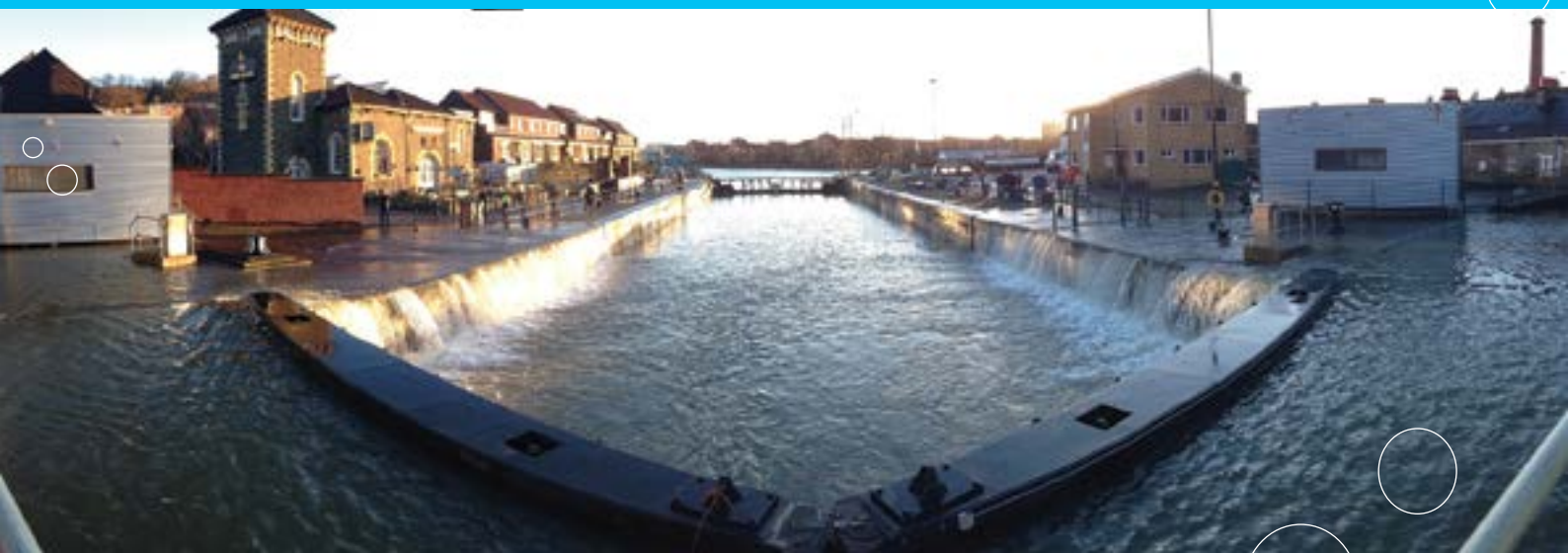


Local Flood Risk Management Strategy

March 2017



Revision schedule

Local Flood Risk Management Strategy

March 2017

Rev	Date	Details	Prepared by	Reviewed by	Approved by
04	March 2017	Two yearly formal update	John Stevens – Flood Risk Officer Patrick Goodey – Flood Risk Manager	John Roy – Group Manager, Transport Assets	Adam Crowther – Service Manager, Strategic City Transport

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Foreword

The widespread flooding experienced across the UK in recent years demonstrates the devastating effects that flooding has on people and their homes and communities. As well as the economic loss suffered by individuals, businesses, and the country as a whole, the end result is significant stress and disruption to people. While we can never prevent floods from occurring altogether, we can better manage the risk that we face.

Following the 2007 summer floods, the government commissioned the Pitt Review¹ to identify lessons to be learned and changes that should be made in order to manage flood risk in the UK more effectively. To achieve these changes, new legislation was brought in called the Flood and Water Management Act 2010. The Act gave important new duties, powers and responsibilities to Bristol City Council who became the Lead Local Flood Authority (LLFA) for the Bristol area.

As the LLFA, an important duty for us is to produce and maintain a Local Flood Risk Management Strategy which sets out our vision for managing flood risk in Bristol together with other organisations that have a role in flood risk management.

The importance of working in partnership was demonstrated during the high tides we had in Bristol during early 2014. During these events Bristol City Council's Flood Risk team, Civil Protection Unit, Parks and Landscapes and Highways and Network Management teams worked together with the Environment Agency and Met Office in order to monitor unfolding events and take proactive action to reduce the risk of flooding, but there is always more that we can all do.

As the LLFA, we are committed to continue in our role co-ordinating flood risk management activities. This document forms our strategy and has been produced in partnership with teams across the City Council as well as the Environment Agency, Wessex Water and Lower Severn *Internal Drainage Board*.



Councillor Fi Hance

Cabinet Member for Energy, Waste and Regulatory Services.

¹ http://webarchive.nationalarchives.gov.uk/20100807034701/http://archive.cabinetoffice.gov.uk/pittreview/_/media/assets/www.cabinetoffice.gov.uk/flooding_review/pitt_review_full%20pdf.pdf

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 <i>watercourse</i> 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 <i>watercourse</i>
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 other 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.
Groundwater	Water held underground in soil or rock
IDB	Internal Drainage Board
Inlet	The entrance to a <i>culvert</i> , <i>sewer</i> 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 <i>surface water</i> , <i>groundwater</i> and <i>Ordinary Watercourses</i>
Local Plan	Includes policies that BCC use for deciding planning applications in Bristol. Made up of several documents.
Main river	A <i>watercourse</i> designated as such by the Environment Agency for which it has responsibilities and powers

GLOSSARY continued...

Term	Definition
Ordinary watercourse	All <i>watercourses</i> that are not designated <i>Main River</i> and which are the responsibility of local authorities or <i>Internal Drainage Boards</i>
Outlet	The exit of a <i>culvert</i> , <i>sewer</i> 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)
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
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 <i>surface water</i> 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 <i>sewer</i> 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 ' <i>storm surges</i> '
Trash screen	A structure installed at the entrance to a <i>culvert</i> 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.

As the LLFA, Bristol City Council (BCC) have responsibility for leading on the co-ordination of flood risk management in Bristol. This is conducted in partnership with other organisations involved in flood risk management activities. BCC, in the role of the LLFA, are also the authority responsible for managing the risk of flooding from local sources – that is *surface water, groundwater and ordinary* (smaller) *watercourses*.

An important duty we have under the Act is to produce and maintain a Local Flood Risk Management Strategy which sets out our vision for managing the risk of flooding from local sources. This document forms our revised strategy, an updated version two years on from its original inception. 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, Wessex Water and the Lower Severn *Internal Drainage Board*. 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 Place 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 guiding principles of the Environment Agency's national strategy. It is also linked in with local development plans and Bristol's status as the European Green Capital 2015, and member of the Rockefeller Foundation's 100 Resilient Cities.

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.



Plate 1 - *Cumberland Road flood wall*

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 Photograph 1 above) 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 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 Photo 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 Photo 3 below.

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 delivery partners, notably the Environment Agency and South Gloucestershire Council) have made significant progress on two large-scale projects, Avonmouth and Severnside Ecology Mitigation and Flood Defence project as well as the River Avon Tidal Flood Risk Management Strategy.

Our work has also influenced many planning applications across the city to ensure new developments are achieving a reduction in flood risk.



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

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.

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.

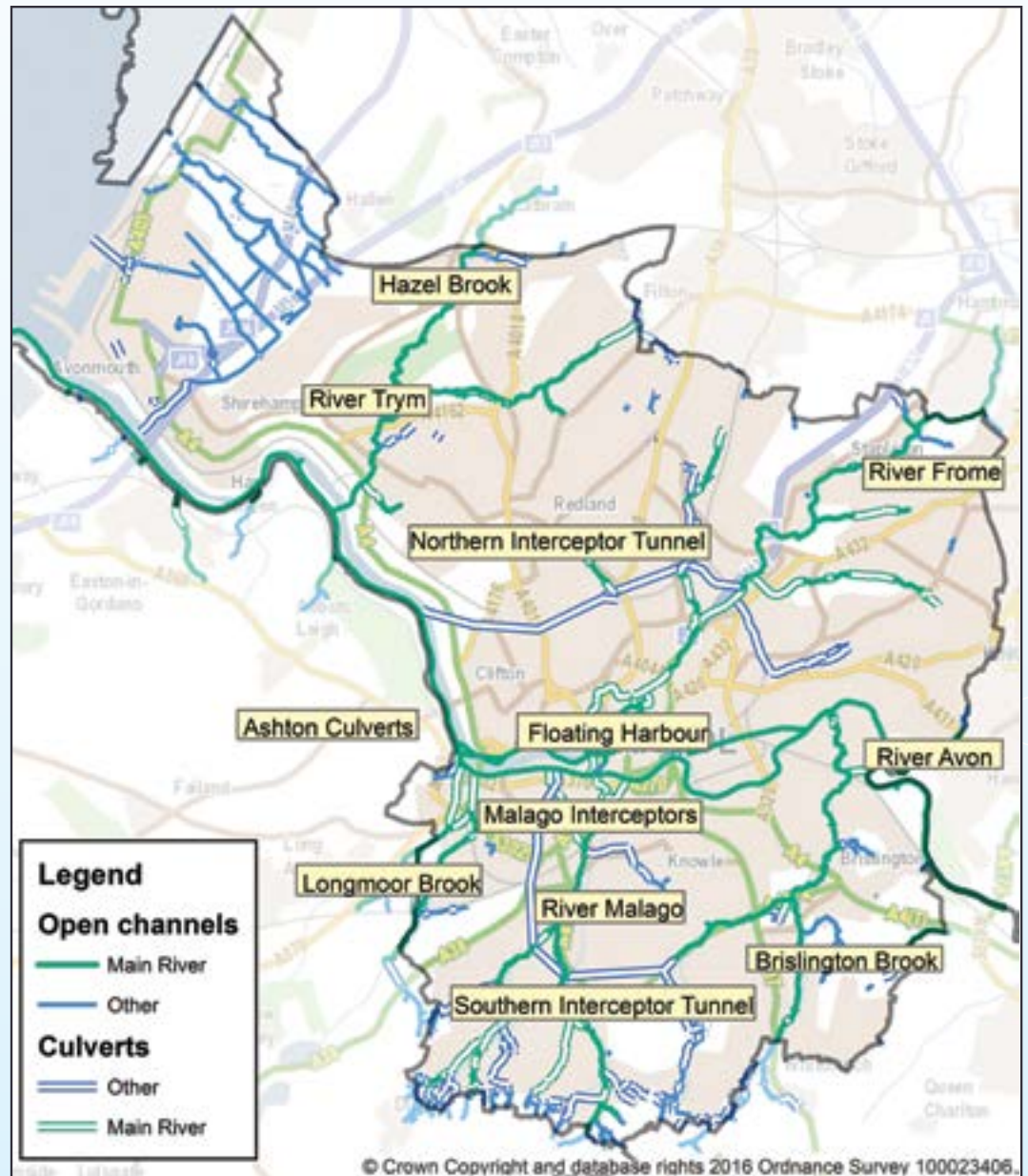


Figure 1 – Rivers and water features in Bristol

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*. However, the wider role of the LLFA requires us to lead the co-ordination of flood risk management. In addition, our position as Harbour Authority, Highways Authority, Coast Protection Authority as well as being a key partner in the Local Enterprise Partnership, 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 studies² predict that approximately 22,300 residential properties are at risk of *surface water* flooding across Bristol and as such the city is recognised as one of the UK's top 10 Flood Risk Areas that are susceptible to *surface water* flooding. This strongly suggests that flooding during very heavy rainfall is likely to be significant and presents the biggest risk to the city. 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.

We have identified a number of areas at particular high risk of flooding from *surface water*³, known as High Risk Areas. The most notable of these are in Ashton, Southmead, Henbury, Hengrove, St George the studies also confirmed that areas at the base of Dundry Hills (from Whitchurch to Withywood) area 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* information⁴.



Figure 2 – Map of surface water flood risk in Bristol
see <http://maps.bristol.gov.uk/bfrm/>

2 <https://www.bristol.gov.uk/planning-and-building-regulations/planning-policy/planning-evidence>

3 https://www.bristol.gov.uk/documents/20182/33916/2012.08.08+SWMP_Final+Phase+1+Report-No+Appendices_0.pdf

4 <https://www.bristol.gov.uk/documents/20182/35100/preliminary-flood-risk-assessment-june-2011.pdf>

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.

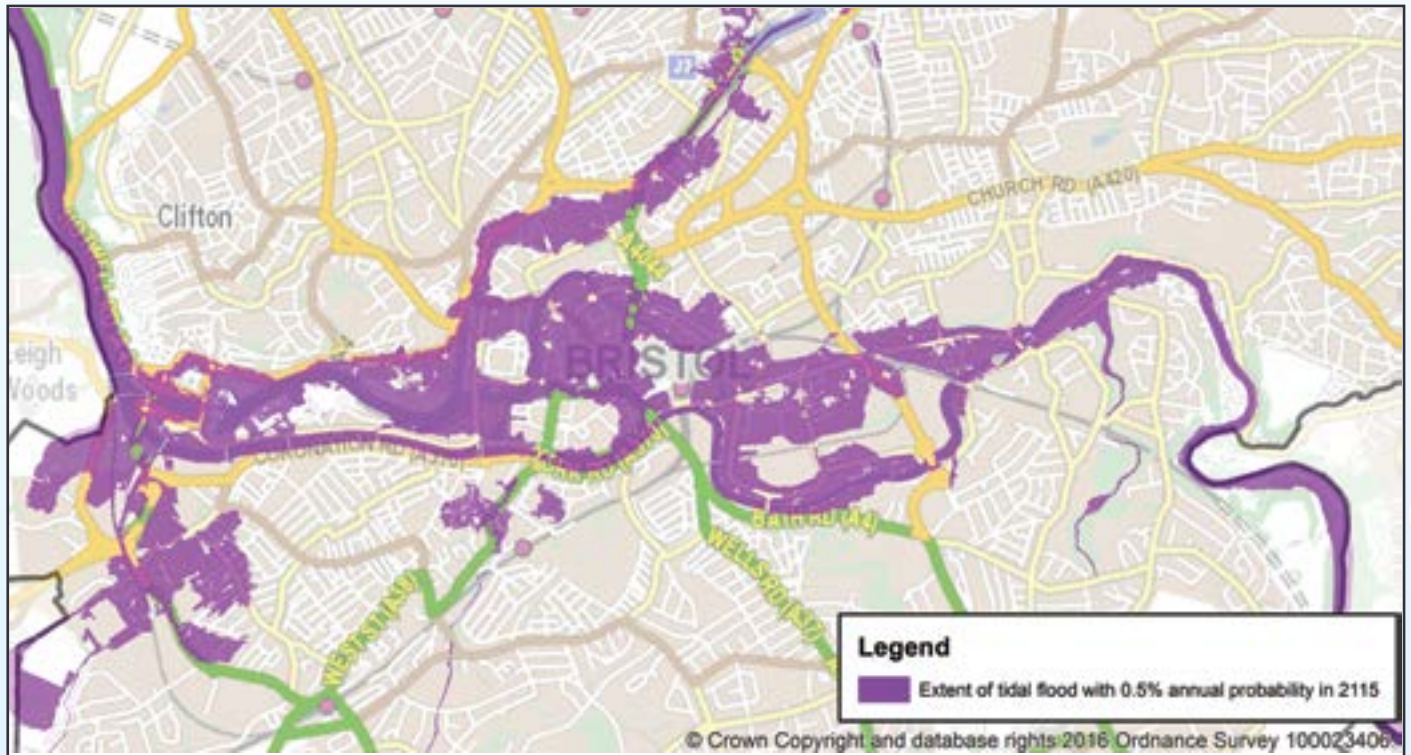


Figure 3 – Map of tidal flood risk in central Bristol. See <http://maps.bristol.gov.uk/bfrm/>

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 1,000 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 to the city centre. Figure 3 shows the present day risk of *tidal flooding* in the central area, with Figure 3 showing the tidal flood risk in the Avonmouth area.

Online maps showing the approximate flood extents during extreme tidal events are available via <http://maps.bristol.gov.uk/bfrm/>.

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. Much of Bristol is now protected to a suitable standard and even predicted increase in extreme rainfall due to climate change is unlikely to significantly alter the risk of *fluvial flooding*, as a result of the defences.



Figure 4 - Map of fluvial flood risk in Bristol.

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

It is acknowledged, however, that we need to work with our partners to monitor these risks closely and ensure they are proactively managed. Figure 4 shows the present day risk of *fluvial flooding* across the whole city, including Avonmouth.

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

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.

	Present Day	Year 2030	Year 2060	Year 2115
Approximate Number of properties at risk ⁵	1,000	1,000	2,600	3,700

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)⁶. It is therefore important that we work with our partners to help manage these constraints and encourage sustainable regeneration of the city.

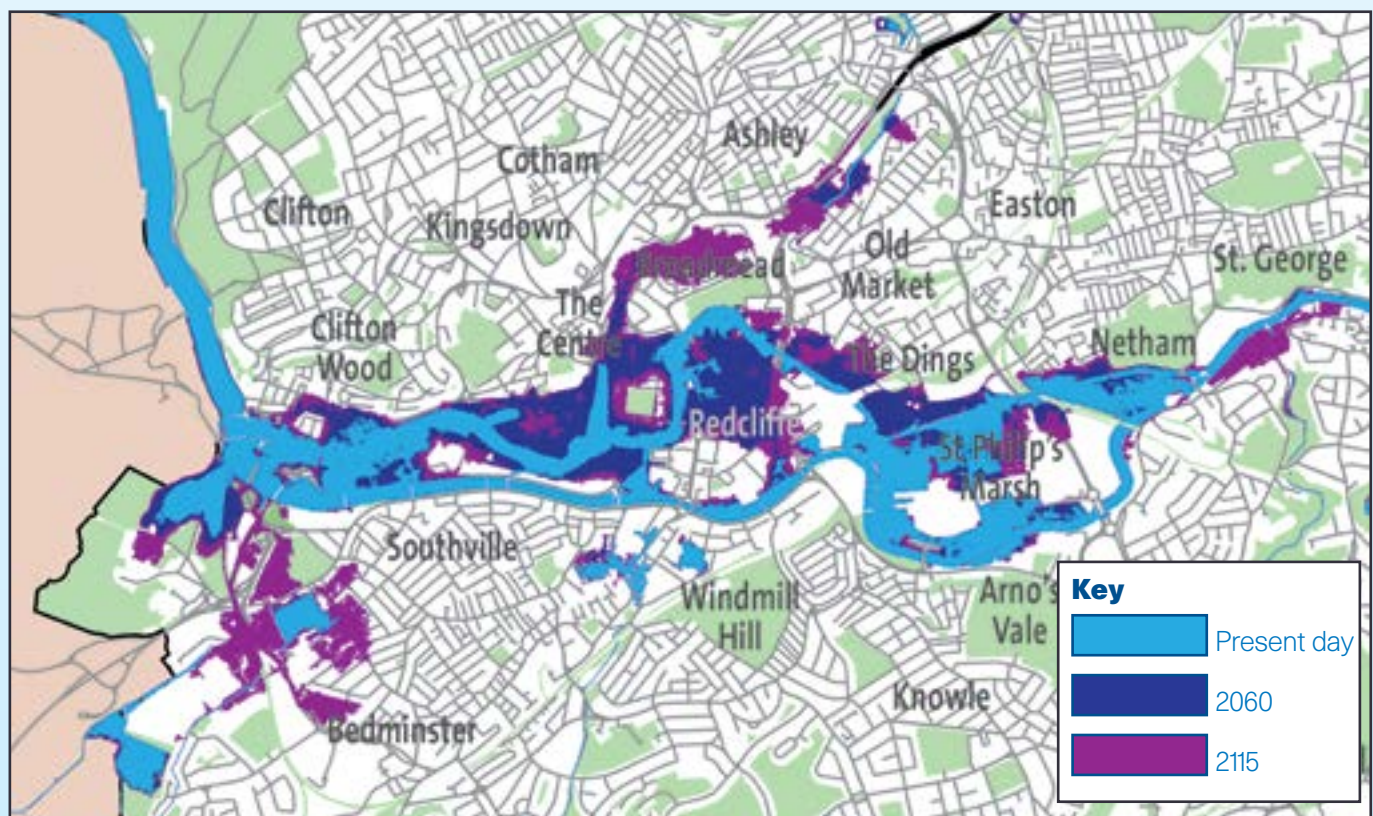


Figure 5 - Tidal flood risk in Bristol inclusive of climate change. See <http://maps.bristol.gov.uk/bfrm/>

⁵ Taken from the 0.5% annual probability (1 in 200 annual chance) tidally-dominant event

⁶ <http://www.westofenglandlep.co.uk/>

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.

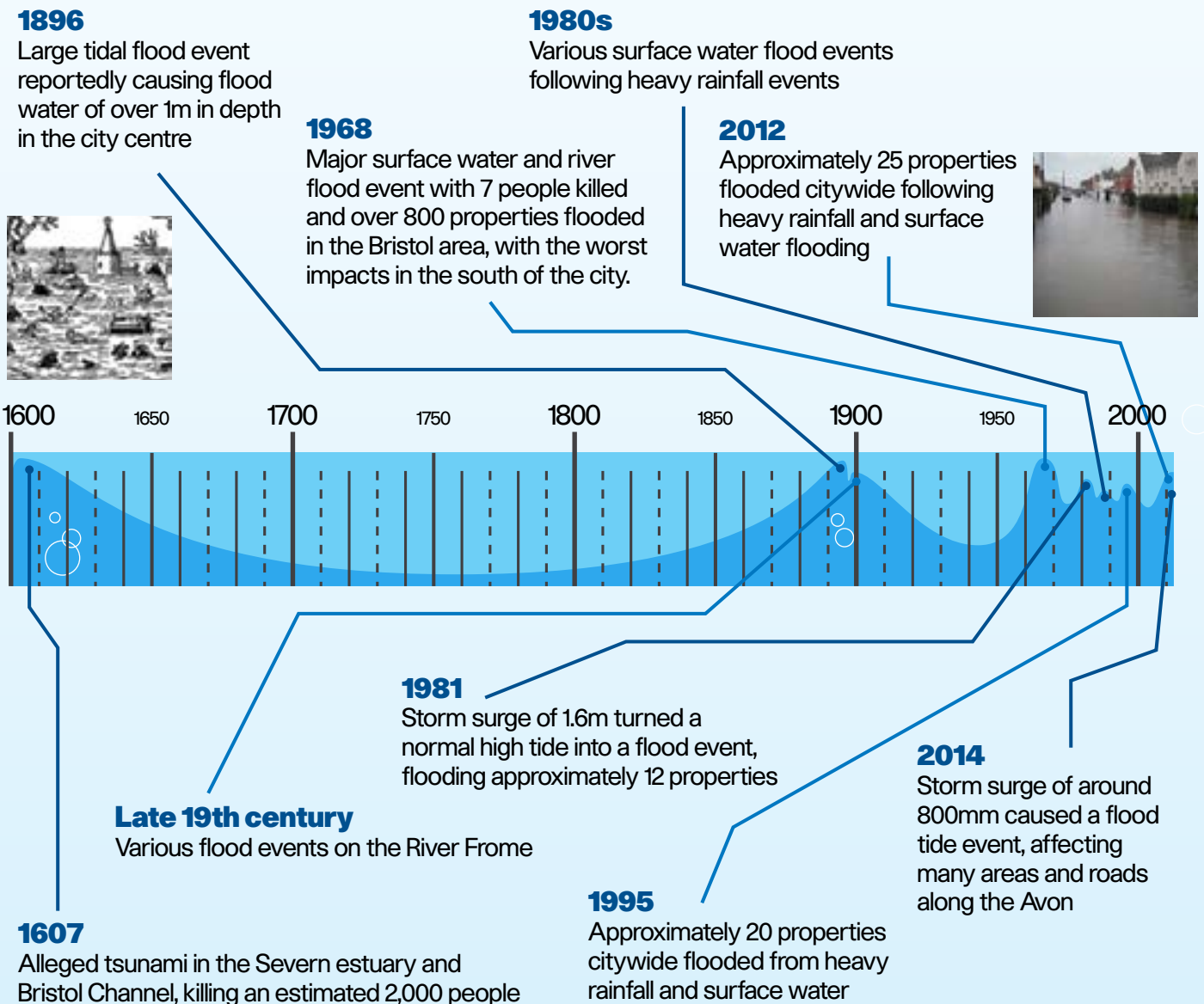
Fluvial flooding

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 above.

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.

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.

Storm surge

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.

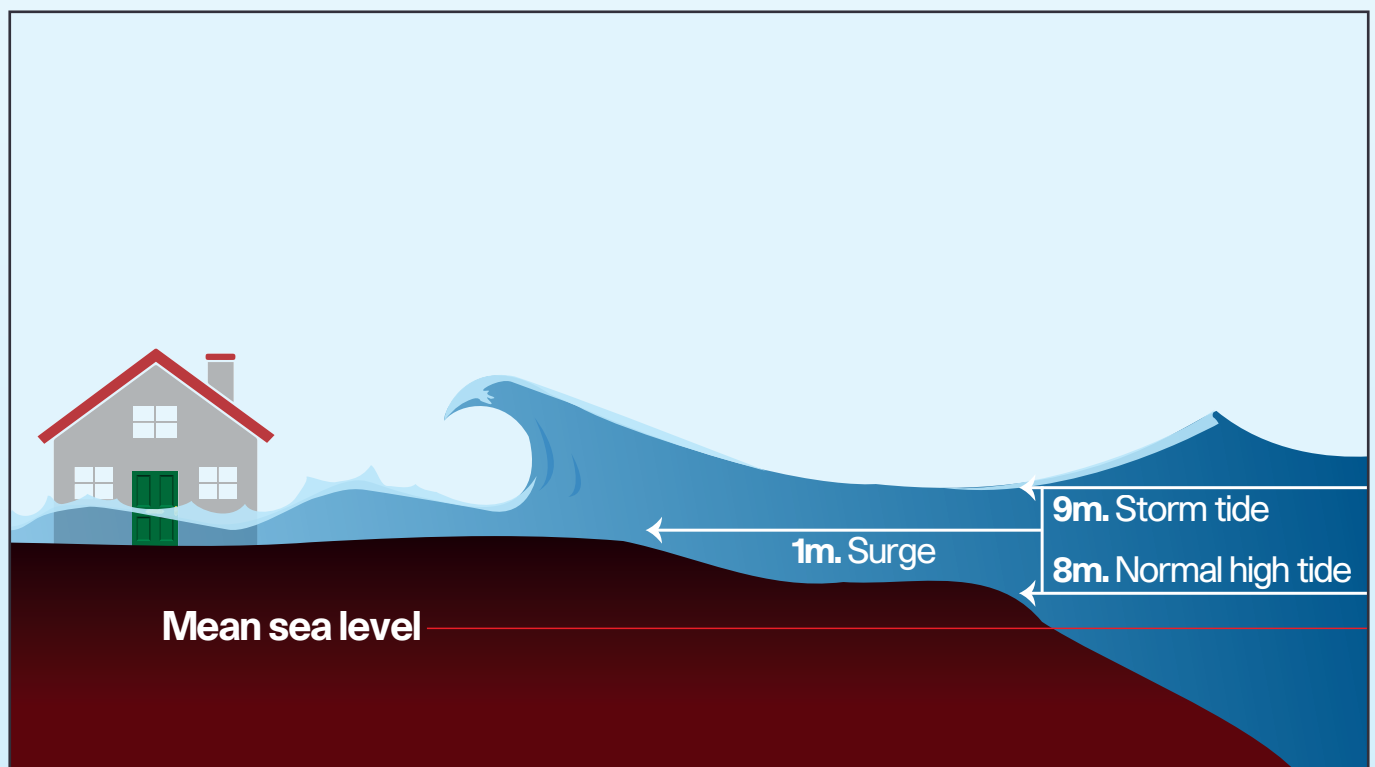


Figure 6 diagram indicating the effect of a tidal storm surge

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 November 21st and 22nd 2012. During these two days, between 20-30 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 and 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 3rd January 2014, we experienced a large *storm surge* in combination with a high *spring tide*. 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 on this flood event that provides additional information.

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 November 16th to the 22nd. 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.

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 requirement⁷ 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.

⁷ 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 events⁸ through to the identification of flood assets for the Asset Register⁹, 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:

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.

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.

National strategy

The Environment Agency is the national government agency who manages *flood risk* on a strategic (national) scale. In 2011, the Environment Agency produced the National *Flood Risk Management Strategy*, highlighting how they are going to approach *flood risk* management. The National Strategy included five main objectives, identified in Figure 7.

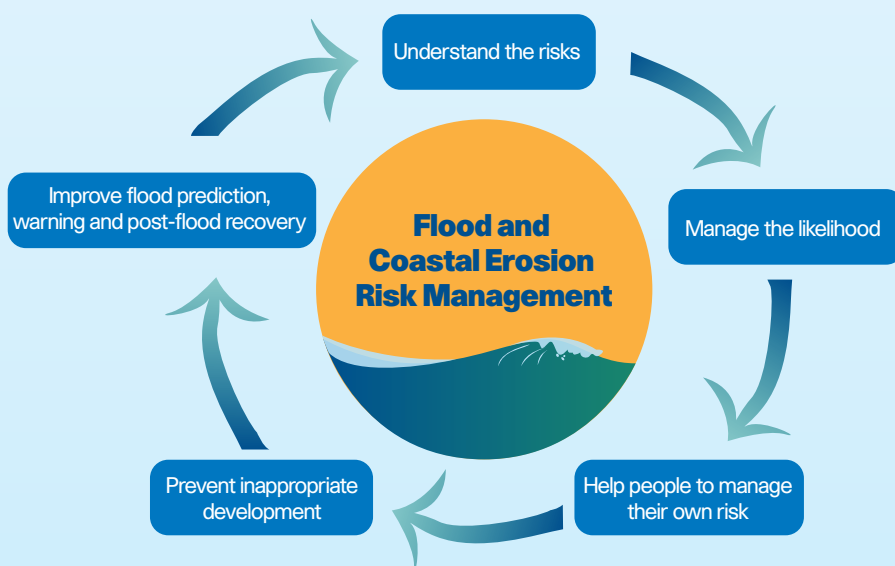


Figure 7 – Objectives from the National Flood Risk Management Strategy

⁸ Under Section 19 of the Flood and Water Management Act, 2010

⁹ Under Section 21 of the Flood and Water Management Act, 2010

Local Strategy

We have used the five objectives from the National Strategy to form the basis of our Local Strategy, to ensure consistency with the national approach. The five objectives have been amended to be specific to Bristol and used to form the five main Local Objectives, and therefore chapters, of our Local Strategy. **Figure 8** shows how the National Strategy Objectives have been implemented as local Objectives.

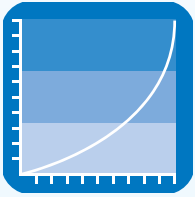


Figure 8 - National Strategy Objectives and the relevant Bristol Strategy agreed local Objectives

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, 2016 – 2018), medium (four to six years, 2018 – 2022) and long (more than six years, 2022 and beyond) term.

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 unfeasible, 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.



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.



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.



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.



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

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. In Bristol, there are five Risk Management Authorities; **Figure 9** shows who they are and what they are responsible for.



Figure 9 - Risk Management Authorities in Bristol and the flooding sources they are responsible for managing

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 as such 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* leads on co-ordinating the flood management activities between these teams. In the instance of receiving notification of a Flood Warning from the Met Office 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.

Civil Protection Unit

- 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.

Highways

- 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.

City Innovation and Sustainability

- 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
- 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 under **Objective 3**.

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 C, 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.

National Objective 1

Understand the Risk

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 D**.

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 either been work required to support our emerging Local Development Framework or under our duty to take a lead role in co-ordinating *flood risk* activities within our area. 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 Wessex Water Frome Valley relief *sewer* will relieve capacity in combined *sewer* areas in Bristol when constructed (due by 2019/20) and we will investigate this further. 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 and 2014 and 2016 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 10 provides some evidence of the verification of study results.

Our studies have also provided potential options to reduce the risks, which are summarised under Objective 2: Manage the Likelihood.

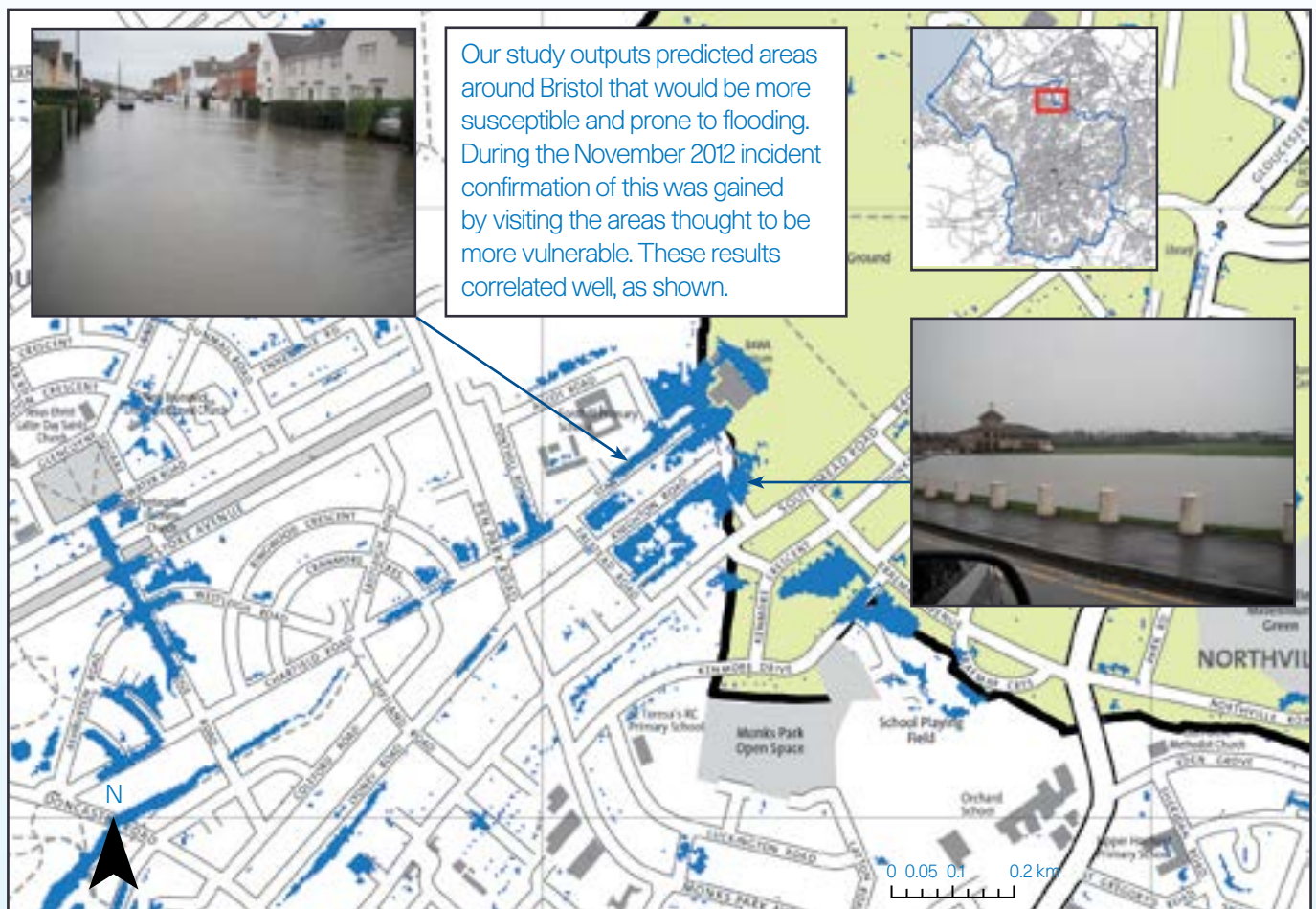


Figure 10 - Evidence of the verification of study results. See <http://maps.bristol.gov.uk/bfrm/>

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.

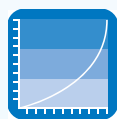
Measures

- 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 D, 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*

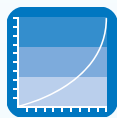
Flood Source	Priority Number	Area/Location	Types of Properties at risk
Tidal	1	City Centre	Commercial, residential, infrastructure
<i>Surface water/ Ordinary Watercourses</i>	2	Dundry Hills	Mostly residential, some schools and commercial areas
Tidal, fluvial	3	Avonmouth	Commercial, residential, infrastructure
<i>Surface water, tidal, river, groundwater</i>	4	Ashton	Residential, commercial and industrial
<i>Surface water</i>	5	Southmead	Mostly residential, some commercial
Tidal	6	St Philips Marsh	Commercial and industrial
<i>Surface water</i>	7	Bamfield Road	Mostly residential, some infrastructure

In addition to the larger high risk areas identified by the various studies and indicated in Table 2 above, we will be adopting a risk-based approach to prioritise future smaller schemes and projects.

We will be reviewing the computer simulation model that predicts *surface water* flooding in the city. Such a review is required given the age (completed in 2010) of the existing 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 will allow 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.

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 *RMA*s is crucial to help define and understand flooding mechanisms and prioritise potential interventions to the 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 *RMA*s, we will be in a good position to ensure we identify the relevant partners for each piece of work we undertake.

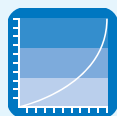
C. Learn from real-life flooding by recording and investigating events



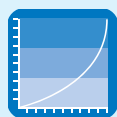
Knowing where and why flooding happens is vital for understanding and therefore managing *flood risk*. We will continue to investigate flood events in partnership with local residents, collecting information such as eye witness accounts, photos, questionnaires (**see Appendix E**) and meteorological 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.



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: South West Incident Management (**SWIM**). It is easy for officers and the public to fill in standard questionnaire forms (**an example is shown in Appendix E**), 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: <https://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. *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>.

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*.

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

Publish appropriate datasets such as the *Flood Risk Asset Register* on the Council's web site

Actions outstanding

Complete integrated Ashton *flood risk* study in partnership with EA and WW

Action No.	Action Name	Short term 2016 - 2018	Medium term 2018 - 2022	Long term 2022 onward
1.1	Complete SWMP update including Ashton <i>surface water flood risk</i> study			
1.2	Complete River Avon Tidal Flood Risk Management Strategy			
1.3	Complete Full Business Case for the Avonmouth/Sevenside Ecology Mitigation and Flood Defence scheme			
1.4	Undertake citywide <i>groundwater</i> risk assessment			
1.5	Undertake vulnerability mapping exercise using study results and enhance infrastructure resilience			
1.6	Undertake comprehensive local flood-risk asset surveys			
1.7	Update and procure the asset survey contract, ensuring national standards are met			
1.8	Utilise Confirm asset management system and transference of applicable information. Including asset inspections, issuing of maintenance work, records of visits from contractors and developing forecast spend profiles.			
1.9	Improve the recording system of <i>flood risk</i> management activities undertaken. To demonstrate clearly to other <i>RMA</i> s and the public the progress made in completion of Strategy actions and the status work carried out.			
1.10	Continue to provide <i>flood risk</i> data to BCC Civil Protection Unit to inform emergency management procedures.			
1.11	Contribute towards the completion of the Horizon 2020 RESilience to cope with Climate Change in Urban arEas (RESCCUE) project with European partners			

National Objective 2

Manage the Likelihood

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**

Bristol is identified as one of the UK's ten Flood Risk Areas¹⁰ and to recognise this 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 (this is covered by Objective 3: Help People Manage Their Own Risk).

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

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

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,

10 Bristol City Council Preliminary Flood Risk Assessment, 2011

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 medium term plan 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.

Strategy policy – actively encourage the removal of built infrastructure where appropriate to encourage more natural management of *watercourses* and drainage channels.

Strategy policy

Actively encourage the removal of built infrastructure where

- appropriate to encourage more natural management of *watercourses* and drainage channels.

Management of Tidal Flooding

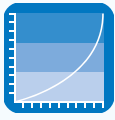
Bristol is also at risk of *tidal flooding*, particularly around the Floating Harbour area and at Avonmouth. Although the Environment Agency have overall responsibility for managing tidal *flood risk*, we, as the *LLFA* and authority responsible for the management of the Floating Harbour, work in partnership 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 either a tidal barrier or flood defence walls. For Avonmouth it involves refurbishment and upgrade of the existing defences to account for sea level rise. These proposals will need a lot of further work to refine the designs and business case and community consultation will be a vital aspect of both projects. For the reasons outlined above, we will continue to take a lead on these projects but work in close partnership with the other *RMA*s and relevant interest groups and authorities.

Measures

- Improve our flood risk management maintenance procedures**
- Use our understanding of flood risk in Bristol to ensure limited resources are targeted at areas of highest risk**
- Seek partnership working opportunities so that those that benefit from flood risk assets contribute towards their planning and management**
- 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.**

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.

We have reviewed and updated our *watercourse* maintenance procedures and procured a new contract that operates in accordance with the updated procedures. We are now working with colleagues in the Highways Authority to incorporate the updated *watercourse* maintenance procedures in to a larger framework contract to provide efficiency savings. The larger framework will also include maintenance of highway gullies. We will therefore be seeking to improve our procedures with regard to improve the efficiency our management of gully maintenance using a risk-based approach.

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.

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 scheme on Embleton Road in Southmead in partnership with Sustrans, part funded by us, the Green Capital Partnership and Wessex Water.

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 can be tested against the work Wessex Water is leading on in the emerging Adaptation and Resilience framework for the Bristol Avon *Catchment*. 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 Partnership¹¹. We will engage with stakeholders on such projects including local communities and other risk management authorities to ensure maximum benefits are achieved.

Strategy policy

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

¹¹ <http://www.bristol.gov.uk/page/environment/bristol-green-capital>

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.

We have identified specific projects and processes through our Action plan that we 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 2 - Actions

Actions completed

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

Actions outstanding

Formalise process for consulting on *RMA* led schemes to maximise inclusion of *SuDS* and green space

Action	Action Name	Short term 2016 - 2018	Medium term 2018 - 2022	Long term 2022 onward
2.1	Continue maintenance of <i>ordinary watercourses</i> and associated structures			
2.2	Implement minor land drainage works as appropriate			
2.3	Deliver Sandburrows Road flood alleviation scheme			
2.4	Deliver Bamfield flood alleviation scheme			
2.5	Deliver Henbury flood alleviation schemes			
2.6	Deliver Scotland Lane flood alleviation scheme			
2.7	Deliver Willway Street <i>culvert</i> tide flap replacement			
2.8	Formalise process for consulting on <i>RMA</i> led schemes to maximise inclusion of <i>SuDS</i> and green space			
2.9	Identify and prioritise Floating Harbour <i>flood risk</i> asset improvement requirements			
2.10	Utilise strategic board groups to identify opportunities for partnership working and funding contributions			
2.11	Follow established process for consenting works to <i>ordinary watercourses</i>			
2.12	Complete green spaces study to assess the importance of existing green spaces on <i>flood risk</i> management in the city			

National Objective 3

Help People Manage Their Own Risk

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, such as the Rapid Response *Catchment* Community Engagement programme that we are involved with in partnership with the Environment Agency. We also attend Neighbourhood Partnership and Forum meetings 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* and with the Mayoral Manifesto 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 CFCR'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.

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.

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 website¹², 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 neighbourhood forum 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.

Measures

- E. Work with existing groups, networks and agencies to engage with communities at risk of flooding**
- F. Involve local people in flood risk management activities taking place in their community**
- G. Help communities understand the benefit of flood plans to improve community resilience and preparedness for flooding**
- H. 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. Neighbourhood Forum meetings are one way we can reach communities, but there is a wide range of other groups, networks and agencies that we can also 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 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.

¹² <https://www.bristol.gov.uk/planning-and-building-regulations/planning-policy/planning-evidence>

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.

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, after and during 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. See the information in the 'Understand the Risk' Objective on page 24 for more information.

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.

Local Objective 3 - Actions

Actions completed

Produce and publish improved *LLFA* section on BCC website

Produce and develop a community engagement activity to manage highway gullies and debris clearance

Action	Action Name	Short term 2016 - 2018	Medium term 2018 - 2022	Long term 2022 onward
3.1	Introduce proposed flood alleviation schemes to neighbourhood forums			
3.2	Identify existing groups, networks and agencies that we can use to engage with communities			
3.3	Produce programme of community engagement activities including flood plan development			
3.4	Ensure final version and future updates of local strategy are freely available to the public in a variety of formats			
3.5	Produce and develop a community engagement activity to manage highway gullies and debris clearance			

National Objective 4

Prevent inappropriate development

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 this¹³.

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 all new developments planning applications for compliance with the National Planning Policy Framework (NPPF), Planning Practice Guidance (PPG), our local *West of England Sustainable Drainage Developers Guides*

13 National Planning Policy Framework, Bristol Local Plan's Core Strategy Policy BCS16

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 *Joint Spatial Plan (JSP)* and subsequent *Core Strategy* update.

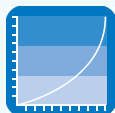
Our policy is that all development is required to incorporate water management measures to reduce *surface water* run-off and ensure that it does not increase *flood risks* elsewhere. Our policies make a presumption for the use of sustainable drainage. Reduced existing runoff rates and volumes from previously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

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



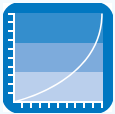
Site-specific *flood risk* assessments and drainage strategies in accordance with the *West of England Sustainable Drainage* Developers Guide allow us to ascertain that the drainage for new developments will function adequately over its lifetime. We will assess against national standards and local requirements for sustainable drainage. We will ensure climate change is appropriately considered and ensure designing for exceedance is included as appropriate¹⁴. Ensuring *SuDS* are used in new developments is critical to managing existing *surface water* flooding across the city, but in particular in the defined High Risk Areas¹⁵. Water sensitive urban design that offers multiple benefits will be sought wherever practical and viable¹⁶. We will provide case-by-case advice on development above minimum risk thresholds.

¹⁴ 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.

¹⁵ https://www.bristol.gov.uk/documents/20182/33916/2012.08.08%20SWMP_Appendix%20A_reduced.pdf/7170de47-a0cd-464a-998f-42e4a8badcfd

¹⁶ Bristol Local Plan – Site Allocations and Development Management Policies – Adopted July 2014 DM15: Green Infrastructure Provision

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.

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

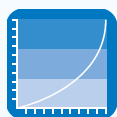


Applying the principles of water sensitive urban design can serve to not only reduce *flood risk* but also to provide other benefits such as reduced water consumption, pollution control and increased biodiversity. We will work with both internal and external developers where we can to incorporate water 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.

Water Sensitive Urban Design

The process of integrating water cycle management with the built environment through planning and urban design.

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 lead on consultation with The Environment Agency, Wessex Water, The Lower Severn *Internal Drainage Board* and the Highway Authority 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* have become 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 Lead Local Flood Authority 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.

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 4 - 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

Actions outstanding






















Update the SFRA (see Appendix D) with results from recent studies

Actions removed

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.

Action	Action Name	Short term 2016 - 2018	Medium term 2018 - 2022	Long term 2022 onward
4.1	Follow established process on consultation of planning applications from a <i>flood risk</i> perspective.			
4.2	Implement drainage adoption on an optional basis with additional requirements, exclusions and charges to be determined.			
4.3	Inform <i>JSP</i> and <i>Local Plans</i> preparation to ensure <i>flood risk</i> is appropriately considered.			
4.4	Update the SFRA (see Appendix D) with results from recent studies.			
4.5	Ensure Flood Team involvement with, and inform distribution of <i>CIL</i> and other funding sources.			
4.6	Identify contributions to flood mitigation schemes through development management process			
4.7	Produce best practice guide to establish water sensitive urban design in Bristol			
4.8	Develop risk based enforcement procedures for auditing approved applications			
4.9	Submit comments in line with the agreed procedures and risk based approach on all Major planning applications with regards to <i>surface water</i> management and drainage. To fulfil the role of the <i>LLFA</i> as a statutory consultee.			

National Objective 5

Improve Flood Prediction, Warning and Post Flood Recovery

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 Triggers¹⁷. 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 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 Civil Protection Unit (CPU), Highways, Duty Officers, Communications Team, Parks and Estates and Marine Services in accordance with the Flood Plan.

¹⁷ Bristol City Council, Flood Plan, 2013



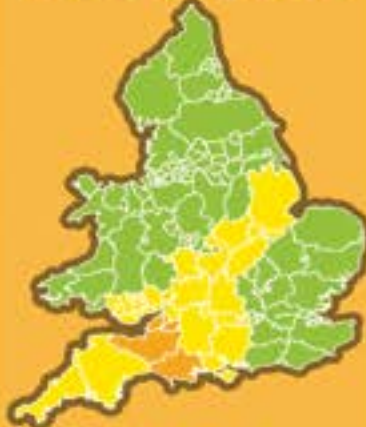




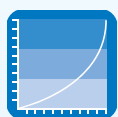
PROACTIVE TRIGGERS	Met Office issue severe weather warning(s)	GREEN No severe weather forecast	YELLOW Be aware	AMBER Be prepared	RED Take action
	Flood Forecast Centre issue Flood Guidance Statement(s) (A Flood Guidance Statement can be issued without a severe weather warning being in force)	Very low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

Figure 11 - Showing Bristol City Council's corporate response to Flood Risk.

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.**

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

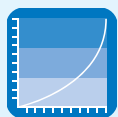


colleagues in BCC and our wider partners to co-ordinate and promote flood response and preparedness across key teams within the authority. For example, as the Flood Risk Management team within the *LLFA*, we take a lead strategic role in responding to a flood event. We will help



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.

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

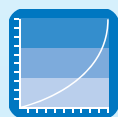


will set up procedures with the BCC working group to use existing studies along with mapping and data management techniques to highlight high risk areas and help improve knowledge and flood prediction. In practice, whilst working in partnership with BCC Civil Protection Unit, we can use this



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 the 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 under the section: 'Help People Manage their Own Risk' many of the objectives have been set to address this.

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

Setup procedures with the BCC working group to use existing studies to help improve knowledge and flood prediction

Attend Environment Agency community flood plan meeting(s) to improve knowledge and help improve community flood resilience

Action	Action Name	Short term 2016 - 2018	Medium term 2018 - 2022	Long term 2022 onward
5.1	Continue to provide advice regarding warnings issued by the Flood Forecasting Centre to the wider authority and other stakeholders.			
5.2	Undertake functions from Section 19 of the FWMA, and endeavour to investigate smaller flood incidents where appropriate.			
5.3	Identify and Undertake training to improve flood knowledge and preparedness of the <i>LLFA</i> team.			
5.4	Liaise and work in conjunction with colleagues in BCC who have a role to fulfil as the <i>LLFA</i> . To promote and co-ordinate flood response and preparedness across key teams within the authority			
5.5	Develop and promote the use of flood data to inform emergency traffic management procedures .			
5.6	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”.¹⁸ 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 Plan¹⁹.

As well as Bristol's own environmental objectives, we also have a statutory duty under the European Water Framework Directive (WFD) to deliver a better water environment. The Directive requires classification of water quality 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 in the EU 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 12.

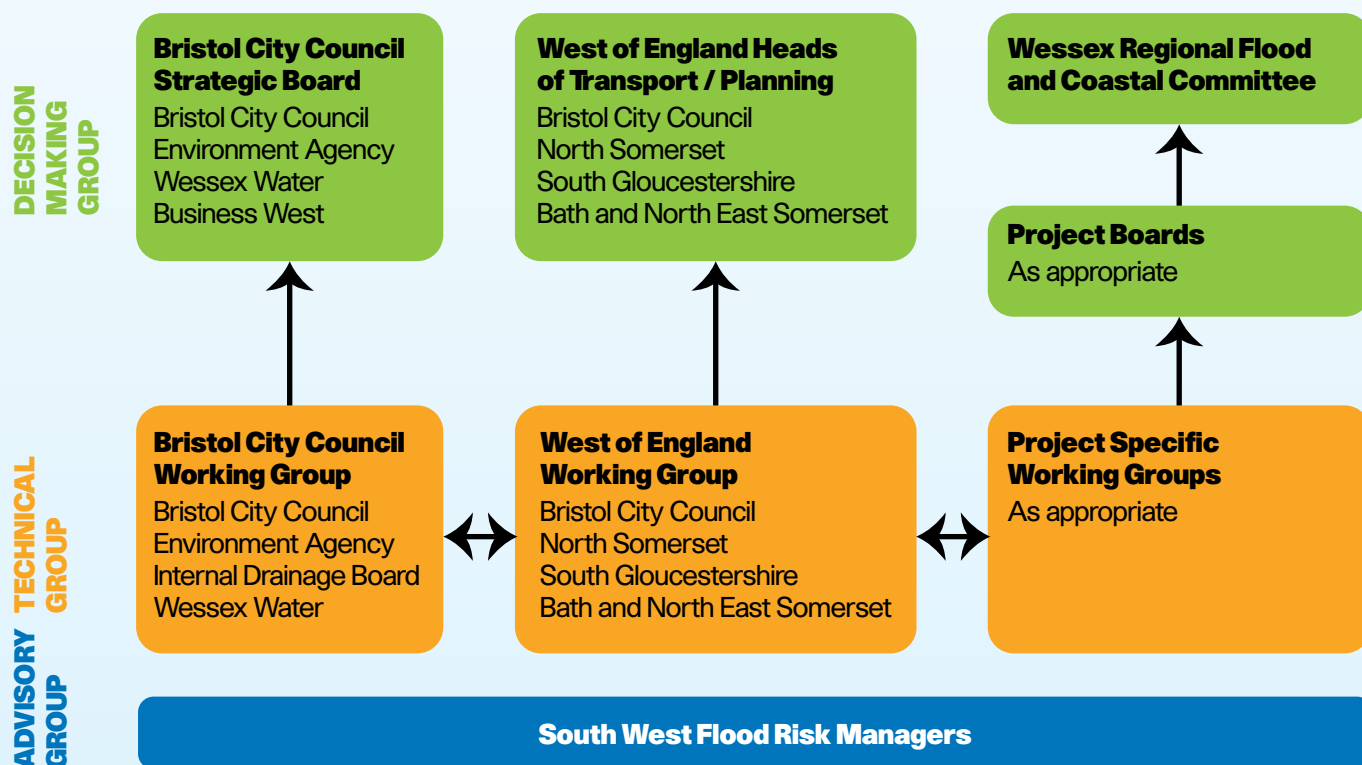


Figure 12 - Flood Risk Governance in Bristol

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.

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 6 weeks 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 and formally updated every two years with official ratification obtained following review by the Place 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. It is also important that key milestones such as the PFRA update and Bristol *Core Strategy* are recognised so that the Strategy can influence these important policy documents. Figure 13 shows a timeline of the review process along with the dates of key milestones.

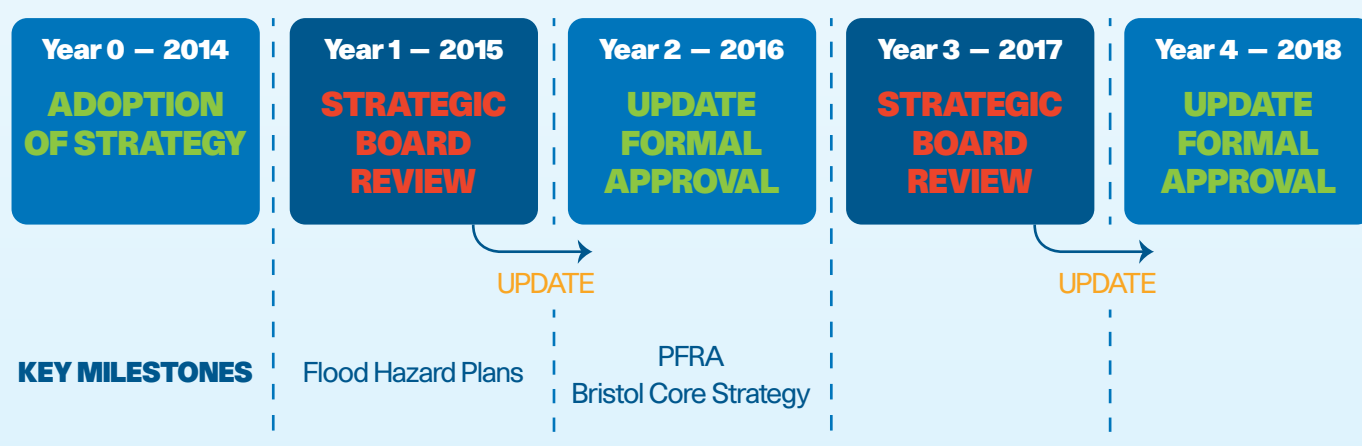


Figure 13 - Timeline of the Strategy review progress

Key documents updates

Preliminary Flood Risk Assessment	Year 0 -2011	Year 6 - 2017	Year 12 - 2023
	Original document	Update required	Update required
Surface Water Management Plan	Year 0 -2012	Year 6 - 2018	Year 12 - 2024
	Original document	Update required	Update required
Strategic Flood Risk Assessment Level 1	Year 0 -2009	Year 6 - 2015	Year 12 - 2021
	Original document – latest version	Update required	Update required
Strategic Flood Risk Assessment Level 2	Year 0 -2011	Year 6 - 2017	Year 12 - 2023
	Original document	Update required	Update required
Local Plan	Year 0 -2011	Year 5 - 2016	Year 10 - 2021
	Latest version	Update required	Update required

Figure 14 Timeline of key flood risk documents required updates

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, European, 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 (through a local services 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 funding that is 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.

- Other funding sources such as European Union funding - in the short term, we have been successful in bidding for, and continue to bid for, EU grant funding to help us implement our ambitions. We continue to seek out alternative funding sources
- 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.

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.

Funding Source	PRIMARY ACTIVITY					
	Studies	Schemes	Maintenance	Community engagement	Promoting sustainability	Emergency response
LLFA	●	●	●	●	●	●
BCC Capital	●	●	●	●	●	●
BCC Revenue	●	●	●	●	●	●
Neighbourhood partnerships	●	●	●	●	●	●
City deal	●	●	●	●	●	●
FDGiA	●	●	●	●	●	●
CIL	●	●	●	●	●	●
Developer contributions	●	●	●	●	●	●
Private beneficiaries	●	●	●	●	●	●
Regional growth fund	●	●	●	●	●	●
DEFRA property level protection	●	●	●	●	●	●
DEFRA one off grants and pilots	●	●	●	●	●	●
EU funding	●	●	●	●	●	●

Strong potential

Medium potential

Low potential

Figure 15 *Flood risk funding sources matrix*

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 G.

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 approximately £400k 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. 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)²⁰, this can be applied to all 26,000 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, £k	Annual benefits (damages avoided), £k	Benefit cost ratio
400	4,380	10.95

This shows that annually the effective benefit to the taxpayer of maintaining highway drainage and *watercourse* assets is approximately 11:1 and therefore represents good value for money. 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.

²⁰ <https://www.gov.uk/government/publications/fcrm-partnership-funding-calculator>

Capital Schemes

Five flood alleviation schemes are identified in this Strategy. Each was assessed using the PF Calculator on the basis of our understanding of the *flood risk* in each area at the time of writing. The present value whole life costs and benefits of each are summarised in Table 4. Note that some of these schemes are in very early stages of development and the costs and benefits are likely to change significantly as the schemes develop. A confidence score has therefore been assigned to each scheme to reflect our confidence in the economic analysis at the time of writing.

Table 4 *Capital scheme cost benefit analysis*

Scheme	PV costs £k	PV benefits £k	Benefit cost ratio	Confidence score
Sandburrows Road	11	56	5.1	Medium
Bamfield	410	2,570	6.2	Low
Henbury	410	630	1.5	Low
Scotland Lane	220	753	3.4	Medium
Southmead Road	66	100	1.51	High (complete)
Willway Street	157	898	3.2	High
Cumberland Road	1,070	32,785	30.6	High

Strategy Summary

- **Bristol is at significant risk from surface water flooding, and our recent studies identify that approximately 26,000 properties are at risk**
- **The central area of Bristol is at risk of flooding from the tide, with approximately 1,000 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 3,700 properties are at risk from tidal flooding in the year 2115**
- **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**

Appendix A

Definition of Risk

For our Strategy, we define risk as:

Risk = Probability x 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 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 functions to be exercised on its behalf by another risk management authority
- 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 consent or refuse works carried out in, or adjacent to *main rivers* and sea 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 enforce land owners to undertake necessary maintenance works on *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 10,000m³ 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 Risk 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 Study Results

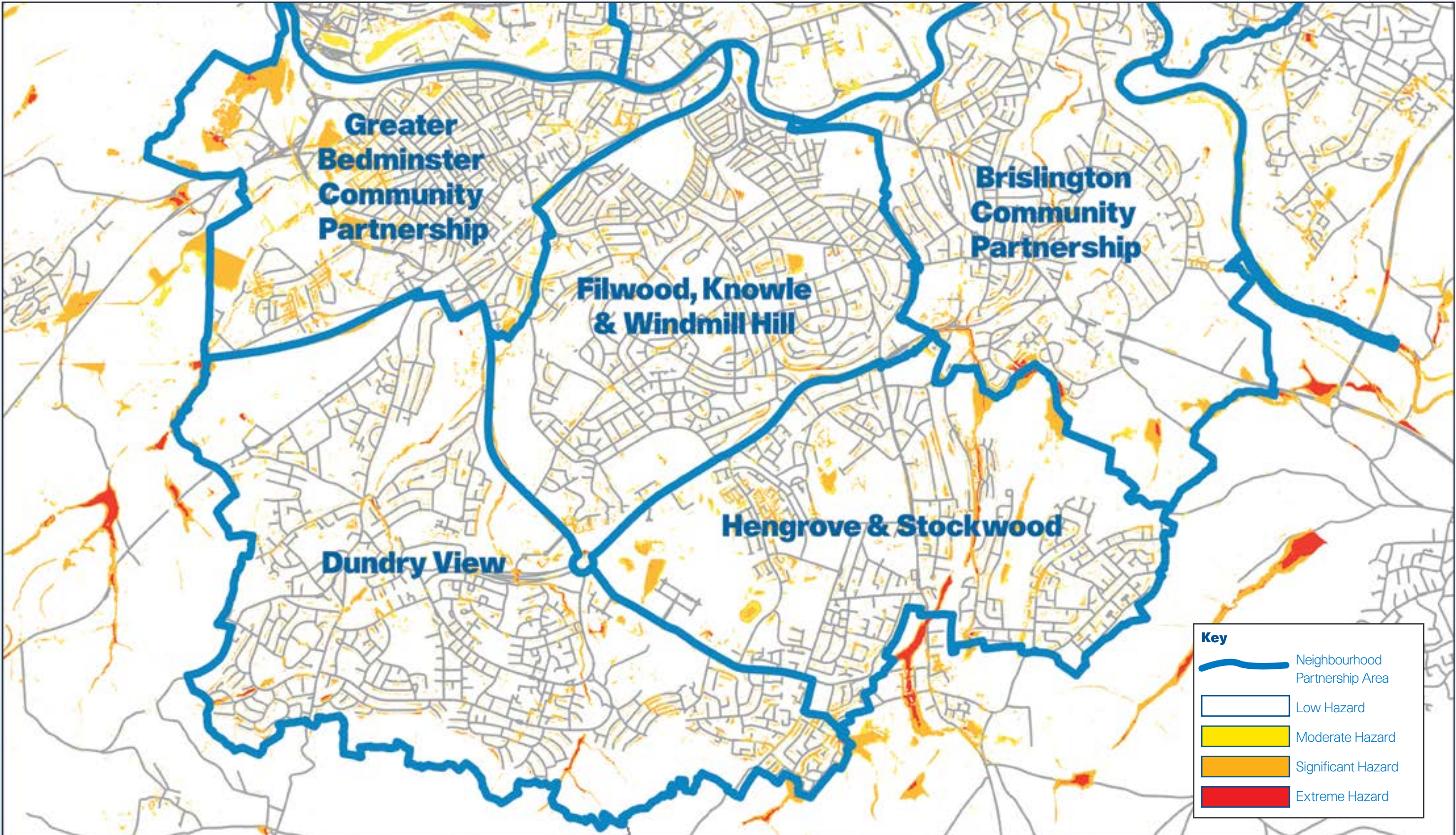


Figure 16 – Study results showing areas of low, moderate, significant and extreme flood hazard by Neighbourhood Partnership area

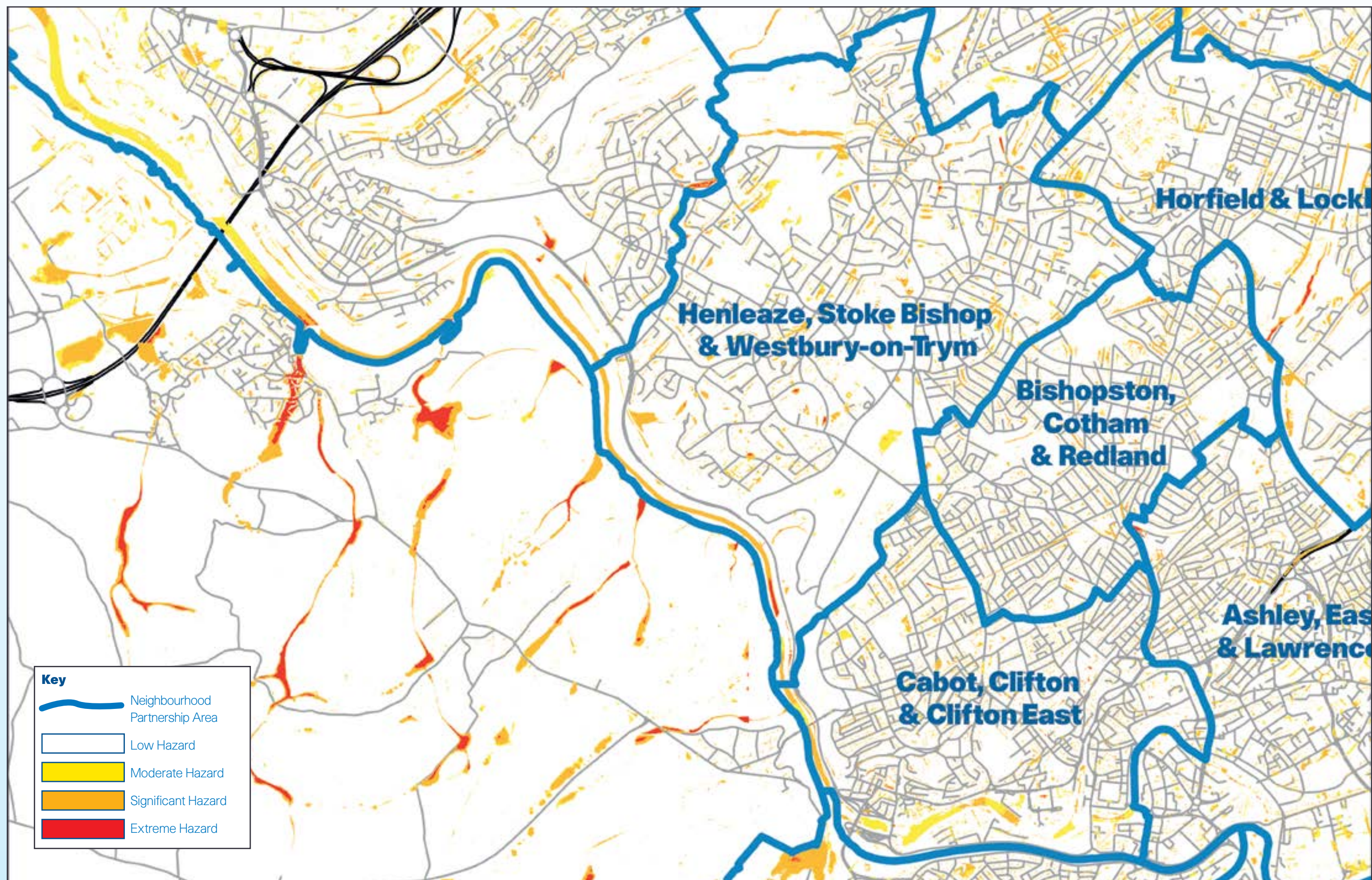


Figure 17 – Study results showing areas of low, moderate, significant and extreme flood hazard by Neighbourhood Partnership area

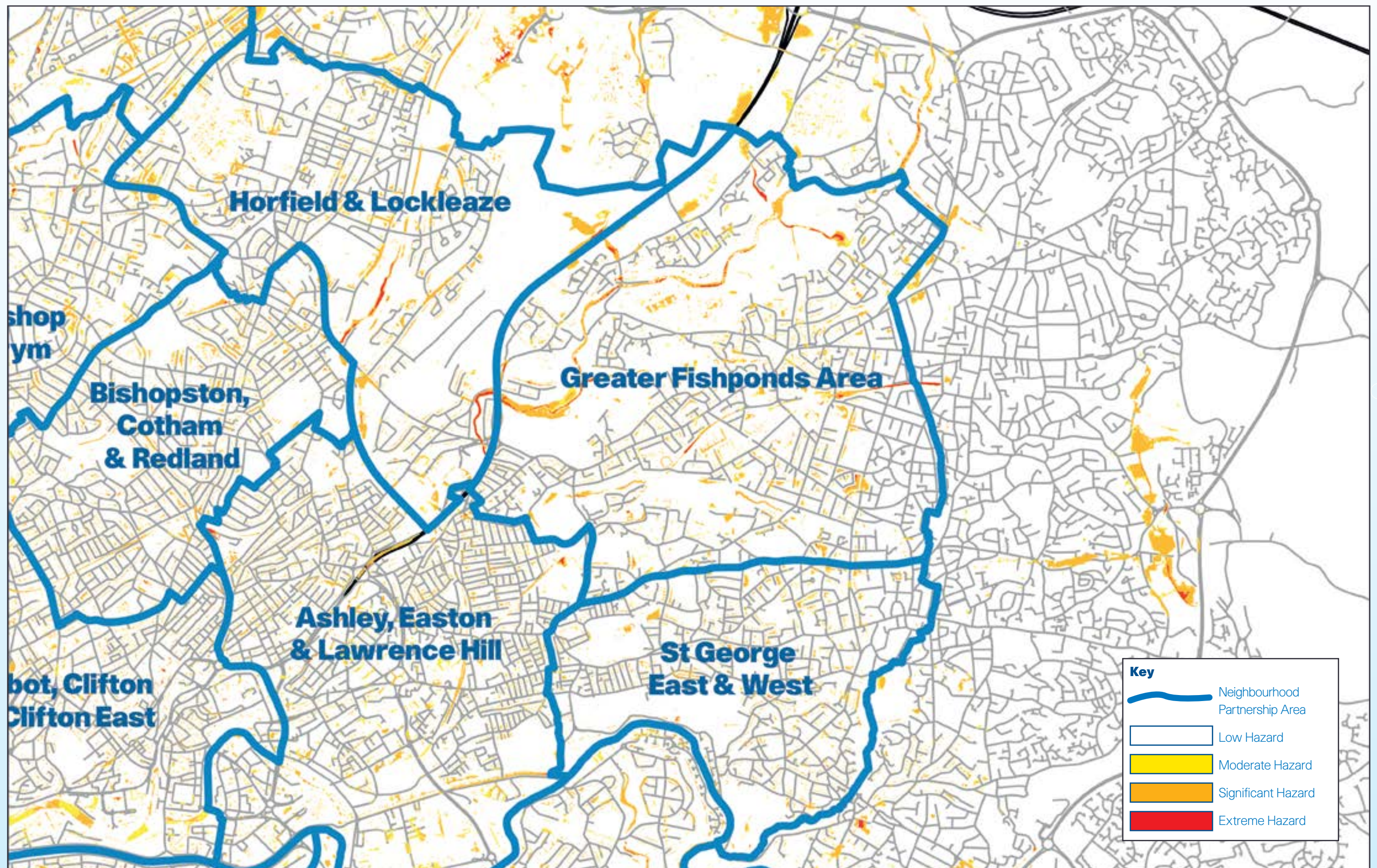


Figure 18 – Study results showing areas of low, moderate, significant and extreme flood hazard by Neighbourhood Partnership area

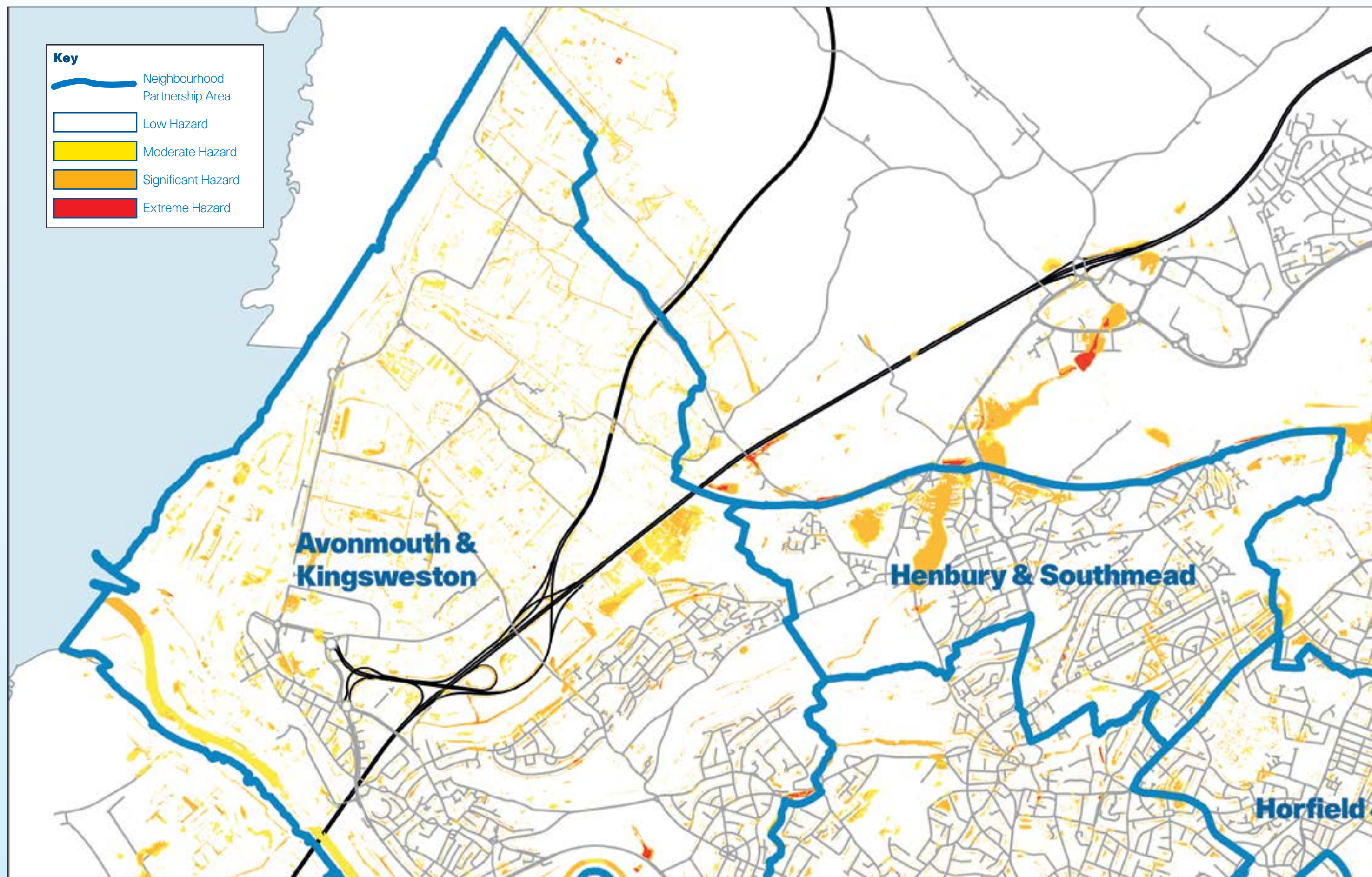


Figure 19 – Study results showing areas of low, moderate, significant and extreme flood hazard by Neighbourhood Partnership area

Appendix D

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
Bristol Strategic Flood Risk Assessment	2009	Tidal (River Avon), river (Frome, Ashton watercourses, Malago), surface water, groundwater	<ul style="list-style-type: none"> To support the emerging Local Development Framework Estimate the likely <i>flood risk</i> from rivers and the sea to various development sites 	<ul style="list-style-type: none"> Literature review of previous studies and historical flood events Summary of <i>flood risk</i> from all sources across the city Focus main assessment of risk to key development areas of the city (e.g. city centre) Utilise complex computer simulation software to predict areas of flooding during high flows and extreme tide levels 	<ul style="list-style-type: none"> Historical river flood events (e.g. 1968) largely mitigated due to construction of large interceptors Significant <i>flood risk</i> posed to the city centre, which is likely to dramatically increase with climate change <i>Flood risk</i> constraints to development in the city centre but less so in remaining areas of the city 	https://www.bristol.gov.uk/planning-and-building-regulations/planning-policy/planning-evidence
Avonmouth/ Severnside Strategic Flood Risk Assessment	2011	Tidal (Severn Estuary) and river (various rhynes)	<ul style="list-style-type: none"> To support the emerging Local Development Framework Estimate the likely <i>flood risk</i> from the sea and the rhyne network to various development sites 	<ul style="list-style-type: none"> Literature review of previous studies and historical flood events Summary of <i>flood risk</i> from all sources across the Avonmouth/Severnside area Focus main assessment of risk to key development areas of the study area Analysis of the likely impact of waves on the extreme tide levels Utilise complex computer simulation software to predict areas of flooding during high flows and extreme tide levels 	<ul style="list-style-type: none"> Significant <i>flood risk</i> posed to Avonmouth and Severnside, which is likely to dramatically increase with climate change Due to presence of tidal flood defences, <i>flood risk</i> in the present day mostly from the rhyne network With climate change and sea level rise, defences likely to be inadequate and flooding from the sea becomes the greatest risk Strategic flood defence solution required to enable development across the area 	https://www.bristol.gov.uk/planning-and-building-regulations/planning-policy/planning-evidence

Study Name	Date completed	Flood Source(s) Studied	Reason for Study	Study Objectives/ Methodology	Conclusions of Study	Link to Information
Surface Water Management Plan (SWMP)	2012	<i>Surface water and Ordinary Watercourses</i>	<ul style="list-style-type: none"> ■ To understand the risk of flooding to Bristol from heavy rainfall ■ Refine existing, national <i>surface water</i> models by including the underground pipe network 	<ul style="list-style-type: none"> ■ Utilise ground-breaking complex computer simulation software to predict areas of flooding during heavy rainfall ■ Identify areas at particular high risk of flooding (High Risk Areas) 	<ul style="list-style-type: none"> ■ Bristol at significant risk of <i>surface water</i> flooding ■ Approximately 30,000 properties at risk during an extreme (1 in 100 year return period) event ■ 12 High Risk Areas identified (Ashton (including Littlecross House site), Bamfield Road, Gloucester Road, Henbury (two sites), M32 (two sites), The Portway, Seventh Avenue, Southmead Road, St Agnes, St George, Trowbridge Road) 	Main study: https://www.bristol.gov.uk/planning-and-building-regulations/planning-policy/planning-evidence Interactive Map of Surface Water Flooding: http://maps.bristol.gov.uk/pinpoint/?service=localinfo&maptype=js&layer=Surface+water+high+risk+areas&theme=floodmap
Proposed Surface Water Property Count Method for Bristol	2015	<i>Surface water</i>	<ul style="list-style-type: none"> ■ Ensure national <i>surface water</i> flood property count methodology was suitable for use with Bristol's <i>surface water</i> 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. 	<ul style="list-style-type: none"> ■ Evaluate suitability of the national count method by comparing property count results in and out of Bristol. ■ Review options to make the method suitable for use with Bristol's <i>surface water</i> modelling data by way of altering certain parameters. 	<ul style="list-style-type: none"> ■ The national count method using its standard parameters is not suitable for use with Bristol's <i>surface water</i> modelling data, but is if two parameters are altered to take account of the larger grid size. 	N/A
Dundry Hills Flood Risk Assessment	2012	<i>Surface water and Ordinary Watercourses</i> in Dundry Hills	<ul style="list-style-type: none"> ■ In response to local knowledge that the area is a known area of high <i>flood risk</i> ■ Build on the results of the SWMP 	<ul style="list-style-type: none"> ■ Utilise site-specific version of the SWMP simulation model ■ Identify areas at highest risk and propose potential methods for mitigating such flooding 	<ul style="list-style-type: none"> ■ Confirmation that flooding is from <i>surface water</i> runoff ■ Due to characteristics of the area (steep slopes with clay soils), flash flooding occurs ■ Two types of intervention are possible to reduce <i>flood risk</i>, named by the study as Tactical and Strategic Options ■ Tactical options include construction of flood mitigation measures (e.g. banks, ditches) to intercept and store flood water ■ Strategic options include encouraging better <i>catchment</i> management, improved rainfall and river flow monitoring and emergency response 	N/A

Study Name	Date completed	Flood Source(s) Studied	Reason for Study	Study Objectives/ Methodology	Conclusions of Study	Link to Information
Central Area Flood Risk Assessment (CAFRA)	2013	Tidal (River Avon) and river (Frome, Ashton <i>watercourses</i> , Malago)	<ul style="list-style-type: none"> ■ Better understand the risk posed from tidal and river sources of flooding to the city centre ■ To refine the Bristol SFRA simulation modelling ■ Understand the role various assets have on <i>flood risk</i> management, notably the Floating Harbour assets ■ Answer an important question as to whether a moderate tide with moderate flow creates worse flooding than an extreme tide 	<ul style="list-style-type: none"> ■ Utilise complex computer simulation software to predict areas of flooding during high flows and extreme tide levels ■ Undertake assessments and tests of the key assets in the central area that impact on <i>flood risk</i> management ■ Propose outline methods for mitigating <i>flood risks</i> from river and tidal sources ■ Establish a timeline of actions for progressing mitigation measures and management improvements 	<ul style="list-style-type: none"> ■ Principal risk posed to central Bristol is from <i>tidal flooding</i> ■ The most dominant flood mechanism is an extreme tide, not a moderate tide in combination with a moderate flow ■ The Ashton area at risk from tidal and river flooding ■ The main route for flood water from the Avon is via three 'low spots' at Avon Crescent, Bathurst Basin and Albert Road ■ Climate change presents a significant risk due to rising sea levels ■ 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 ■ The Floating Harbour plays a crucial role in <i>flood risk</i> management ■ Options to mitigate <i>flood risk</i> are proposed in the short term, medium term and long term ■ Short term options include raising the three 'low spots' ■ Medium term actions include establishing a Harbour asset management plan and improving flood response ■ Over the long term, a strategic solution to manage <i>flood risk</i> is required 	https://www.bristol.gov.uk/documents/20182/33916/CAFRA_Summary_final.pdf

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

Appendix E

Flooding Questionnaire

Report Property Flooding at: <https://swim.geowessesex.com/bristol>

Report Property Flooding

Fill in the details below to submit a report about property flooding.

About you (the reporter)

Contact Name

Please fill in a least one contact method below

Please note, we need an email address if you want to receive a PDF copy of your report.

Email Address

Landline Phone No

Mobile Phone No

Find Property

Find the property you are filing in this report for

Search by Postcode or Property Name

Search by Street Name

ABOUT THE FLOODING

What date did the flooding start?	/ /
What date did the water reach its peak level?	/ /
What time did the flooding start?	:
What time did the water peak?	:

☐ Please check this box if the date above is a best guess

What was the duration of the flooding?
We need to know if you are still flooded so please select the appropriate option

<input type="checkbox"/> Water still present	<input type="checkbox"/> Less than 1 hour	<input type="checkbox"/> 1 hour to 24 hours
<input type="checkbox"/> 24 hours to 1 week	<input type="checkbox"/> More than 1 week	<input type="checkbox"/> Not sure

Please tell us what type of property is affected
You need to tick at least one property type

<input type="checkbox"/> Residential	<input type="checkbox"/> Commercial	<input type="checkbox"/> Other
--------------------------------------	-------------------------------------	--------------------------------

Depth of water outside

Would you class anyone at the flooded property as vulnerable? ☐ Yes ☐ No

How many vehicles were damaged at this location? :

Is there a long term history of flooding at this location? ☐ Yes ☐ No

Do you know where the water is coming from (select all that apply)?
You need to select at least one flooding cause / source

<input type="checkbox"/> Ditches and drainage channels	<input type="checkbox"/> Lake / Reservoirs	<input type="checkbox"/> River
<input type="checkbox"/> Water rising out of the ground	<input type="checkbox"/> Blocked road drainage	<input type="checkbox"/> The Sea
<input type="checkbox"/> Surface water drainage	<input type="checkbox"/> Foul drainage (sewerage)	<input type="checkbox"/> Bridge/culvert
<input type="checkbox"/> Rainwater flowing over the ground	<input type="checkbox"/> Waves caused by vehicles	<input type="checkbox"/> Not sure

Do you have any further comments on the cause of the flooding?

Have there been any problems with blockages/repair works etc?

How quickly did the flooding begin?

☐

Sudden

☐

Gradual

How fast was the water moving? (slow is walking pace)

☐

Fast

☐

Slow

☐

Still

What was the appearance of the water?

☐

Clear

☐

Muddy

☐

Polluted with sewage

Is there anything you would like to add to describe the flooding?

Do you know where the water is going to?

☐

Ditches and drainage channels

☐

Road drainage

☐

River

☐

Stream / Watercourse

☐

The Sea

☐

Not sure

Are people staying at a new address as a result of the flooding?

☐

Yes

☐

No

What services were affected by the flooding?

☐

Services not affected

☐

Mains Sewer

☐

Private Sewer

☐

Water Supply

☐

Gas

☐

Electricity

☐

Phoneline

☐

Not sure

In what ways was the community restricted by flooding?

☐

All road access blocked

☐

Some road access blocked

☐

Local shop(s) closed

☐

No access to place of work

☐

Public transport disrupted

☐

Not sure

Is there anything else you would like to say about the impact the recent flooding had?

Appendix F

Approach to the scrutiny of new developments' drainage proposals

Appendix F contains additional information regarding our strategic approach to the scrutiny of new developments' drainage proposals. We manage this by the following means;

- Publication of supporting local *SuDS* design guidance and requirements in production of the West of England Sustainable Drainage Developers Guide.
- Provision of coordinated drainage input and scrutiny of development proposals through the planning pre-application and application process, prioritised on those developments with the greatest impact.
- In response to concerns over the maintenance of sustainable drainage in shared ownership²¹, we are investigating approaches for the adoption of drainage. Adoption would be on an optional basis with additional requirements, exclusions and charges. Should developers not wish *SuDS* features on their site serving more than one property to be adopted, we will require details of the maintenance arrangements.

Our local *SuDS* design guidance outlines the different drainage strategy drivers likely to influence drainage design in different areas of the city. We have established this using a risk-based approach, adopted *flood risk* management documents and supporting published evidence. Figure 16 shows a map of various areas, with the reasoning behind the overarching drivers for each area provided in Table 5.

The boundaries between areas shown are indicative. Developments should test the assumptions using site-specific characteristics as appropriate.

²¹ Pitt Review 2008

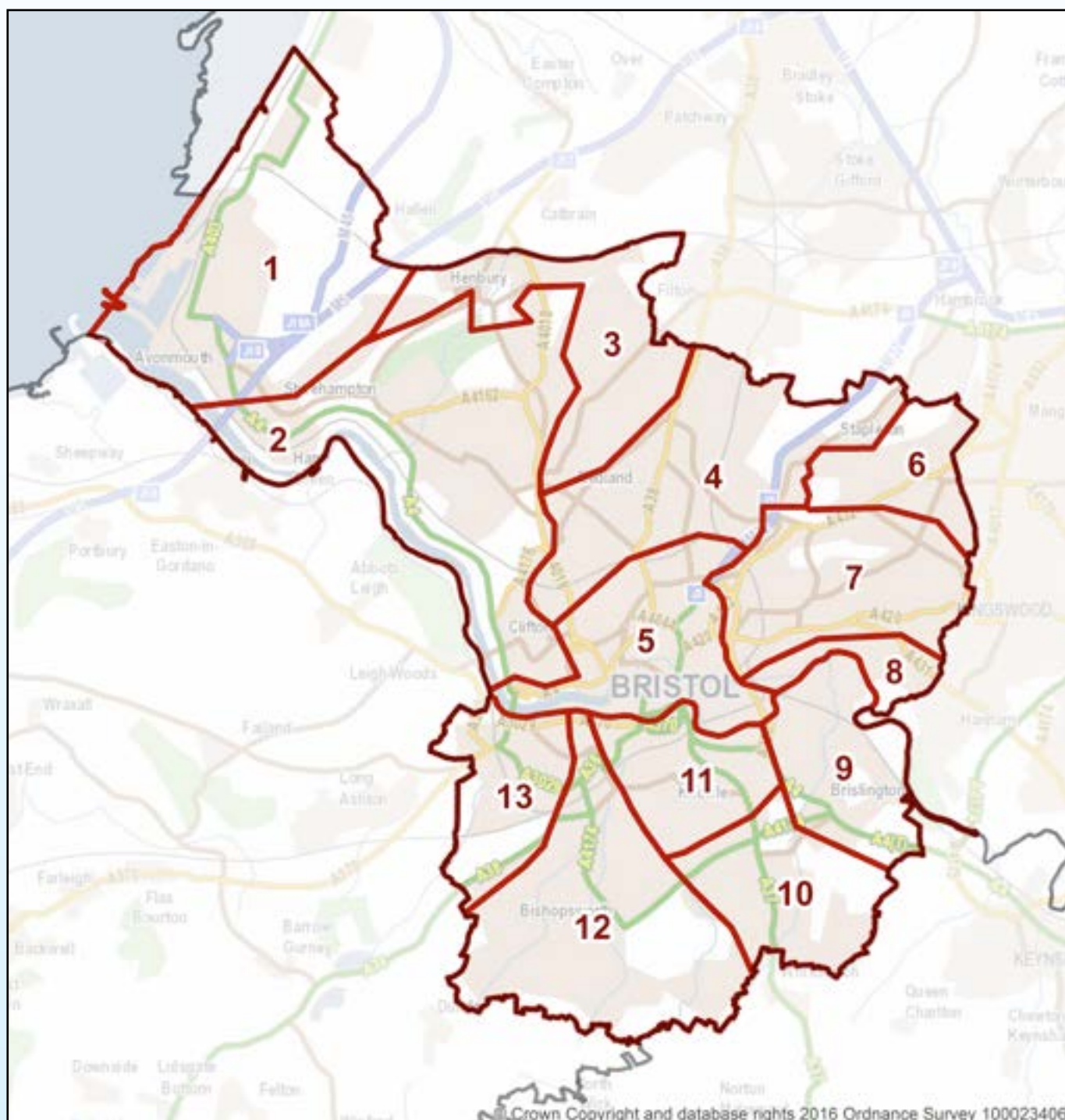


Figure 20 - Map indicating the Discharge Strategy Driver Areas

Table 6 - Overarching drivers for each area identified in Figure 16

	Discharge Zone	Overarching drivers	Reason
1	Avonmouth and Lawrence Weston	<i>Surface water</i> storage with consideration of tide locking	A largely flat area with some ground levels below <i>spring tides</i> that requires storage during times of tide locking
2	Westbury Limestone and River Trym	Infiltration where possible, or reduction in discharge rate and water quality improvements	Large areas of limestone with good infiltration potential (ref BGS Infiltration for <i>SuDS</i> Map). River Trym can respond rapidly and has “poor” water quality classification in places (ref BCC water quality classification map 2013)
3	Southmead and Henleaze	Reduction in discharge rate, water quality improvements	SWMP identified areas at high risk of <i>surface water</i> flooding. Water quality classification of Trym in Southmead “bad” (ref BCC water quality classification map 2013)
4	North of Northern Storm Water Interceptor (NSWI)	Limit discharge to capacity of existing sewer network	Majority of this area is drained to the NSWI, which diverts flow to the tidal Avon. Reducing discharge therefore considered to provide little benefit provided <i>surface water sewer</i> network has capacity. Reduction will be required where localised capacity issues are known; see the SWMP and WaSC.
5	Central area and Floating Harbour	Water quality mitigation and improvements. Reduction in discharge to combined sewers	Testing of the Floating Harbour carried out weekly shows that water quality deteriorates after heavy rainfall (ref Harbour and rivers water quality web page). Reduction in volume and rate of water discharged to the combined <i>sewer</i> network therefore required
6	Fishponds Brook	Infiltration where possible, or reduction in discharge rate and water quality improvements	Pockets of ground suitable for infiltration (ref BGS Infiltration for <i>SuDS</i> Map). Outside these areas, reductions in discharge rate are required because of the potential impact of the Fishponds Brook on the river Frome flows upstream of the NSWI. Water quality classification of Fishponds Brook “poor” (ref BCC water quality classification map 2013)
7	East Bristol	Reduction in discharge rate and water quality improvements	Historically known to be at high risk of <i>surface water</i> flooding. Water quality classification of Coombe Brook “poor” (ref BCC water quality classification map 2013)

	Discharge Zone	Overarching drivers	Reason
8	North of River Avon	Infiltration where possible, or reduction in discharge rate in places	Some areas with good infiltration potential (ref BGS Infiltration for <i>SuDS</i> Map). Where infiltration not appropriate, reduction in discharge may be required dependant on location; see the SWMP and WaSC.
9	Broom Hill and Brislington	Infiltration where possible, or reduction in discharge rate and water quality improvements	Large areas with good infiltration potential (ref BGS Infiltration for <i>SuDS</i> Map). Brislington Brook is a rapid response <i>catchment</i> with history of flooding and has “poor” water quality classification (ref BCC water quality classification map 2013)
10	Brislington Brook	Reduction in discharge rate and water quality improvements	Brislington Brook is a rapid response <i>catchment</i> with history of flooding and has “poor” water quality classification (ref BCC water quality classification map 2013)
11	Bedminster	Reduction in discharge rate	History of flooding in this area with lower areas vulnerable to the effects of tide locking.
12	Malago and Pigeonhouse tunnels	Limit discharge to capacity of <i>sewer</i> network	Area benefits from the Malago and Pigeonhouse interceptor tunnels. Discharge at capacity of <i>sewer</i> network largely appropriate, though reduction will be required where it provides local benefits, particularly at the top of the <i>catchment</i> ; see the SWMP and WaSC.
13	Ashton Gate	Reduction in discharge rate	SWMP identified areas at high risk of <i>surface water</i> flooding, also vulnerable to the effects of tide locking.

Appendix G Strategy Action Plan

National Objective 1 Understand the Risk

LOCAL OBJECTIVE:

■ GAIN A GREATER UNDERSTANDING OF THE FLOOD RISKS POSED TO BRISTOL AND ITS PEOPLE AND PLACES

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

Action No.	Action Name	Short term 2016 - 2018	Medium term 2018 - 2022	Long term 2022 onward	Associated Measure(s)	Funding Source	Cost Estimate	Stakeholder Involvement	Benefits
1.1	Complete SWMP update including Ashton surface water flood risk study				1A, 1B, 1C	FDGiA, LLFA, WW	50k - 100k	BCC, EA, WW	2, 5
1.2	Complete River Avon Tidal Flood Risk Management Strategy				1A, 1B, 1D, 2B, 2C, 3B, 4A, 4C, 4F	LLFA, Local Levy	200k	BCC, EA, WW, LEP	2, 5
1.3	Complete Full Business Case for the Avonmouth/Sevenside Ecology Mitigation and Flood Defence scheme				1A, 1B, 1D, 2B, 2C, 3B, 3D, 4A, 4C, 4F	LEP, LLFA, FDGiA	1.9m	BCC, SGC, EA, WW, LEP, Bristol Port, Natural England, LSIDB, Network Rail	1, 2, 3, 5, 6
1.4	Undertake citywide groundwater risk assessment				1A, 1B, 1C, 1D	LLFA	15-25k	BCC, EA, WW	5
1.5	Undertake vulnerability mapping exercise using study results and enhance infrastructure resilience				1A, 1D	LLFA	£10k	BCC	
1.6	Undertake comprehensive local flood-risk asset surveys				1D, 1E	LLFA	TBA	BCC	2
1.7	Update and procure the asset survey contract, ensuring national standards are met				1D, 1E	LLFA	Staff time	BCC	2
1.8	Utilise Confirm asset management system and transference of applicable information. Including asset inspections, issuing of maintenance work, records of visits from contractors and developing forecast spend profiles.				1D, 1E, 2A, 2C, 5B	LLFA	Staff time	BCC	2, 4
1.9	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 work carried out.				1B, 1C, 1D, 2C, 3D	LLFA	Staff time	BCC, EA, WW, LSIDB	2, 5
1.10	Continue to provide flood risk data to BCC Civil Protection Unit to inform emergency management procedures.				1A, 1C, 1D, 2B, 5A, 5B, 5C, 5D	LLFA	Staff time	BCC	1, 2, 4, 5
1.11	Contribute towards the completion of the Horizon 2020 RESilience to cope with Climate Change in Urban arEas (RESCCUE) project with European partners				1A, 1B, 1D, 2B, 2C, 3A, 3B, 3D	EU	200k	BCC, EA, WW, RESSCUE project partners, Utility providers, Infrastructure providers	1, 4, 5

National Objective 2

Manage the Likelihood

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	Action Name	Short term 2016 - 2018	Medium term 2018 - 2022	Long term 2022 onward	Associated Measure(s)	Funding Source	Cost Estimate	Stakeholder Involvement	Benefits
2.1	Continue maintenance of <i>ordinary watercourses</i> and associated structures				2A, 2B	Revenue	50k / annum	BCC, EA	1
2.2	Implement minor land drainage works as appropriate				2A, 2B	Revenue, Capital	20k / annum	BCC	1
2.3	Deliver Sandburrows Road flood alleviation scheme				2B, 2C, 2D, 1A	Revenue, third party	£11k	BCC, WW, Others	1,5
2.4	Deliver Bamfield flood alleviation scheme				2B, 2C, 2D, 1A	FDGiA, other	£410k	BCC, EA, WW	1
2.5	Deliver Henbury flood alleviation schemes				2B, 2C, 2D, 1A	FDGiA, other	£410k	BCC, EA	1
2.6	Deliver Scotland Lane flood alleviation scheme				2B, 2C, 2D, 1A	Highways	£220k	BCC	1,5
2.7	Deliver Willway Street <i>culvert</i> tide flap replacement				2B, 2C, 2D, 1A	FDGiA, LLFA, Revenue	£100k	BCC, EA, WW	1,5
2.8	Formalise process for consulting on <i>RMA</i> led schemes to maximise inclusion of <i>SuDS</i> and green space				2C, 2D, 4B, 4D, 4E, 1B	LLFA	Staff time	BCC, EA, WW, IDB	1,3,5,6
2.9	Identify and prioritise Floating Harbour <i>flood risk</i> asset improvement requirements				2B, 2C, 1A, 1E	LLFA	Staff time	BCC, EA	1,2
2.10	Utilise strategic board groups to identify opportunities for partnership working and funding contributions				2C, 4F, 5C	LLFA	Staff time	BCC, EA, WW, IDB, Others	5
2.11	Follow established process for consenting works to <i>ordinary watercourses</i>				2B	LLFA	Staff time	BCC	1
2.12	Complete green spaces study to assess the importance of existing green spaces on <i>flood risk</i> management in the city				1B, 2D	LLFA	Staff time	BCC, IDB, WW, EA	1,3,4,6

National Objective 3

Help People Manage Their Own Risk

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	Action Name	Short term 2016 - 2018	Medium term 2018 - 2022	Long term 2022 onward	Associated Measure(s)	Funding Source	Cost Estimate	Stakeholder Involvement	Benefits
3.1	Introduce proposed flood alleviation schemes to neighbourhood forums				3A, 3B, 2C, 5D	LLFA	Staff time	BCC	5
3.2	Identify existing groups, networks and agencies that we can use to engage with communities				3A, 5C	LLFA	Staff time	BCC, EA	5
3.3	Produce programme of community engagement activities including flood plan development				3A, 3B, 3C, 3D, 1A, 5B, 5D	LLFA	Staff time	BCC, EA, WW	1, 5
3.4	Ensure final version and future updates of local strategy are freely available to the public in a variety of formats				3D	LLFA	Staff time	BCC	5
3.5	Produce and develop a community engagement activity to manage highway gullies and debris clearance				3A, 3B, 2B, 2C, 5D	LLFA	Staff time	BCC	1, 2, 4

National Objective 4

Prevent inappropriate development

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	Action Name	Short term 2016 - 2018	Medium term 2018 - 2022	Long term 2022 onward	Associated Measure(s)	Funding Source	Cost Estimate	Stakeholder Involvement	Benefits
4.1	Follow established process on consultation of planning applications from a <i>flood risk</i> perspective.				4A, 4B, 4C, 4D, 4E	LLFA	Staff time	BCC, EA, WW	1, 5, 6
4.2	Implement drainage adoption on an optional basis with additional requirements, exclusions and charges to be determined.				2A, 2C, 2D, 4A, 4B, 4C, 4D	TBC	TBC/Staff time	BCC, WW	1, 3, 4, 5, 6
4.3	Inform <i>JSP</i> and <i>Local Plans</i> preparation to ensure <i>flood risk</i> is appropriately considered.				4A, 1A, 2B	LLFA	Staff time	BCC, EA, WW, LSIDB	1, 2, 5
4.4	Update the SFRA (see Appendix D) with results from recent studies.				4A	LLFA	Staff time	BCC	2, 6
4.5	Ensure Flood Team involvement with, and inform distribution of <i>CIL</i> and other funding sources.				4F	LLFA / CIL & other	Staff time / Variable	BCC	5, 6
4.6	Identify contributions to flood mitigation schemes through development management process				4F, 2C	LLFA	Staff time	BCC	1, 6
4.7	Produce best practice guide to establish water sensitive urban design in Bristol				4D	LLFA	Staff time	BCC, EA, WW	1, 2, 3, 4, 5, 6
4.8	Develop risk based enforcement procedures for auditing approved applications				4B, 4C	LLFA	Staff time	BCC	1, 2, 6
4.9	Submit comments in line with the agreed procedures and risk based approach on all Major planning applications with regards to <i>surface water</i> management and drainage. To fulfil the role of the <i>LLFA</i> as a statutory consultee.				1D, 2C, 2D, 4B, 4C, 4D, 4E, 4F	LLFA	Staff time	BCC, EA, WW, LSIDB	1, 3, 5, 6

National Objective 5

Improve Flood Prediction, Warning and Post Flood Recovery

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	Action Name	Short term 2016 - 2018	Medium term 2018 - 2022	Long term 2022 onward	Associated Measure(s)	Funding Source	Cost Estimate	Stakeholder Involvement	Benefits
5.1	Continue to provide advice regarding warnings issued by the Flood Forecasting Centre to the wider authority and other stakeholders.				5A, 5B, 5C, 1B	LLFA	Staff time	BCC, Others	5
5.2	Undertake functions from Section 19 of the FWMA, and endeavour to investigate smaller flood incidents where appropriate.				5D, 1C	LLFA	Staff time	BCC	2, 5
5.3	Identify and Undertake training to improve flood knowledge and preparedness of the LLFA team.				5D	LLFA	Staff time	BCC	2
5.4	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				5A, 5B, 5C, 5D	LLFA	Staff time	BCC	2, 5
5.5	Develop and promote the use of flood data to inform emergency traffic management procedures .				5B, 5D, 1D	LLFA	Staff time	BCC	1, 4
5.6	Attend Environment Agency community flood plan meeting(s) to improve knowledge and help improve community flood resilience				5C, 5D, 3A, 3C	LLFA	Staff time	BCC, EA	2, 4



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