Cyfoeth Naturiol Cymru
Natural Resources Wales

Environment Agency

Severn preliminary flood risk assessment

December 2018

The Environment Agency in England and Natural Resources Wales have worked together to produce this report.

We work together to manage flooding on the River Severn and its tributaries. The cover photo shows how important this is. This is an area in Wales where the River Vyrnwy joins the River Severn. Historically, river embankments (known locally as 'argaes') were built to stop farmland from flooding. In large flood events, these overtop from the river at different times and floodwater gets stored on the floodplain. This helps to reduce the impact of river flooding downstream in England in towns like Shrewsbury and Ironbridge. Photo credit: Richard Becker / Alamy Stock Photo

About the Environment Agency

We are the Environment Agency. We protect and improve the environment.

We help people and wildlife adapt to climate change and reduce its impacts, including flooding, drought, sea level rise and coastal erosion.

We improve the quality of our water, land and air by tackling pollution. We work with businesses to help them comply with environmental regulations. A healthy and diverse environment enhances people's lives and contributes to economic growth.

We can't do this alone. We work as part of the Defra group (Department for Environment, Food & Rural Affairs), with the rest of government, local councils, businesses, civil society groups and local communities to create a better place for people and wildlife.

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Working together

The River Severn is the longest river in Britain. It starts in the Welsh mountains and flows for 350km through the Welsh and English countryside until it meets the sea in the Bristol Channel in England. There are many towns and cities in the river basin district, including Newtown, Welshpool, Newport and Cardiff in Wales and Shrewsbury, Worcester, Coventry, Gloucester, Hereford and Bristol in England.

The 2013 / 14 winter storms and flooding had significant impacts on many communities, businesses, infrastructure and the environment in the catchment. In the future a changing climate could create more weather extremes leading to more frequent and more severe flooding.

The Environment Agency and Natural Resources Wales (NRW) work together to manage flood risk in the Severn river basin district. We have jointly produced this report to meet our requirements in the European Floods Directive (2007/60/EC). These requirements are transposed into the Flood Risk Regulations (2009) in England and Wales.

The Regulations require us to complete a flood risk assessment and produce supporting maps of the river basin district. This is known as a preliminary flood risk assessment (PFRA). We have considered both past and potential future floods and their impact on human health, the economy, the environment and cultural heritage.

We have then used this information to identify areas where there is a significant risk of flooding. These are known as flood risk areas (FRAs). This will help us prioritise our flood risk management interventions for people, the economy and the environment (including cultural heritage) by focussing our efforts on those communities with the greatest risk from flooding.

We will jointly produce flood risk and flood hazard mapping by the end of 2019 and flood risk management plans (FRMPs) by the end of 2021 for FRAs to meet the next steps under the regulations. FRMPs will include actions to address the risks within FRAs.

This report has identified nine FRAs in the Severn river basin district and these will be our priority over this flood risk regulations cycle. We will continue to plan for and manage the risk of flooding to all communities at risk in the Severn river basin district, whether they are within in a FRA or not to ensure people, the economy and the environment are resilient now and in the future.

Contents

Map of proposed flood risk areas in England

This is available separately to the report. This map shows how the proposed flood risk areas are distributed around England. It is a larger version of the map you can find in Chapter 5 of this report. You can find it on data.gov.uk.

1. Introduction

This report covers the Severn river basin district (RBD) and meets the requirements of the Flood Risk Regulations (2009). The Environment Agency and Natural Resources Wales have worked together to produce the report.

About preliminary flood risk assessments

The European Floods Directive (2007/60/EC) requires EU member states to assess and map flood risk and plan for managing it. These requirements are transposed into the Flood Risk Regulations (2009), which set out the process for completing an assessment of flood risk known as a preliminary flood risk assessment (PFRA) and producing maps of river basin districts (RBDs). The Regulations require us to use this information to identify areas where there is a significant risk of flooding.

Flood risk areas (FRAs) are areas where the risk of flooding is likely to be significant for people, the economy or the environment including cultural heritage. By risk we mean not just the chance that flooding will occur (the probability), but also the impact of the flooding.

For FRAs, we will undertake flood risk and hazard mapping and produce flood risk management plans (FRMPs). We will use FRAs to help us identify those locations where engagement and partnership working to develop a FRMP will help resolve complex flooding issues. For areas not identified as FRAs, we will also continue to manage flood risk as necessary.

In England and Wales, the regulations direct the Environment Agency (for England) and Natural Resources Wales (NRW) (for Wales) to undertake PFRAs and identify FRAs for river, sea and reservoir flooding. Lead local flood authorities (LLFAs) do this work for surface water, smaller watercourses and groundwater flooding and collaborate closely with the Environment Agency and NRW to ensure that all sources of flood risk are managed within the RBD. The cycle of work repeats every six years. Flood hazard and flood risk maps are due in 2019 and FRMPs in 2021 for this cycle.

LLFAs completed PFRAs and an assessment of FRAs in 2017:

- you can find these for England on GOV.UK. English LLFA PFRAs
- you can find these for Wales on the NRW website (naturalresources.wales) Welsh PFRAs (English)

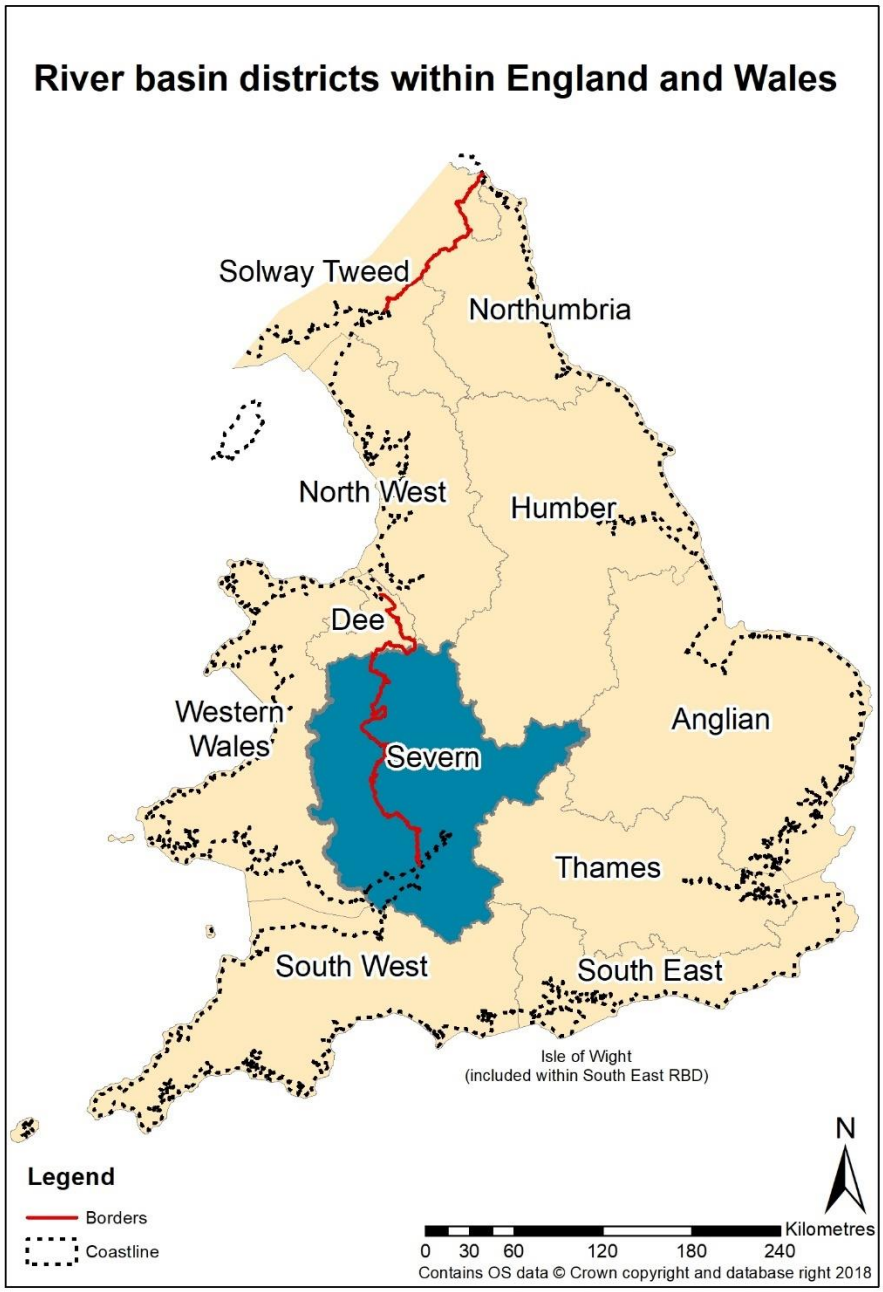
The Severn river basin district (RBD)

We present information at a large river catchment scale and these areas are known as river basin districts (RBDs). A RBD covers an entire river system, including rivers, lakes, groundwater, estuaries and coastal waters.

The Severn RBD covers an area of 21,500 kilometres squared. Part of the RBD is in England and part of it is in Wales. The Severn is the longest river in Britain, stretching 350 kilometres from its source to the mouth of the Bristol Channel. The RBD has a varied landscape, from the uplands of Wales, to the valleys and rolling hills of central England and the lowlands of the Severn Estuary. The main tributaries in England are the Warwickshire Avon, Teme, Wye and Bristol Avon. The main tributaries in Wales are the Wye, Usk and Taf.

The maps below show where the Severn RBD is compared to the other RBDs in England and Wales.

Figure 1. Location and map of the Severn RBD



We have also prepared preliminary flood risk assessment maps to show:

- River sub basins (sub catchments in the Severn RBD (Figure 2)
- Topography (the variation in ground levels) in the Severn RBD (Figure 3)
- Land use in the Severn RBD (Figure 4)

These maps also show the RBD, any sub RBD boundaries and the coastline.

Figure 2. Map of river sub basins in the Severn RBD

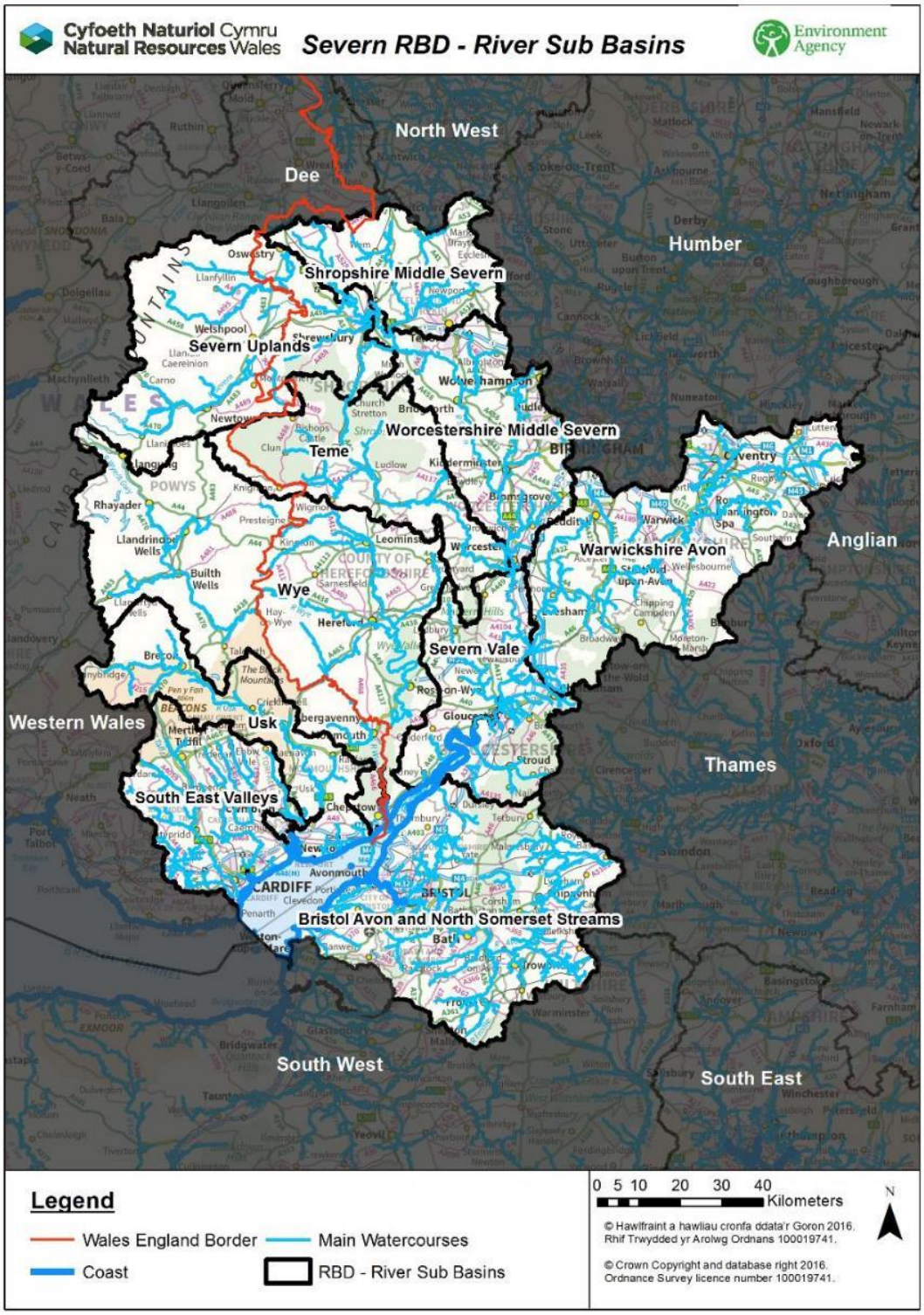


Figure 3. Map of ground levels in the Severn RBD

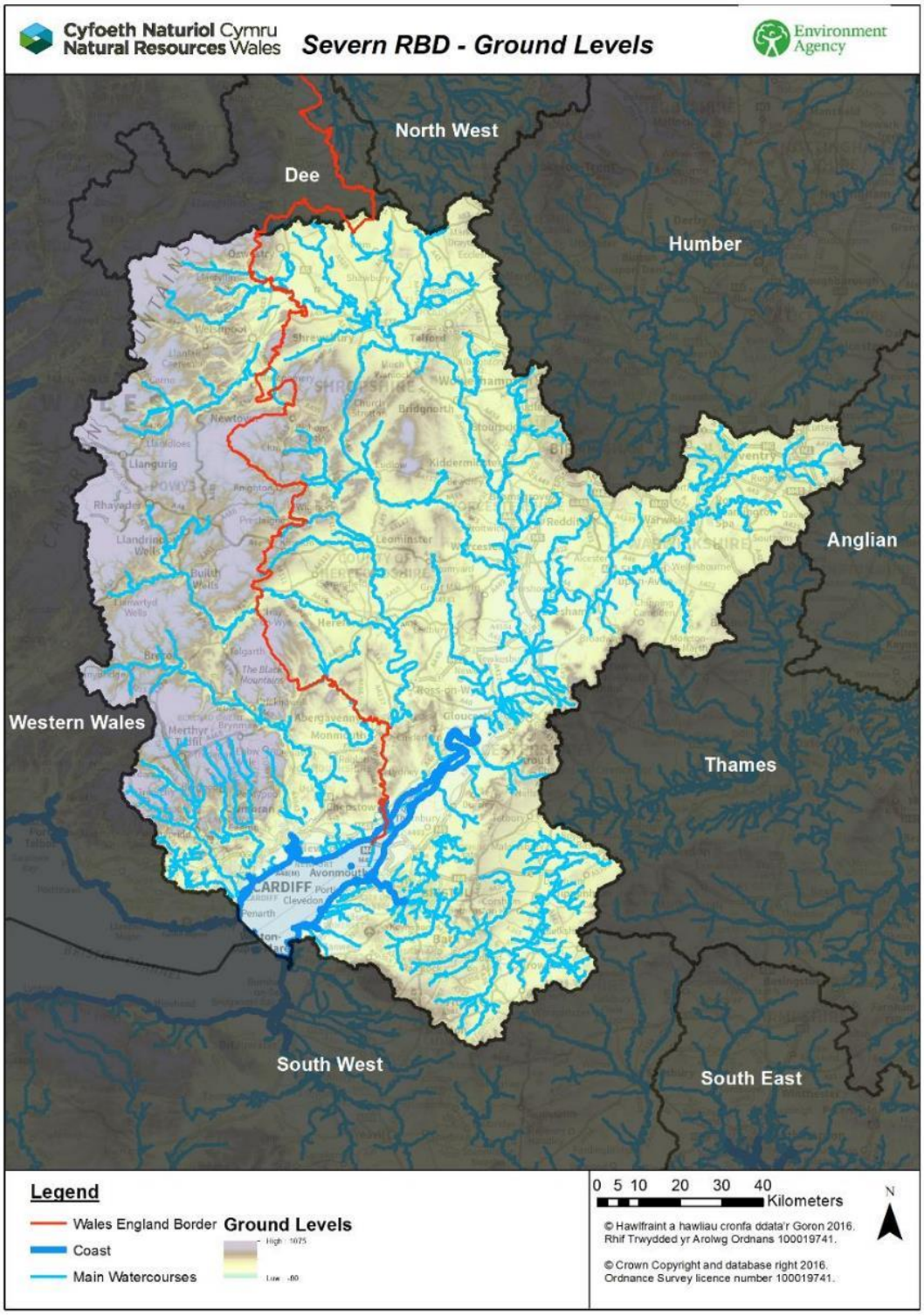
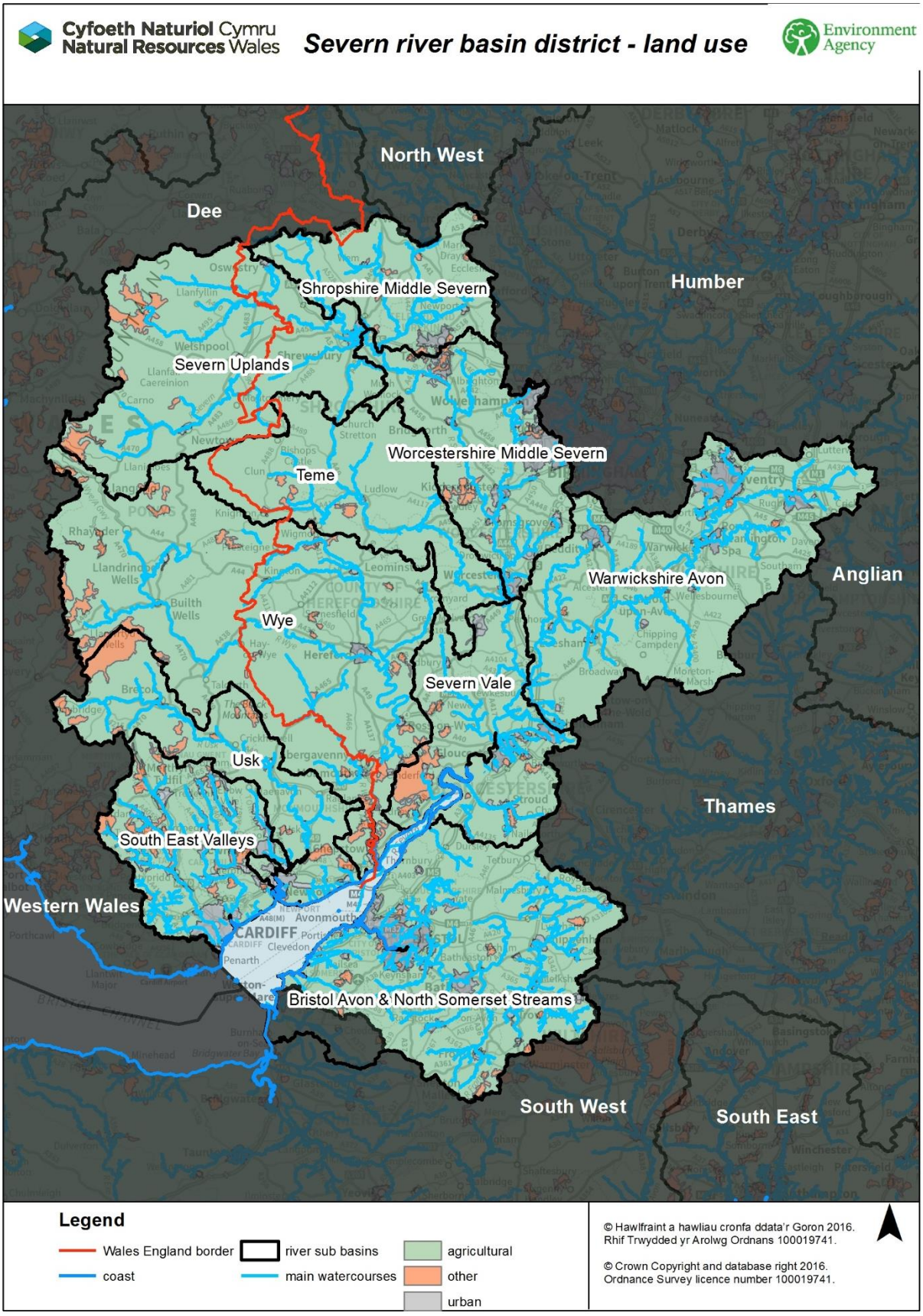


Figure 4. Map of land use in the Severn RBD



The Severn RBD is home to more than 5.75 million people, and includes major urban centres such as Bristol, Cardiff, Coventry, Worcester, Shrewsbury and Gloucester. Outside these areas, it is mostly rural, with land managed for agriculture and forestry.

The water bodies of the Severn RBD are made up of 7,512 kilometres of river, 76 lakes, 36 canals, 40 groundwater bodies and 545 kilometres squared of estuary. The sheer size of the RBD gives rise to the huge variety of land uses, geology and topography. The catchment contains a wide range of habitats associated with its upland areas, river valleys and floodplains, farmed landscapes and urban areas. The natural environment is also valued for its navigational and recreation uses and is an attraction for the people who live and work there, plus the many tourists who visit. The Environment Agency and NRW also use RBDs to plan water quality work through river basin management plans (RBMP). RBMPs set out how organisations, stakeholders and communities will work together to improve the water environment. RBMPs were published in 2015:

- You can find these for England on GOV.UK. River basin management plans 2015
- You can find these for Wales on River basin management plans published 2015-2021 (English)

RBDs are similar to the catchment boundaries used by Regional Flood and Coastal Committees (RFCCs). RFCCs are committees established by the Environment Agency under the Flood and Water Management Act (2010). They are made of members appointed by LLFAs and independent people with relevant experience. The Environment Agency must consult with RFCCs about flood and coastal risk management work in their region and take their comments into account. In England the English Severn and Wye and Wessex RFCCs (for the Bristol Avon catchment) cover the Severn RBD.

RFCCs do not exist in Wales. The recently formed Welsh Flood and Coastal Erosion Committee covers the Welsh parts of the Dee RBD, and advises Welsh Government Ministers on all aspects of flood risk management. The Flood and Coastal Erosion Committee replaces the previous Flood Risk Management Wales committee, which was the Wales equivalent of an RFCC for Natural Resources Wales.

Working together

The Environment Agency and NRW work together to manage flood risk in the Severn RBD and a formal agreement sets out how we do this. We do take different approaches but we share data and regularly liaise on the planning and delivery of FRM services. For example, we work together to forecast and warn for floods as they pass through the Severn catchment and we make sure that flood schemes do not make flooding worse up or downstream.

There is a Wales/England cross border group to oversee our work under the Regulations and ensure it is joined up. For the Severn RBD:

- We have produced a shared PFRA (this document)
- We will work together on flood risk and hazard maps (due in 2019)
- We will work together on FRMPs (due in 2021)

We have presented the next sections of the report in two different parts. Part A covers England and Part B covers Wales. This is because we take different but complementary approaches to how we assess flood risk.

What this report covers in England (in section A)

This preliminary assessment report provides information on past and potential future flood risk from main rivers, reservoirs and coastal flooding. You can find more information about main rivers and a map online on GOV.UK main river map for England.

We have reviewed past flooding events and used our understanding of flood risk to assess what could be affected by flooding. We then have used this information to identify significant FRAs. We then set out the work we are going to do next to meet the requirements of the Regulations.

To find information on flooding from surface water, smaller watercourses and groundwater flooding, please view the LLFA PFRAs and FRAs.

What this report covers in Wales (in section B)

This preliminary assessment report provides information on past and potential future floods from any source: main river, reservoirs, the sea, surface water, ground water and from ordinary watercourses. There are not separate reports for Lead Local Flood Authorities and for NRW, it is consolidated in one report.

We have reviewed past flooding events and used our understanding of flood risk to assess what could be affected by flooding. We then have used this information to identify significant FRAs for all sources of flooding. Following this, we set out the work we are going to do next to meet the requirements of the Regulations.

Section A: The Severn RBD in England

2. Past flooding

England has experienced major flooding from the rivers and the sea in the past. We have explored here the most significant floods in recent history that have helped us to learn more as a nation about the nature of flooding. Historic records tell us that flooding has occurred dating back hundreds (and even thousands) of years. This information is largely based on historical information, such as newspaper stories and pictures, rather than scientific records.

A brief history of recent flooding in the Severn RBD from rivers and the sea

Due to its size, river basin district-wide events are extremely rare, though large parts of the RBD have been affected during individual incidents. The most recent major events that impacted over large parts of the RBD include 1947, 1968, 1998, 2000 and 2007. The 2007 event was the largest flood in England in recent history.

Other smaller more localised events, such as those experienced in 2014, can be very disruptive to communities within the area affected. Historically, infrastructure and many of the transport links connecting communities have been built within floodplains. Road flooding causes access issues and travel disruption. Water can take many weeks to drain from the floodplain and this delays the recovery of the communities affected by flooding. Flooding events have been recorded throughout the RBD since the thirteenth century.

We know most about the flooding that has happened in the last 50-100 years because better records have been kept. We have hundreds of records about flooding that have informed what we know about the causes and consequences of it happening. The main sources are flooding from the sea and flooding from prolonged rainfall, torrential rainfall and rapid snow melt. We have explored these in more detail below.

Although unusual in England, rapidly melting snow can cause major and widespread flooding and loss of life. In the winter of 1946-1947, heavy snow fell for 55 days that caused a large build-up of snow. This melted rapidly in March 1947, leading to widespread flooding in the Severn catchment, including Worcester, Bewdley, Gloucester and Shrewsbury. In December 1965 snow melted rapidly and there was major flooding on the River Frome.

Torrential rainfall can cause flash flooding in smaller river catchments. Many of the smaller steeper catchments like Much Wenlock and Church Stretton in Shropshire and Chew Magna in Somerset are particularly vulnerable to this type of flooding and have suffered from repeated flash flooding.

Combined high tides and a sea surge during storms causes the most severe flooding on the coast. In December 2000, a high tide combined with high river levels flooded 45 properties in the Gloucester and Tewkesbury areas. In the lower reaches of the River Wye tidal flooding has also impacted on communities around Chepstow such as

Brockweir and Tintern. The most recent events occurred in 2014 with the previous highest recorded event occurring in December 1981.

Continuous heavy rainfall over a long time causes major and widespread flooding, especially when this follows earlier rainfall and the ground is already wet. There was major river flooding in 1968 on the River Avon at Warwick and Evesham. In Easter 1998, heavy rain fell in the Midlands resulting in extensive flooding which tragically led to 2 deaths. Over 1,000 properties and 1,400 caravans were flooded in the Severn RBD. Widespread flooding of highways and farmland particularly affected the Warwickshire Avon.

Autumn 2000 was the wettest recorded in the British Isles and rivers rose to record levels. Communities affected by these floods included Tewkesbury, Upton-upon-Severn and Gloucester.

More recently in 2007, prolonged heavy rainfall in June and July caused widespread flooding throughout the Severn catchment. An estimated 10,000 properties were affected in the Severn RBD. Towns and villages became cut off and the M5, M40 and M50 were closed. 350,000 people were without drinking water when Mythe water treatment works flooded. Road and rail passengers were stranded and the estimated damage in Worcestershire alone was up to £6.4m a week. We worked with emergency services and the military to help prevent the loss of electricity at Walham and Castle Meads sub stations.

We have summarised below the most significant flood events to have affected the Severn RBD from 2011, which is when the first cycle of flood risk management planning began under the regulations. These floods had significant harmful consequences at a national level to human health, the economy, the environment and/or cultural heritage. They have also significantly improved our understanding of flood risk and changed how we approach and manage flooding.

In autumn 2012 a series of heavy rainfall events, including 4 major storms in one week in November, caused widespread river flooding because they fell on saturated ground.

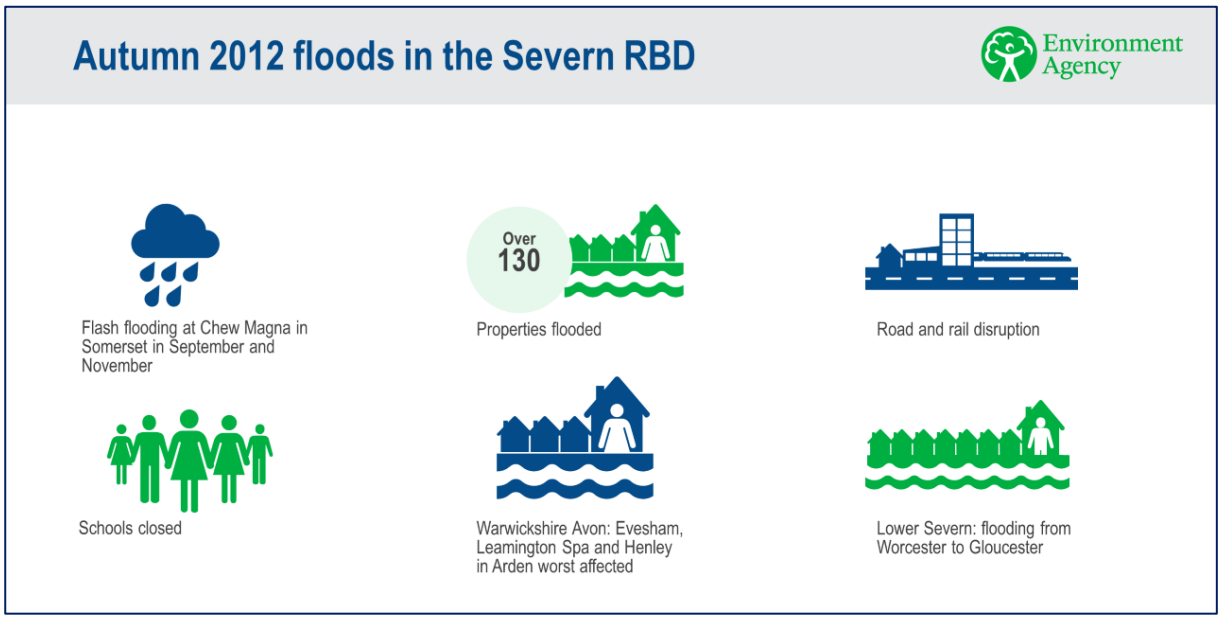


Figure 5. The impacts of the 2012 floods in the Severn RBD

Between December 2013 and March 2014, high tides and series of heavy rainfall events caused tidal flooding and repeat river flooding. It was the stormiest weather in England for 20 years.

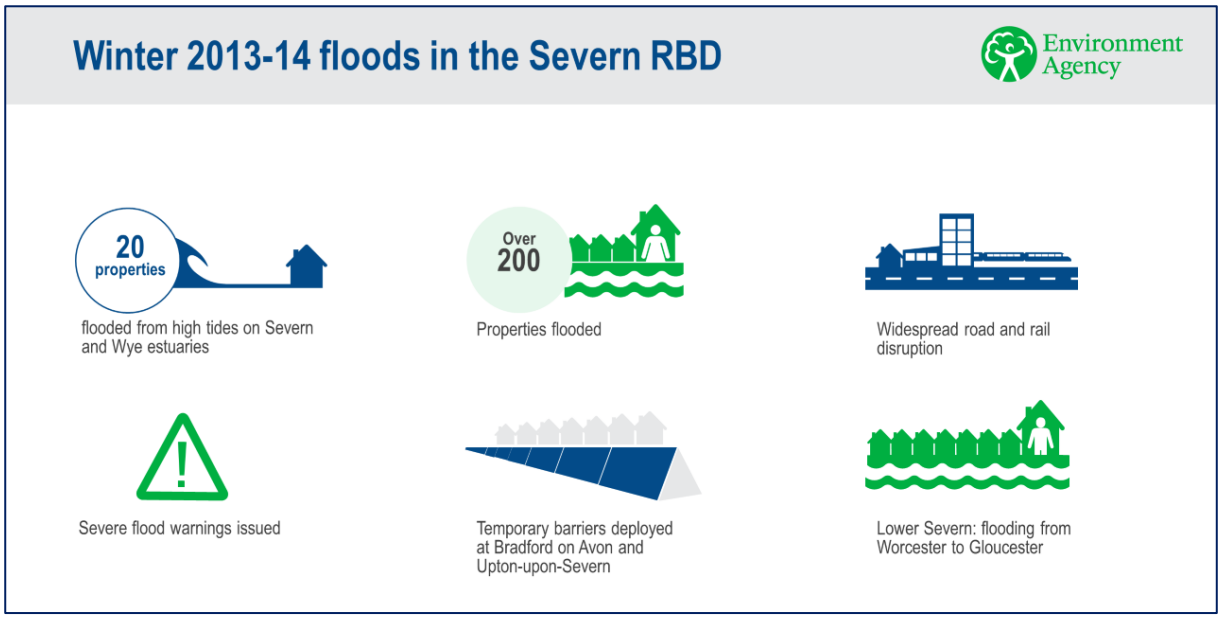


Figure 6. The impacts of the Winter 2013-14 floods in the Severn RBD

In March 2016, heavy rainfall overnight caused flooding in the Warwickshire Avon catchment. Up to 70 low-lying properties were affected and there was localised road and rail disruption. It was the worst flooding in the area since Easter 1998.

How do we use information on past flooding?

Our understanding of flood risk is not static and it has changed over time with each major flood. We learn more about what causes flooding and how severe it might be by observing

our weather conditions, how flooding happened and recording where flooded. We use this information to:

- Map the largest recorded extent of flooding known to have happened. We call this our historic flood map
- Understand how extensive the flooding was, the depth and flow, what it affected and the route flooding took . This information is often very detailed and locally specific. Such information can sometimes be found on Lead Local Flood Authority (LLFA) websites in their flood investigation reports
- Inform estimates of the highest rainfall totals, maximum river flows and highest tide levels that might be expected over a given time period. We use this to inform our computer models that generate floodplain extents and inform our predictive flood maps
- After major floods, such as 1953, 1998, 2000 and 2007, the government commissioned lessons learnt reports. These document what happened and have informed how we and others have adapted our approaches to managing flood risk over time. You can find these reports on GOV.UK

Reservoir flooding

There are 132 reservoirs in England and 135 reservoirs in Wales in the Severn RBD. Reservoirs have different purposes. They have been built to feed canals, reduce flood risk, irrigate farm land, for fisheries and provide water supply. The larger reservoirs, such as Clywedog, Elan and Vyrnwy in Wales, were mainly constructed for water supply. They have a limited effect on flood flows downstream, although they can help to locally attenuate flood waters.

Reservoir flooding is extremely unlikely to happen. All large reservoirs must be inspected and supervised by specialist Reservoir Engineers. We enforce the 1975 Reservoirs Act in England and we make sure that that reservoirs are inspected regularly and important safety work is done.

Our legislation is also kept under review to ensure reservoirs are managed to high standards by third parties and a consistent level of operation is maintained.

There has been no reservoir flooding in England resulting in a loss of life since 1870, when a reservoir at Rishton, Lancashire failed. The last event in England causing major loss of life was slightly earlier in Yorkshire in 1864, when the Dale Dyke Reservoir failed whilst it was being filled for the first time, leading to 250 fatalities in the Sheffield area. The government made reforms to reservoir standards following the tragedy.

3. Potential flooding

We use computer modelling to map floodplains so that we can understand the areas most likely to flood. And we use historic records to check our results are representative of what we know has happened in the past. This helps us to have a consistent understanding of flood risk across the country regardless of the records available for a given area. We also consider the flood risk impacts of climate change and planned development. We use this information to inform actions that we and others take to manage flood risk and to raise awareness in communities that could be affected.

Risk of flooding from main rivers and the sea

The Environment Agency undertake a national assessment of flood risk across the entire country, taking into account the likelihood of flooding and potential consequences known as the National Flood Risk Assessment (NaFRA). NaFRA has recently been updated to include the results of the survey of all the flood defences in England we completed after the winter 2013/14 flooding. NaFRA tells us how risk levels vary across the floodplain and shows the reduction in risk where we have defences. We have assessed different scenarios so that we could see how much difference current flood defences and maintenance work make to flood risk. We now use this information to make decisions about future investment in flood defences and other interventions to increase the resilience of local communities.

Risk management authorities (RMAs) have worked together to reduce the risk to many thousands of properties. Since 2007, RMAs have constructed or improved flood defence schemes in the Severn RBD reducing the risk of flooding to communities. In England these include:

• flood defence schemes along the River Severn, at Shrewsbury, Bewdley, Worcester (Hylton Road), Kempsey, Upton–upon-Severn, Uckinghall, Deerhurst, Prestbury and Cheltenham;

• flood defence schemes on the River Wye, protecting areas of Hereford, Hampton Bishop and Ross-on-Wye;

• flood defence schemes on Horsbere and Daniels brooks, protecting parts of Gloucester;

• a flood defence scheme on the Warwickshire Avon in Rugby protecting large parts of the town;

• a flood storage area to the north of Kidderminster, which reduces the risk of flooding in the town centre from the River Stour;

• new flood defences in the Bristol Avon catchment, protecting communities such as Wrington, Chew Magna and Radstock.

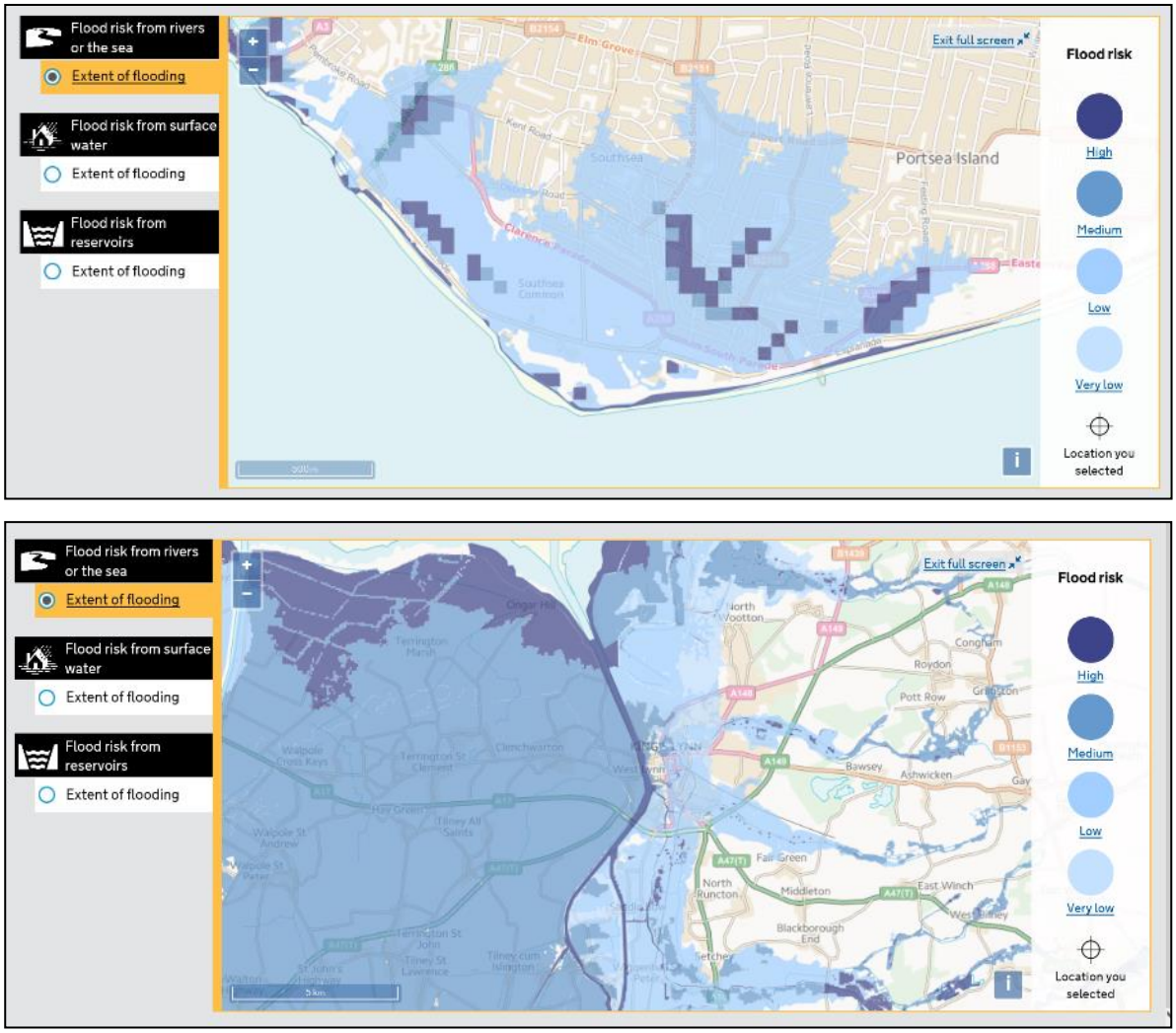
Flood defences have also been constructed in smaller communities and some of these have been community-led. Many of these schemes protected properties from flooding in 2012 and 2014. RMAs have spent over £65 million building new defences and maintain existing ones since the 2007 floods. By 2021, they plan to spend a further £50 million to protect about 3,000 homes and maintain existing defences.

The Risk of Flooding from Rivers and the Sea map

The Risk of Flooding from Rivers and the Sea map is a summary version of the NaFRA that we publish on the government website. It shows the chance of flooding from rivers and the sea presented in categories that take account of flood defences and the condition they are in. The categories are:

- high risk means that each year, there is a 3.3% chance or greater of flooding
- medium risk means that each year, there is between a 1% and 3.3% chance of flooding
- low risk means that each year, there is between a 0.1% and 1% chance of flooding
- very low risk means that each year, there is less than 0.1% chance of flooding

Figure 7. Extracts from the risk of flooding from rivers and the sea

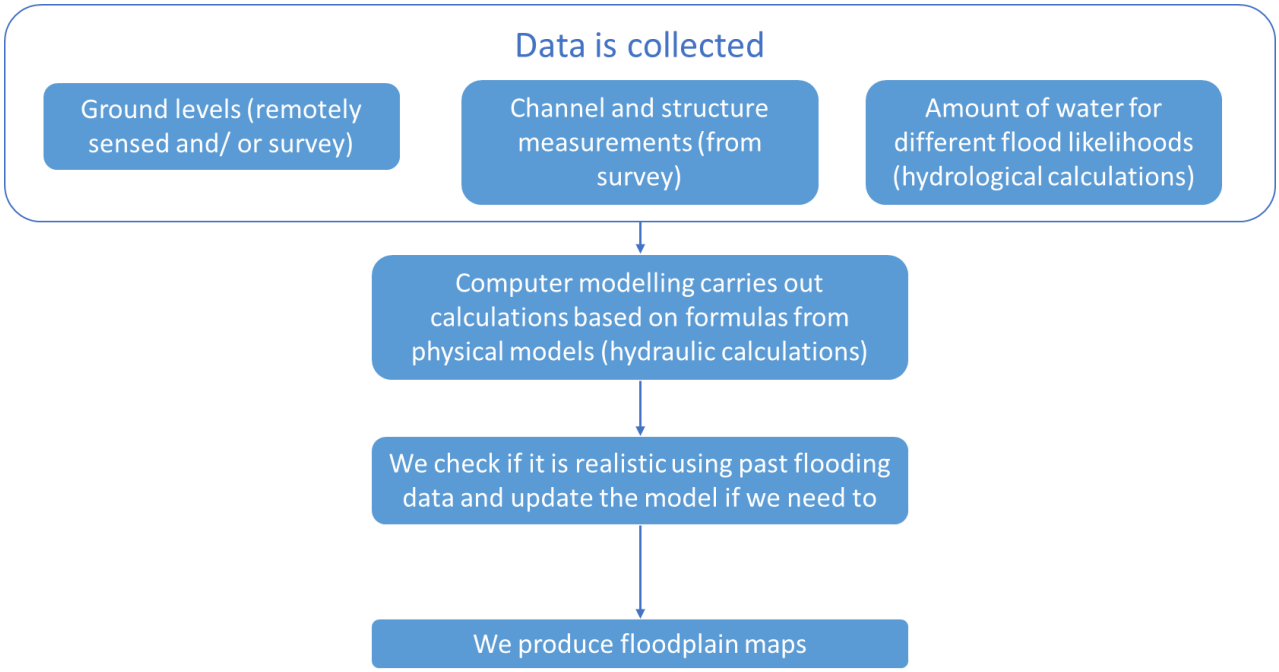


You can view this map at [find out if you're at risk of flooding in England](#).

How we map floodplains for river and sea flooding

How we map floodplains has changed over time from plotting the extent of previous floods to taking full advantage of modern technology and using computers to process large amounts of data. We have summarised how we do this below.

Figure 8. How we model floodplains



The Environment Agency publishes a national scale map of mapped floodplains known as 'the flood map for planning'. This is available through GOV.UK (add link) and is a collection of local detailed modelling, high level national scale modelling and historic flood extents. Developers and local planning authorities use this map to help make decisions on the locations and suitability of planned future development, so the most vulnerable development can be located to areas with the lowest likelihood of flooding.

The flood extents don't take into account flood defences and so they are precautionary. This is because not all flood defences are the same: they offer different standards of protection and are in different conditions. There is always a chance that flooding could occur behind defences if they are overtopped in an extreme flood and/ or fail. The flood map for planning allows us to take this into account in long term land use planning decisions.

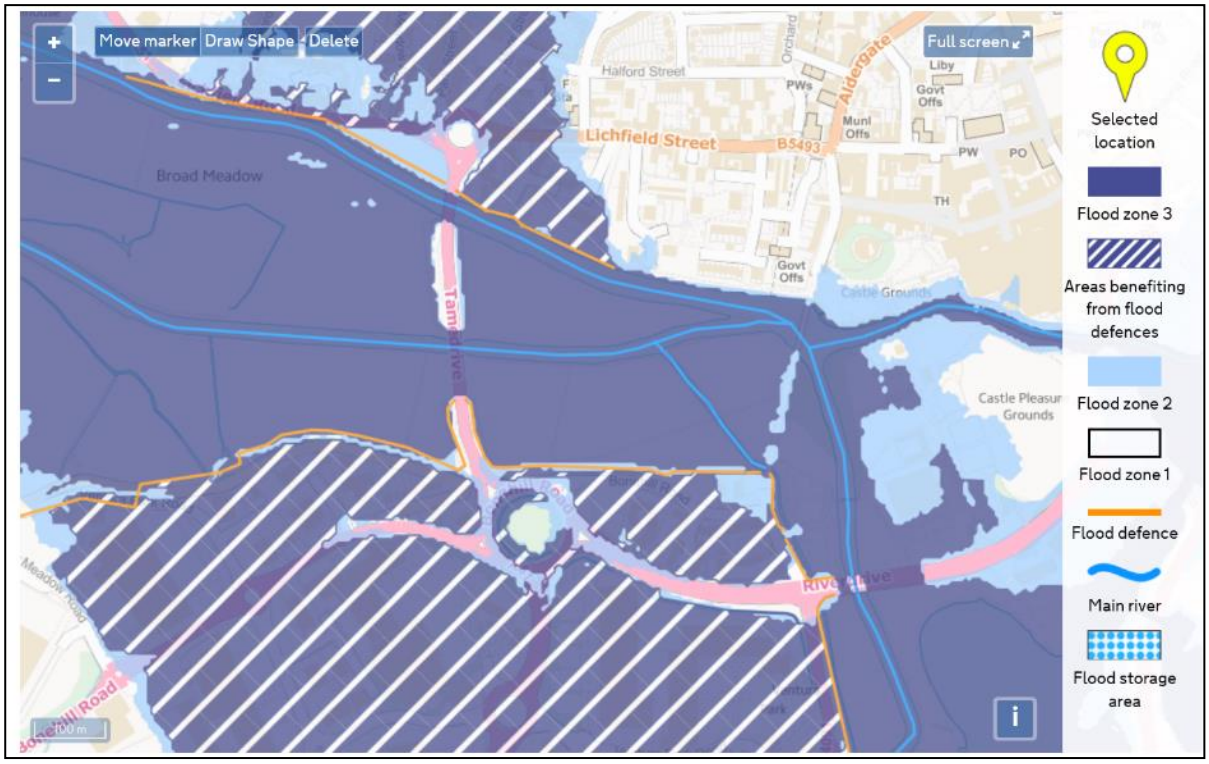
The flood map for planning

The flood map for planning shows river and sea flooding across different flood zones. These flood zones have different flood likelihoods. National planning policy tells planners and developers how to use these flood zones to inform planning decisions. This map shows:

- Flood zone 1: Low probability: less than a 0.1% chance of main river and sea flooding in any given year
- Flood zone 2: Medium probability: between a 1% and 0.1% chance of main river flooding in any given year or 0.5% and 0.1% chance of sea flooding in any given year

- Flood zone 3: High probability: greater or equal to a 1% chance of main river flooding in any given year or greater than a 0.5% chance of sea flooding in any given year
- the routes of major flood defences
- areas that benefit from major flood defences
- main rivers: the larger rivers that we undertake flood risk management on
- flood storage areas (none on this example)

Figure 9. Extract from the flood map for planning



You can view this map at flood map for planning.

How we check the modelling is realistic

We use data from past flooding to check that the outputs of our river models are realistic. The data can include:

- recorded flood levels and flows from river gauging stations
- the amount of rain that fell
- recorded flood extents e.g. from photos and mapping where a flood has left debris behind, and
- recorded flow paths e.g. from accounts of how things flooded

If the checking shows that the predicted flooding for flood event that is a similar size to one that has been experienced is not quite right, we amend our model until we get it to represent as closely as possible what happened. The amount of data available to check our models varies from place to place and this affects how much we can check our models.

Often there is less information available to check models for extreme flood events. After the flooding in winter 2015-16, when some flood defences were overwhelmed, we wanted to understand more about how extreme flooding could get. Scientists did this by calculating the most likely extreme rainfall and sea levels we might get and mapping the extent of flooding that would happen. The extents of flooding compared well to the existing extreme flooding information that the emergency services use to plan for flood response. This gives us confidence that our extreme flood outlines (a combination of flood zones 2 and 3 on the flood map for planning) represent realistic severe fluvial and tidal flooding.

The impact of climate change and long-term developments

Flood risk changes over time. There are many reasons for this - population increase, new development and changes in the way land is managed – but the main reason is climate change. Our climate is influenced by both naturally occurring variations in the climate system and human activity, such as increasing greenhouse gas emissions. General climate change projections show an increased chance of warmer, wetter winters and hotter, drier summers with a higher likelihood of more frequent and intense rainfall. We expect to see an increase in severe events, such as flooding. At the same time, sea levels are gradually rising, as the oceans warm up and ice caps melt. Based on recent observations, we already know that:

- 2017 was the fifth warmest year over land in a record that began in 1910
- nine of the ten warmest years in the UK have been since 2002 and the top ten have all occurred since 1990
- seven of the ten wettest years for the UK have been since 1998
- sea levels have risen by about 16cm since the beginning of the twentieth century, when corrected for land movement. (This is the way that the land mass of the England is changing after the last ice age. The huge mass of the ice weighed down the land and it is now readjusting, rising in the north west and sinking in the south east)

Damages from flooding and coastal change are already high, averaging an estimated £1 billion per year in the UK. The Climate Change Risk Assessment says that under the 4°C warming scenario (by this we mean the scenario for the 2050s that shows average temperatures are 4°C warmer than today), the number of households at a significant

chance of flooding (3.33% chance of flooding in any one year) is projected to increase from 860,000 today to 1.9 million by the 2050s. Whilst government is committed to limit global warming to well below 2 ºC, planning for a reasonable worst case scenario (4 ºC) allows us to take a risk based approach.

The Environment Agency has published climate change guidance on GOV.UK which sets out how to make an allowance for climate change when estimating future river flows, sea levels and rainfall intensity. We and others use this when designing new flood and coastal defences and making decisions about the safety of new developments. The guidance is based on climate change projections from 2009 and different scenarios of carbon dioxide (CO2) emissions to the atmosphere. There are different allowances for different periods of time over the next century. It is important to remember though that there is uncertainty about future climate change and the exact way this will affect flood risk.

Scientists are currently updating the climate change projections for the UK. These are due to be published in late 2018 and will give greater regional detail. We will consider the impact the new projections will have on future flooding and reissue the guidelines after publication for the full set of river, sea and rainfall projections.

As well as climate change, flood risk in the future will also be affected by:

- new developments that can generate more and faster runoff from rainfall that enters our rivers
- the number of properties that will be built on floodplains
- population growth, as more people live and work in areas at risk
- ageing assets, like flood embankments and underground culverts that are more likely to fail as they age

Decisions about investment in flood defences and the range of different actions we take to adapt to climate change will also affect future flood risk. We will need to invest in measures that work alongside traditional flood defences to help manage future flood risk. This includes property resilience, natural flood management and temporary barriers. We must continue to increase our understanding of flood risk under a changing climate and maintain policy and implementation by the Environment Agency, local authorities and developers to manage future flood damages and create resilient places. Current policy steers the most vulnerable development away from areas at high risk of flooding, but where development does need to go ahead there are policy safeguards to ensure development will remain resilient to the long-term effects of flooding, including climate change impacts.

4. RBD flood risk information

How we assess the consequences of potential floods

The information below describes the metrics we have used in this section and how these meet our requirements to explore flood consequences in the Regulations.

Human health consequences

How we have measured it: The number of people at risk of flooding, based on how many residential properties could be affected and multiplying this using statistical evidence on how many people live in these properties.

Other indicators: The impacts on both physical and mental human health are wide ranging. Flooding can also affect people in different ways, for example, depending on their age and levels of social deprivation. This information is harder to measure consistently at a national and strategic level.

Economic consequences

How we have measured it: The number of non-residential properties (businesses) and key services at risk of flooding. This can tell us the scale of the likely impact on the local economy at a nationally consistent scale. However, locally it does not tell the full picture as some businesses are larger than others e.g. large local employers compared to small independent businesses.

Other indicators: There are many other measures of economic damage, such as the financial losses to businesses, agriculture and due to infrastructure loss. The length of road and rail affected can also be calculated.

Impacts can also be felt wider than the immediately flooded area e.g. when roads are closed and people struggle to get to work or when gas lines are disrupted, affecting fuel supplies.

However, given the national and strategic nature of this report, the location of businesses and key services provides a high-level overview of economic impact.

Environmental consequences

How we have measured it: The area of Special Area of Conservation (SAC) has been used as an indicator at a national level of internationally significant conservation sites that could be affected by flooding.

Other indicators: There are other environmental designations such as regionally and nationally important sites e.g. Sites of Special Scientific Interest (SSSI), international designations such as RAMSAR and Special Protection Areas (SPAs) and information on protected species.

However, given the national and strategic nature of this report, the area of SAC affected provides a high-level overview of environmental impact.

Cultural heritage consequences

How we have measured it: The number of listed buildings (LBs) at risk has been used as an indicator at a national level of significant cultural heritage sites that could be affected by flooding.

Other indicators: There are other cultural heritage designations such as World Heritage Sites, Scheduled Monuments and Registered parks and gardens.

However, given the national and strategic nature of this report, the number of LBs affected provides a high-level overview of the scale of impact of flooding on cultural heritage.

Rivers and sea

The table below shows the risk to human health, the economy, the environment and cultural heritage in the Severn RBD in England for river and sea flooding.

Table 1: Risk from river and sea flooding in the Severn RBD

People at risk	Non-residential properties at risk	Key services at risk	SACs at risk	Listed buildings at risk
17,213	2,031	306	5,967	956

Reservoirs

The likelihood of flooding from a reservoir is far lower than for other types of flooding. Legislation ensures reservoirs are regularly inspected by trained civil engineers and owners are legally required to do essential safety works. There are very high safety standards for reservoirs in the UK which makes the likelihood of a failure very low.

We have mapped the maximum flood extent in the event of reservoir breach. Our maps are an absolute worst-case scenario, which assumes reservoirs are full at the time of breach, that there are no emergency reservoir operating measures and that lots of different reservoirs fail at the same time.

We assess risk by counting how many people, properties and cultural sites are within the maximum flood extent and the area of environmental sites affected. We have shown this data by RBD in table 1. Reservoir flooding is highly unlikely and these numbers are precautionary for the reasons given above. It would take all the reservoirs in any RBD failing at the same time to cause the impact our numbers show. The information for the Severn and Dee RBD includes Wales as we did the work together. You should not directly compare the impacts of reservoir flooding in table 2 with river and coastal flooding in table 1 as the reservoir flood mapping shows a much less likely flood.

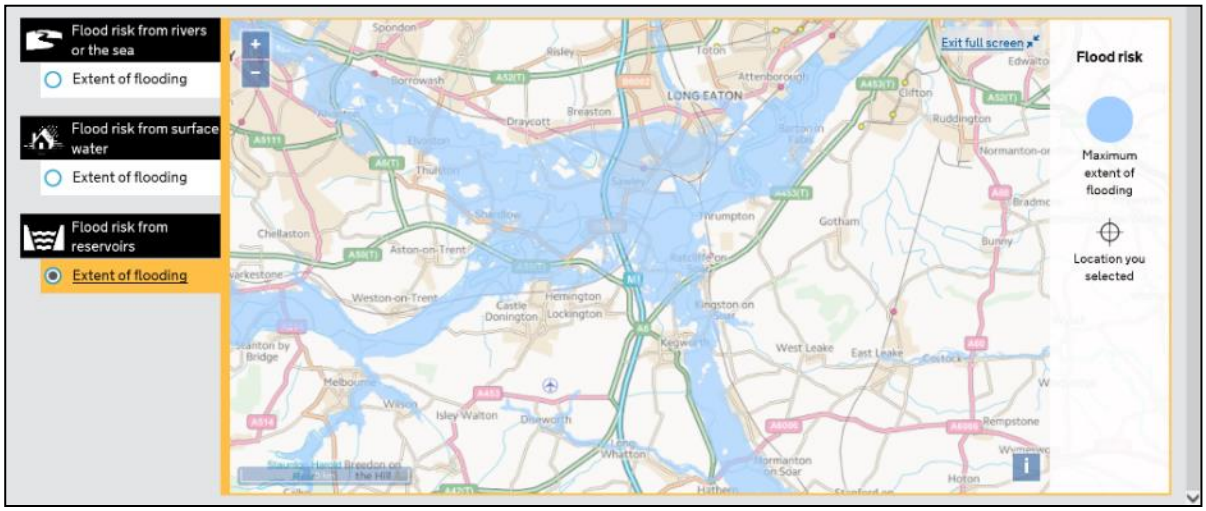
In the extremely unlikely event that reservoirs failed, the highest risk to people would be in the Thames RBD, with the lowest risk in the Dee, South East and Solway Tweed RBDs. The risk to the economy is highest in the Humber and Thames RBD and lowest in the Dee, South East and Solway Tweed RBDs. The risk to SACs is highest is the Anglian and Severn RBDs and lowest in the Thames, South East and Northumbria RBDs. The risk to cultural heritage is highest in the Humber, Severn and Thames RBDs and lowest in the South East, Solway Tweed and Dee RBDs.

We are currently updating our reservoir mapping to make the most of new data and technical advances. The new mapping will consider different scenarios by considering differences in the condition of a reservoir and the catchment it is in at the time it fails. It will be available at the end of 2019.

The risk of flooding from reservoirs map

The flood risk from reservoirs map on GOV.UK shows the maximum extent of flooding, depth and speed of flow in the unlikely event that a reservoir fails.

Figure 10. Extract from the flood map for reservoirs map



You can view this map at find out if you're at risk of flooding in England.

Table 2. Risk from reservoir flooding in the Severn RBD

People at risk	Non-residential properties at risk	Key services at risk	SACs at risk	Listed buildings at risk
261,750	36,620	732	6,050	3,360

5. Flood risk areas

We have used the latest information on flood risk to human health, the economy and environmental and cultural heritage sites to assess which areas nationally are the most significantly affected from river and sea flooding.

What is a flood risk area?

FRAs are areas where the risk of flooding is likely to be significant for people, the economy or the environment (including cultural heritage). By risk we mean not just the chance that flooding will occur (the probability), but also the impact or consequence. In an area with few people or few properties, the consequences of flooding may be relatively low even if the likelihood of flooding is high. In comparison, in areas with high numbers of people, property, infrastructure or assets the consequences are likely to be higher but the probability of flooding may be much lower because there are flood defences.

How we have defined flood risk areas

We identified communities at risk of flooding using datasets on flood risk, properties and communities. The data we used are:

- Flood risk: Risk of flooding from rivers and the sea. This shows the results of NaFRA and the chance of flooding from rivers and the sea, presented in four flood risk likelihood categories.
- Properties: National receptor database. This allows us to assign the level of flood risk to individual properties. We made sure we included schools, hospitals, care homes, infrastructure and other services as well as homes and businesses.
- Communities: Office for National Statistics built-up areas (from the 2011 census). This data provides information on the villages, towns and cities where people live, and allows comparisons between people living in built-up areas and those living elsewhere.

We then analysed the information at a community level to calculate a “community risk score” to each community. The community risk score is based on:

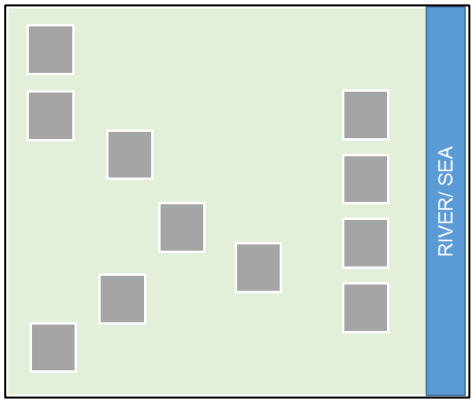
- the number of properties (residential and non-residential) within the community which are at high, medium, low or very low risk of flooding
- the annual likelihood of flooding for each individual property at risk within the community
- the percentage of all properties within the community that are properties at risk of flooding

Calculating the community risk score

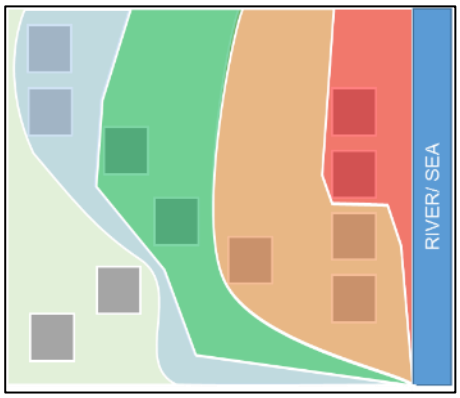
We have shown how we have done this using the worked example below.

Step 1: We defined the community using the built up area data

In this example, there are 11 properties identified within this built-up-area.



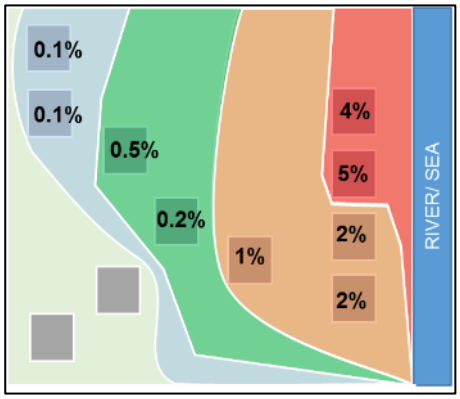
Step 2: We used the NaFRA data to identify which properties are at flood risk



Step 3: We used the NaFRA data to identify how likely each property is to flood

Then we added these up to produce the total flood risk within the community (i.e. in this example 14.9%).

Then we divide the total risk by the number of properties to get the average annual probability of flooding for all the properties within the community (in this example this is 14.9%/11 which gives an average annual probability for this community of 1.35%).



Step 4: We generated the community risk score

We multiplied the total flood risk of the community by the average annual probability of flooding for all properties within the community.

This allows us to distinguish between two communities that share the same average annual probability of flooding for all properties. This means that we have considered both large and small communities on an equal footing.

In this example, the calculation would be 14.9% x 1.35% giving a community risk score of 20.1. We have used this risk score to rank communities.

Using the community risk score

We ranked communities according to their risk score to understand how they contribute to overall national flood risk. We initially selected communities that represented 50% of total risk across the country as a starting point. We then engaged with local experts to check, adapt and refine the selection based on best available knowledge, including:

- sites that are import for the environment or cultural heritage
- roads, rail and other similar infrastructure
- the location of industrial sites that could cause major pollution to happen
- vulnerable local sites, such as caravan parks or camp sites
- future planned development

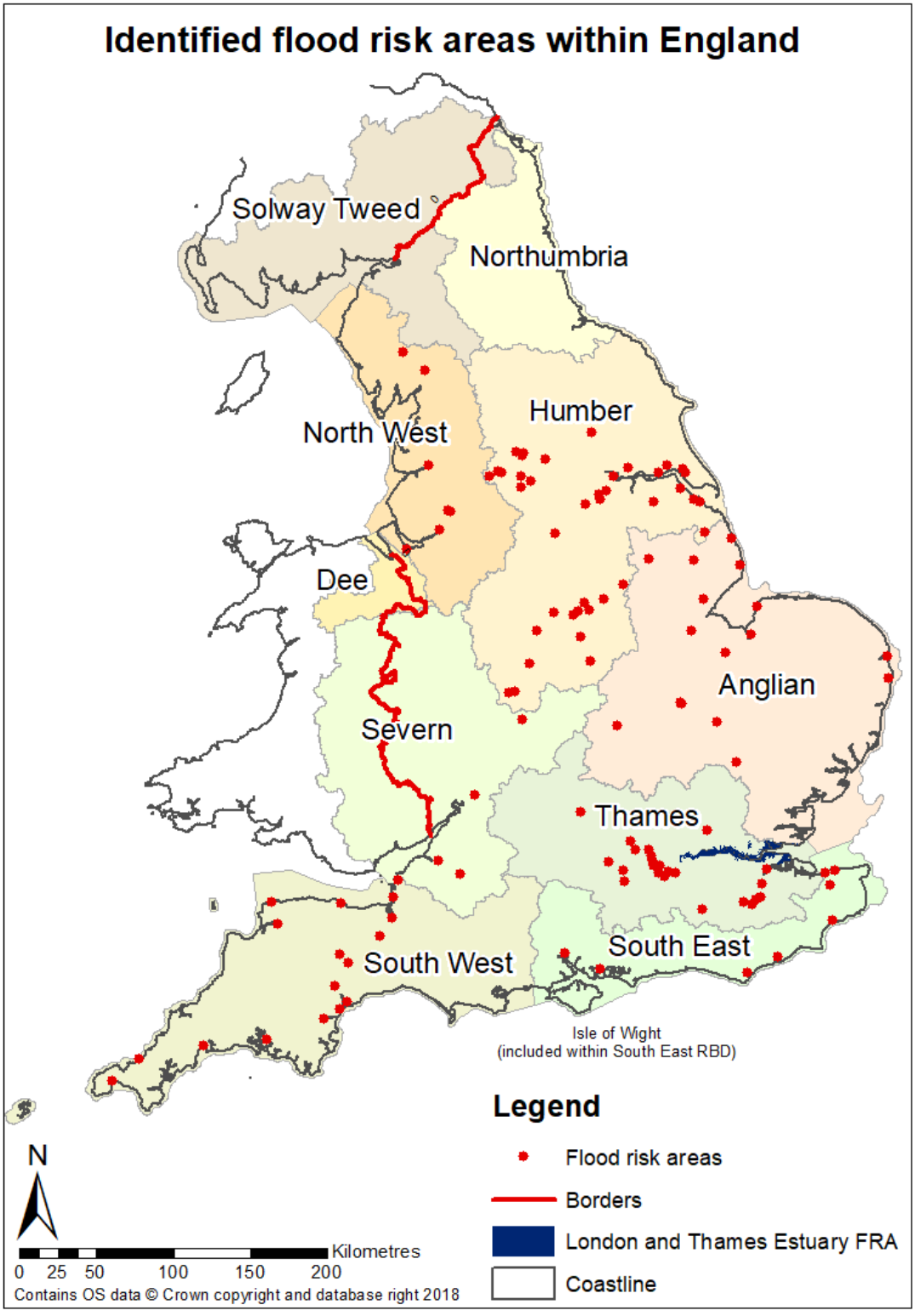
Identified flood risk areas

We have identified 116 communities that are at significant risk of flooding in England and you can see these on the map below. We have also provided a more detailed map of these separately to accompany the report. You can also download this as data from data.gov.uk

The number FRAs varies around the country:

- The highest number are in Humber RBD (40) followed by Thames RBD (25)
- There are a similar number in Anglian RBD (18) and South West RBD (17)
- There are also a similar number in South East RBD (8), North West RBD (8) and Severn RBD (5)
- There are no FRAs in Dee RBD, Northumbria RBD or the Solway Tweed RBD
- There are two FRAs that overlap RBD boundaries: one between South East and Thames RBDs (Whitstable) and one between Severn and South West RBDs (Weston-super-Mare)

Figure 11. Identified flood risk areas



Section B: The Severn RBD in Wales

The Welsh Government are seeking an approach for this cycle in the regulations that brings together all sources of flooding. This involves identifying hotspots of flooding from combined flood sources and seeks to optimise resource efforts for all risk management authorities by working together across all sources of flood risk to meet the regulations. This provides a more consistent and coordinated approach to flood risk management in Wales.

Roles and Responsibilities

The Floods and Water Management Act 2010 clarified the roles and responsibilities for the different sources of flooding that could affect Wales. In addition, the Welsh Government National Flood and Coastal Erosion Risk Management Strategy identified all the risk management authorities in Wales that need to work together.

In 2013, NRW became responsible for the management of flood risk from main rivers, reservoirs and the sea in Wales. NRW have produced the Welsh part of the Severn RBD report jointly with Welsh LLFAs (given their responsibility for surface water, ordinary watercourses and groundwater), Welsh Government and the Welsh Local Government Agency (WLGA).

The LLFAs in Wales that are covered by the Severn RBD are Powys County Council, Monmouthshire County Council, Blaenau Gwent County Borough Council, Torfaen County Borough Council, Merthyr Tydfil County Borough Council, Rhondda Cynon Taff County Borough Council, Caerphilly County Borough Council, Cardiff County Borough Council, Newport County Borough Council, Vale of Glamorgan County Borough Council (small part within RBD boundary only), Carmarthenshire County Council (small part within RBD boundary only) and Ceredigion County Council (small part within RBD boundary only).

The Minister for the Environment and Cultural Heritage has set the threshold for FRAs in Wales.

What this section contains

We have assessed and identified those areas within the Welsh part of the Severn RBD that are most at risk of flooding from any source or combination of sources (main river, reservoirs, the sea, surface water, ground water and from ordinary watercourses) in this section. We have assessed significant past flooding that has affected the Severn RBD in Wales since 2011 and then considered the potential harmful consequences of future flooding. Using this information, we have then identified those areas within Wales where most significant flood risks exist. These are known as FRAs. For these FRAs, we will complete flood hazard and flood risk mapping completed by 22 December 2019 then FRMPs by 22 December 2021.

6. Methodology

The PFRA is a high-level screening exercise to identify areas where the risk of flooding is considered to be significant. We have used this to prioritise areas that require more detailed flood mapping and action planning. We have used existing information to write this PFRA and to identify FRAs.

Both the Regulations and the Directive clearly state what the PFRA should comprise, but they do not provide a definition of 'significant' flood risk to apply. In cycle 1, LLFAs made local decisions about what was locally significant with regards to past flood events and future flood risk. This led to a range of thresholds being used, particularly for recording past flood events. As this PFRA seeks to achieve a consolidated and consistent approach by including flood risk from multiple sources, we have standardised the methodology and thresholds to ensure we can report consistently across Wales.

Thresholds

We have summarised below the thresholds we have agreed to define significant flood risk across Wales for this PFRA.

Past flood events: Flood events are deemed to be significant in Wales for the purpose of this report if 20 or more residential properties were flooded per town or postcode area. We have included flood events exceeding this threshold for fluvial, tidal and surface water sources since 2011 in this report.

Future flood risk: Information and statistics included within this report for future flooding are based upon the 0.1% Annual Exceedance Probability (AEP) for risk of flooding.

The central climate change allowance[1] has been used for climate change flood flow estimates.

The following sections cover past flooding and potential future flooding and describe some of the information we have used to help us identify FRAs.

[1] The central climate change allowance equates to the 50th percentile of a medium (A1B) emissions scenario, as derived from research into regionalised data of climate change on flood flows (EA/DEFRA). It was previously known as the 'change factor'.

7. Past Flood Risk

We have used historical flood records held by NRW and LLFAs for flooding from rivers, the sea, reservoir, surface water and groundwater. We have identified floods since the production of cycle 1 PFRAs in 2011 that exceed our definition of a significant flood event (20 or more residential properties were flooded in a town or village from any source). There was only one event that exceeded this threshold in the Severn RBD in Wales. We have explored this further below.

Flood events have been captured by community rather than date. We recognise that through setting the threshold in this way that there may be some communities which experience regular flooding but are not captured in this assessment as less than 20 properties have been affected.

When there has been flooding experienced, we combine information on the flood extent with data on the areas affected, from the National Receptor Database (NRD). The NRD enables us to capture information regarding social, economic, environmental and cultural receptors to help us understand the consequences from the flood. We also look at the pathways by which flooding occurred, or flood conveyance routes. We use flood extents, conveyance routes and the impacts of past floods to improve our flood models that identify where flooding may happen in future.

For the Welsh part of the Severn RBD, there was one flood incident that met the above criteria for significant flooding. This occurred in Cwmbran in May 2014.

Cwmbran Flood, May 2014

Extreme rainfall caused flooding in the Cwmbran area of Torfaen County Borough Council on 22nd May 2014. The likelihood of the event was assessed as being greater than 1%, which means that each year there is a greater than 1% chance of a similar event occurring. The Met Office data gave a peak intensity of at least of 78 mm/ hour for 30 minutes. There was internal flooding to 198 properties, which were identified by the LLFA who worked together with South Wales Fire and Rescue Service, NRW, Bron Afon and Dŵr Cymru Welsh Water.

Table 3. Number of properties flooded in areas of Cwmbran

Area of Cwmbran	Properties flooded
Greenmeadow/Fairwater	71
Pontnewydd	35
Llantarnam	25
Two Locks	18
St Dials	12
Thornhill	8

Coed Eva	8
Henllys	8
Croesyceiliog	6
Upper Cwmbran	3
Old Cwmbran	3
Ty Canol	1

The LLFA did a post flood survey that showed that:

- 108 properties flooded from culvert overloads;
- 26 properties flooded from the public sewerage system;
- 64 properties flooded from overland surface water flows such as from roof drainage, garden run-off, and highway run-off.

There were two supermarkets that suffered structural damage due to the heavy rainfall which caused flat roofs to collapse under the weight of water.

The LLFA have used photographic records, verbal accounts and post event surveys and concluded that flooding was from a combination of:

- the capacity of foul, storm and combined drains and the highway drainage system on or near overland flood routes being exceeded
- six specific culverts along the course of the Dowlais Brook and five others becoming unable to transport the excess flows created by the event
- the rapid deposition of debris onto security and trash screens at these locations

Figure 12. Flooding in Cwmbran in May 2014

Groundwater flooding

Groundwater flood events in Wales are rare. The geology (underlying rock type) and topography (steep sided valleys) mean that groundwater flooding is a very unlikely to occur. Due to the history of mining in certain areas of Wales, flooding recorded as groundwater may actually be from disused mine workings. Whilst this is becoming more of a concern for some LLFAs it still remains a very low likelihood and very low frequency.

Since 2011, Rhondda Cynon Taff have recorded over 100 incidences of flooding from groundwater. Some of these recorded incidents may have flooded from disused mine workings.

Reservoir flooding

Flooding from a reservoir is a high consequence, low likelihood event. All reservoirs in Wales that are greater than 10,000 cubic meters of water retained above ground level, are covered by the Reservoirs Act 1975 (as amended). The Act was brought in to reduce the risk to the communities downstream of these reservoirs as a consequence of an uncontrolled release of water. The risk from reservoir flooding is greatly minimised by strict preventative legislation making it very low likelihood.

There have been no incidences of reservoir flooding in Wales since 2011. NRW is the enforcement authority for the Reservoirs Act 1975 in Wales and we regulate the sector to ensure that reservoirs are inspected regularly and essential safety work is carried out.

8. Potential Flood Risk

We can use flood risk modelling and mapping to assess the risk of flooding from future floods in the Severn RBD. We use this to understand where and what is currently at risk by assessing the likelihood and consequence of potential river, sea, reservoir, surface water and groundwater flooding.

We use the following information to inform our models:

- topography;
- land use;
- location of watercourses;
- representation of watercourse structures;
- location of flood plains that retain water;
- characteristics of watercourses (lengths, modifications);
- effectiveness of any works constructed for flood risk management;
- location of populated areas;
- areas in which economic activity is concentrated

We produce maps to visually illustrate the areas at risk of flooding and these are available on the NRW website. These maps show information on the risk of flooding to communities for all sources of flood risk. Our maps enable us to extract information on where and what is most at risk and inform the actions are needed to address the risk.

For this report, we have looked at the 0.1% Annual Exceedance Probability (AEP) risk of flooding and assessed what is at risk from a flood of this size for people, economics, the environment and cultural heritage within the RBD. We have captured this data from the best available information at this time and presented this in table 4. We will review and update this data in the next stage of this Floods Directive cycle.

The impact of climate change

We can use our flood models to assess how flood risk might change due to climate change. We have run our flood risk models with the most current climate change allowances to provide an indication of what is likely to be at risk in the future compared to the present day risk.

We have based the climate change allowance for river and sea on the Welsh government guidance note (guidance for flood consequence assessments climate change allowances) on adapting to climate change. We have based the climate change allowance for surface water flooding on Environment Agency guidance (flood risk assessments climate change allowances).

There are separate allowances for river flows, rainfall intensity and sea level rise which provide the best estimate of what the likely impacts are in the future. We have used the central allowance over a 100-year time horizon to assess the likely impact of climate change.

Consequences for people, the environment, cultural heritage and economic activity

Table 4 gives a summary of what is at risk in the Welsh part of the Severn RBD in the present day and with a future allowance for climate change. The data includes flooding from river, sea and surface water sources within the 0.1% AEP flooding outline. The data presented below is the best available at this point in time.

Table 4. What is at risk of flooding in the Welsh part of the Severn RBD, now and in the future

Element	Indicator measured	Number in defined area (RBD)	Number in maximum extent of flooding	Number in maximum extent of flooding with climate change
People				
People*	Number of people	1459209	148964	207662
Properties	Residential properties	620940	63389	88367
Services	Number of infrastructure sites	8785	1152	1658
Environment				
Special Areas of Conservation (SAC)	Area of SAC (in km2)	793	116	121
Special Protection Areas (SPAs)	Area of SPA (in km2)	500	95	102
RAMSAR	Area of RAMSAR (in km2)	187	73	73
Sites of Special Scientific Interest (SSSI)	Area of SSSI (in km2)	760	175	186
Scheduled Ancient Monuments	Area of Scheduled Ancient Monuments (in km2)	2.1	1.4	1.7
Licensed Abstractions	Number of licensed abstractions	538	225	241
Economy				
Non-residential properties	Number of non-residential properties	20421	3557	4795
Airports	Number of airports	5	0	0
Railways	Number of railway properties	61	28	34
Agricultural land (Grades 1, 2, 3)	Area of agricultural land (in km2)	833	150	161

* The number of people at risk of flooding has been calculated using guidance from the Office for National Statistics General Lifestyle Survey, 2011 and is based on the number of residential properties.

Groundwater flooding

Due to the nature of groundwater flooding, it is difficult to map and model. Geological maps can give an indication of areas which may be susceptible to groundwater flooding, of which there are very few in Wales. This means that we have little need to include groundwater flooding in our models in the same way as we do for river, sea and surface water flooding due to the very low likelihood of occurrence.

In Wales, groundwater flooding is most likely to occur from disused mine workings which makes it even more difficult to forecast, map and model as detailed mine works mapping is not available. It is best done on a small-scale, case by case basis when the need arises.

Reservoir flooding

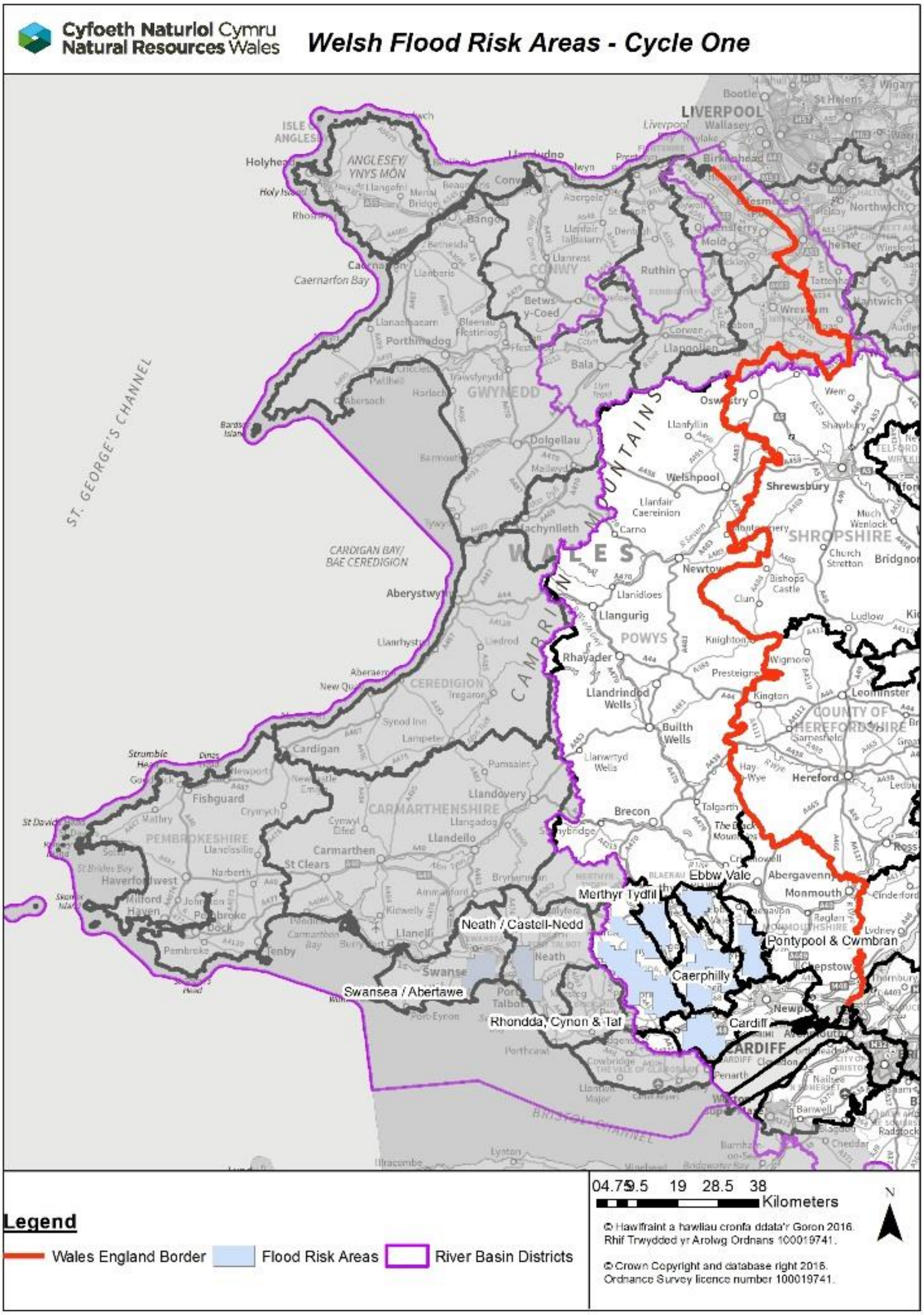
Reservoir mapping was completed for reservoirs across Wales during 2013. The long term flood risk maps are still the best available information for identifying areas likely to be inundated by reservoir flooding and you can find them on our website. We are currently in the process of updating our reservoir maps to include all reservoirs that are greater than 10,000 cubic meters. Reservoir maps indicate where could be at risk but do not indicate any likelihood of a flood occurring. We know that through the strict regulation from the Reservoirs Act (1975) (as amended), flooding from reservoirs has a very low likelihood and it is for this reason that despite the high consequences should a reservoir flood occur, we have not included reservoir flooding in the process for identifying FRAs. We have worked with Emergency Planners to identify the reservoirs that have the greatest potential impact in the unlikely event of failure and developed emergency flood plans for those reservoirs.

9. Flood Risk Areas

We have assessed and identified in this report those areas within the Severn RBD in Wales that are most at risk of flooding from any source (main rivers, reservoirs, the sea, surface water, ground water and from ordinary watercourses). The previous two chapters cover the assessment of significant past flooding and the potential harmful consequences of future flooding. We have used this information, along with other information available, to identify those areas that are at significant risk of flooding. These are known as FRAs. It is these FRAs that will have flood hazard and flood risk mapping completed by 22 December 2019 then FRMPs by 22 December 2021.

An arbitrary threshold for significant flood risk was used to define FRAs across Wales for surface water flooding only in the first cycle of PFRAs in 2011. The threshold used in Wales was set by Welsh Ministers of 5000 people or more affected in the 1% annual exceedance probability event. This generated eight FRAs across Wales, with six in the Severn RBD.

Figure 13. Flood risk areas from the first cycle in 2011



We applied for an exemption in the legislation which meant that we did not need to identify FRAs for flooding from main rivers, reservoirs and the sea in the first cycle. Because of this, we produced flood hazard and flood risk mapping and FRMPs covering all of Wales for flooding from main rivers, reservoirs and the sea.

The exemption used in the first cycle does not apply to the second cycle. This means that FRAs are required to identify significant flood risk from main rivers, reservoirs and the sea. In addition, those FRAs that were set in the first cycle for surface water sources need to be reviewed and updated. The FRAs in Wales for this cycle cover all sources of flood risk.

Methodology for defining flood risk areas

In Wales, we have developed a tool to help identify the locations of greatest risk of flooding. This is called the communities at risk register (CaRR), and it considers a number of factors to identify the locations (communities) at greatest at risk of flooding. We use the CaRR to inform, plan and prioritise our investment programme to target investment in the most at risk communities. It is not an absolute ranking of risk, it is an indicator of relative significance of risk from location to location. As it is done on a consistent basis, different locations can compared across Wales.. For these reasons, we have used the CaRR to define our Flood Risk Areas.

The CaRR uses outputs from flood models to consider the number of people at risk, the hazard they are exposed to over a range of probabilities, the speed of onset of flooding and their ability to respond in terms of social vulnerability to flooding. It also uses factors such as availability and standard of flood warnings and flood defences. The CaRR then calculates a score for each community which enables communities to be ranked based upon the risk of flooding. This is carried out across Wales for flooding from the sea, main rivers and surface water to create a consistent picture of flood risk.

We have used the CaRR to identify and rank communities from high to low and identify those that are at significant risk of flooding from any source.

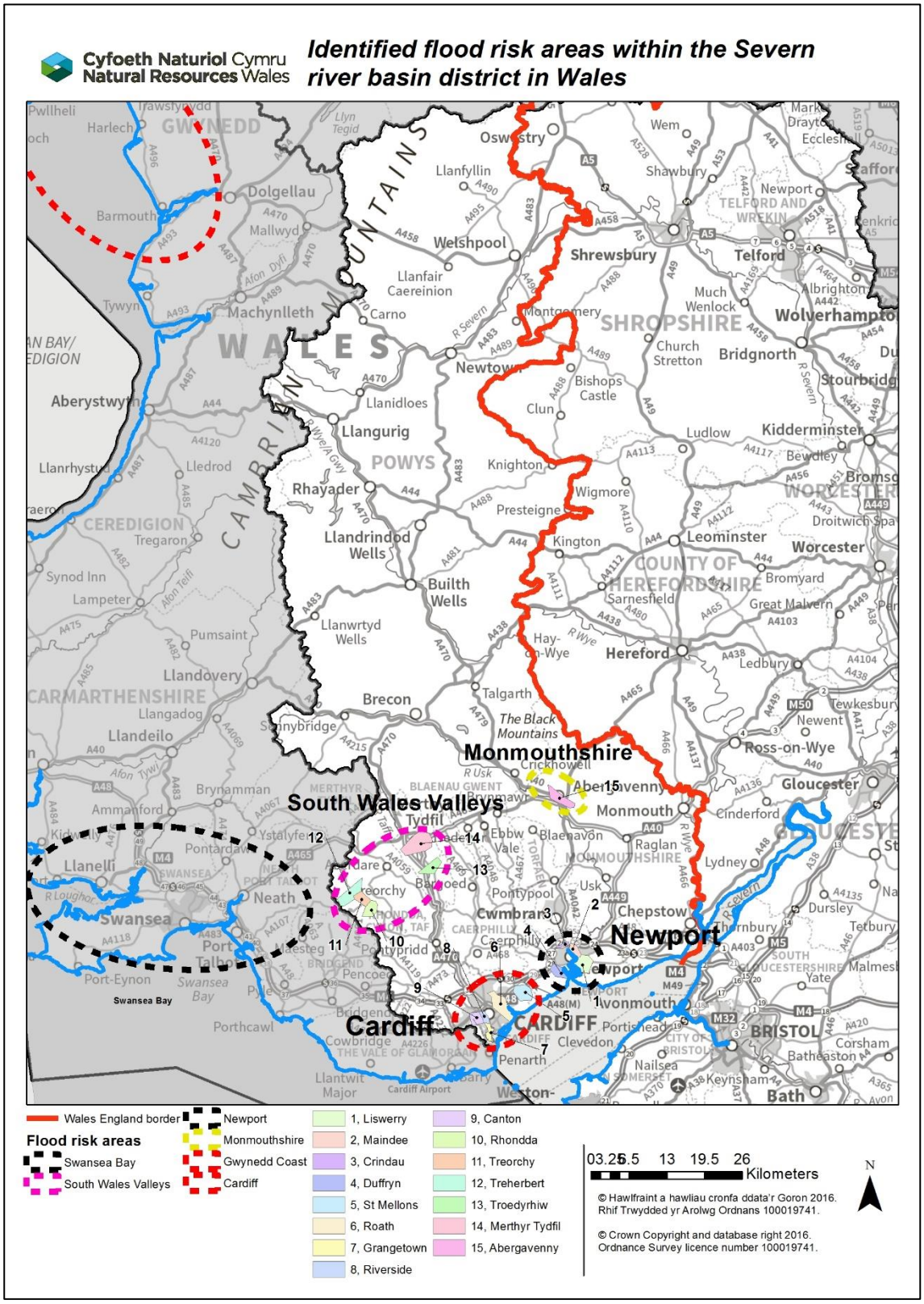
Flood risk areas

We have ranked communities using the CaRR on a Wales-wide basis. FRAs have been identified at this scale to define those communities that are most at risk in all of Wales. The Welsh Government set the threshold for communities at significant risk of flooding with input from NRW and the Welsh Local Government Association (representing LLFAs).

Within the Welsh part of the Severn RBD, there are 4 Flood Risk Areas that include 15 individual communities. These are shown in figure 14 and these are:

- Newport, including the communities of Liswerry, Maindee, Crindau and Duffryn (shown as locations 1-4 in figure 14)
- Cardiff, including the communities of St Mellons, Roath, Grangetown, Riverside and Canton (shown as locations 5-9 in figure14)
- South Wales Valleys, including the communities of Rhondda, Treorchy, Treherbert, Troedyrhiw and Merthyr Tydfil (shown as locations 10-14 in figure 14)
- Monmouthshire, including the community of Abergavenny (shown as location 15 in figure 14).

Figure 14. Identified flood risk areas within the Severn RBD in Wales



10. Summary and next steps for England and Wales

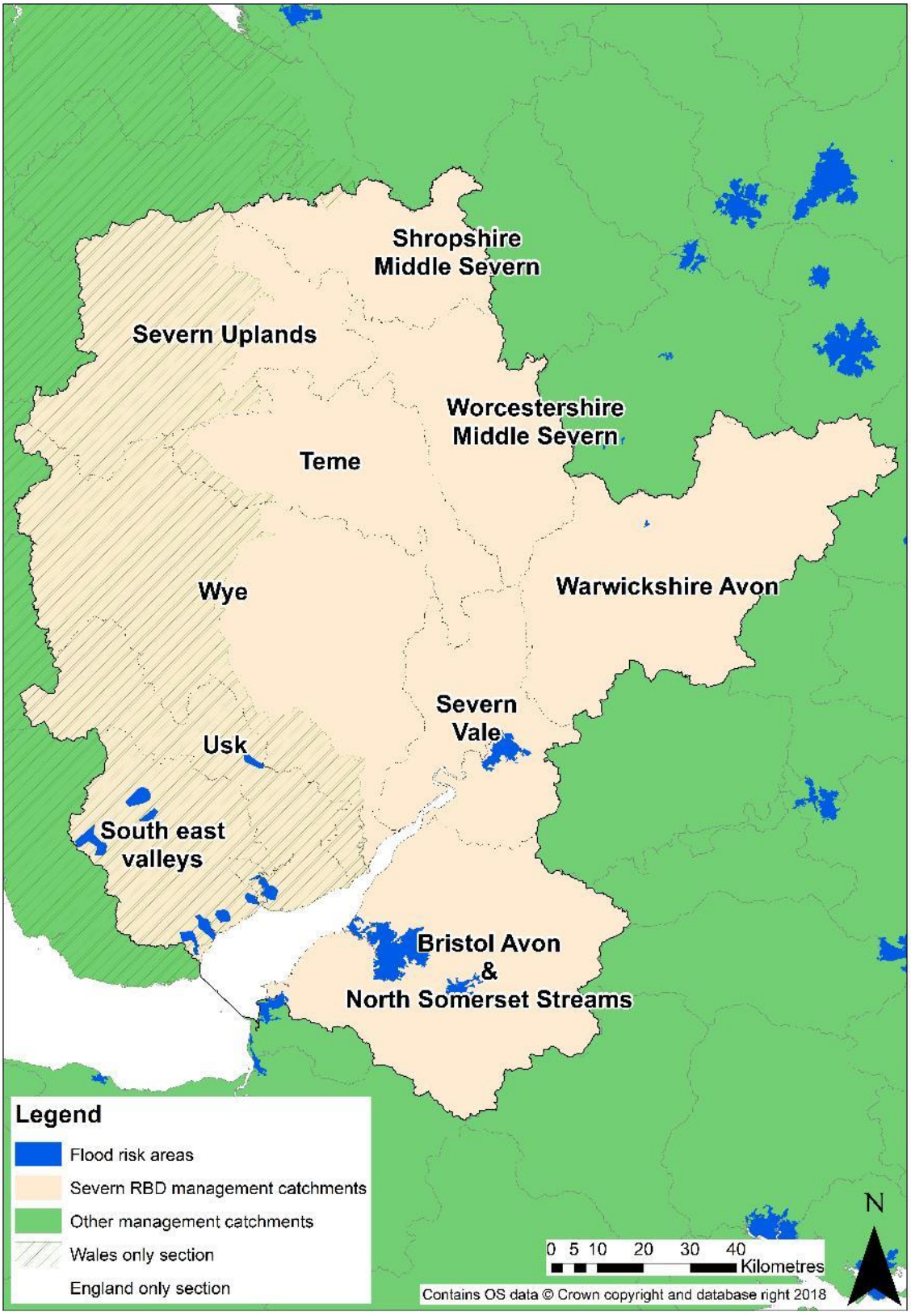
This report meets our shared requirements under the Regulations to produce a preliminary flood risk assessment. We have also used the information to identify nationally significant FRAs.

We will continue to plan for and manage the risk of flooding to all communities, whether they are in a FRA or not, but the FRAs will be our priority. There are many local reasons why we would pursue a flood risk management intervention for a particular community. Being in a FRA or not will not affect the amount of funding for flood defences and the way we comment on local plans and planning applications.

Flood risk areas in the Severn RBD

You can see the FRAs for the Severn RBD on the map below. There are 5 in England from river and sea flooding, which are Gloucester, Henley-In-Arden, Bristol, Bath and Weston-Super-Mare. There are 4 in Wales from all sources of flooding, which are Monmouthshire, Cardiff, Newport and South Wales Valleys.

Figure 15. Flood risk areas in the Severn RBD



Next steps

Natural Resources Wales and the Environment Agency will produce flood risk and hazard mapping by the end of 2019 and FRMPs by the end of 2021 for FRAs to meet our requirements under the Regulations. FRMPs must include objectives and measures to address the risks within FRAs. FRMPs will help us prioritise our flood risk management interventions for people, the economy and the environment (including cultural heritage) by focussing our efforts on those communities with the greatest risk from flooding.

In England, the Environment Agency will work with LLFAs to produce flood risk and hazard mapping. They will also need to do this for FRAs from surface water, smaller watercourse and groundwater flooding.

In Wales, NRW will work together with LLFAs to produce flood risk and hazard mapping. Then they will produce a FRMP for each RBD in Wales: Severn, Dee and Western Wales that cover all sources of flooding.

We will continue to work together through the Wales/England Cross border group to oversee our work under the flood risk regulations 2009 and ensure it is joined up and seamless.

There is ongoing work that will inform the future work we need to do. This could mean that the results look different to ones we have presented in this PFRA. The content of the PFRA will not change, but work to complete the flood risk and hazard mapping as well as the FRMPs will take account of the most up-to-date and relevant data and information. This work will include:

- updated UK climate projections, that are due in late 2018
- updating reservoir flood mapping, which should be available by the end of 2019
- flood investigations into any major flood events that change our national understanding of flood risk
- local updates to floodplain models, that will inform updates to the NaFRA/ NFRA and the Wales Flood Risk Assessment
- a major revision to the Wales Flood Risk Assessment has recently been completed. NaFRA in England will also be undergoing a major revision with results of this work available in 2021

Information collected for the PFRA and identifying FRAs will be also be useful for informing other plans and strategies. For example, it could be used by local planning authorities to inform strategic flood risk assessments/ strategic flood consequence assessments for local plans.

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12. Glossary

Communities at Risk (CaRR)

A tool used in Wales to identify and rank communities at risk from all sources of flooding.

Department for Environment, Flood and Rural Affairs (Defra)

Government department that sets policy for flood and coastal management in England.

Environment Agency

The Environment Agency oversee flood risk management in England.

Floods Directive

This is European legislation that sets out how we need to identify, map and plan for flood risk management work. This was put together after the major and devastating floods that affected central Europe in the early 2000s.

Flood Risk Area (FRA)

Areas where the risk of flooding is significant nationally for people, the economy or the environment (including cultural heritage). We report these to the European Commission and need to do further work in these areas under the Flood Risk Regulations.

Flood Risk and Hazard Mapping

We need to produce maps showing the distribution of flood risk and hazard (how deep water is and how fast it flows) for Flood Risk Areas by the end of 2019.

Flood Risk Management Plan (FRMP)

We need to produce a plan for each Flood Risk Area that sets out what we want to achieve when we manage flood risk and how we will do that by the end of 2021.

Flood Risk Regulations

This is legislation that sets out how we need to meet the European Floods Directive in England and Wales.

Listed Building (LB)

These are buildings, objects or structures that are considered to be nationally important for their architectural or historic interest. They are included in a special register called the 'List of Buildings of Special Architectural or Historic Interest'.

Lead Local Flood Authority (LLFA)

There are County, Unitary or Metropolitan Boroughs that are responsible for managing flooding from surface water, smaller watercourses and groundwater such as Staffordshire County Council, Birmingham City Council and Walsall Metropolitan Borough Council. There are 152 in England and 22 in Wales.

National Flood Risk Assessment (NaFRA)

The Environment Agency undertake a national assessment of flood risk from rivers and the sea that takes into account flood defences and the condition they are in. We publish a summary of this on the government website called the Risk of Flooding from Rivers and the Sea map.

National Receptor Database (NRD)

A database that contains information on property types. It can be displayed in mapping software and used for analysis.

Natural Resources Wales (NRW)

Natural Resources Wales oversee flood risk management in Wales.

Preliminary Flood Risk Assessment (PFRA)

These consider past and potential future floods that have had significant consequences to human health, the economy, the environment and cultural heritage.

River Basin District (RBD)

These are large river catchments in England, Wales and Scotland and we report at this scale to the European Commission. They cover an entire river system, including river, lake, groundwater, estuarine and coastal water bodies.

River Basin Management Plan (RBMP)

River Basin Management Plans set out how organisations, stakeholders and communities will work together to achieve an improved water environment for each River Basin District.

Regional Flood and Coastal Committee (RFCC)

These are regional committees made up of a government appointed Chairperson, local Councillors and people with special and relevant skills that make decisions about regional funding for flood defences.

Risk Management Authority (RMA)

Risk management authorities are defined in the Flood and Water Management Act (2010). They include the Environment Agency, local authorities, water companies, Internal Drainage Boards and highways authorities.

Special Areas of Conservation (SAC)

Special Areas of Conservation are protected by the European Habitats Directive because they have habitats that are important internationally.

Strategic Flood Consequence Assessment (SFCA)

Strategic Flood Consequence Assessments are done by Local Planning Authorities in Wales to inform local planning policies and allocate sites through Local Development Plans.

Strategic Flood Risk Assessment (SFRA)

Strategic Flood Risk Assessments are done by Local Planning Authorities in England to inform local planning policies and allocate sites through Local Plans.

Welsh Flood and Coastal Erosion Committee

The Committee provides high level advice on the strategic direction of flood and coastal erosion risk management in Wales, working closely with Risk Management Authorities and the Welsh Government.

Welsh Government (WG)

The devolved government for Wales that sets flood and coastal management policy in Wales.

Welsh Local Government Association (WLGA)

The Welsh Local Government Association represents the interests of local government and promotes local democracy in Wales.

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