of CIL and other funding sources.	✓	✓	✓	DLUHC (LLFA)	Staff time	BCC	6
2.4	Identify contributions to flood mitigation schemes through development management process.	✓	✓	✓	DLUHC (LLFA)	Staff time	BCC	1, 6
2.5	Submit comments in line with the agreed procedures and risk based approach on all Major planning applications with regards to surface water management and drainage. To fulfil the role of the LLFA as a statutory consultee.	✓	✓	✓	DLUHC (LLFA)	Staff time	BCC, WW, LSIDB	1, 3, 5, 6
2.6	Develop risk based enforcement procedures for auditing approved applications.	✓	✓	✗	DLUHC (LLFA)	Staff time	BCC, EA, WW, LSIDB	1, 3, 5, 6
2.7	Comment on Bedminster Green regeneration planning applications in line with the BG masterplan.	✓	✗	✗	DLUHC (LLFA)	Staff time	BCC, EA, WW	1, 3, 4, 5, 6

## Today's growth and infrastructure – resilient in tomorrow's climate

**Local Objective:** Actively manage flood risk infrastructure to reduce the likelihood of flooding causing harm to people and damage to society, the economy and the environment

### Benefits key

- 1 Reduce flood risk
- 2 Increase understanding
- 3 Environmental
- 4 Resilient communities
- 5 Partnership working and efficiencies
- 6 Sustainability

Action No.	Action Name	Short term 2023–2025	Medium term 2025–2029	Long term 2029 onward	Funding Source	Cost Estimate	Stakeholder Involvement	Benefits
3.0	Continue maintenance of ordinary watercourses and associated structures.	✓	✓	✓	Revenue	50k / annum	BCC	1
3.1	Implement minor land drainage works as appropriate.	✓	✓	✓	Revenue, Capital	20k / annum	BCC	1
3.2	Identify and prioritise Floating Harbour flood risk asset improvement requirements.	✓	✓	✓	DLUHC (LLFA)	Staff time	BCC, EA	1, 2
3.3	Utilise strategic board groups to identify opportunities for partnership working and funding contributions.	✓	✓	✓	DLUHC (LLFA)	Staff time	BCC, EA, WW, IDB, Others	5
3.4	Follow established process for consenting works to ordinary watercourses.	✓	✓	✓	DLUHC (LLFA)	Staff time	BCC	1
3.5	Complete green spaces study to assess the importance of existing green spaces on flood risk management in the city.	✗	✓	✓	DLUHC (LLFA)	Staff time	BCC, IDB, WW, EA	1, 3, 4, 6
3.6	Deliver Bedminster Green river restoration scheme.	✓	✓	✗	CIL, Local Levy, FDGiA	£4m	BCC, EA, WW, Others	1, 3, 4, 5, 6
3.7	Continue to support delivery of the ASEA project up to 2024 through the project delivery board.	✓	✗	✗	FDGiA, EDF	£20k	BCC, EA, SGC	1, 3, 5
3.8	Continue to lead the BAFS project in partnership with the Environment Agency through regular project co-working, progress meetings and project boards.	✓	✓	✓	Local Levy	£350k	BCC, EA, WECA	1, 2, 3, 4, 5, 6
3.9	Complete BAFS OBC build stage one by autumn 2023.	✓	✗	✗	Local Levy	£650k	BCC, EA	1, 2, 5
3.10	Commence BAFS OBC build stage two by early 2023.	✓	✗	✗	Local Levy, WECA Investment Fund	£500k	BCC, EA, WECA	1, 2, 5
3.11	Aspire to commence construction for the BAFS in 2026.	✓	✓	✗	FDGiA, BCC reserves, EDF	£216M	BCC, EA, WECA, WW, Others	1, 2, 3, 4, 5, 6
3.12	Finalise RFP SuDS detailed designs and Full Business Case by December 2023.	✓	✗	✗	Flood & Coastal Resilience Innovation Programme	£200k	BCC, SGC, WW	1, 3, 5
3.13	Develop detailed designs for the RFP river restoration proposal by May 2024.	✓	✗	✗	Flood & Coastal Resilience Innovation Programme	£400k	BCC, EA, Others	1, 3, 5, 6

# A nation ready to respond and adapt to flooding and coastal change

**Local Objective:** Increase public awareness and encourage communities to take action to manage the risks that they face

Understand communities flooding concerns and priorities, and gather knowledge based on their perception of flooding

- Benefits key
- 1 Reduce flood risk

2 Increase understanding

3 Environmental

4 Resilient communities

5 Partnership working and efficiencies

6 Sustainability

Action No.	Action Name	Short term 2023–2025	Medium term 2025–2029	Long term 2029 onward	Funding Source	Cost Estimate	Stakeholder Involvement	Benefits
4.0	Introduce proposed flood alleviation schemes to local communities.	✓	✓	✓	DLUHC (LLFA)	Staff time	BCC	2, 4, 5
4.1	Ensure final version and future updates of local strategy are freely available to the public in a variety of formats.	✓	✓	✓	DLUHC (LLFA)	Staff time	BCC	2, 4
4.2	Continue raising awareness of the risk of flooding to citizens of Bristol and the resources available to help manage this.	✓	✓	✓	DLUHC (LLFA)	Staff time	BCC	2, 4, 5
4.3	Provide input on flood emergency plans with key responders.	✓	✓	✓	DLUHC (LLFA)	Staff time	BCC	2, 4, 5

# A nation ready to respond and adapt to flooding and coastal change

**Local Objective:** Improve preparedness for flood events and post flood recovery.

**Benefits key**

- 1 Reduce flood risk
- 2 Increase understanding
- 3 Environmental
- 4 Resilient communities
- 5 Partnership working and efficiencies
- 6 Sustainability

Action No.	Action Name	Short term 2023–2025	Medium term 2025–2029	Long term 2029 onward	Funding Source	Cost Estimate	Stakeholder Involvement	Benefits
5.0	Continue to provide advice regarding warnings issued by the Flood Forecasting Centre to the wider authority and other stakeholders.	✓	✓	✓	DLUHC (LLFA)	Staff time	BCC, Others	5
5.1	Undertake functions from Section 19 of the FWMA, and endeavour to investigate smaller flood incidents where appropriate.	✓	✓	✓	DLUHC (LLFA)	Staff time	BCC	2, 5
5.2	Identify and undertake training to improve flood knowledge and preparedness of the LLFA team.	✓	✓	✓	DLUHC (LLFA)	Staff time	BCC	2
5.3	Liaise and work in conjunction with colleagues in BCC who have a role to fulfil as the LLFA. To promote and co-ordinate flood response and preparedness across key teams within the authority.	✓	✓	✓	DLUHC (LLFA)	Staff time	BCC	2, 5
5.4	Develop and promote the use of flood data to inform emergency traffic management procedures.	✓	✓	✓	DLUHC (LLFA)	Staff time	BCC	1, 4
5.5	Attend Environment Agency community flood plan meeting(s) to improve knowledge and help improve community flood resilience.	✓	✓	✓	DLUHC (LLFA)	Staff time	BCC, EA	2, 4





## **Flood Risk Management Team**

[flood.data@bristol.gov.uk](mailto:flood.data@bristol.gov.uk)

### **Documents available in other formats:**

If you would like this information in another language, Braille, audio tape, large print, easy English, BSL video or CD rom or plain text please contact us:

**[flood.data@bristol.gov.uk](mailto:flood.data@bristol.gov.uk)**