Managing flood and coastal erosion risks in England

1 April 2015 to 31 March 2016

Report by the Environment Agency

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

Acting to reduce the impacts of a changing climate on people and wildlife is at the heart of everything we do.

We reduce the risks to people, properties and businesses from flooding and coastal erosion.

We protect and improve the quality of water, making sure there is enough for people, businesses, agriculture and the environment. Our work helps to ensure people can enjoy the water environment through angling and navigation.

We look after land quality, promote sustainable land management and help protect and enhance wildlife habitats. And we work closely with businesses to help them comply with environmental regulations.

We can't do this alone. We work with government, local councils, businesses, civil society groups and communities to make our environment a better place for people and wildlife.

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Executive summary

December 2015 brought successive storms, record level rainfall and river levels, all leading to widespread flooding across the North of England. This was devastating for the 17,000 homes and businesses which were hit by the flooding. Since then, there has rightly been much focus on helping those affected communities to recover and on repairing flood defences.

Flood risk assets also protected around 12,500 properties during floods in early December and about 10,900 over the Christmas period. Without them, the damage to lives and livelihoods would have been very much worse. This is why efforts have continued throughout the year to deliver the planned programme of new flood schemes. The Environment Agency, local councils and internal drainage boards completed 173 schemes during the year, reducing flood risk to almost 49,000 homes and coastal erosion risk to over 5,500 homes. This work is all part of the 6 year investment programme which will reduce flood and coastal erosion risk to 300,000 homes by March 2021. This was also a good year for improving the environment through flood and coastal erosion risk management work, with 693 hectares of habitat having been created or improved.

Part of the government's response to the flooding was the announcement of a £75 million fund for the restoration and repair of flood defences. This included £10 million to repair the Foss Barrier, which was damaged during the storms.

2015 to 2016 also saw the publication of flood risk management plans. These, along with updated river basin management plans, sit along shoreline management plans. Together they set the direction for flood and coastal risk management helping to secure a long-term integrated planning approach and partnerships which are so important in managing the risks we face effectively.

Together the government and risk management authorities are reviewing the lessons learnt from 2015 to 2016 and building them into the future of flood risk management. Work is already underway to strengthen our collective capacity to respond to future incidents, to increase the resilience of our communities and businesses and to understand how best to face the extremes that climate change may bring.

Sir James Bevan KCMG

Chief Executive

Emma Howard Boyd

Chair

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1. Introduction

This report summarises flood risk management activities carried out by the flood risk management authorities of England (as defined by the Flood and Water Management Act 2010) during the period April 2015 to March 2016. Responsibility for managing flood and coastal erosion risks rests variously with the Environment Agency, lead local flood authorities (LLFAs), district councils (where there is no unitary authority), internal drainage boards (IDBs), water and sewerage companies and Highways England.

1.1. Scale of risk of flooding and coastal erosion

Properties in areas at risk from flooding

Taking account of new flood risk management schemes and detailed modelling studies, the Environment Agency has continued to improve its provision of flood risk information.

The Environment Agency estimates the number of residential and non-residential properties in areas at risk of flooding to be:

- 2.7 million properties in areas at risk of flooding from rivers and the sea (see table below)
- 3.2 million properties in areas at risk of flooding from surface water (see table below)
- approximately 660,000 properties in areas at risk of flooding from both surface water and rivers and / or the sea
- between 122,000 and 290,000 properties in areas at risk of flooding from groundwater (not including properties also in areas at risk of flooding from rivers and the sea, but may include properties also in areas at risk of flooding from surface water)

The very small increase in the number of properties in areas at risk of flooding from rivers, the sea, and surface water over the previous year result mainly from improving and updating the property dataset used to establish numbers of properties at risk of flooding.

Level of risk	Number of properties in areas at risk of flooding from rivers and the sea	Number of properties in areas at risk from flooding from surface water
High	271,000 (169,000 residential)	324,000 (239,000 residential)
Medium	542,000 (375,000 residential)	504,000 (395,000 residential)
Low	1,747,000 (1,372,000 residential)	2,353,000 (1,879,000 residential)
Very Low	105,000 (79,000 residential)	Not assessed
Total	2,641,000 (1,995,000 residential)	3,181,000 (2,513,000 residential)

Table 1 Numbers of properties in areas at risk from flooding

The levels of risk used to compile this information are based on a percentage of risk of flooding in any year. The categories are:

- high - greater than a 3.3% chance of flooding in any given year
- medium - between a 3.3% and 1% chance of flooding in any given year
- low - between a 1% and 0.1% chance of flooding in any given year
- very low - less than a 0.1% chance of flooding in any given year

These figures include non-residential properties such as churches, businesses, public houses, schools and offices. No breakdown for properties in areas at risk of flooding from groundwater is available.

Properties in areas at risk from coastal erosion

The coast is a particularly dynamic environment and coastal change through erosion or permanent inundation has always been a risk for those living and working by the sea. Isostatic rebound (the 'rebalancing' of land mass in the UK since glacial retreat at the end of the last ice age) exacerbates this slightly in the south and east of England. However, sea level rise caused by climate change is a critical factor influencing rates of coastal erosion by the sea, especially in areas of sedimentary geology on the east and south coasts of England. Uncertainty about the rates of sea level rise means uncertainty about coastal erosion risk, especially over long timescales, up to 100 years or more.

The Environment Agency estimates that over 700 properties (more than 250 residential) could be lost to coastal erosion by around 2030, and over 2000 (more than 950 residential) could be lost by around 2060. These estimates take into account the interventions proposed in shoreline management plans (SMPs). Without the interventions, such as beach or sea wall maintenance and the building of new defences, these figures could increase to about 5,000 properties (more than 3,400 residential) by 2030 and about 28,000 (more than 20,000 residential) by 2060. District councils or unitary local authorities act as coastal risk management authorities in coastal areas. They lead on preparing many of the SMPs and constructing and maintaining coast protection defences where appropriate.

The erosion risk information used by the Environment Agency is currently being updated in partnership with local authorities in light of the erosion events experienced in 2013 to 2014, but the above predictions are unlikely to change significantly.

1.2. Legislation updates

Flood Risk Regulations 2009

The Flood Risk Regulations transfer into UK legislation the requirements of the 2007 EU Floods Directive and provide a consistent approach to managing flood risk across Europe. On 30 October 2015, following the public consultation on the draft flood risk management plans (FRMPs) the previous year, the Environment Agency published two consultation response documents:

- a joint River Basin Management Plan and FRMP consultation response document[1], outlining the key themes and changes
- a FRMP consultation feedback summary document[2], summarising consultation feedback

The Environment Agency then published the 1st cycle of FRMPs[3] on 17 March 2016 (see Section 4.1).

Flood and Water Management Act 2010

The Flood and Water Management Act 2010 enacts proposals from previous government strategies relating to water and flood risk management. It also takes account of the government's response to Sir Michael Pitt's review of the summer 2007 floods.

The act aims to provide better, more comprehensive management of flood risk - including reducing flood risks associated with extreme weather - and to protect water supplies for consumers.

During 2014 to 2015, Defra (the Department for Food, Environment and Rural Affairs) commissioned an external evaluation of the local flood risk management aspects of the Flood and Water Management Act 2010. The aim of this review, 5 years following the introduction of the act, was to look at the local flood risk management elements and assess whether the act is achieving its ambitions.

This year, as a result of carrying out the evaluation, Defra has been able to:

- work with stakeholders to develop an action plan for local flood risk management, in line with the recommendations of the Committee on Climate Change
- prepare a post-legislative scrutiny memorandum for the Environment, Food and Rural Affairs (Efra) Select Committee, which includes a preliminary assessment of how well the act has met its objectives
- undertake a statutory review into the Flood Risk Management Overview and Scrutiny Committee (England) Regulations 2011

In addition, Defra has published a scoping review of LLFA investigations of flooding events undertaken and published as required by section 19 of the act. This study assessed the principal factors contributing to flooding from surface water in England and Wales since 2010, and their prevalence.

Defra will publish the local flood risk management action plan, the post-legislative scrutiny memorandum, and the post implementation review of the Flood Risk Management Overview and Scrutiny Committee (England) Regulations 2011 during 2017.

Environmental Permitting Regulations

Environmental Permitting Regulations came in to force in April 2008, and provide a single, common, risk-based framework for permitting and compliance. They initially covered pollution control, such as water discharges and waste management. The Water Act 2014 provided new powers to expand this to enable the regulations to be used for other aspects of regulation in the water environment.

During 2015 to 2016, the Environment Agency prepared for the transfer of flood defence consenting into the environmental permitting regime from 1 April 2016. Part of government's 'better regulation' initiative, this move aims to help reduce costs and administrative burdens on customers. Work carried out during 2015 to 2016 included:

- supporting Defra in laying the Environmental Permitting (England and Wales) (Amendment) (No. 2) Regulations 2016 before Parliament
- carrying out a public consultation on charges for permitting for flood risk activities
- developing new guidance and application forms for customers
- establishing a new IT system for recording and managing permit applications and providing guidance and training for staff

Moving more of the Environment Agency's regulatory activities to within the environmental permitting framework provides for a greater consistency of approach across different types of permitting, so giving more clarity and simplicity. It also allows the Environment Agency to focus its main regulatory effort on those activities which pose the greatest environmental risk. This is not only a great benefit for customers, but is also better for the environment.

2. Flooding and coastal erosion during 2015 to 2016

Summary

The lasting memories of 2015 to 2016 will be of significant flooding experienced in many parts of the country, associated with the ‘atmospheric river’ of storms coming in from the Atlantic. Over 17,000 properties were flooded, while defences protected around 12,500 properties during floods in early December and about 10,900 over the Christmas period.

In late spring and early summer 2015, the overall risk of flooding across the country was very low. During the summer months, flood risk increased due to summer thunderstorms, a typical weather pattern for the UK. These storms caused significant surface water flooding in Kent, parts of East Sussex and Brighton and Hove, particularly around the 15 and 16 August 2015.

As autumn approached, more severe weather patterns became prevalent, influenced by the unusual warmth of the north west Pacific Ocean and the southern part of the north Atlantic. These factors helped create warm, moisture laden air flows, brought towards the UK on stronger than usual jet streams.

Figure 1 Appleby-in-Westmorland, Cumbria

The end of autumn saw prolonged and successive periods of heavy rain, saturating the ground and leaving areas susceptible to flooding in the event of further rainfall.

In November, this led to widespread flooding, including the first Cumbria flood of the winter.

December 2015 was a record breaking month. It saw:

- the wettest calendar month for the UK since 1910, and the wettest 2-month period on record
- highest rainfall record for the UK on 5 December, reaching 341.4 mm on the Honister Pass, Cumbria
- the highest 48 hour rainfall record for the UK, reaching 405 mm in Thirlmere, Cumbria, in just 38 hours

In response to the flooding across northern England, the Environment Agency redeployed around 350 staff and moved about 5 kilometres of temporary defences to affected areas. Fire services and the Environment Agency provided 425 mobile pumping units available to strategic command centres and over 700 military personnel supported flood response efforts across the country. This included use of a chinook helicopter to help dam a flood defence at Croston.

In addition to the flooding, the Environment Agency also had to manage many regulatory and environmental consequences. For example, during the flooding in early December, around 70 sewage treatment works were flooded.

The storms on the 5 and 6 December 2015 were felt most in Cumbria and Lancashire, where record rainfall levels combined with already saturated ground to cause widespread flooding. Some of the most affected communities included Carlisle, Kendall, Cockermouth, Keswick, Appleby-in-Westmorland, Morecambe and Lancaster.

Figure 2 Flood warnings and alerts, 6 December 2015

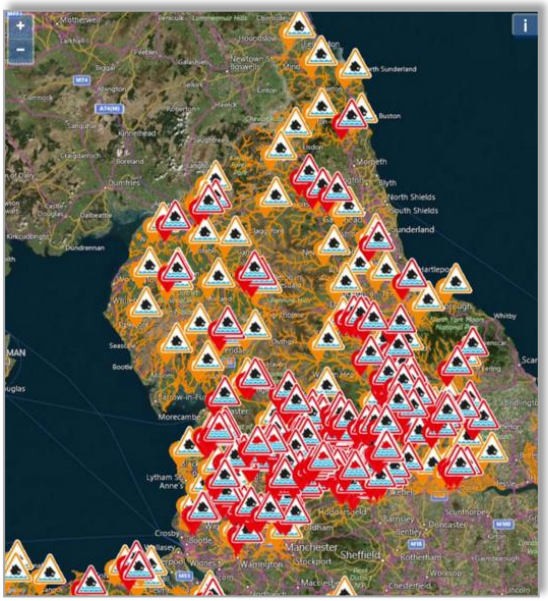


Figure 3 Summerseat Pub near Bury, Lancashire

A series of Atlantic lows in early and middle December brought sustained wet weather to the west and north of England, including storms on Christmas Eve and Boxing Day. The rain on Boxing Day led to serious flooding across parts of Lancashire, north Manchester and West Yorkshire.

Power cuts affected 20,000 homes and there was severe flooding across the Pennines, for example in Mytholmroyd and Hebden Bridge (West Yorkshire).

As floodwaters moved downstream, thousands of properties were subsequently flooded in north Manchester, York, Leeds and surrounding areas.

The rain-saturated ground meant that catchments remained vulnerable to further flooding well into the new year. In early February 2016, a combination of high tides and gale force winds affected the south west of England. Trash screens were overtopped in Portreath, Cornwall, and localised flooding affected travel routes.

The seriousness of the winter flooding led to the then Secretary of State for Environment, Elizabeth Truss MP, announcing a National Flood Resilience Review, aimed at better protecting the country against future flooding and extreme weather events. The cross-government review team were to look at how flood risk is calculated, 'worst case' scenario planning, impacts of climate change and the risk to nationally significant infrastructure.

Separate from the main winter flooding period, localised flooding occurred in various places in England between April 2015 and March 2016. Approximately 550 properties were reported as flooded, with about 230 being from river or sea flooding and 320 from surface water or a combination of sources. These figures may not include those from small, localised flooding and subsequent investigations may lead to a revision of the figures.

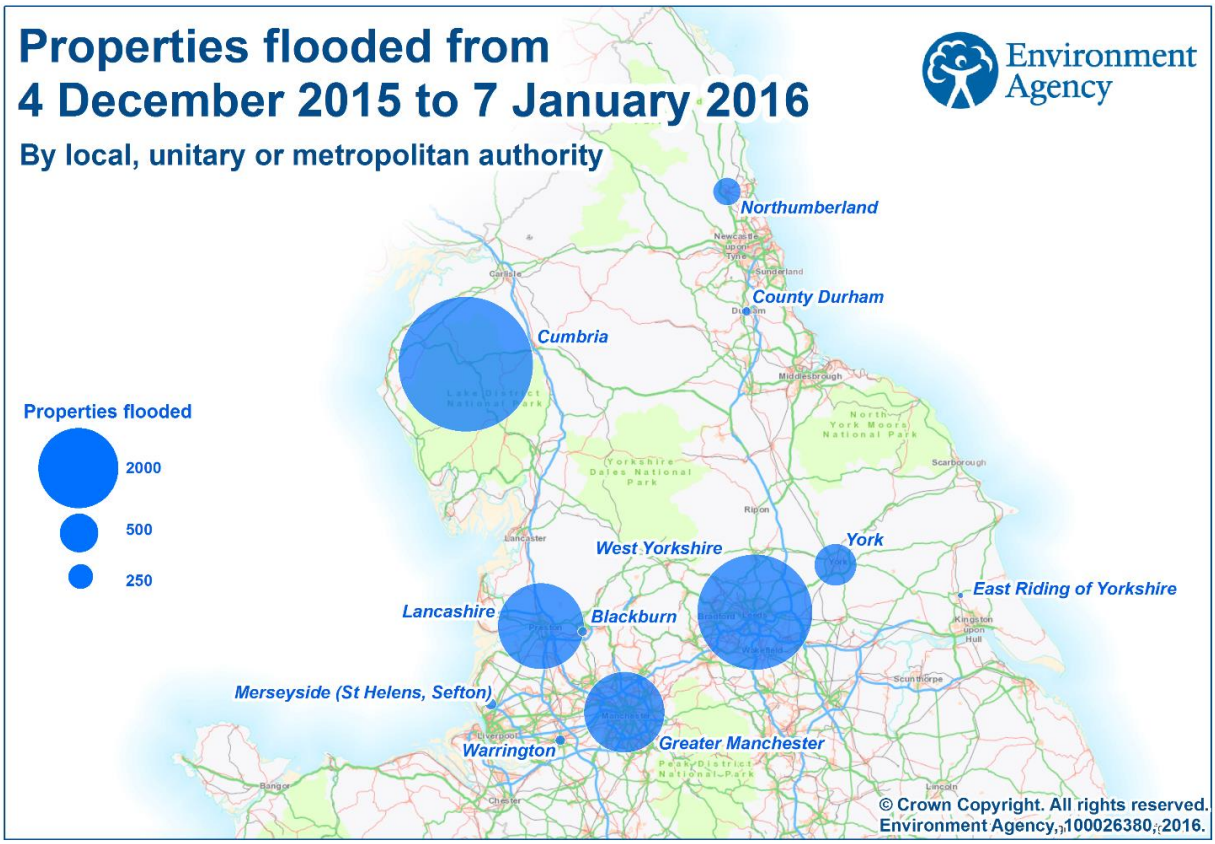


Figure 4 Areas and numbers of properties affected by flooding in December and January, larger dots signify higher property numbers

Throughout the year, the Flood Forecasting Centre produces a daily flood guidance statement for emergency responders. This sets out flood forecast information for 5 days ahead. The statements highlight the risk from river, groundwater, coastal and surface water flooding. A 'red, amber, yellow and green' risk system helps identify the risk, with more detail included on both how likely flooding might be, and the impact of that flooding.

The periods of peak flood risk during 2015 to 2016 are reflected in the numbers of times the Flood Forecasting Centre's flood guidance statements were at low (yellow) or amber (medium) or red (high) risk status, as shown below.

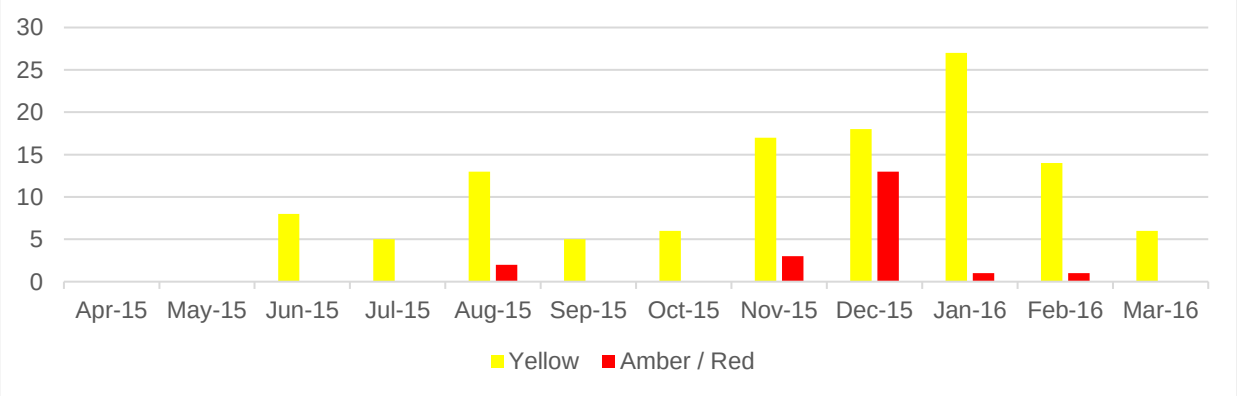


Figure 5 Number of days per month when Flood Guidance Statements showed overall flood risk at yellow or above

2.1. Flood warnings issued

Flood warnings and alerts are issued to help people prepare for flooding. There are 3 categories of flood warning:

- flood alert - meaning flooding is possible, so be prepared
- flood warning - meaning flooding is expected, immediate action is required
- severe flood warning - meaning there will be severe flooding and a possible danger to life

During this year, 4,717 flood alerts and warnings were issued to over 1.2 million properties, as well as 108 severe flood warnings to over 18,000 properties. Almost all of the severe flood warnings were issued in November and December, reflecting the scale of events during this period. Two severe flood warnings were issued in February 2016 linked to risks posed by combined astronomical high tides and gale force winds. The numbers of each type of warning and alert issued each calendar month during 2015 to 2016 are shown below.

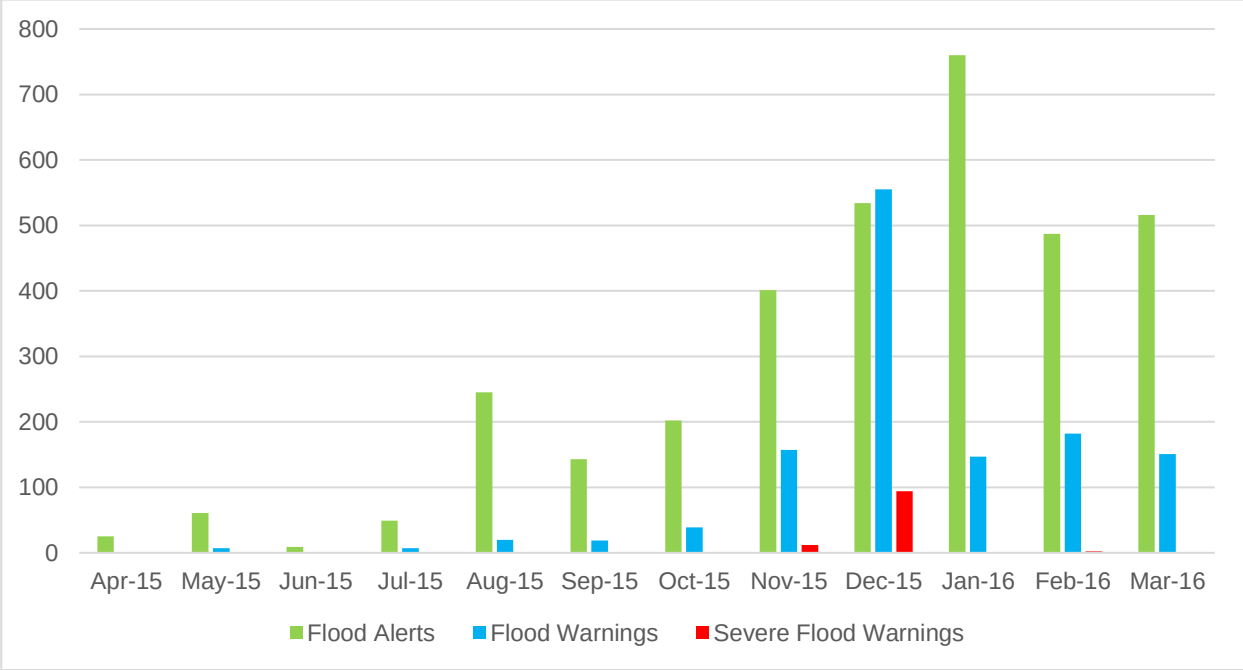


Figure 6 Flood alerts and warnings issued

2.2. Economic impacts of flooding

The Environment Agency estimates the economic costs of the significant flooding in December 2015 and early January 2016 to range between £1.3 billion and £1.9 billion, with a best estimate of £1.6 billion. This includes, where data is available, estimated costs for damages to households, businesses, transport, utilities and flood infrastructure, as well as costs to local authorities, agriculture, tourism and wildlife and heritage sites.

These costs compare with the 2013 to 2014 winter floods (Costs and Impacts of the Winter 2013 to 2014 floods: report[4]), which have an estimated economic cost of £1.3 billion, and the summer 2007 summer floods (Costs of the Summer Floods 2007 in England report[5]) with an estimated economic cost of £3.9 billion (all figures in 2015 prices).

The Environment Agency will carry out additional verification of the winter 2015 to 2016 flood damage estimates as further data become available. There is inevitably a delay in identifying the true cost of national flood damages, as estimates rely on a large number of contributors. Many of these are in turn dependent on the lengthy process of gathering detailed technical assessments of damages and repairs from contractors and insurance loss adjustors.

3. Investing and improving

3.1. Income and investment during the year

During 2015 to 2016, the Environment Agency invested £741million on flood and coastal erosion risk management in England. Of this, £438 million was capital investment, including £123 million distributed to local councils and IDBs to deliver flood and coastal defence schemes that are local priorities. Defra provided £665 million in grant-in-aid.

Partnership funding

In 2015 to 2016, public and private partner contributions to Environment Agency-led flood and coastal erosion risk management projects totalled an estimated £31 million. Other risk management authorities raised an estimated £25 million in financial and in-kind contributions for projects they lead on. This takes the total partnership funding raised since April 2011 to £190 million, 54% for other risk management authority-led projects and 46% for Environment Agency-led projects.

The Environment Agency forecasts that over £300 million of partnership funding will contribute to projects between now and 2021, over £170 million of which has already been fully secured. This highlights the increasing levels of partnership funding that is being drawn in to contribute towards reducing flood risk in England. These contributions mean that many more projects can be completed than would be the case under government funding alone.

Sandwich tidal defences

The single largest flood risk management scheme in Kent in over 30 years, the Sandwich town tidal defence scheme supports growth of the local economy as well as reducing flood risk. It is also the first of its kind in terms of being delivered in partnership with both public and private finance.

The scheme follows development of the Pegwell Bay to Kingsdown Coastal Defence Strategy in 2008 and reduces risk to almost 500 homes and 100 businesses in Sandwich.

It also protects valuable infrastructure, including the main coastal access route, and important tourism and employment areas, such as those pictured here during flooding in 2013. The £24 million scheme was jointly funded by the Environment Agency, Kent County Council and Pfizer, who's local site is also a beneficiary. Work on the scheme started in 2013 and was completed in autumn 2015.

Local levy

Other sources of investment included £33 million in local levy provided by local councils to the 12 regional flood and coastal committees (RFCCs). Committees have invested £18 million and the remainder is being carried forward and is earmarked for future projects. Precepts from IDBs and general drainage charges also supplemented flood and coastal erosion risk management activities.

Incident and Recovery funding

Following the 2015 to 2016 winter floods, the government announced additional funding of £75 million to repair, restore and maintain priority flood risk management assets, including £10 million in York. The incident and recovery investment in 2015 to 2016 was £21.6 million, with the majority of the recovery programme due to be delivered in 2016 to 2017.

The recovery programme of repairs was delivered in addition to the planned capital programme for 2015 to 2016. In March 2016, the government announced an additional £700 million of funding for flood defences through to 2021. This included £150 million of capital funding for the areas badly affected by the December floods, notably York, Leeds, Cumbria and the Calder Valley and a £160 million boost to the maintenance budget.

The £270 million of additional funding provided by the government following the flooding in England during 2013 to 2014, was split across 3 financial years. This funding has now been fully used by the Environment Agency, local authorities and IDBs. With it they have funded urgent repairs, emergency related costs, maintenance and the repair of essential flood defence assets.

Efficiency savings

The Environment Agency actively makes efficiency savings, to achieve best possible value for the investment of public funds, as required by HM Treasury. Opportunities for improving efficiencies come from national level initiatives that allow operational improvements and localised project-specific activities. The efficiencies gained are recorded under specific categories so that their effectiveness can be evaluated. The efficiency categories include:

- innovation and value engineering, such as using innovative solutions, materials or construction methods in schemes to meet project objectives for less cost
- packaging similar projects together, including by geography, project type or timeframe, helping suppliers offer better value and maximising project management benefits
- using different contracting methods to spread risk and gain greater value
- controlling the scope of a project by challenging the agreement of original project scope and outcomes, and to any changes that are proposed during the project
- streamlining projects to ensure processes are completed as quickly and efficiently as possible
- standardisation of common components, enabled by the introduction of outcome-based specifications through the implementation of Building Information Modelling (BIM)

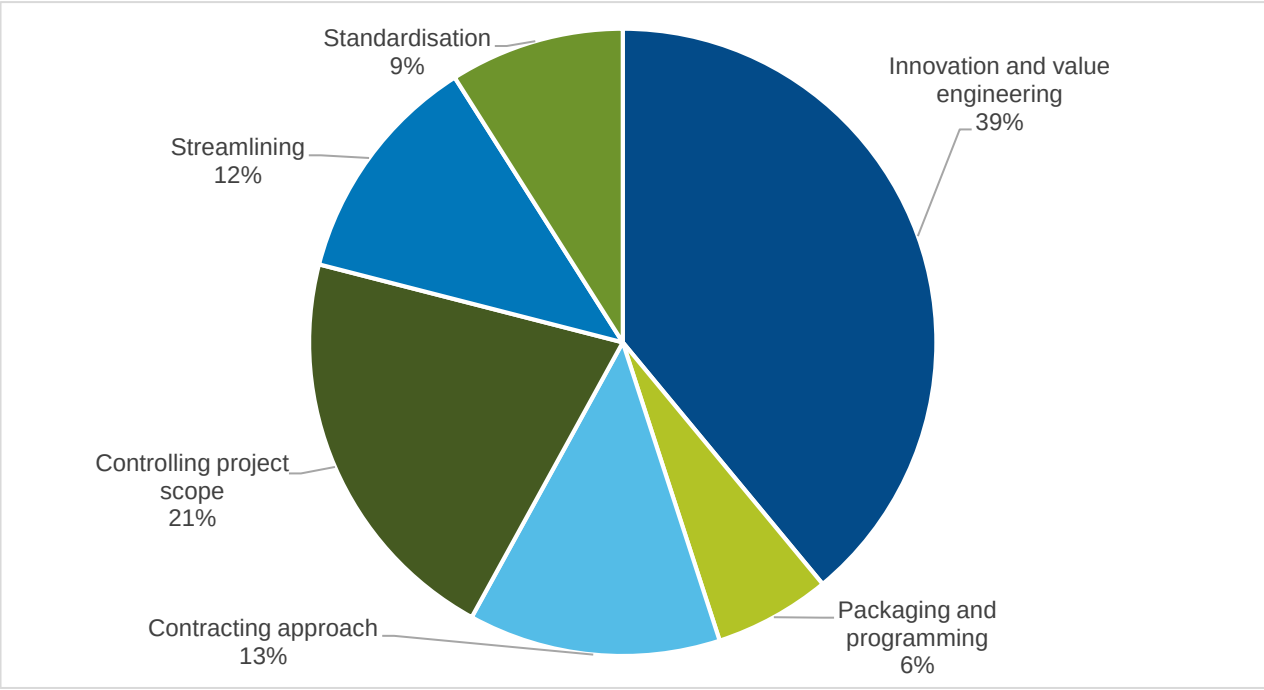


Figure 7 Efficiencies by category 2015 to 2016

3.2. Building, maintaining and improving flood and coastal erosion risk management schemes

Reducing risk to properties

Between April 2015 and March 2016, risk management authorities completed 173 schemes. The majority of schemes (85) were to address risk of river flooding. The remainder comprised schemes to address risk of flooding from the sea (26), surface water (35), coastal erosion (16) and mixed categories (11).

This work reduced flood risk for almost 49,000 homes, almost 12,000 of which are in areas of significant economic deprivation. In addition, over 5,500 homes are now at reduced risk of coastal erosion, almost 300 of which are in areas of significant economic deprivation.

Forecasts show that working with risk management authority partners, the Environment Agency is on track to complete schemes that will reduce flood and coastal erosion risk to 300,000 homes in the period April 2015 to March 2021.

Willerby and Derringham flood alleviation scheme

In June 2007, Hull and the Haltemprise area of East Yorkshire were flooded, with over 12,000 properties affected. As a result, East Riding of Yorkshire Council, in partnership with the Environment Agency and Hull City Council, developed plans to reduce flood risk across the area, including the Willerby and Derringham flood storage scheme.

During extreme rainfall events, these communities were susceptible to surface water flooding, due to the existing drainage systems being overwhelmed. Four new storage areas now slow and capture the flow, allowing the water to be released into the drainage system at a rate that doesn't cause flooding downstream. Together, the storage reservoirs and lagoons can store over 235,000 cubic metres of flood water and protect over 8,000 properties.

Whilst creating the lagoons, East Riding of Yorkshire Council found evidence of prehistoric tree-clearance and salt production, field systems and settlement remains. Among the artefacts found was a polished stone axe head believed to be from the Neolithic or Bronze Age period. The project was paused so these important relics could be documented and protected.

The project, completed during this year, was funded by £8.8 million of Flood Defence Grant in Aid and £4.8 million from the European Regional Development Fund.

Asset condition and maintenance

The Environment Agency maintains around 7,000 kilometres of raised walls and embankments on main rivers, around 1,000 kilometres of coastal schemes (for example, sea walls), about 22,600 structures (for example, pumping stations and sluice gates) and around 36,000 kilometres of watercourses. Local authorities, IDBs and private riparian owners are responsible for maintaining a further 1,700 kilometres of raised walls and embankments and around 9,600 structures.

Routine maintenance on flood and coastal risk assets prevents deterioration and ensures their operational readiness for flood incidents. The effectiveness of maintenance programmes is monitored by a risk based asset inspection programme. The Environment Agency aims to have 97% of its high consequence assets at or above target condition.

At the end of March 2016, 95.7 of high consequence assets managed by the Environment Agency were in target condition, compared with 96.6% the previous year. The change was a result of damage caused to defences during the significant flooding in winter 2015 to 2016, notably in the north and south west.

The Environment Agency's recovery programme of repairs will bring the assets affected in last winter's floods up to at least their pre-flood condition. By the end of March 2016, 19% of these repairs had been completed. The remainder will be completed before the end of autumn 2016. This will contribute to achieving the corporate target of 97% of assets at or above target condition by April 2017.

Reducing carbon footprint

The Environment Agency delivered a 35% reduction in its carbon footprint against its 2006 to 2007 baseline during 2015 to 2016, due to improvements in the carbon efficiency of temporary and permanent pumping systems. This was despite a sustained period of incident response across England during the winter of 2015 to 2016, which required significant energy input to manage water levels. The Environment Agency is now working towards an ambitious new sustainability plan, 'eMission', which sets out a target for a 45% reduction in carbon emissions by March 2020, compared to the baseline year of 2006 to 2007.

Lead local flood authority asset registers

The Flood and Water Management Act 2010 requires each LLFA to establish and maintain a register of flood risk assets and arrange for the register to be available to the public. In March 2016, 94 (62%) of the 152 LLFAs reported that their asset register was populated and available for inspection, compared with 83 (55%) last year. 56 (37%) authorities said work on their registers was in progress and only 2 (1%) said they had yet to start.

Reservoirs

Under the Reservoirs Act 1975, the Environment Agency is responsible for regulating the 1,800 third-party-owned large raised reservoirs in England. This is an increase of 5 since last year, as new or existing reservoirs have been registered for the first time. The Environment Agency also operates 213 large raised reservoirs, mainly for flood risk management purposes. This number has also increased by 4 since last year, due to the construction of new flood risk reservoirs. The act aims to ensure that dams and reservoirs are safe.

The Environment Agency published its 2013 to 2014 biennial report on regulatory and operational activities under the Reservoirs Act in May 2015. The next biennial report will be published in April 2017, covering the period 2015 to 2016.

The Reservoirs Act 1975 was amended by the Flood and Water Management Act 2010 in 2013, requiring the Environment Agency to designate a large raised reservoir as high-risk if it thinks that, in the event of uncontrolled release of water from a reservoir, human life would be endangered. Only high risk reservoirs will have to meet the full requirements of the Reservoirs Act in future.

The Environment Agency has completed the risk designation process for 1,754 of the 2,013 large raised reservoirs and expects that around 10% of them need no longer be designated high risk. These reservoirs will no longer have to comply with the full inspection and supervision requirements of the act.

Since 2010, the Environment Agency has published maps showing areas at risk of flooding in the unlikely event of a reservoir failure. These maps are intended for emergency planning purposes and can be used by the Environment Agency to support reservoir risk designation. During this year, the Environment Agency began a 2 year project to refresh these reservoir maps. The new maps will include:

- different scenarios representing different dam breach conditions

- flood extent, depth, velocity and hazard for each reservoir
- information to help reservoir owners, panel engineers and the general public to assess the possible consequences of dam failure
- information to help local authority spatial planners assess flood risk to a proposed development from reservoirs upstream

During 2015, there were only 2 reportable incidents at dams or reservoirs in England, compared with an annual average of 7. Reportable incidents are those where a failure results in a sudden and uncontrolled release of retained water, or where an emergency or precautionary draw-down of water or repair works are required. Operators are required to such incidents to the Environment Agency so that they can be investigated and lessons learned and shared.

Improving property and community resilience

Resilient communities, where people know, understand and accept their risk of flooding, are much better able to cope when flooding happens. Helping people protect themselves from flooding reduces both the extent and duration of the consequences. Property level resilience measures are practical tools that both help prevent water getting in and reduce the vulnerability of property to damage. During 2015 to 2016, Defra and the Environment Agency worked with others on projects to help improve property and community resilience. Actions included:

- A property level flood resilience grant scheme established by government as a part of the recovery package to help those affected by flooding during winter 2015 to 2016. This approach was first used as the repair and renew grant scheme in the aftermath of the 2013 to 2014 flooding, where around 6,000 householders benefited. The scheme is managed by local councils and provides up to £5,000 to help householders make repairs to their homes which will make them more resilient to future flooding.
- A flood repairable[6] research project undertaken by the University of West of England. Funded by Defra, the project is looking into adaptation of property through use of water resilient building materials. The research has already produced a list of around 140 approaches which might help reduce damage to property as a result of flooding.

In addition, learning and resources arising from the Defra Flood Risk Community Pathfinder Scheme carried out over the previous 2 years has been collated in a Community Engagement Hub[7] on the National Flood Forum website. The hub provides a wealth of information on property level resilience and on the individual pathfinder projects, which will help community groups and other authorities carry out projects in their own area.

Lancaster University's Flood Projects Research Team worked with children and young people in north Lincolnshire and in Surrey in a project to help them reflect on their experiences of being flooded. The outcome was a 'flood manifesto[8]' which outlined their ideas for action in areas of flood management, public health and education.

Agricultural land, commercial property and other assets protected

Analysis of project benefit areas show that flood and coastal erosion risk management capital schemes completed during the year provided improved protection to 11,500 commercial properties and around 75,000 hectares of agricultural land, of which 43,000 hectares were classified as grade 1 or 2. Over 150 kilometres of railway and around 1,845 kilometres of primary roads were also provided with improved protection.

3.3. Working with the natural environment

Creating and improving habitat

To meet requirements of the EU Habitats, Birds and Water Framework Directives (WFD), the Environment Agency, local councils and IDBs have worked to maximise the wider environmental benefits of flood risk management schemes. Through flood and coastal erosion risk work during 2015 to 2016 they have achieved a great deal, including:

- creating or improving 514 hectares of water dependent habitat
- creating 179 hectares of intertidal habitat

- Improving 21 kilometre of protected rivers

The Environment Agency and IDBs have also resolved barriers to eel (and fish) passage on 30 flood and coastal erosion risk management structures. This helps address Part 4 of the Eel Regulations 2009, which requires action to stop and reverse the decline in eel stocks in European waters.

Crossens pumping station

This station near Southport in North West England, has had a £5 million upgrade to make it fish and eel friendly.

The works included replacement of six of the existing pumps with eel-friendly axial pumps. Upstream of the site there is prime eel habitat and eel passes are included as part of the project. This means that the station is no longer a barrier to eels in either their upstream or downstream migrations.

The pumps have a combined output of nearly 20 cubic metres per second, this is one of the largest eel-friendly pumping installations in Europe. As well as protecting eels, the station reduces the risk of flooding to 660 properties.

In addition to meeting these legal requirements, risk management authorities have undertaken partnership projects with a range of wider environmental benefits, including:

- 13 projects to reduce the impacts of non-native species
- 114 projects to help protect priority species
- 27 projects to improve recreation or amenity sites

Partners in these projects have included the Angling Trust, Forestry Commission, National Trust, wildlife and river trusts, and the Royal Society for the Protection of Birds (RSBP).

Natural flood management

Natural flood management uses, restores or emulates the natural function of floodplains and the coast to manage flood risk and coastal erosion. Working with natural processes can include slowing the flow of rivers so that peak volumes are delayed or reduced, and creating saltmarsh to help absorb the impacts of waves on the shore.

Typically used in combination with traditional defences, natural flood management can offer a wide range of benefits in addition to reducing flood and coastal erosion risk. They can create important wildlife habitats, improve the local environment, and create recreation opportunities.

Natural flood management schemes have already demonstrated reductions in flood risk in places as diverse as the River Quaggy, in Lewisham, and Pickering Beck in Yorkshire. A joint plan involving the Environment Agency, Stockton-on-Tees District Council and the Forestry Commission will use natural flood management to create an upstream water storage area to support flood defences at Lustrum Beck, Stockton-on-Tees. The project will help reduce flood risk to around 150 properties. Natural flood management has also been incorporated into both the Cumbria Flood Action Plan and Calderdale Flood Action Plan, published in response to the winter flooding.

4. Understanding and reducing risk and minimising consequences

4.1. Strategic planning

Lead local flood authority local flood risk strategies

The Flood and Water Management Act 2010 requires all 152 LLFAs to develop, maintain and monitor strategies for managing local flood risk. Local flood risk includes flooding from surface water, groundwater and ordinary water courses.

By March 2016, 114 (75%) LLFAs said they had completed and published their local flood risk strategies, compared with 59 (39%) at the same time last year. 26 (17%) LLFAs said that public consultations on their draft strategies were either complete or underway, compared with 43 (29%) last year. Only 12 (8%) LLFAs said their strategies were in progress, compared with 50 (32%) last year. These 12 are:

- Council of the Isles of Scilly
- Derby City Council
- Gateshead Council
- Herefordshire Council
- London Borough of Barking & Dagenham
- London Borough of Barnet
- London Borough of Bexley
- London Borough of Hammersmith & Fulham
- London Borough of Haringey
- London Borough of Islington
- Redcar & Cleveland
- South Tyneside Council

The act also requires LLFAs to investigate flooding in their areas, publish results of their investigations and notify other relevant risk management authorities. Across all 152 LLFAs, over 950 investigations began during this year and over 150 were published. 16 authorities said they were each carrying out more than 10 investigations, with one carrying out 387 investigations. Many LLFAs initiated investigations following the winter flooding. Some authorities chose to do one or two investigations covering multiple communities and other local authorities chose to individual investigations for each affected community.

Flood risk, river basin and shoreline management planning

The river basin and flood risk management planning processes help identify common priorities and opportunities to manage water courses in ways which benefit people and wildlife. These 6 yearly plans, flood risk management plans[9] and updated river basin management plans[10] have now all been published.

FRMPs set out how risk management authorities will work together, and with communities, to manage flood and coastal risk for the 6 years ending in 2021. For the first time, FRMPs bring together information about all sources of flooding at a river basin and catchment scale, and the measures and actions being considered to manage the risk and improve resilience. Measures also detail how risk management authorities will incorporate climate change allowances into flood risk management works. Impacts from a changing climate will be considered in plans for location-specific works to reduce flood risk from all sources. This will help:

- identify where working with natural processes and natural flood management can help to reduce flood and coastal erosion risk
- catchments to adapt and become more resilient to the impacts of climate change

For each FRMP, a Strategic Environmental Assessment (SEA) and a Habitat Regulations Assessment (HRA) was produced and published. Following publication of FRMPs, the Environment Agency reported to Europe on the measures contained within each FRMP and will monitor implementation on progress annually.

The river basin management plans (RBMPs) set out the priorities for protecting and improving the quality of the water environment to achieve benefits for wildlife, the economy and to people's health and wellbeing. These plans form an important part of the collaborative and integrated approach to catchment planning for water which will help to achieve multiple benefits for biodiversity, water quality, water resources and flood and coastal risk management.

Shoreline management plans (SMPs) continue to guide long-term coastal management across England. These plans are now between four and ten years old, and for some the actions set out in them are now being reviewed. These reviews are informed by community engagement and coastal strategies such as those for the Wirral, the Suffolk coast around Lowestoft, the Humber and the Severn Estuary.

The national network of regional coastal monitoring programmes also informs SMP reviews. The national network of programmes has been in place since 2010, leading to efficiencies in procurement, better targeting of resources and improved sharing and use of information. This helps strategic planning, investment decisions and scheme design. After a successful first five years as a nationally co-ordinated programme, a new five year investment phase has been agreed that will cover a range of elements including bathymetry, aerial photography, ecological and LIDAR (light detecting and ranging) surveys. This initiative is considered a model of good practice internationally, with the French government now adopting a similar approach.

The coastal group partnerships between local authority and Environment Agency coastal engineers and advisers developed SMPs and continue to maintain them. They also run the regional monitoring programmes and share good practice. During this year, the Environment Agency and coastal groups have reviewed the objectives, membership, governance and activities of the coastal groups to ensure they remain an effective network to which partners can continue to commit. The review is expected to conclude in 2016.

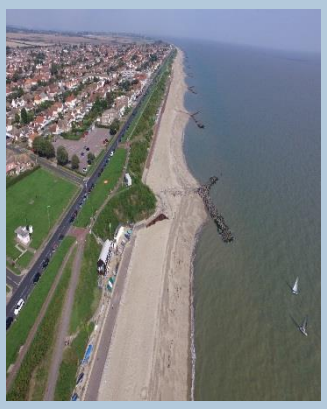
The 'no active intervention' policies in SMPs require coastal adaptation now and in the future. Defra is working with the Environment Agency and Local Government Association Coastal Special Interest Group to guide local authorities in helping communities to adapt to coastal change. The Environment Agency administers the coastal erosion assistance grant, which can provide £60,000 per year towards local authority costs of removing properties at imminent risk from erosion.

4.2. Development and flood risk

Clacton coastal defences

In 2008, Clacton's coastal defences were failing, and beaches were closed for safety reasons, cutting them off from public use. However, a strong partnership between Tendring District Council, the Environment Agency, Essex County Council, and Anglian Water worked jointly to deliver the new scheme.

The £36 million coast protection scheme involved 23 rock groynes and 900,000 cubic metres of beach nourishment. Over 3,000 homes have increased protection. Public access to the beach has been restored and the scheme now provides a platform for rejuvenation of this Essex coastal resort.



Implementing the National Planning Policy Framework

Government policy requires that, where development does go ahead in areas at risk of flooding or coastal erosion, it must be shown to be necessary, safe and resilient to flooding without increasing risk to others.

The Environment Agency does not object to development in flood risk areas where it complies with the National Planning Policy Framework. The vast majority of planning decisions are in line with Environment Agency advice. Examples of resilience measures which can permit development in a flood risk area include:

- having adequate flood risk mitigation, such as flood risk management schemes
- floor levels being above the expected flood levels
- demonstrating the safety of people in and around buildings

Each year the Environment Agency provides comments on applications and collects information about the outcome of planning applications to which it has objected. The outcomes recorded during each year do not necessarily match the initial objections made in the same period.

In 2015 to 2016 the Environment Agency provided detailed technical comments on 7,430 planning applications. It initially objected to 2,684 applications and continues to work with local planning authorities (LPAs) and developers to resolve issues so that, in many cases, the initial objection can be removed before a planning decision is made.

During 2015 to 2016, the Environment Agency was made aware of 2,015 outcomes of planning applications to which it had objected in the past. These included:

- initial objections that were later removed because a solution was found before the LPA made its decision
- sustained objections, where no solution could be found before the LPA made its decision whether to grant or refuse the application

Based on the 2,015 outcomes:

- across all development types, 96.8% of planning outcomes were in-line with Environment Agency flood risk advice
- for applications for development of new homes in 2015 to 2016, 99.7% of 66,132 new homes had planning outcomes in line with Environment Agency advice. Between April 2011 and March 2016 this was 99.6% of 315,804 new homes

Planning outcomes are counted as being in-line with the Environment Agency's advice when applications with flood risk issues have been:

- refused by the LPA

- withdrawn by the applicant before an LPA decision could be made
- found to be acceptable following further investigation, for example, when a suitable Flood Risk Assessment was provided by the developer
- redesigned by the developer to be more flood resilient following detailed discussions with the Environment Agency and other technical advisers

In 2015 to 2016 the Environment Agency sustained its objection on flood risk grounds to 32 appeal decisions. Of these 27 were dismissed and one was withdrawn. Of the four allowed, two were determined in-line with the Environment Agency's advice, and two appeals were decided contrary to Environment Agency advice (one partially mitigated Environment Agency concerns through the use of planning conditions).

During 2015 to 2016, no applications were called in by the Secretary of State for Communities and Local Government for determination for flood risk reasons under the 'Call in Direction[11]'. During 2014 to 2015 the Secretary of State for Communities and Local Government called in one application for determination for reasons including flood risk.

This was a revised and resubmitted version of an application previously called in during 2013 to 2014. A public inquiry into the submission was carried out in 2015 and on 6 July 2016 the Secretary of State published his decision to refuse the planning application for reasons including flood risk. This decision will be included in the statistics for 2016 to 2017.

Statutory consultee roles

In April 2015, LLFAs became statutory consultees on major planning applications with surface water drainage implications to ensure technical advice is available to local planning authorities (LPAs). LPAs continue to consult the Environment Agency on proposed developments in locations where the Environment Agency has notified the LPA of critical drainage problems, as well as those flood zones where the risks from sea and river flooding are greatest. These flood zones are defined as:

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map)
Zone 3b The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

Table 2 Flood zone descriptions

4.3. Working with other risk management authorities

Internal drainage boards

IDBs carried out a range of water level management works and operations during 2015 to 2016 to contribute towards reducing flood risk. As a result of local investment of an estimated £38 million during this period, in addition to grant-in-aid and other government funding, work included:

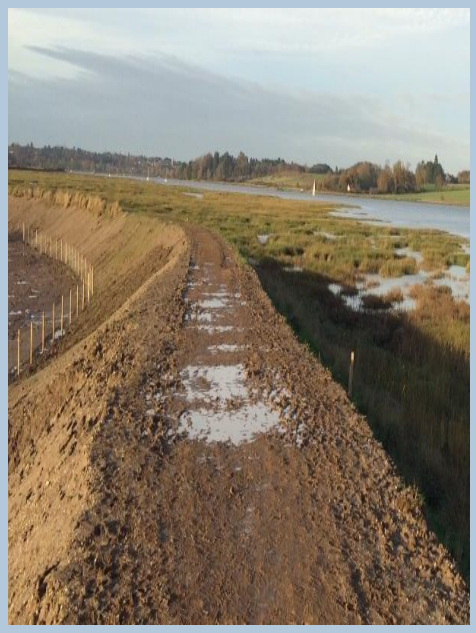
- channel maintenance works
- operation of pumping stations, sluices and other water level control structures
- new and improved flood management and land drainage infrastructure
- contributions to main river maintenance through the Environment Agency precept

These combine to provide important benefits to local landscape, communities and the environment, including the recovery of SSSIs.

Waldringfield community coastal defence

Following the tidal surge of December 2013, the community of Waldringfield on the Deben Estuary in Suffolk formed the Waldringfield Flood Defence Group. The group approached the East Suffolk IDB seeking support improve resilience along 1 kilometre of rural frontage that helps defend the village. The Group raised funds from a variety of sources, including the government's Coastal Communities Fund. The East Suffolk IDB and staff from the Water Management Alliance started the £309,000 project in February 2015.

The project enhanced the existing seawall and a pilot project to restore saltmarsh along the frontage added further natural flood protection to the seawall. The project also created 6 hectares of freshwater wetlands and suitable alternative habitat for water vole. This locally funded partnership project was completed in December 2015 and was praised as a model for affordable rural coastal defences in the future.



Partnership working between IDBs and the Environment Agency under Public Sector Co-operation Agreements continued during 2015 to 2016. The addition of 16 new agreements during the year brought the total in place at the end of March 2016 to 46, with a further 24 agreed in principle. These agreements across England include activities such as main river maintenance works, provision of mutual assistance during flood events and subsequent flood recovery works. The key benefit of these agreements is in finding the most effective local agent, resulting in more efficient working practices and more work on the ground to reduce flood risk for local communities.

Highways England

Since its creation in 2015, Highways England has continued to operate, maintain and improve the existing strategic road network under the commitments made in its Road Investment Strategy[12] and Delivery Plan 2015 to 2020[13].

The Road Investment Strategy identifies a ring fenced environment fund of £300 million to address environmental issues across the strategic road network. From this fund, Highways England will invest £78 million over the next 5 years to tackle commitments in the Flood and Water Management Act 2010 to improve flood resilience.

In its first year of operation, Highways England has developed projects which will help to:

- improve the resilience of the road network

- reduce the risk of flooding to communities adjacent to the network
- improve water quality by using sustainable drainage systems

Highways England is working closely with the Environment Agency to develop projects which will provide multiple benefits for communities and deliver value for money for the taxpayer.

An early success of partnership working is the construction of a new £6 million storage reservoir to protect Catterick Village and the A1 motorway from flooding in North Yorkshire. Highways England joined forces with the Environment Agency and North Yorkshire County Council to fund and design a scheme to significantly improve flood protection for around 165 homes and businesses and reduce the risk of flooding on the A1. The scheme is scheduled for completion in 2016.

As well as delivering the commitments made under the Road Investment Strategy, Highways England was also able to support Cumbria County Council's flood response effort during the winter storms. On 5 December 2015, a 4 mile stretch of the A591 between Grasmere and Keswick was closed following a landslide. Although temporary access was available for cyclists, pedestrians and a limited bus service, there was a lengthy diversion for other road users. Highways England's ability to procure and deliver repairs quickly meant that Cumbria County Council were able to reopen the road ahead of schedule.

Water and sewerage companies

Between April 2015 and March 2016, water and sewerage companies invested £102 million on new or improved schemes to reduce the risk of sewer flooding to properties. They have also invested a further £53 million maintaining the public sewer system to prevent blockages and flooding. In addition to major schemes, water and sewerage companies have invested a further £12 million in property-level protection and mitigation measures to reduce the likelihood of customers' homes experiencing sewer flooding.

These companies have worked with others this year to:

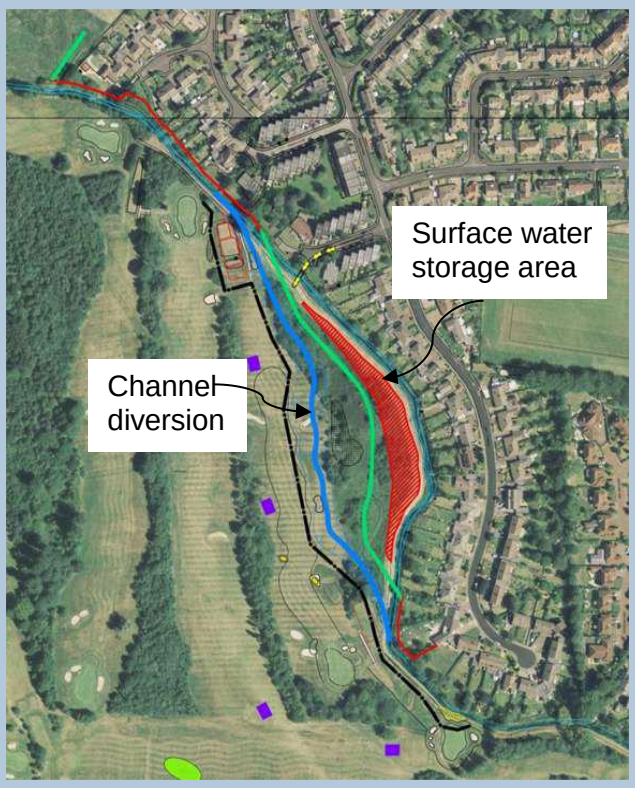
- support LLFAs with their local strategies and flood investigations
- share data to support flood risk assessments of multiple sources of flooding
- develop their drainage strategies to inform future investment
- deliver sustainable and innovative solutions to reduce flood risk and enhance the environment

Brunton Park integrated urban drainage scheme

Repeat flooding during heavy rainfall to about 100 homes in Gosforth was found to be a result of combining river, surface water and sewer flood flows.

A viable solution was found when Northumbrian Water proposed an integrated plan. This included diverting 360m of main river and using the original channel to create a 7,500 cubic metres storage area to manage excess water. A new river flood defence, 2 kilometres of surface water and foul sewers and an underground foul water storage tank completed the scheme.

By working together and jointly funding the project Northumbrian Water, the Environment Agency and Newcastle City Council were able to provide flood protection for the community, improve water quality and create valuable wetland habitat. The £7.3 million scheme[14] represents excellent value for money and a model for future collaborative working.



Water and sewerage companies' stronger relationships with other risk management authorities and partners have been important to their success, especially when engaging with communities and planning the delivery of outcomes. Their work with partners, landowners and farmers to find innovative solutions within river catchments to protect and enhance the water environment is also reducing flood risk to communities.

The water sectors' planned operational mitigation measures and asset recovery plans helped ensure essential water and waste water services were maintained during the severe winter flooding. The companies provided information on the resilience of their assets to flooding as part of the National Flood Resilience Review.

4.4. Improving access to information

Flood warnings

Flood warnings provide valuable time for those in affected areas to prepare for flooding. During 2015 to 2016, the Environment Agency expanded its warning services to provide over 1.2 million properties with a form of warning service. During 2017, more properties at the highest risk of flooding will receive direct warnings from the Environment Agency.

Contact has previously been predominantly through telephone landlines but, increasingly, people prefer to communicate on the move. Many customers now fully register for the flood warnings service using their mobile phone or device across mobile network operators.

To increase take-up of flood warning services available to mobile network users, the Environment Agency is working with mobile providers to register customers to the flood warning service on an opt-out basis. This means that those customers with addresses in flood warning areas could be automatically registered to the warning system.

Working with the mobile provider EE, the Environment Agency has added over 400,000 EE customers to the system, and is now working with O2, Vodafone and 3 to put similar data sharing arrangements in place. This could add a further 600,000 mobile phone users to the warning system.

Online information

During this period, the Environment Agency also made improvements to flood information on GOV.UK[15]. In response to customer feedback, the information now includes:

- easier and quicker searches for local flood information
- improved access and display of river and sea level information
- an improved 5 day forecast which replaces the previous 3 day service
- updated advice on what to do before, during and after a flood

These flood data are now being used more widely across other responder organisations, including the Red Cross 'emergency app' which has been downloaded over 10,000 times.

Flood awareness campaign

The Environment Agency's annual flood awareness campaign was carried out between 2 November and 13 November 2015. The campaign promoted the simple steps that people can take to protect themselves, their family, homes and businesses. In addition to inviting people to sign up for free flood warnings, it also asked people to check their flood risk using the flood maps and know what to do when a flood happens.

The campaign resulted in over 25,000 visits to the campaign website, and 529 downloads of the partner pack. 16,137 people checked their flood risk, 1,934 registered for warnings and 803 people completed a flood plan as a direct result of the campaign.

Open data

The Environment Agency has also released a range of flood and coastal erosion risk management datasets as open data. These include information on flood warning and flood risk as well as some of the underlying information to create models, such as terrain information captured using aerial light detecting and ranging (LIDAR).

There are already clear benefits of releasing data in this way, including:

- development of web applications
- communities using data to help protect themselves from flooding
- communicating flood risk to the public in a more accessible way

Making data open means that all users have the same access to data and are able to use it without charge or restriction. Data can be used for analysis or as part of wider projects or applications, and can create more opportunities for data to be accessed by a wider audience.

Research and development

The joint flood and coastal erosion risk management research and development programme is run by Defra, the Environment Agency, Welsh Government and Natural Resources Wales. The programme provides evidence, information, tools and techniques to flood and coastal erosion risk management authorities in England and Wales. It ensures that high quality science is being used to inform policy and practice.

The 2015 to 2016 programme produced the following outputs:

- modelling and mapping catchment processes[16] guidance which will help practitioners select the best tools to use when working with natural processes to reduce flood risk

- research into methodologies for estimating the costs and impacts of the winter 2013 to 2014 floods[17]
- A wave ensemble[18] product developed by the Environment Agency and the Met Office which provides different wave predictions given the uncertainty in the weather conditions to help flood forecasting in UK coastal waters.
- the understanding the benefits of flood risk management[19] project will help quantify the benefits of stakeholder engagement and mapping and modelling data
- the public perceptions of risk and risk communications[20] project investigated the types of communication with the public which are most effective in improving understanding of flood risk and encouraging people to take action
- new data and techniques developed in the quantifying incident management benefits[21] project produced tools which will help risk management authorities assess and compare potential benefits of different flood management options

The programme also began work during this period on projects which will be completed during 2016 to 2017. These include:

- a real-time inundation map[22] to look at options for transforming real-time flood forecasts into real-time flood impact and consequence information
- a new blockage management[23] guide which will set out options for assessing the risk of water courses being blocked by debris, help to clear blockages when they occur, and methods to identify and reduce future blockage risks
- new guidance on the inspection, maintenance and rehabilitation of old waterfront walls[24] produced in collaboration with the Construction Industry research and Information Association (CIRIA)

Alongside the achievements of the programme, the Environment Agency is connected to over 60 external research projects, which will inform future strategic thinking and operations.

5. Looking ahead

Risk management authorities collectively work on a continuous improvement basis, to ensure that lessons are learned from flood events and actions are taken to better protect communities at risk in the future. This year is no different. The significant flooding and its impacts during winter 2015 to 2016 have been cause for reflection on how flood and coastal risk is managed in England.

Several reviews and reports have come out of that process which will guide flood and coastal risk management work going forward:

- The Cumbrian Floods Action Plan[25], published in June 2016, was developed with the local community and sets out what the Environment Agency and partners are doing to reduce flood risk across Cumbria, focussing on integrated catchment planning.
- The National Flood Resilience Review[26], published in September 2016, commented on what went well during the response to these events, as well as identifying areas for improvement in future flood and coastal risk management, including improving resilience of national infrastructure; incident response, modelling and communication.
- The Bonfield Action Plan[27], published in September 2016, which sets out how businesses can make it easier for people to protect their homes from damage from flood water.

As well as these important reviews on longer term management of flood and coastal risk, plans have also been put in place to prepare for future flooding. The Environment Agency's actions have included:

- improving its own operational plans and resilience to become more responsive during incidents
- supplementing existing temporary defence capabilities to better support communities at risk
- updating its data gathering and presentation to enable faster and more accurate decision making

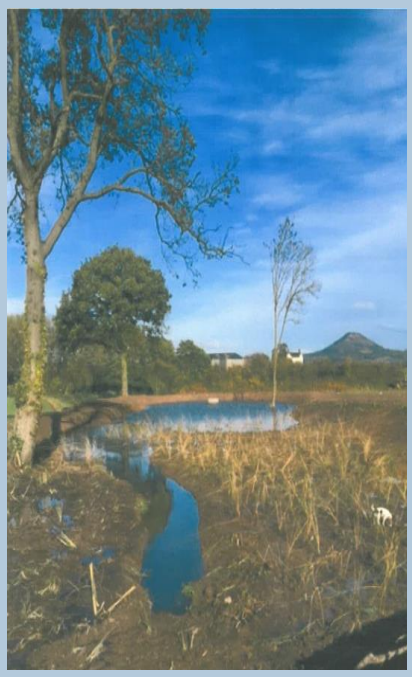
These activities - alongside implementation of measures in flood risk, river basin and shoreline management plans and confirmation of future funding scenarios - will all contribute to better flood risk management.

Severn Trent Environment Protection Scheme (STEPS)

During the next year, Severn Trent Water hopes to build on the success of their STEPS[28] project, launched in October 2015. The project aims to reduce pollutants entering groundwater and water courses and so improve drinking water quality. The scheme offers grants for land management and small infrastructure improvements, such as creating wetlands, buffer strips, cover crops, pesticide handling facilities and rainwater harvesting. Eligible farms can apply for grants of up to £5,000.

During its first 2 application rounds, Severn Trent awarded grants to over 280 farms. Successes include a Shropshire farm project to build a wetland and reed bed to slow farm run-off and treat sewage, which received a third of the £15,000 costs.

The first of its kind amongst water companies, STEPS is a great example of how working together achieves shared goals. Severn Trent are launching another round of applications from 1 January 2017 for 10 weeks. During this time they hope to increase awareness of the scheme and enable more environmental improvements.



Although it is difficult to link individual storms or floods to climate change, the scientific consensus is clear that climate change will alter weather patterns and increase the frequency and severity of extreme events, resulting in greater risks to the country. The Environment Agency published its second Climate change Adaptation Report[29] in 2016, setting out the steps the organisation is taking to plan for and mitigate against the effects of climate change and severe weather.

Their long term investment scenarios for flooding show that the expected annual damage caused by flooding could be reduced by 12% over the next 50 years despite climate change. The government has committed £2.5 billion to reduce flood risk to at least 300,000 households by 2021. This reduces risk by 5%.

Defra's 25 year Environment Plan provides a great opportunity to take a long-term view on how to protect and improve our natural resources. One important area for improvement is better management of rainfall in the natural environment. Managing the environment in an integrated way enables better decision-making by partners, informed by consideration of a broad range of issues. There are obvious benefits to managing water in a way that reduces both flood risk and water stress, and that delivers wider environmental benefits, by slowing the flow of water from the land into our rivers and smoothing the flow of the rivers themselves.

The focus of the flood and coastal risk management community has to be twin-track. On the one hand we need to improve what we do now, learning lessons from the recently published reviews and evolving our approach to work more effectively together. On the other we need to look further into the future so we ensure we are prepared for climate change, we benefit from integration and we continue grow the resilience of communities.

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- Crystal Moore, Russell Turner and Bridget Beer at the Flood Forecasting Centre
- Michael Whitehead and Joanne Morphet at Highways England
- Department for Environment, Food and Rural Affairs
- All 152 lead local flood authorities
- 10 water and sewerage companies operating in England (Anglian Water, Northumbrian Water, Severn Trent Water, South West Water, Southern Water, Thames Water, United Utilities, Welsh Water, Wessex Water, Yorkshire Water)

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