Draft National Flood and Coastal Erosion Risk Management Strategy for England

Vision: a nation ready for, and resilient to, flooding and coastal change – today, tomorrow and to the year 2100.

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Chair's foreword

A nation resilient to flooding and coastal change

The country has come a long way since 1953, when an East Coast storm surge killed over 300 people. In 2013, there were no fatalities during a much stronger surge because warnings, evacuation procedures, and flood schemes are much improved.

In recent decades, we have got much better at managing flood risk as a result of collaboration between governments, the Environment Agency, local authorities, Internal Drainage Boards, and local communities themselves. The government's 6 year, £2.6 billion flood and coastal defence programme means that the Environment Agency is on course to better protect a further 300,000 homes by 2021, but we must guard against complacency.

Climate change increases the risks and means we need to build on our progress, but we can't do so infinitely. It is not realistic to try to manage more increasingly intense flooding and sea level rise with limitlessly high walls and barriers.

One way the Environment Agency can help – as the Secretary of State said in his climate change speech in November – is to "explore new philosophies around flood and coast management". The draft strategy begins that process. The consultation gives you the chance to tell us how to raise our ambitions even higher.

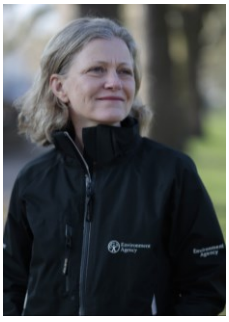
For every £1 spent on protecting communities from flood, around £9 in property damages and wider impacts is avoided. According to the Institution of Civil Engineers, over 45% of national infrastructure and construction up to 2020/21 will be financed through the private sector. We need a systemic shift in the way people think about investment.

We need to move from the concept of protection to resilience – property owners should be encouraged to build back better after a flood. This could involve home improvements such as raised electrics, hard flooring and flood doors.

That is an economic opportunity. Low-carbon, flood resilient planning and development in the right places will deliver long term returns for investors. It will also develop skills, technology, and expertise in the national economy and create jobs.

We believe the concept of standards for flood and coastal resilience is worth exploring. There needs to be a consistent approach to flood risk across the country but the tools for delivering it vary from place to place. This could include flood and coastal defences, natural flood management, ensuring new development is safe from flood risk, and adapting property so people can recover quickly.

If you haven't already, sign up for our free flood warnings and find out more from our flood campaign. Only 34% of people in flood risk areas believe their property is at risk. We need to build a nation of climate champions who understand their risk, are responsible for it, and know how to act on it.



Thank you to my colleagues and our partners for their work on this document.

Emma Howard Boyd, Chair

Introduction

Climate change is the biggest challenge we face. It poses the greatest threat to our economy, environment, health, and way of life. The increased risk of flooding and coastal change that it brings is significant.

The most recent climate change predictions confirm we will experience wetter winters and drier summers, with an increased likelihood of more intense rainfall leading to flooding. We can already see the impact of a changing climate, with increased flooding over the past decade, and summer heatwaves. In all climate futures, we'll experience a continued rise in sea level well into the next century. This will affect our coastline significantly.

Flooding of any kind is horrendous. Erosion destroys. They are dirty, invasive, damaging, and they can kill. They can force people to leave their homes and their businesses, cause prolonged mental ill health, and destroy livelihoods, natural habitats and other valued places. Even at their best, flooding and coastal change can be inconvenient and disruptive. The final FCERM strategy will apply to all risk management authorities and all sources of flooding and coastal change, such as flooding from rivers and surface water.

The scale of potential future flooding and coastal change is significant. Despite the positive work the Environment Agency and other risk management authorities are already doing we need to adopt a different philosophy. This will ensure that as a nation we take urgent and immediate action so that we can all live in **climate resilient places** that are able to manage and adapt to flooding and coastal change. Working alongside local people and partners, we need to act now without delay, but also plan to adapt to risks as they change. This is especially important given the time-limited commitments to the Flood Re insurance scheme, which are due to end in 2039.

As a nation, we need to be prepared for a 2°C rise in global temperatures, but plan for a 4°C rise. In November 2018 the Secretary of State for Environment, Food and Rural Affairs called for a new philosophy for managing all sources of flooding and coastal change. This strategy sets out how we will achieve this. The challenges the nation faces will affect everyone, so it's only right that everyone plays their part in working towards a climate resilient country.

We need sustained investment across society to prevent flood damage to properties and infrastructure in England increasing significantly. The Environment Agency estimates that as a nation we need an average annual investment of at least £1 billion in flooding and coastal change infrastructure over the next 50 years. (Environment Agency, 2019, long term investment scenarios). The cost of becoming resilient to flooding and coastal change can be spread between government, business and people by promoting sustainable investment in infrastructure, housing and the environment.

Traditionally, investment has been targeted at new flood and coastal infrastructure and its subsequent maintenance. While this will remain very important, we'll need a wider range of tools for creating climate resilient places. In combination, natural flood management offers opportunities to slow, store or filter floodwaters, while community resilience and preparedness can help individuals and communities recover after a flooding or coastal event.

There are many priorities for the nation – improving our environment within a generation, managing sustainable water supplies, and supporting sustainable economic growth. There are already significant numbers of properties in areas at risk from flooding and coastal

change, but as the population grows, we're likely to see the number of properties built on the flood plain almost double by 2065. (Environment Agency, 2019, long term investment scenarios).

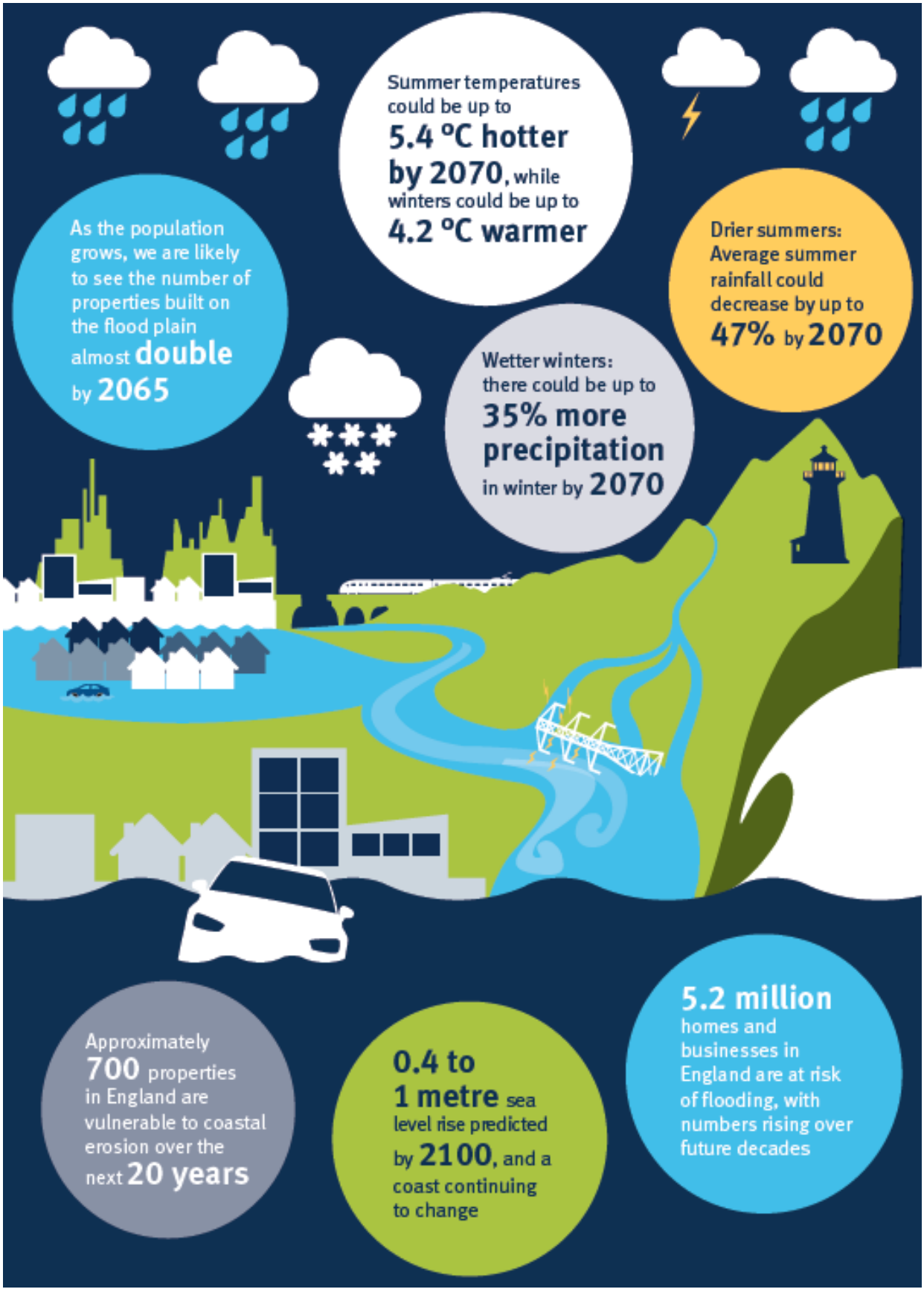


Figure 1: Current and future flood and coastal change risks (sources, Environment Agency, 2019 & Met Office, 2018, UKCP18 Headline Findings)

Making the right investment and planning decisions will be vital to keep pace with population growth and climate change. How we manage flooding and coastal change will help ensure that **today's growth and infrastructure is resilient in tomorrow's climate**.

We can't prevent every flood or change to our coast. Together people, businesses, public and voluntary sectors need to support each other to prepare for the unavoidable flooding and loss of homes to the sea. As climate change increases, we'll need to mobilise and empower **a nation of climate champions** that can better take responsibility for dealing with the risks posed by flooding and the erosion of our coastline.

We can tackle flooding and coastal change if we act now. Our vision is for **a nation ready for, and resilient to, flooding and coastal change – today, tomorrow and to the year 2100**.

Resilience includes accepting that in some places we can't eliminate all flooding and coastal change, and so we need to be better at adapting to living with the consequences. For example, by designing homes that can be restored quickly after they've been inundated with water, or potentially moving communities out of harm's way. It also includes plans to ensure we respond effectively during a flood, and that people and livelihoods can recover as quickly as possible.

This draft strategy paints a national ambition for England that can also work for local places. It recognises that every place is different – made up of different people, with different skills, needs and infrastructure, and in often very different environments. It embraces the idea that the best solution for a given place now is likely to look different in the future. It also recognises innovation may lead to new approaches to managing different climate issues or societal expectations.

Looking to the year 2100, the draft strategy aims to blend long term ambitions with shorter term practical steps. The focus of this draft strategy is on the objectives we should take forward as a nation over the next 10 to 30 years to help support the longer term ambitions for change needed by 2100. It also sets out shorter-term measures to achieve the strategy's objectives.

This draft strategy is not a policy document but a consultation by the Environment Agency, reflecting its own views and those we have heard from other stakeholders. Policy on flood and coastal erosion risk is for the government and the strategy will be finalised in the light of the consultation responses and the government's forthcoming national policy statement on flood and coastal risk before being submitted to the Secretary of State for Environment, Food and Rural Affairs for approval.

The Environment Agency will develop arrangements for the monitoring and reporting of the strategy's progress with risk management authorities. With the final strategy we will publish an action plan on how we will take forward the strategy objectives and measures with partners. The next assessment of progress and review of the strategy is planned for 2026 but the vision and approaches described within the draft strategy are intended to establish an approach capable of being pursued until 2100.

The final strategy will also sit alongside the Environment Agency's next 5-year action plan, due to be published in 2020.

Setting the context for the draft strategy

The impact of flooding and coastal change

England has a long history of flooding and coastal change, and as the frequency of these occurring increases, the way we manage these will need to change too.

Figure 2: Past flooding and coastal events in England

The changing landscape for flooding and coastal change

The original national flood and coastal change risk management strategy for England, published in 2011, provided the overarching framework for action by all risk management authorities to tackle all sources of flooding and coastal change, including surface water. Significant progress has been made and, on the whole, risk management authorities have met the original strategic objectives and measures. The progress is detailed in the Environment Agency's managing flood and coastal erosion annual risk annual reports. This draft strategy is a review of the strategy published in 2011.

Guidance was issued alongside the 2011 strategy for risk management authorities on sustainable development. The Environment Agency will update this guidance using the United Nations Sustainable Development Goals.

Boston Barrier

An example of how work contributes to sustainable development is the new Boston Tidal barrier in Lincolnshire. Due for completion in 2019, it will protect over 15,000 properties from coastal flooding. Although the project's primary aim is to reduce the risk of flooding to the town, there are significant other benefits which fit directly with the United Nations Sustainable Development Goals. It's a good example of the wider benefits that investment in flooding and coastal change can bring. For example:

- with improved protection, businesses can invest with more certainty, having a positive impact on the local economy
- it used sustainable and less environmentally damaging approaches, such as moving materials by sea rather than land, and working with Natural England and the Marine Management Organisation to dispose of dredged materials locally
- it enhanced the natural, built and historic environment for the benefit of local people and wildlife

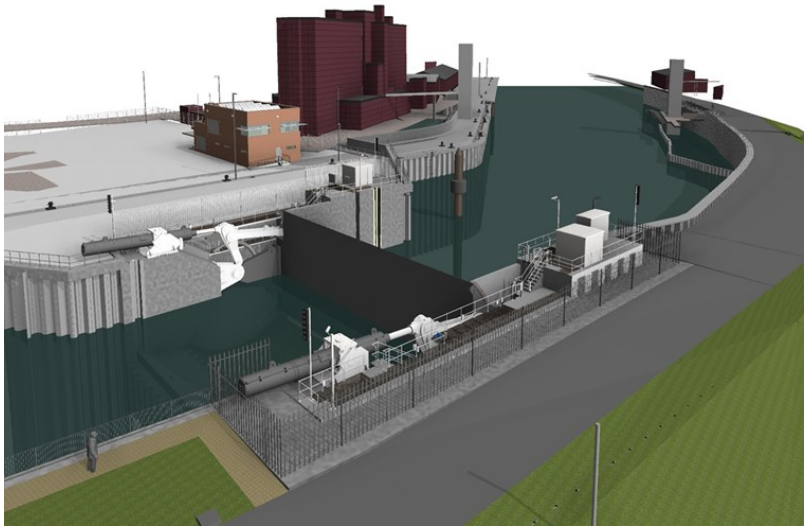


Figure 3: Computer graphic of the Boston Barrier, Lincolnshire

A lot has happened since 2011, including significant events such as the 2013 east coastal tidal surge, the 2013 to 2014 winter flooding in the south of England and the 2015 to 2016 winter flooding in the north of England. There's growing evidence of the impact of climate change from the UK Climate Change Risk Assessment 2017 and the updated 2018 UK Climate Impacts Projections.

There have been record levels of investment in the management of flooding and coastal change, with £2.6 billion of government funding going towards better protecting 300,000 homes between 2015 and 2021. (Environment Agency, 2019, flood and coastal erosion risk management programme 2015 to 2021). In addition the government's partnership funding approach has generated further significant investment from those benefitting from the programme. As of April 2019, partners have already contributed £486 million of funding which is making a significant contribution to the projects ensuring 300,000 homes are better protected by 2021. Over £170 million of further partner contributions have also been secured to better protect homes in the next flood and coastal change management programme due to begin in April 2021.

Government investment for flood risk management has also been made available from funds linked to local economic growth such as the funding from local enterprise

partnerships. Many infrastructure providers have also increased their investment to ensure the services they provide are resilient as well.

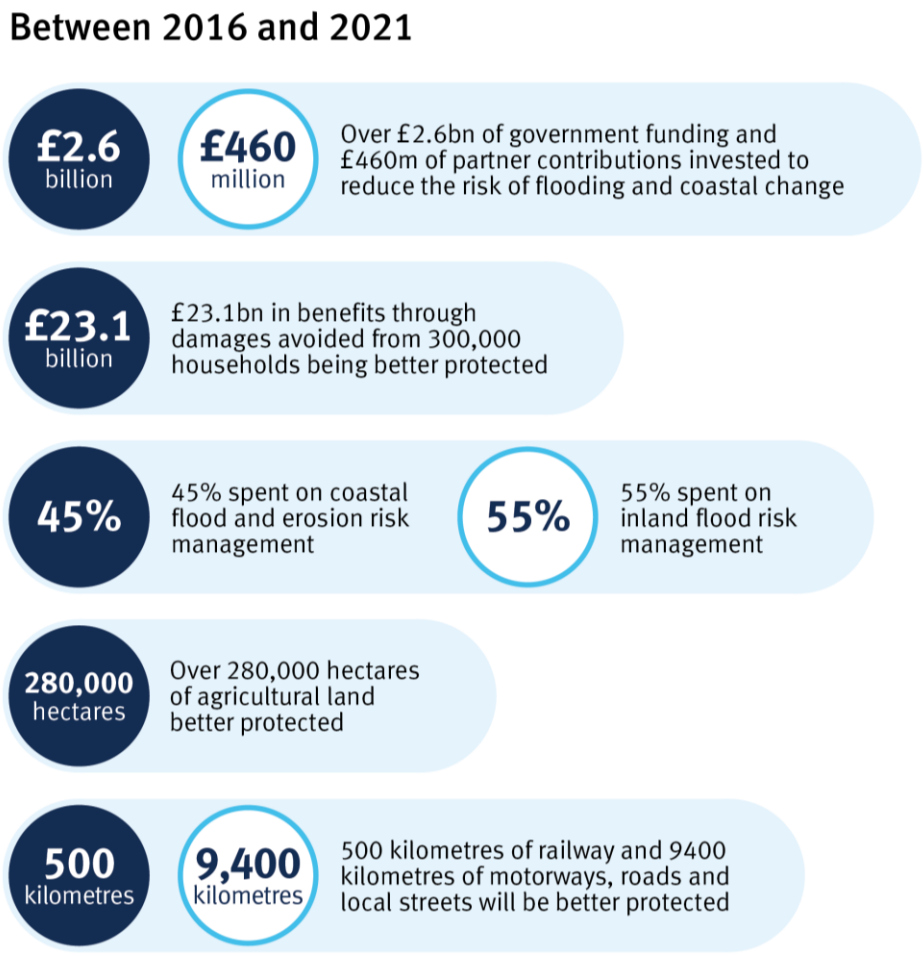


Figure 4: existing activity to manage flooding and coastal change in England. (Environment Agency, 2019)

All of these things, and more, mean that now is the right time to review what we're doing to ensure we prepare the nation for the range of possible climate change scenarios and the flooding and coastal change risks they will bring.

People, places and plans

Working with many other organisations the Environment Agency has developed this draft strategy which seeks to put people at the heart of decisions about their place. Different people will define 'their' place in different ways. For some it might be their home, for others their city, town or village. A place could also mean a river catchment, a tidal estuary or the coast. There's no right or wrong definition. The concept of what a place is within the draft strategy is flexible, so the size and scale of a place is decided in the most appropriate way for the people that live there, and their environment.

By taking this flexible approach, the draft strategy can fit into existing plans for places. A plan for a place may fit in with the administrative boundary for a neighbourhood plan, or a local authority local plan or even a city region. However, flooding and coastal change does not respect administrative boundaries, and so it may be more appropriate in some cases

to align a plan for a place with flood risk management plans or shoreline management plans.

The involvement of people in planning for managing the risks associated with flooding and coastal change is essential, whatever the spatial planning scale of the place.

The roles and responsibilities for those managing flooding and coastal change

Environment Agency

The Environment Agency has several roles in relation to flood risk and coastal erosion management, including as a category 1 responder under the Civil Contingency Act (1994).

The Environment Agency takes a strategic overview of the management of all sources of flooding and coastal change. This includes, setting the direction for managing the risks through the national flood and coastal erosion risk management strategy for England and through plans (including shoreline management plans and flood risk management plans). Alongside this we carry out surveys and mapping; undertake warning and informing and report to the minister about flood and coastal erosion risk and how the national and local strategies are being applied by all of the authorities involved. We also provide evidence and advice to inform government policy and support others to develop risk management skills and capacity.

The Environment Agency also has an operational role and is the lead authority for managing the risk of flooding from main rivers, reservoirs, estuaries and the sea. This includes acting as an expert advisor, notably providing planning advice to local planning authorities on planning applications, local plans and environmental assessments.

Lead local flood authorities

Lead local flood authorities (LLFAs) (unitary authorities or county councils) are responsible for developing, maintaining and applying a strategy for local flood risk management in their areas and for maintaining a register of local flooding infrastructure. They also have an operational role as the lead authorities with responsibility for managing the risk of flooding from surface water, groundwater and ordinary watercourses.

Lead local authorities are also a category 1 responder in relation to flooding from local sources under the Civil Contingency Act (1994).

District councils

District councils are key partners in delivering local flood risk management and can carry out flood risk management works on ordinary watercourses. They also work with lead local flood authorities and others to ensure decisions on development in their area effectively manage the risks from flooding. District and unitary councils in coastal areas are also the coast protection authorities.

Internal drainage boards

Internal drainage boards (IDBs) are an integral part of water level management, for flood risk, land drainage and the environment.

Each internal drainage board is a local independent public authority established in areas of special drainage need in England. They have operational responsibilities and play an important role in the areas they cover (approximately 10% of England). Working in partnership with other authorities they undertake works to manage water levels to meet local needs. They have permissive powers to manage water levels within their respective drainage districts.

Highway authorities

Highway authorities are responsible for providing and managing highway drainage and roadside ditches, and must ensure that road projects do not increase flooding.

Water and sewerage companies

Water and sewerage companies are responsible for managing the risks of flooding from water and foul or combined sewer systems and providing drainage from buildings and yards.

Risk management authorities

The Environment Agency, lead local flood authorities, district councils, internal drainage boards, highways authorities and water and sewerage companies are collectively known as risk management authorities. All risk management authorities have a duty to co-operate with each other and to share information.

The main distinction in the responsibilities between risk management authorities is the source of flooding or coastal change each is responsible for. This simply means where the water comes from – larger (main) or smaller (ordinary watercourses) rivers and streams, reservoirs, the sea, eroding coastlines, water that runs off land (surface water), groundwater or the sewer. If your home or business is flooded, it does not matter where the water comes from, but to manage these risks it's a helpful distinction. Often flooding spans country boundaries so risk management authorities that border Scotland and Wales are also required to work collaboratively with both the Scottish Environmental Protection Agency and Natural Resources Wales.

Risk management authorities are required to exercise their flooding and coastal change functions in a manner which is consistent with the national strategy and guidance. The local strategies produced by lead local flood authorities must also be consistent with the national strategy. The Environment Agency and coast protection authorities may only carry out works where they are desirable having regard to the national strategy.

The risk management authorities, coast protection authorities and regional flood and coastal committees are just some of the organisations that have a role in, or are affected by, flooding and coastal change. Landowners, householders, businesses, insurers, environmental groups, community action groups, consultancies, government departments, and many more, all have a vital part to play.

Regional flood and coastal committees

The regional flood and coastal committees are established by the Environment Agency under the Flood and Water Management Act 2010. They bring together members appointed by government, the Environment Agency and lead local flood authorities (LLFAs) with relevant experience for 3 purposes:

- to ensure there are coherent plans for identifying, communicating and managing flood and coastal erosion risks across catchments and shorelines
- to promote efficient, targeted and risk-based investment in flood and coastal erosion risk management that optimises value for money and benefits for local communities
- to provide a link between the Environment Agency, LLFAs, other risk management authorities, and other relevant bodies, to engender mutual understanding of flood and coastal erosion risks in its area

The Environment Agency's strategic overview

This draft strategy is a good example of what we can achieve by working together and providing a strategic direction for flooding and coastal change management in England. In continuing to shape the direction of flooding and coastal change, we need to continue to build effective partnerships and improve the performance of all risk management authorities. This will need clear leadership – not direction or control, but a coalition of partners. We can do this within the current legal framework through the Environment Agency making stronger use of its strategic overview role of all sources of flooding and coastal erosion.

We think the focus of the Environment Agency's strategic overview should continue to:

- provide national data, information and tools on flooding and coastal change, to be shared publicly, appropriate for the decisions that risk management authorities need to make in helping everyone understand the risks we're managing
- lead effective partnerships that enable place-shaping, to manage flooding and coastal change
- provide timely and effective information and warnings
- exercise a general supervision of flooding and coastal change in England.

and change to include:

- leading flooding and coastal change as part of broader climate resilience contributing to integrated solutions to the environmental and societal challenges the nation faces
- overseeing the collaboration, sharing and monitoring between flooding and coastal change infrastructure owners
- providing reporting and assurance that the final strategy's objectives and measures are being progressed

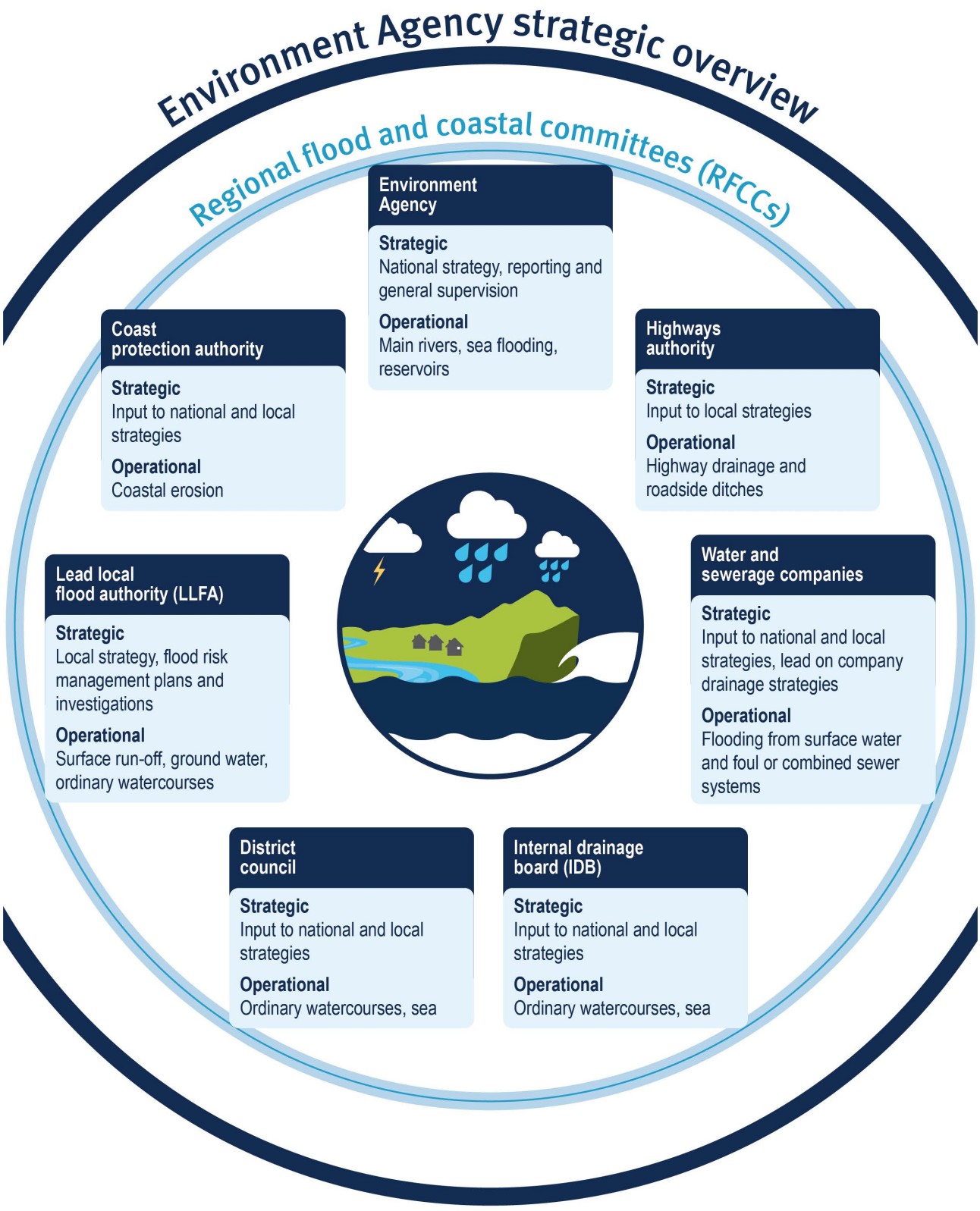


Figure 5: The risk management authorities and other organisations involved in managing flooding and coastal change in England

Contribution to wider environmental objectives

Managing flooding and coastal change provides a significant opportunity to improve and protect the natural, historic and built environments.

Risk management authorities through all their activities should minimise damage to and, where possible improve, the local natural, historic and built environments. Where it is not possible to avoid damage to protected features (for example designated sites, protected habitats and historic buildings) it may be necessary to provide compensatory measures to comply with legal requirements.

The objectives and measures in this draft strategy are intended to support the achievement of wider environmental objectives and the ambition. This is primarily in relation to supporting the 25 year environment plan which sets out the government's ambition to leave our environment in a better state than we found it. Specifically it will support the 25 year environment plan objectives to protect threatened species and provide richer wildlife habitats; reduce the risk from natural hazards; and adapt to and mitigate climate change. The strategy also takes account of the natural, built and historic environments that are valued by so many people and protected within different pieces of legislation.

All risk management authorities need to work with natural processes. Working with natural processes can include protecting and restoring the natural function of catchments, rivers, floodplains and our coast. Significant evidence of the benefits of working with natural processes already exists in the Environment Agency's natural flood risk management evidence base and case studies published in 2017. The maintenance and restoration of a range of ecosystem services, or natural functions of the environment, can provide valuable additional benefits including:

- water quality improvements through reductions in run-off and diffuse pollution
- water resource provision through aquifer recharge
- mitigation of and adaptation to climate change through, for instance, wetland creation and coastal and fluvial realignment
- the provision of urban biodiversity and amenity green spaces through sustainable drainage systems

All risk management authorities have a role to play in supporting sustainable development. Their choices and long term decisions should result in gains for our environment by:

- reducing carbon by considering the wider carbon costs or benefits of flood and coastal risk management projects both over their construction and operational life
- contributing to the achievement of sustainable development, balancing the needs of society, the economy and the urban, rural and natural environment, taking account of the cultural heritage and seeking to secure environmental benefits
- meeting legal requirements, to have regard to the purposes of conserving and enhancing the natural beauty, wildlife and cultural heritage and promoting opportunities for public understanding and enjoyment of national parks; have regard to biodiversity conservation; comply with the Water Framework Directive, Environmental Quality Standards Directive and the Groundwater Directive; regarding the marine environment, comply with the Habitats and Birds Directives and to preserve, maintain and re-establish wild bird habitat; regarding the terrestrial/freshwater environment, having regard to the Habitats and Birds Directives and taking appropriate steps to help achieve the preservation, maintenance and re-establishment of wild bird habitat

Ambitions, strategic objectives and measures

The strategy has been split into 3 high level ambitions: **climate resilient places, today's growth and infrastructure – resilient to tomorrow's climate and a nation of climate champions, able to adapt to flooding and coastal change through innovation.** The delivery of these ambitions is achieved through a series of objectives which have either 2030 or 2050 timescales associated with them. These objectives are then supported by a number of measures with shorter timescales to show how the longer term objectives will be achieved.

Figure 6: The timescales and elements that make up the draft strategy

Climate resilient places

Climate change is already altering our weather and with it the flooding and coastal change the nation faces is evolving too. The government's 25 year environment plan states that current global commitments under the Paris agreement are insufficient to limit the average temperature rise to well below 2°C. The approaches taken to manage flooding and coastal change therefore need to be able to adapt to a range of future climate change scenarios, including a 4°C rise in global average temperature.

Progress towards climate resilient places

Previous and ongoing work of the Environment Agency and other risk management authorities has ensured we are already making progress towards having climate resilient places. This includes:

- between April 2015 and March 2021 the Environment Agency and other risk management authorities are investing over £2.6 billion of government funding to reduce the risk of flooding and coastal change to over 300,000 homes. By March 2019 over 150,000 homes have been better protected
- in addition to the government's contribution, partners have also already contributed over £460 million to enabling more homes to be better protected
- many flooding and coastal change schemes already include a mix of solutions, for example flood walls, property level resilience measures or woody debris dams to slow water
- work undertaken by risk management authorities to manage flooding and coastal change regularly improves the environment. Between April 2017 and March 2018 work by risk management authorities enhanced 111km of waterbodies and 248 hectares of habitat as well as creating a further 556 hectares of new habitat. (Environment Agency, 2019)

To help continue the work to create climate resilient places we need sustained and long term investment in helping to mitigate and manage the risks associated with flooding and coastal change. The Environment Agency's long term investment scenarios set out the economic case for future management of flooding and coastal change and what this could look like over the next 50 years in England. It is a set of scenarios which describe possible 'What if..?' futures, but does not predict which of these futures will happen. The long term investment scenarios do not set out who should pay, but it is expected contributions will come from central and local government, businesses and those benefiting from any work.

Long term investment scenarios

The Environment Agency has produced an updated economic assessment to aid planning for flood and coastal risk management over the next 50 years. It considers a full range of climate change scenarios. The long term investment scenarios show that without increased investment, flood damage to properties and infrastructure in England will significantly increase.

The long term investment scenarios report estimates an average annual investment of at least £1 billion in flooding and coastal change infrastructure is necessary over the period to 2065. For every £1 spent on protecting communities, around £9 in property damages and wider impacts are avoided.

As the population grows, we are likely to see the number of properties built on the flood plain almost double by 2065. Current planning policy and its implementation mitigates most of the potential damages to properties from flooding and coastal change in the long term.

With optimum investment, it is possible to prevent a rise in property damages over the next 50 years even with a high climate change scenario (4ºC warming) and many more homes in the flood plain.

Over two thirds of properties in England are served by infrastructure sites and networks located in (or dependent on others in) areas at risk of flooding. Infrastructure sites and networks must be resilient to flooding to avoid wider impacts on people and properties in England. The National Flood Resilience Review 2016 sets out how government is working with utilities companies, regulators and others to implement long term resilience plans.

Figure 7: Long term investment scenario overview - with optimum investment it is possible to prevent a rise in property damages over the next 50 years even with high climate change and many more homes in the flood plain

There are commitments in many existing government strategies and individual organisations' plans which will contribute to creating climate resilient places. These include the government's 25 year environment plan and its sister document the clean growth strategy. In addition the government have committed to publishing a national infrastructure strategy. More local authorities, infrastructure providers and developers are also taking action to enhance the flood and coastal change resilience of their infrastructure and services.

Although this draft strategy focusses on flooding and coastal change, climate resilient places also need to cope with drought and heat, protect and improve habitats and ultimately be places that people want to live, work and relax in. Managing these challenges in a changing climate and with a growing population will require sustainable water management to be at the heart of every solution and embraced by every decision maker.

Many of the proposals in this draft strategy are applicable to wider water management and assist with better joining up of both flood and drought resilience within our environment. Looking more broadly still, it is not possible to create climate resilient places able to adapt to flooding and coastal change without also protecting and enhancing the natural, historic and built environments. This needs to be reflected in all decisions to ensure the environment is improved within a generation.

We need to act now without delay. We also need to be dynamic and plan for our **climate resilient places** to adapt over time. To do this people need to understand and take ownership of the steps needed to make the places in which they live and work resilient to a range of climate futures.

To improve the overall resilience of the nation to flooding and coastal change we need to apply a different philosophy. This draft strategy is seeking to set out a different approach to how we consider flooding and coastal change in the decisions that are made at a national and local level. While it will never be possible to prevent all flooding and coastal change the current approach has been developed responding to previous floods rather than to meet the challenges of climate change. If we don't change our approach, we risk locking future generations into a legacy of increasing challenges.

Central to creating climate resilient places will be the need to explore and develop the concept of standards for flood and coastal resilience for all places at risk.This will be considered by the government later in the year in its national infrastructure strategy which is being developed in response to the National Infrastructure Commission's National Infrastructure Assessment published in 2018.

The Environment Agency believes that there needs to be a consistent approach across the country but one that recognises that the tools for delivering resilience will vary from place to place, based on technical, environmental, economic and social needs and constraints. The responsibility for agreeing the best combination of resilience tools will rest with the most appropriate decision maker depending on the scale of the place.

Strategic objective 1.1: Between now and 2050 the nation will be resilient to future flood and coastal risks. Over the next year the Environment Agency will work with partners to explore and develop the concept of standards for flood and coastal resilience.

Through this draft strategy we introduce the concept of 'resilience for places' which refers to the ability for a community in a place to cope with, and recover from, all sources of flooding or coastal change.

People and places around the country need to know the impacts of the risk they face from flooding and coastal change, how significantly it will affect their lives and how best to respond. Many opinion formers support the idea of flood and coastal resilience standards.

The National Infrastructure Commission recommended a long term goal of establishing a 'national standard of flood resilience'. They proposed that major urban areas should be resilient to 0.1% annual likelihood events and other parts of the country should be resilient to events of 0.5% annual likelihood.

The Environment Agency would like to work with risk management authorities and other partners to explore and develop the concept of standards for flood and coastal resilience, and in doing this we will consider the pros and cons of all options.

A vital tool for future resilience in many places will remain building and maintaining our flood and coastal change infrastructure. It is important, however, to be aware that the protection provided by flood and coastal change infrastructure can only ever be one part of our nation's toolkit for creating more climate resilient places. In some places it makes economic sense to invest heavily in engineered solutions to improve resilience, for example the Thames Estuary. But, building our way out of managing future climate risks will not alone be the right approach in the majority of places.

This is supported by the Environment Agency's long term investment scenarios which tested the benefits of investing in very high levels of protection across the country. In theory, very high levels of protection could make a big positive difference to managing

long term flood and coastal risks. But, technical, social and environmental limitations can make this difficult to achieve in many places. For instance, to contain an extreme flood through an urban area unacceptably high flood walls or a lot more space for flood waters may be required.

The value people put on the look and feel of a place means we have to think even more innovatively about how to reduce the risk and create climate resilient places. For instance, in Keswick the Environment Agency agreed with the local community and local partners to use glass panels instead of stone to increase the effective height of defences while keeping much loved views of the river. In Cockermouth, a self-raising barrier was used to allay local concerns about the look of the flood scheme.

These challenges are not specific to England. Even in the Netherlands, a country whose identity and culture is entwined with its flood and coastal infrastructure, communities oppose the idea of ever higher flood and sea walls. At Hondsbossche, sand dunes support coastal infrastructure so the existing flood defences don't have to rise and rise. Natural flood management like this is also adaptable to different levels of climate change - and it supports tourism, the local economy and the environment. In Japan, the authorities are developing ever more innovative options to protect communities from tsunamis and typhoons because, once again, people want alternative solutions to flood and coastal infrastructure alone.

It is also important to recognise that, despite our collective best efforts, we will not always be able to prevent flooding and coastal change happening. In these places, the priority will be to keep people safe and to develop resilience tools that minimise the impacts of flooding or coastal change and to aid recovery after an incident. Over a period of time, it may mean supporting individuals and communities to move out of harm's way.

The Environment Agency believes we need a national suite of resilience tools to help places to avoid, prevent, protect, respond and recover from the future threat of flooding and coastal change. These tools should include:

- **making decisions on land use**, which reflect the level of current and future flooding and coastal change risk. For example, by directing development away from the areas at risk and making sure that new development is safe for its lifetime and does not increase risks elsewhere
- **managing the flow of water through the environment** to reduce the risks in upstream and downstream areas, through natural flood management, good land management, temporary flood storage areas and sustainable drainage systems
- **protecting areas from flooding and coastal change** by investing in flood walls, sea defences and embankments. In combination, this should also include assessing the benefits of temporary flood barriers or working with natural processes by creating multi-functional green infrastructure or using natural flood management. It is also important to recognise that it is not possible to completely protect everyone from all risks
- **designing places, buildings and infrastructure more effectively.** For example, by improving building standards, so people can cope with the impacts of flooding and coastal change and return to normal more quickly
- **enhancing community resilience** by providing effective warnings and emergency response services, and by encouraging and supporting volunteers and community groups so people take action to move their possessions, stay safe and evacuate when needed
- **adapting property and services to boost their resilience**, by reducing the damage and disruption and making recovery quicker when a flood does happen. This includes

designing and altering property and infrastructure so that they are less easily or less seriously damaged when there is a flood, and making sure that the people most at risk are mentally and physically prepared for what could happen

- **responding quickly and effectively to flood and coastal erosion events** by forecasting and monitoring to assess the risks as well as warning and informing communities and local responders
- **recovering quickly after a flooding or coastal change event** by repairing damages, restoring the economy and supporting community wellbeing. This includes effective use of insurance to transfer recovery costs between parties
- **accepting that some areas will flood and erode** and enabling local areas to achieve a managed transition. There are already areas of managed realignment on the eroding coast. Increasingly in coming years there will need to be a similar approach in some areas of high flood risk from rivers. This will mean identifying some areas of flood plain which need to be clear for flood waters, and creating and sustaining more wetlands

Figure 8: Tools used to achieve place based resilience standards

Every place is different and the exact combination of tools selected will need to be tailored to a particular place and reflect the local aspirations and opportunities, economic and environmental needs of that place and people. There cannot be a 'one size fits all' approach. The tools for delivering placed based resilience will not be the same everywhere. Offering a combination of tools will give people control and choices about how they respond to flooding and coastal change, while creating clear expectations on the role and contribution of risk management authorities in achieving resilience in a place. Alongside this, the Environment Agency will review its appraisal guidance for flooding and coastal change projects, so that investment decisions better account for a range of climate change futures.

Some of the tools for delivering resilience go beyond the role and direct influence of risk management authorities and so it will be vital that they also work closely with land managers and the business and environment sectors. It will also be important to involve local elected members who have a democratic mandate for representing local community views as well as regional flood and coastal committees. In places like Cumbria, local partners and the community are already working with risk management authorities to develop an action plan based on applying a variety of resilience tools.

Cumbria strategic floods partnership

The Cumbria strategic floods partnership was formed following the devastating flooding experienced during the winter of 2015 to 16. The partnership is made up of the public and private organisations, local partners and members of local communities who are working in partnership with catchment management groups. The Cumbria floods action plan was developed by the partnership, and contains about 100 actions to increase resilience to flooding.

Actions include investing in physical flood defences in combination with upstream land management and techniques to slow the flow of flood water upstream of places at risk whilst maximising the amount of flood water that can be carried safely by our river channels. Importantly the plan also contains actions for local people to progress with farmers and landowners which has helped to develop community ownership for the action plan.

Figure 9: Photograph of flooding in Keswick, Cumbria during the winter 2015 floods

Climate resilience is recognised as important in the government's 25 year environment plan through 2 key goals which aim to reduce the risk from natural hazards' and 'adapt to and mitigate climate change'. Developing a national suite of tools for flood and coastal resilience in places would help contribute to these goals and demonstrate progress against the government's national adaptation plan.

How we assure ourselves that the best combination of resilience tools are being applied in places is a key question facing us as a nation. Depending on the scale of the place the final decision maker will vary. For example, at a catchment scale the most appropriate decision maker may be the Environment Agency, at a city scale it may be the local authority but at a small village scale it may be more appropriate for a parish council to make the decision. In some places risk management authorities, people and businesses will voluntarily want to progress resilience tools and this should be encouraged. In other areas more support will be required.

To achieve our objective we have the following measures:

Measure 1.1.1: By 2021 the Environment Agency will enhance the appraisal guidance for flooding and coastal change projects, so that investment decisions better reflect a range of climate change scenarios.

Measure 1.1.2: By 2022 the Environment Agency will work with partners to explore and develop the concept of standards for flood and coastal resilience, and will consider the pros and cons of all options. This will feed into the government's flood policy statement in 2019. The Environment Agency will also develop a national suite of tools that be used in combination to deliver flood and coastal resilience in places.

Strategic objective 1.2: Between now and 2050 risk management authorities will help places plan and adapt to flooding and coastal change across a range of climate futures.

To be better prepared for climate change we need to take action now, so we are ready for the impacts and can make sure the places people live, work and play in are safe. Although we have more certainty around what a changing climate will look like in the future, planning for it is uncertain, daunting and expensive. It is easier to plan for one future climate but much more difficult to plan for a range.

Looking out to the year 2100, people in every place need to be able to identify the decisions for managing flooding and coastal change that need to be taken now and those which can be made in the future. To ensure this happens decision makers need to be agile to the latest climate science, growth projections, investment opportunities and other changes to our local environment.

Flooding and coastal change is not static but constantly changing. It requires an iterative and dynamic approach for places that can be reviewed over time in response to changing risks. We call this 'adaptive approaches' and it promotes positive action before it is needed. It is already used in some locations in England.

For example, the Thames Estuary 2100 plan identifies a series of approaches or options for different climate change, social and economic futures. The plan is adaptable to a changing climate to ensure that the actions taken by all partners are the right ones and taken at the right time to benefit people and the economy. The approach can be applied to any place-based plan enabling a combination of resilience tools to be developed, agreed and mapped across adaptive pathways to the year 2100 and beyond.

Thames Estuary 2100

The Thames Estuary is protected today by a world class system of defences providing protection to 1.25 million people and £200 billion of property. Climate change, growth and other pressures mean the risk of tidal flooding will increase over time. The Thames Estuary 2100 Plan, approved by government in 2012, was developed to provide strategic direction for managing flood risk to the end of the century.

The plan has climate change at its core. It includes a series of pathways for different climate change and socio-economic futures. The current plan has 3 phases:

- 2010 to 2034 focuses on maintaining the current flood defence system and safeguarding land for future improvements through local strategies and spatial plans
- 2035 to 2049 will see work to reshape the riverside with improvements to many flood walls, embankments and small barriers
- 2050 to 2100 is when the plan expects decisions to be needed on long term investments, including the construction of a new Thames Barrier.

The first full review of the plan will be in 2020 and will consider how the climate, environment and socio-economic conditions in the estuary have changed and are expected to change in the future. This will influence whether the Environment Agency and partners need to alter the current pathway and how this may impact future investment and management of the tidal flood defences. (Environment Agency, 2012, TE2100 Plan).

Figure 10: The Thames Barrier, London

Taking an adaptive approach is not a reason to delay taking immediate action as there will be many no-regrets and low-regrets activities we can do to improve resilience in a place. This could include avoiding inappropriate siting and design of new building in risk areas or employing natural flood management tools to slow the flow of water.

The potential benefits of developing long term adaptive approaches is that it gives people time and opportunity to think differently about how they fund and work with others to deliver the flood and coastal resilience tools they need in a place. This could include developing new and innovative funding mechanisms to deliver higher standards of protection for flooding and coastal infrastructure. It could also provide the long term framework for better aligning planning and investment cycles with potential funders, infrastructure providers and utilities, to unlock investment in flood and climate resilient infrastructure and services. The adaptive approach is also able to accommodate any future change to existing planning frameworks that support the management of flooding and coastal change.

Figure 11: The potential benefits of adaptive pathways

Taking an adaptive approach also enables risk management authorities to plan more effectively for the maintenance and replacement of the existing flooding and coastal change infrastructure that people rely upon. They allow us to manage flooding and coastal change without closing off future management options and with regular monitoring and review respond to a changing climate and reflect changing local social, environmental and economic needs.

Taking an adaptive approach does not create a need for a separate set of plans, instead they will inform the development options in strategic local spatial plans and others' plans. Importantly, adaptive approaches can provide the opportunity to regularly review if the right approach and combination of resilience tools are being followed and at the right pace. This will ensure places are ready for a range of climate change scenarios, including planning for a 4°C rise in temperature.

Happisburgh – Norfolk coast

An example of where of an adaptive approach has been used is Happisburgh on the North Norfolk coast. The seaward edge of the Happisburgh cliffs had been a coastal management challenge since the 1980s. Beginning in the 1930s, a small community of non-standard chalet-style dwellings were built behind the cliff top along Happisburgh beach. More substantial brick-built houses were constructed further back from the edge. Defences were installed to help reduce erosion in the 1960s, after the 1953 storm surge. The defences along this section of coast began to fail in the late 1980s due to the low beach levels. In the 1990s and early 2000s, North Norfolk District Council promoted several coast protection schemes to try to address the problem. These were not successfully approved and funded because they weren't cost-effective.

In 2010, North Norfolk District Council was awarded £3 million of Defra funds to test an alternative adaptive approach as part of the pathfinder projects. This investigated and implemented the acquisition and removal of properties immediately at risk, and cleared the site, making it a more attractive cliff-top area and a safer place to live and visit, by improving access to the beach.

Since 2010, North Norfolk District Council continue to intervene at this dynamic location to address safety and access challenges, whilst 'roll back' policy is still in operation.

Figure 12: A property at risk of coastal erosion being demolished (image courtesy of North Norfolk District Council)

As part of the strategic overview role for flooding and coastal change, the Environment Agency has a key role to play in facilitating adaptive approaches as part of any place based plan. Alongside developing a national suite of resilience tools, the Environment Agency would like to develop a framework to help risk management authorities work with and others to take an adaptive approach to planning for flood and coastal resilience in a place.

The Environment Agency is currently developing a new way of producing a single picture of flood risk from rivers, the sea and surface water using both our existing detailed local information and improved national datasets. This will incorporate the improvements being undertaken to improve surface water mapping by lead local flood authorities. Collectively this will vastly improve the evidence base for making decisions about spatial planning, prioritising investments in flood and coastal infrastructure and targeting the work of emergency responders when planning their incident response. The new national mapping, modelling and data will provide a key evidence base to assist places in taking an adaptive approach and identify key decision points for informing when resilience tools should be

applied. It will also support the implementation of the government's surface water action plan.

The Environment Agency intends to test and develop an adaptive approaches framework for a range of different scales and social contexts through a number of frontrunner places. Working with risk management authorities and other partners, the Environment Agency will progress these frontrunners from the start of the next flood and coastal risk management programme starting in April 2021.

To achieve our objective we have the following measures:

Measure 1.2.1: By 2021 the Environment Agency and risk management authorities will identify frontrunner places for developing adaptive approaches for a range of different scales and social contexts, working with local places and partners.

Measure 1.2.2: By 2024 the Environment Agency will publish a new picture and evidence of current and future flood risk that will help places better plan and adapt for climate change.

Measure 1.2.3: By 2024 the Environment Agency will develop a national framework to help risk management authorities, people, businesses and public bodies identify the steps and decisions needed to take an adaptive approach to planning for flood and coastal resilience in a place.

Measure 1.2.4: By 2025 the Environment Agency will produce a new set of long term investment scenarios to inform future policy and investment choices for delivering flood and coastal resilience.

Measure 1.2.5: By 2026 lead local flood authorities will update their local flood risk strategies to incorporate adaptive approaches to planning for flood and coastal resilience in a place.

Strategic objective 1.3: Between now and 2030 all those involved in managing water will embrace and embed adaptive approaches to enhance the resilience of our environment to future flooding and drought.

It is not possible to separate the management of our natural environment and our rivers and coasts from the way we manage and reduce risk of flooding and coastal change. Our natural environment goes through periods of both flood and drought – so we should be looking at adaptive approaches that benefit them both for the benefit of people and wildlife.

The Environment Agency is working with water companies to put water and flood management at the heart of the sector's agenda. Our water industry strategic environmental requirements sets the ambition for the water environment to be managed in a way that is more resilient to flood and drought, to support people, wildlife and the economy. Through developing their business plans for 2020 to 2025, many water companies have secured customer support for investing in managing the risks associated with flooding and extreme weather events.

Water companies are already planning for sustainable water resources over the next 25 years. They are also embarking on long term drainage and waste water management plans. Several water companies are already taking an adaptive approach to their long term water resource planning alongside assessing the resilience of water infrastructure. By joining up planning around drought and flood resilience, we can better help people manage these extremes whilst also looking for environmental enhancement.

We already know that holding water back, slowing run-off and encouraging infiltration, either naturally or through engineering design, can reduce flooding downstream. When used alongside conventional flood and coastal infrastructure, there is also a growing evidence base around the benefits of working with natural processes on a smaller scale.

Stroud rural sustainable drainage project

After areas of Stroud flooded in 2007 and 2012, residents established community flood action groups to campaign for better protection from flooding. Studies showed large engineered storage solutions were not appropriate so local authorities made a bid for local levy funding to develop a natural flood management project.

A strong local, supportive partnership is a key strength of the project, and helps to maintain local political support. The way the project works encourages local ownership and builds skills by working with local landowners and contractors to design and construct natural flood management measures on their own land.

This has led to working with over 20 landowners to reduce flood risk across the 250 Km^2 catchment. Over 400 measures such as leaky woody dams, earth field bunds, silt traps, dry ponds and off-line storage areas now intercept flows from about one quarter of the catchment area. (Short, Chris & Clarke, Lucy & Carnelli, Fabio & Uttley, Chris & Smith, Brian, 2018, Capturing the multiple benefits associated with nature-based solutions: Lessons from a natural flood management project in the Cotswolds, UK. Land Degradation & Development.)

Figures 13 and 14: Leaky dams; some of the measures used in the Stroud rural sustainable drainage project

Encouraging working with natural processes is a key part of our approach and can take many forms. This includes encouraging the most appropriate crops, farming techniques that limit soil erosion, natural flood risk management tools on farmland as well as the creation of inter-tidal or coastal habitat. In 2016 the government announced £15 million to learn more about these interventions. This funding was allocated to 60 projects across England, creating the natural flood management programme. The 60 projects are split as 26 catchment scale led by risk management authorities and 34 community scale projects led by community groups and charities.

Although working with natural processes should be encouraged everywhere, the greatest opportunities and perhaps easiest to visualise natural process solutions are in rural areas.

We are expecting to have a new environmental outcome driven payment system to replace the Common Agricultural Policy supported by the Agriculture Bill. The government's 'Health and Harmony' policy statement on the future of food and farming encourages farmers and land managers who wish to improve the environment by entering into environmental land management contracts which could span several years. One objective of these contracts is to prevent, reduce and adapt to climate change and other environmental hazards like flooding. This includes forestry and woodland management which is a theme of the 25 year environment plan.

Future Fens

The Fens in the East of England were first drained in the 1600s and largely funded by wealthy landowners to create valuable land for farming. The present-day landowners are the modern-day custodians of one of the richest legacies of flood risk and drainage management in the country. We need innovative, co-ordinated and sustainable solutions from landowners, businesses, planning authorities, communities and risk management authorities, to manage this landscape for the long term.

The Fens are particularly fertile, containing around half of the grade 1 agricultural land in England (National Farmers Union, https://www.nfuonline.com/assets/23991).

An adaptive approach is needed to manage this catchment to balance the needs of people, the environment and agriculture. This will identify the decisions which need to be taken now and those that will need to be taken in the future. This could include strategic, long term agreements between farmers, land managers and supermarkets about the future of the Fens and the contribution that flood risk investments could play in sustaining agriculture.

Figure 15: Aerial photograph of the Fens. Kite aerial photography by Bill Blake Heritage Documentation

Over the coming decades, there are also opportunities for using an adaptive approach to explore what climate resilience means in places where flood risk management and food production is interdependent. In places like the Fens where this is high grade agricultural land critical to food production, there is the need to better join up our strategic and long term objectives around flood and climate resilience with the environment and its use.

To achieve our objective we have the following measures:

Measure 1.3.1: From 2021 the Environment Agency will use the lessons learned from the Defra £15 million natural flood management projects and other pilot projects to expand and mainstream working with natural processes by all risk management authorities.

Measure 1.3.2: From 2021 the Environment Agency will work with farmers, landowners and others to identify opportunities for using agricultural practices (through funding, advice and regulation) to manage flooding and coastal change.

Measure 1.3.3: From 2020 risk management authorities will seek to better align long term planning for flood and coastal change with water company business planning cycles to identify opportunities for managing both floods and droughts.

Strategic objective 1.4: Between now and 2030 risk management authorities enhance the natural, built and historic environments so we leave it in a better state for the next generation.

The government's 25 year environment plan: 'A Green Future: Our 25 Year Plan to Improve the Environment' sets out what the nation should do to improve the environment, within a generation. Risk management authorities have a part to play in helping to achieve those aspirations and should take opportunities to improve our natural, built and historic environment through their programmes, strategies and activities to manage flooding and coastal change.

We depend upon our environment for services such as clean water, air, food, climate mitigation and reducing flood and coastal change risk. Managing flooding and coastal change interacts with the environment in a number of ways, both positively and negatively. Intervening in the natural environment to reduce flood risk and coastal change can mean making changes to the physical water environment that can have impacts on some natural habitats and species. Risk management authorities have a key role to play in mitigating and compensating for those activities that are damaging whilst overall making a more positive contribution to the environment. This should include contributing to the achievement of statutory requirements relating to the protection of habitats, conservation and the water environment. But it should also include opportunities for enhancing the health and ecology of our rivers and coastal waters through investments in flood and coastal projects. The 25 year environment plan aspires to return 75% of waterbodies to a natural or a near natural condition which may mean repairing some of the damage from past activities.

There are many examples around the country where we have seen the positive role creating or restoring natural habitats such as salt marsh, floodplain meadows and woodland can play in reducing flooding or where natural flood management measures that create or restore habitats can slow the flow of floodwaters. Risk management authorities should work with those seeking to create or restore natural habitats as part of the nature recovery network to help ensure the network can contribute to reducing risk.

Under the draft strategy ambition 'today's growth and infrastructure is resilient in tomorrow's climate', there are proposals for how risk management authorities can also contribute to wider objectives relating to delivering biodiversity and environment net gain in local places through the spatial and development planning process. It is also equally

important that risk management authorities protect and enhance the built and historic environment for the benefit of future generations.

Taking an adaptive approach provides a long term framework for risk management authorities to identify opportunities for enhancing the natural, built and historic environments as part of delivering more climate resilient places.

To achieve our objective we have the following measures:

Measure 1.4.1: From 2021 risk management authorities will contribute to improving the natural, built and historic environment through their investments in flood and coastal projects.

Measure 1.4.2: From 2021 risk management authorities will work with partners and others to identify how the nature recovery network, the northern forest and other habitat improvements can help to manage flood risk and coastal change.

Measure 1.4.3: From 2021 risk management authorities will help to ensure that 75% of all water bodies are in natural or near-natural condition within 25 years.

Strategic objective 1.5: Between now and 2030 risk management authorities will use funding and financing from new sources to invest in making the nation resilient to flooding and coastal change.

To achieve the aims of this draft strategy and keep building the nation's resilience to flooding and coastal change, especially in the face of a changing climate, we will need to invest more money over time. At a time where there are many competing demands on government money, much of that investment may need to come from new sources other than the taxpayer. We need to consider 'who pays' for future climate resilience and the balance of payments from people and businesses at risk from flood and coastal change versus everyone contributing through the public purse.

The growth of green finance and increasing awareness about climate resilience in financial markets offers an important opportunity to secure this investment. New ways of funding and financing could help to deliver adaptive approaches, particularly for some of the largest and most challenging areas such as the Thames and Humber estuaries, where investment needs will be high. New funding and financing tools could give risk management authorities more power and control over how they invest in the future.

There are two related concepts within this area of new investment: funding and finance. Finance means borrowing money now which we pay back over a number of years it potentially offers a very effective way to deliver adaptive approaches over the coming decades. Funding means finding new sources of money each year to pay for activities that make places more resilient to flooding and coastal change.

There is a major appetite in financial markets for green investments, which generate a return on investment while also protecting or improving the environment. This growing market in green finance could offer borrowing at significantly lower costs than traditional forms of borrowing, which can make financing far more cost effective. There are also risks associated with financing, which would need to be carefully managed.

There are a range of new sources of funding that might enable such an approach. In general, these approaches work by getting beneficiaries: the people; businesses; infrastructure providers; and others who benefit from a flooding and coastal change action to contribute towards the cost.

These funding tools would build on the government's partnership funding approach we already successfully use. Upfront borrowing might in turn make it easier to secure partnership funding contributions, because it is easier to secure a small amount of money over a long period than it is to secure a large contribution upfront.

To achieve our objective we have the following measures:

Measure 1.5.1: By 2021 the Environment Agency will work with the government on its green finance strategy to explore new options for funding and financing flooding and coastal change that deliver more private funding in the future.

Measure 1.5.2: By 2025 risk management authorities will test whether it is feasible to use upfront financing to deliver an adaptive approach in a place which will need very significant investment in future.

Today's growth and infrastructure – resilient to tomorrow's climate

Places are about much more than the people who live there. The people are served by utility providers, connected by transport links, supported by hospitals, schools and care homes, and sustained by shops and businesses. These are complemented by parks and green spaces that add to our wellbeing and connection to the natural environment.

Progress towards ensuring today's growth and infrastructure is resilient to tomorrow's climate

Previous and ongoing work of the Environment Agency and other risk management authorities has ensured we are already making progress towards ensuring today's growth and infrastructure is resilient to tomorrow's climate. This includes:

- in the financial year 2017 to 2018, 99.4% of planning applications involving new homes were decided in line with Environment Agency advice. (Environment Agency, 2019, Managing flood and coastal erosion risk annual report 2017 to 2018 (unpublished))
- working in close partnership with Defra and the Cabinet Office, the Environment Agency has made major improvements to the modelling and evidence base of the risk of widespread flooding in England to inform the Cabinet Office national risk register of civil emergencies
- flooding and coastal change schemes completed between 2016 and 2021 will better protect over 280,000 hectares of agricultural land and help avoid more than £1.5 billion worth of direct economic damage to agricultural land. Transport infrastructure will also be better protected including 500 kilometres of railway and 9400 kilometres of motorways, roads and local streets. (Environment Agency, 2019)
- in 2018 to 2019, the Environment Agency are investing over £200 million in maintaining existing flood and coastal risk management infrastructure to ensure it continues to protect communities and our staff have carried out more than 90,000 inspections to ensure they remain ready to protect communities. (Environment Agency, 2019)

A robust spatial planning process is essential to creating and maintaining places resilient to flooding and coastal change, especially in the face of changing climate. Local planning authorities are crucial to getting the right kind of sustainable growth in the right places. The Environment Agency and lead local flood authorities have a key role to play in engaging and advising developers and planners to enable resilient development, as well as identifying opportunities to protect and enhance the environment for people and wildlife.

Local people, partners and authorities come together to shape the future of their local places, through influencing spatial planning priorities. Spatial plans can help develop adaptive approaches for places, providing clarity on what a place may look like in the future and determining appropriate resilience for a place.

Sustainable growth and resilience to flooding and coastal change must go hand in hand. All risk management authorities have a role to play in helping places plan and adapt for climate change, ensuring existing places are protected and continue to prosper.

Funding for new and improved flooding and coastal change infrastructure comes from a range of sources, for example government, businesses and those directly benefiting. The government's investment in flood and coastal change infrastructure projects is primarily focussed on better protecting existing homes. These projects can also provide wider benefits such as creating environmental enhancements, stimulating sustainable growth and accelerating regeneration. Where this is the case, some government funding has also been made available from other funding sources linked to supporting local economic growth. In addition projects aimed at reducing the risks from flooding and coastal change can also help to provide long term confidence to investors looking to build new houses, fund new infrastructure, and develop new businesses in places at risk.

The Environment Agency's long term investment scenarios highlight the importance of infrastructure resilience. They found over two-thirds of properties in England are served by infrastructure sites and networks located in, or dependent on others located in, areas at risk of flooding. All infrastructure providers need to be clear about the level of resilience customers expect of their service and how they'll need to adapt to keep pace with climate change.

The adaptive approach enables infrastructure providers to plan to be resilient to a range of climate change futures. Resilient infrastructure can sustain great places for people to live and prosper, but can also enable sustainable growth by providing confidence for others to invest and provide wider environmental benefits. In some cases, our infrastructure will need to be relocated away from areas of flooding and coastal change. Elsewhere, improving resilience will be enough. Whatever the local decision, the key is to make sure the resilience tools are planned and funded well in advance of when they'll be needed.

Strategic objective 2.1: Between now and 2030 all new development will contribute to achieving place based resilience to flooding and coastal change.

About 12% of England is in the floodplain. 1,800km of our coast are at risk of erosion (Environment Agency, 2019). Many more areas are at risk of flooding from surface water running off the land. Ideally, no one wants to build in these areas. The government's planning policy makes this clear, steering development away from floodplains or tidal flood zones. In some locations, for example, in the middle of some cities, this isn't possible. Where this is the case, planning policy requires that developments are designed to be resilient to flooding or coastal change. Local planning authorities have democratic accountability for approving proposals for new development. The Environment Agency and lead local flood authorities are statutory consultees for most planning applications and for strategic local development plans. The 2 consultees work closely to ensure government planning policy and guidance is followed.

We know as the nation's population grows we'll need many more new homes. The Environment Agency's long term investment scenarios show the importance of local planning authorities implementing planning policy effectively. We're likely to see a doubling of the number of properties built in the floodplain over the next 50 years. Continued implementation of government planning policy can limit most of the potential flood damages to properties. However, if planning policy or its implementation is weakened, property damage could increase by 38% over the next 50 years. (Environment Agency, 2019, long term investment scenarios).

It will be challenging in some places to make future development climate-resilient, due to limited development areas outside of the flood plain. Over the next 50 years, 20% of projected new development on the flood plain will occur in just 3% of local authorities.

(Environment Agency, 2019, long term investment scenarios). So it's key to find opportunities where investment to reduce the impacts of flooding and coastal change can also bring climate-resilient and sustainable growth.

Better and earlier cooperation on the design of places where people live and work can help minimise future damage from flooding and coastal change. This cooperation has to go beyond just local authorities, developers and risk management authorities, to include infrastructure providers. This will help ensure not only peoples' properties, but also the infrastructure and services they rely on, are resilient to flooding and coastal change and can adapt for future climate change.

To achieve our objective we have the following measures:

Measure 2.1.1: From 2021 risk management authorities will invest in planning skills and capabilities to ensure they can advise planners and developers effectively to enable climate resilient places.

Measure 2.1.2: From 2025 the Environment Agency and lead local flood authorities will advise local planning authorities on how adaptive approaches should inform strategic local plans.

Strategic objective 2.2: Between now and 2030 all new development will seek to support environmental net gain in local places.

Enabling sustainable growth does not mean increasing flooding and coastal change or damaging the environment. 'Net gain' is an approach to development that aims to leave the natural environment in a measurably better state than beforehand. Net gain can also help ensure that new development contributes towards managing the risk of flooding and coastal change. The net-gain approach has several advantages:

- it offers a degree of flexibility in improving the environment rather than requiring rigid like-for-like replacement for losses
- it could be a means of raising funding for investing in the environment through, for instance, placing a legal requirement on developers
- for developers, it could streamline the planning process and help them proceed more quickly

The government has committed to mandating that certain new developments must achieve 'biodiversity net gain'. This should improve how the planning system addresses development's impact on habitats and allow new development to proceed without negatively affecting our wildlife. Developers and infrastructure providers will have a key role to play in achieving biodiversity net gain. This includes risk management authorities where they're constructing and delivering flood and coastal infrastructure projects. This obligation on risk management authorities is expected to take effect from 2021, which is the start date of the next flood and coastal risk management programme.

Biodiversity net gain is a positive step towards the wider opportunities offered by 'environmental net gain', a way of improving all aspects of resilient and sustainable development. Environmental net gain was identified in the government's 25 year

environment plan as a key means of achieving its ambition ‘to be the first generation to leave the environment in a better state than we found it.’

We know growth will not be sustainable if its net impact is to harm our natural environment – which includes geology, soil, air, water and all living things, or our cultural heritage – or ignore the risks posed by natural hazards. Establishing environmental net gain in the planning system would allow us to maintain and improve the nation’s resilience to natural hazards such as flooding and coastal change as well as the effects of climate change. This could include more sustainable drainage systems in new development or retrofitted into existing, and the wider use of best practice land management techniques. Environmental net gain could also provide an opportunity to secure investment in flooding and coastal change benefits through new developments and funding partners.

To achieve our objective we have the following measures:

Measure 2.2.1: From 2021 all risk management authorities will achieve biodiversity net gain in all programmes and projects.

Measure 2.2.2: From 2021 all risk management authorities will seek to work with developers and planners to achieve environmental net gain as part of strategic development proposals.

Cambridge Oxford Arc

3.3 million people live in the Oxford to Cambridge (OxCam) Arc. It hosts some of the most productive and fastest-growing cities in the UK.

Too much and too little water, alongside aging infrastructure, are key considerations in enabling the proposals for one million new homes by 2050 – a doubling of previously proposed growth, which is estimated to increase GVA (gross value added) from £90 billion to £250 billion a year.

In the government's 2018 Budget funding was confirmed for a pan-Arc Local Natural Capital Plan to coordinate investment in housing, infrastructure and the environment to support transformational growth across the Arc. The aim is to make sure new development maximises its economic potential, increases resilience to flooding as well as integrates environmental infrastructure with other development to provide high-quality and productive places for people to live and work.

Environmental net gain provides a lever, not only for improvements in biodiversity, but also for improvements in flood and water infrastructure to support OxCam ambitions to be a model for climate-resilient growth.

Figure 16: New development in the OxCam Arc

Strategic objective 2.3: Between now and 2030 all risk management authorities will contribute positively to local economic regeneration and sustainable growth through their investments in flooding and coastal change projects.

Our long term ambition should be to support local economic regeneration and sustainable growth through investments in flood and coastal infrastructure projects that facilitate the development of climate-resilient places. You can look at this in 2 ways. Firstly, stopping economic blight in places that have experienced repeat flooding and, secondly, facilitating resilient development and unlocking opportunities for sustainable growth.

Stopping long term economic blight in places that have experienced repeat flooding has become a serious challenge to some local economies. We know after flooding there are generally more small business failures, and other employers move away. We also know flood victims can suffer serious mental health problems, affecting their ability to work, and further harming businesses.

Local communities and partners in places with local economic vulnerabilities can find themselves caught in a funding trap. Their weaker economies mean they're less able to contribute to the costs of projects that would help to reduce the long term risks from flooding or coastal change.

There are many examples around the country where we can see how investments in flood and coastal infrastructure can make available areas of land previously thought undevelopable. In doing so, risk management authority projects have helped to accommodate population growth and unlock opportunities for new housing and businesses in some local places. Some risk management authorities have succeeded in securing private-sector contributions or funding from local enterprise partnerships for flooding and coastal-change infrastructure projects, where they've been able to demonstrate benefits to job creation and new businesses in a local community.

Investment decisions in flood and coastal infrastructure could better account for the benefits to sustainable growth and resilient development. Understanding how to integrate these benefits is an area where further research and development is needed in the coming years.

Selly Park, Birmingham

At Selly Park, Birmingham, a new flood alleviation scheme has created new development land, protected 150 homes, an important highway and an emergency route. All thanks to an innovative flood storage scheme. The scheme provides £21 million of 'avoided damages' to property. It was made possible through a catchment partnership approach and securing developer contributions. (Environment Agency, 2017, Selly Park North flood risk management scheme briefing)

Figure 17: Emma Howard Boyd joins colleagues to announce the start of works at the Selly Park scheme

Figure 18: Aerial photograph of works at Selly Park.

Leigh flood storage area

The Leigh flood storage area was built in 1982 following the 1968 flood, to reduce the risk of flooding to 1,200 homes and businesses in Tonbridge in Kent. It played a key role in protecting homes and businesses during the winter 2013/14 floods. In recent years, the Environment Agency has been developing a scheme to enlarge the flood storage area, working with local councils. The total costs are approximately £21.5 million, with a quarter of the funding coming from local sources, including from the South East Local Enterprise Partnership. (Environment Agency, 2018, Leigh expansion and Hildenborough embankments scheme)

The scheme has succeeded in securing local enterprise partnership funding because it will help to create opportunities for more housing and employment to support the growth and infrastructure strategy in Kent. The local economic benefits will include 200 businesses being better protected from flooding, and the creation of 50 direct jobs and 100 associated jobs.

The Leigh flood storage area is one of the flagship projects in the Medway Flood Partnership, a consortium of local partners in Kent, who have come together to develop a shared action plan for better managing flood risk in the Medway. (Environment Agency, 2017, Medway Flood Action Plan)

Figures 19 and 20: Photographs of Leigh flood storage area

To achieve our objective we have the following measures:

Measure 2.3.1: From 2021 the Environment Agency will identify ways in which flood and coastal infrastructure projects can better contribute to local economic regeneration and sustainable growth.

Strategic objective 2.4: Between now and 2050 places affected by flooding and coastal change will be 'built back better' and in better places.

Either as a proactive step or in response to flooding, more should be done to encourage property owners to build back better and in better places. This could involve installing property flood resilience measures to aid recovery or taking steps to permanently move away from the risk.

Flood-resilient measures which help people return to their homes quickly after flooding, such as raised electrics, hard flooring, waterproof plaster and flood doors, often cost more than typical non-flood-resilient measures. If you're already paying for clean-up and other related activities, it can be quicker and cheaper to just return your property to how it was before the flood. Most insurance companies take this view too, and won't pay for replacement with flood-resilient products.

If insurance companies changed their policies on pay-outs following flooding or coastal change, places could be built back better, making them significantly more resilient, so people feel safer. Taking this one step further, insurance companies could incentivise customers at risk of flooding and coastal change to take this kind of action before a flood. This could work in a similar way to how they incentivise customers to have strong locks on windows and doors for security reasons. Mortgage lenders could also have a strong influence, for instance, by requiring resilience measures to be fitted to a property at risk of flooding or coastal change before they grant a mortgage.

In some cases, the scale of flooding or coastal change may be so significant the concept of ‘build back better’ may not be appropriate, as recovery back to the same place is not the best long term solution in the decades to come. For example, coastal authorities can identify through coastal change management areas where to build back better and in better places.

The Adaptation Sub Committee’s 2018 report identified the challenges facing some of England’s coastal communities in the face of climate change. It calculated implementing the current shoreline management plans to protect the coast would cost £18 to £30 billion, depending on the rate of climate change. It also found that it will not be beneficial to protect or adapt 149 to 185 kilometres of England’s coastline as currently planned by England’s coast protection authorities. The Adaptation Sub Committee recommended developing adaptive approaches with coastal communities, to better involve them in the difficult decisions they’ll need to make in future. All risk management authorities should be prepared to provide the necessary support to achieve this.

To achieve our objective we have the following measures:

Measure 2.4.1: By 2025 the Environment Agency will work with government, insurers and financial institutions to review the legal, policy and behavioural changes needed to 'build back better and in better places' and improve the resilience of homes and business.

Measure 2.4.2: By 2021 coast protection authorities and the Environment Agency will refresh the shoreline management plans and keep them under review.

Strategic objective 2.5: Between now and 2030 all flooding and coastal infrastructure owners will understand the responsibilities they have to support flood and coastal resilience in places.

Flooding and coastal change infrastructure includes flood walls and sluices. It may also include natural features that provide an element of protection to people. Flooding and coastal change infrastructure is one of a combination of tools supporting an adaptive approach for improving the resilience of a place. But it’s a very important one.

Building and maintaining flooding and coastal change infrastructure to keep pace with climate change will remain critical to the future resilience of people, property and other infrastructure. The responsibility and management of flooding and coastal change infrastructure is complex.

In any given place, all infrastructure operators need to work together. Failure of one piece of flooding and coastal change infrastructure potentially compromises them all, and, ultimately, the safety of people living and working behind them. Some key infrastructure is privately owned, with limited legal responsibilities on owners to maintain it in a proper state. As local people and partners determine the tools they require to deliver flood and coastal resilience, it may be necessary to review the responsibilities of flood and coastal change infrastructure owners.

The government's surface water management action plan highlighted that consistent and complete infrastructure information is critical to managing surface water flooding, but the same can be said for all other sources of flooding and coastal change. Part of the Environment Agency's strategic overview role is to oversee the condition of the nation's flood and coastal change infrastructure, regardless of ownership. To support this and provide a clear understanding of the risks, risk management authorities should provide information in a consistent way. As part of the delivery of the surface water management action plan, the Environment Agency will work with lead local flood authorities and other expert bodies to develop guidance setting out best practice on local flood infrastructure management and record keeping.

Brunton Park flood alleviation project

This is a partnership project between the Environment Agency, Northumbrian Water and Newcastle City Council. It is a good example of infrastructure providers working together to deliver a combined solution that reduces the risk of flooding to 85 properties.

Flooding in September 2008 resulted from the combined effects of surface water, the sewer network and the main Ouseburn River. The preferred option for the scheme was to address all sources of flood risk through the creation of a new river channel with new defences up and downstream of the new channel. This option allowed for the creation of a storage channel adjacent to the existing river which will store excess surface water from Brunton Park in periods of heavy rainfall.

In addition to the flood alleviation project, Northumbrian Water installed 2 kilometres of new surface water and foul sewers and a new underground foul storage tank within Brunton Park to reduce the risk of sewer flooding in the area.

Figure 21: the new river channel at Brunton Park

Change is needed to clarify the responsibilities of flooding and coastal change infrastructure owners, but also to encourage greater collaboration between infrastructure owners to make better use of public funding and resources. Such an approach would reflect recommendations from recent research to improve asset management (Interreg, North Sea Region, 2019, A perspective on the future of asset management for flood protection) and also allow a better and more coordinated response to managing flooding and coastal incidents.

To achieve our objective we have the following measures:

Measure 2.5.1: By 2021 the Environment Agency will work with lead local flood authorities and other expert bodies to develop guidance setting out best practice on local flood infrastructure management and record keeping.

Measure 2.5.2: By 2024 the Environment Agency will require risk management authorities to report on the resilience of their flood and coastal change infrastructure in a nationally consistent way.

Measure 2.5.3: By 2024 the Environment Agency will work with risk management authorities to develop recommendations for flooding and coastal change infrastructure owners that enable greater collaboration, sharing and monitoring between them.

Strategic objective 2.6: Between now and 2050 the Environment Agency and risk management authorities will work with infrastructure providers to ensure all infrastructure investment is resilient to future flooding and coastal change.

Following the 2015/16 winter floods, the government undertook the National Flood Resilience Review. This assessed the resilience of key local infrastructure such as energy, transport, water and communications, and identified ways to protect it better. The review found 41% of transport and utility infrastructure is in areas at risk of flooding. Around 36% is directly at risk and 5% is at risk due to its dependence on electricity supplies, which are also at risk. Over 55% of water and sewerage pumping stations, 20% of railway lines, 10% of major roads, 28% of gas infrastructure and 14% of electricity sub-stations are in areas at risk of flooding. (HM Government, 2016, National Flood Resilience Review)

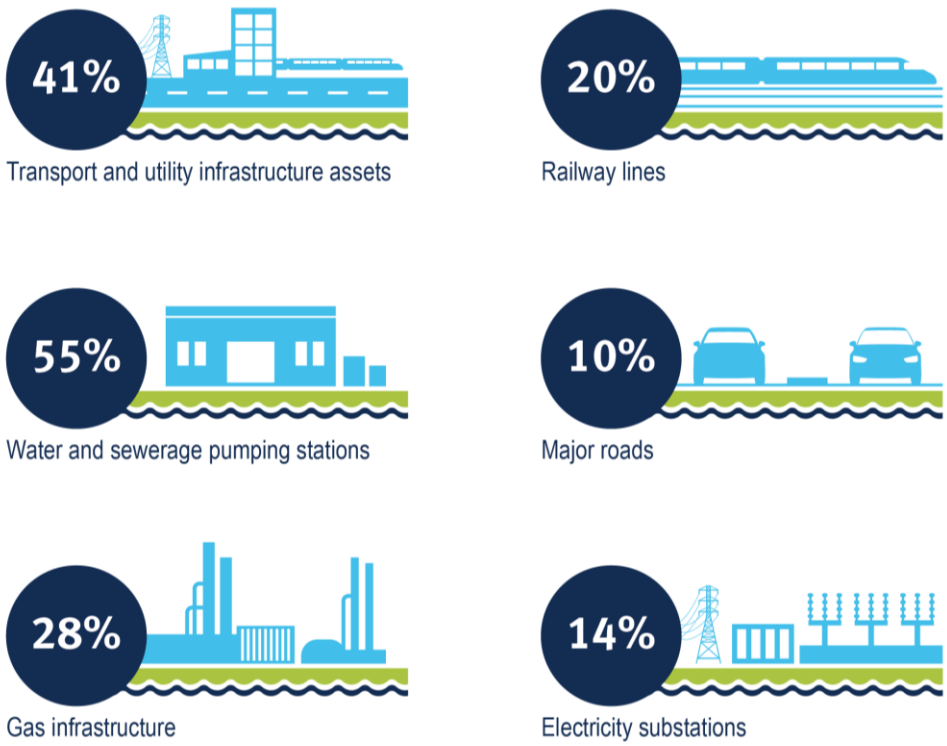


Figure 22: Key infrastructure at risk from flooding and coastal change

The current plans and strategies of risk management authorities go part of the way to providing the ambition for resilience, and describe what a place will look like in the future. However, to understand the full picture, the current and future plans of key infrastructure providers need to be considered as well.

Many government departments and agencies are reviewing opportunities for improving the climate resilience of infrastructure including HM Treasury's forthcoming national infrastructure strategy. The government's national adaptation programme and the Third Strategy for Climate Adaptation Reporting sets a clear expectation that utility companies and major industries will report on how they are adapting to climate change. Most recently, the government has commissioned the National Infrastructure Commission to examine the resilience of the UK's infrastructure.

All risk management authorities should work with infrastructure providers to ensure they properly consider resilience to flooding and coastal change throughout their operations. In some places, building back infrastructure in high-risk locations may not be the most economic or sustainable option. By developing flood and coastal resilience, it will be easier for infrastructure providers to determine how their long term investment plans can contribute to climate resilient places.

Humber flood risk management strategy

The Humber estuary is of national importance. It includes key ports such as Hull, Grimsby, Immingham and Goole, significant transport infrastructure, well-established chemicals and manufacturing industries, and internationally important habitats. It's also home to over 660,000 people and 73,000 businesses.

To help ensure long term resilience across this vital estuary, the Environment Agency, Humber Local Enterprise Partnership (LEP) and 12 local authorities are working together to comprehensively review the current Humber Flood Risk Management Strategy.

The challenges the estuary faces with rising sea levels and river flooding risks mean that between 2015 and 2021 over £250 million is being invested to better protect over 55,000 homes. But this won't be enough to keep up with future climate risks, especially if key infrastructure is to remain resilient. The Humber strategy will identify a number of trigger points at which difficult decisions will need to be taken, allowing for implementation before they're needed.

Figures 23 and 24 Aerial photographs of the Humber estuary

We need to set clear and high expectations that the infrastructure being planned today is resilient in tomorrow's climate. To support this the Environment Agency will review its guidance to planners following the UK Climate Impact Projections 2018. This will ensure all infrastructure – water, transport, power, hospitals, schools and more – takes future flooding and coastal change into account during their design and build.

To achieve our objective we have the following measures:

Measure 2.6.1: By 2021 the Environment Agency and risk management authorities will work with infrastructure providers to ensure all infrastructure investment is resilient to future flooding and coastal change.

Measure 2.6.2: By 2021 the Environment Agency will establish a Flood and Coastal Infrastructure Task Force to better align the long term investment planning of publicly funded infrastructure bodies.

A nation of climate champions, able to adapt to flooding and coastal change through innovation

Everything this draft strategy sets out to do is about helping people face the impacts of flooding or coastal change. As a nation, we are only just beginning to acknowledge the increasing risks from flooding and coastal change. The Environment Agency estimates over 5 million people in England are at risk from flooding and coastal erosion. Many millions more are affected when essential transport services and water infrastructure become interrupted or damaged by flooding or coastal change incidents. The blunt truth is it's not possible to prevent all flooding and coastal change. Everyone must live with this risk.

Research shows for every individual directly affected during a large flood - with a 1% annual chance of occurring - about 16 more suffer knock-on effects from losses of utility services. (Environment Agency, 2019). The impact of flooding on people is devastating, and can last long after the flood waters have gone away. People can be out of their homes for months or even years, but the impact on their lives is wider when businesses, schools and transport routes are affected. Even when formal 'recovery' has ended, the implications of living with the knowledge of risk are substantial. So it's not surprising there's strong evidence linking floods to mental health and wellbeing issues. Estimates from Environment Agency research suggests that the costs of mental health impacts of flooding could be £3,000-£7,000 per flooded household, depending on the scale of the flooding. (Environment Agency, 2019, Benefits of recreation, tourism and health, (unpublished)).

In 2018, only 34% of people with properties in areas the Environment Agency identified at risk, believed their property was either definitely or probably at risk. There's no data to quantify awareness amongst those who live at risk of utilities, transport routes or services being affected. Put simply, people and businesses are living at risk of flooding and coastal change without knowing.

There are many ways to increase awareness of flooding and coastal change. The Environment Agency and Met Office already run a world-class flood forecasting and warning service. Together, they're continually improving the service.

To create climate-resilient places, the ownership of flooding and coastal change needs to include everyone. We all have a role to play. This means people at immediate risk of flooding and those who aren't; small and large businesses, as much as national and local government. This is why we need **a nation of climate champions**.

Improving awareness of flooding and coastal change, and with it responsibility and action, will not be instant. But by mobilising a nation of climate champions, and with all risk management authorities working even better together, we can make this happen.

Progress towards a nation of climate champions, able to adapt to flooding and coastal change through innovation

Previous and ongoing work of the Environment Agency and other risk management authorities has ensured we are already making progress towards ensuring we have a nation of climate champions: This includes:

- the Environment Agency's flood forecasting service which provides people, businesses and the emergency services vital time to prepare in a flood. Currently 1.4 million properties are signed up to our free flood warnings
- since the floods of winter 2015/16, the Environment Agency have invested in new kit including vehicles, 40km of temporary flood barriers and 250 high volume pumps. We have around 6,500 trained staff across the country, ready to respond to flooding, including 500 flood support officers
- the Flood Forecasting Centre (FFC) is a partnership established between the Environment Agency and the Met Office. The centre operates 24 hours a day every day, and provides Emergency responders and Local Authorities in England and Wales with daily flood and coastal risk assessments
- over the last 6 years the Environment Agency has targeted the 5.2 million households and businesses in England at risk of flooding with information and advice about how to prepare for, and respond to, flooding
- the Flood and Coast Conference is an important part of bringing those who manage flood and coastal erosion together. It provides an opportunity to share lessons, celebrate success, showcase innovations and discuss ways to meet future challenges. Attracting 1,700 delegates over 3 days, the event offers a combination of formal conference sessions and an exhibition space

We need to inspire people to take action ahead of time and take responsibility for some of the solutions needed to help them when warnings are issued. Achieving this will need a range of approaches, tailored to different people. For some, easy-to-use digital tools will be the most appropriate answer, but for others it may be formal education in schools. There's no 'one size fits all', and all risk management authorities need to be able to adapt their approach.

Over the past 5 to ten years, more and more risk management authorities have been involving local people early on, to benefit from their local knowledge and help shape sustainable decisions in their area. This is not the case everywhere, and there's undeniably more to do to ensure inclusive engagement across all people in a place.

The draft strategy's consultation's proposals for developing flood and coastal resilience for places should help to ensure local people have a voice. They will be at the heart of the decisions taken to shape what climate resilience means for the places they live and work in. Ultimately, people will enable the final strategy to work. If we don't take this approach, the feedback will be loud and clear – people will feel like decisions are being imposed on them.

To achieve this isn't easy. It takes time and energy. Not all people can, or want, to give that time. It's also hard for risk management authorities to manage expectations where there are legal, financial or practical constraints on decisions they can make. But asking people for their views undoubtedly leads to better solutions, better understanding, and a stronger relationship between local people, their risk management authorities, and their environment.

As a nation, we face some hugely difficult decisions about how we respond to future risks in light of climate change. For many places, flooding is a reality and we're already losing homes to the sea. Along the coast and inland there are already places where homes and businesses can no longer be protected from flooding and coastal change. This means tough choices will need to be made. We need our communities and infrastructure to be better prepared for floods and coastal change, so that they recover more quickly from the damage and disruption and, where necessary, to help people and communities move out of harm's way. To ensure people accept the decisions, the choices need to be made by everyone, not just a few. The number of places where tough choices are likely to be required is only going to increase.

The threats posed by a changing climate are a global challenge, and we are not facing them alone. Our nation is already recognised as an expert in managing flooding and coastal change. We're well respected internationally and regularly offer our expertise and learn from others' experiences. For example, the Environment Agency regularly shares best practice with the Rijkswaterstaat in the Netherlands and the United States Army Corps of Engineers. It also contributes to international networks such as I-STORM which offers knowledge on using and constructing coastal barriers, protecting places from the sea.

I-STORM

I-STORM is an international network for Storm Surge Barrier managers and operators from around the world. The network exists to help knowledge exchange, foster continuous improvement and assist with future adaptation plans for Storm Surge Barriers and the places they protect. The range of activities undertaken by the network ensures the regular sharing of expertise, review of respective organisational challenges and opportunities and collaborative working towards international consistency across the storm surge barrier industry.

With the Rijkswaterstaat from the Netherlands, the Environment Agency is a founding member. Governance for the network is through a strategic board and below that, a delivery board. Both of these Boards include representatives from core members the Rijkswaterstaat, US Army Corps of Engineers, Venice Water Authority and the Environment Agency with the delivery board chair position held by the Environment Agency.

Faced with the challenges of increased flooding and coastal change, we need a thriving and innovative flood and coastal change profession. Risk management authorities, coast protection authorities and the commercial sector have an important role to play in working effectively with communities to develop climate resilient places. Better use of digital tools should be key part of this due to the mobile nature of modern life.

Strategic objective 3.1: Between now and 2030 young people at 16 should understand the impact of flooding and coastal change, but also recognise the potential solutions for their place, and opportunities for career development.

We can achieve a lot by making better use of the information we hold, in a way people understand. However, the significant challenges the nation faces require a better understanding of the impact, and the role everyone needs to play to address it. Flooding and coastal change are already regularly used as case studies within schools to show the impacts of natural hazards and climate change. However, more can be done and we need to take a long term view in helping those delivering the school curriculum to further include flooding and coastal change in it. This will have both immediate and longer-term benefits:

- short-term improvement in understanding by young people, who also share information with their friends and families – enabling action now
- ensuring all young people have the understanding, so when they reach adulthood they can contribute to place-based resilience and adaptive approaches – supporting action in the future
- encouraging young people to consider a career in flooding and coastal change, which will help increase the pool of specialists needed – ensuring long term

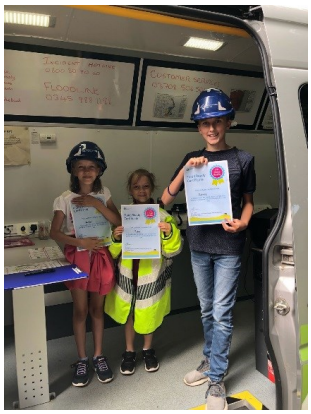


Figure 25: Photograph of children with Flood Ready certificates

Geographical Association

In 2018, the Environment Agency worked with the Geographical Association to produce materials for geography teachers that supported the existing national curriculum for GCSE and A level exams.

Topics covered included the causes, effects and responses to flooding. All the content was supported by real life examples and data, helping students develop a strong understanding of the subject.

Figure 26: A student takes part in a GCSE workshop

To achieve our objective we have the following measures:

Measure 3.1.1: By 2021 flooding and coastal change materials will be provided to help teachers deliver existing elements of the national curriculum.

Strategic objective 3.2: Between now and 2030 people will understand the potential impact of flooding and coastal change on them and take action.

Regardless of whether people recognise they're at risk of flooding and coastal change, or live in a place that's been affected, they all need to play a role in shaping the solutions. Community groups, flood action groups and wardens play a vital part in raising awareness, raising funds and running community schemes. We welcome this and want to encourage others to do the same, and to encourage all groups to have a presence, even when the memories of floods and their devastating impact fade. Increasing climate change evidence shows flooding and coastal change has and will continue to be something we need to act on today. As we look to manage that, everyone's involvement will be essential.

A key part of this is helping people and businesses understand what services they can expect from public bodies, what action they can take themselves, and how to get help in the event of an emergency, or recover from flooding or coastal events. Risk management authorities will need to engage with local people and businesses on the journey of understanding, accepting and taking action to the risks they face. This will require many to evolve their approach to involving the public and the skills of their staff. It's important all risk management authorities recognise this, and encourage people to play a part in decisions about their place.

The impact of flooding or coastal change is long-lasting and can be incredibly significant. People suffer from depression, anxiety and post-traumatic stress disorder to levels similar to those seen after major disasters, including terrorist attacks. In a recent study 36% of people flooded were suffering from post-traumatic stress disorder 12 months after, and 24% were still suffering after 24 months (The English national cohort study of flooding and health: cross-sectional analysis of mental health outcomes at year one). Children are acutely affected during and after floods. They lose their homes, friendship networks and familiar surroundings. They also see adults under great strain and witness the exceptional and long term tensions flooding brings. (Mort, M., Walker, M., Lloyd Williams, A., Bingley, A. & Howells, V., 2016, Children, Young People and Flooding: Recovery and Resilience Project Report. Lancaster, UK: Lancaster University).

Helping people recover from flooding and coastal change, however they've suffered, is a direct cost to local authorities through increased use of services. It also affects businesses of all sizes if people can't work. This has a direct long term impact on the local economy.

Independent organisations, often from the third sector, also have a vitally important role - both to help people prepare for and recover from flooding and coastal change. Organisations such as the National Flood Forum and the Action for Rural Communities in England, work with communities in different parts of the country. The work these organisations can do is often limited by their funding. As the risk of flooding and coastal changes increases, so will the need for these organisations.

England has a recognised world-class flood forecasting and warning service. The Met Office and the Environment Agency provide warning services to people and businesses for severe weather and flooding. Together, they're continually improving their combined services and giving people more accurate information, with more warning, for all sources of flooding. Bringing other risk management authorities into this work will be important,

particularly as warnings for surface water flooding are developed. Despite these improvements, more needs to be done to ensure everyone understands the language, and can access simple digital tools that prompt them to act, regardless of whether there's an imminent risk of flooding or coastal change. This includes expanding the Environment Agency's flood warning service to everyone at high risk of flooding and developing a range of different ways to warn people at risk, wherever they are.

Embracing new digital tools will be a key part of this because it provides the opportunity to provide bespoke information to any person or business based on their need.

Flood warning service and Google alerts

The Environment Agency has worked closely with Google Public Alerts to make flood warning information more accessible. Google Public Alerts is a platform for disseminating emergency messages for hazards or threats.

The system works in a number of ways:

- whenever someone in a live flood warning area performs a Google search for a flood related term, flood warning information will be highly visible on the search results page
- in the future for the most extreme incidents Google will enable the alerts to be visible in Google maps

There will also be a role for improved digital tools to ensure discussions on resilience for places, and the tools needed to achieve them, are open and understandable to everyone. If these digital tools aren't clear, we risk confusing people and failing to involve them in flooding and coastal change.

The information and language used needs to be accessible and tailored to different audiences. For example, people will want information to ensure their family and property are safe, whereas businesses will want to use it to make decisions that can improve the profitability, viability and longevity of their commercial activity.

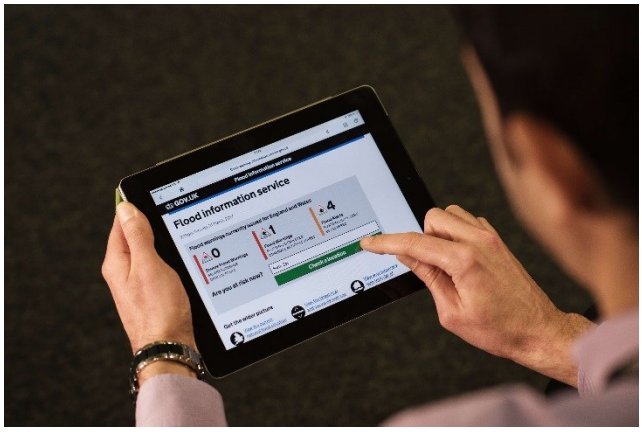


Figure 27: A user accessing the Environment Agency flood information service

To achieve our objective we have the following measures:

Measure 3.2.1: By 2022 government and risk management authority research programmes will identify how best to help people and businesses understand, accept and take responsibility for their risk to flooding and coastal change. This will help all risk management authorities better shape the way they work with people and businesses.

Measure 3.2.2: By 2021 all risk management authorities will develop and use digital tools to better communicate flooding and coastal change. This will help achieve greater awareness and responsibility of the risks people face.

Strategic objective 3.3: Between now and 2030 people will receive a consistent and coordinated level of support from all those involved in response and recovery from flooding and coastal change.

Throughout the draft strategy, we have been clear that it's impossible to completely remove the risk of flooding and coastal change and that we need a combination of tools to improve the resilience of places. Dealing quickly and effectively with incidents of flooding or coastal change, and the subsequent recovery from them, is a vital part of this.

The impacts of a flood or coastal change event on a place are complex. They can include impacts on the economy, infrastructure, social wellbeing, homes and the environment. Effective recovery needs to address all of these. Resilience tools for a place need to consider and prioritise all parts of recovery. Following a major flooding or coastal change, it's essential the decisions that follow help people and places be more resilient in the future. This may include building back better, and in better places, away from future risk. Whatever the scale of flooding and coastal change, recovery needs to be well-coordinated to ensure people involved are supported.

There are many organisations that play a role in managing what happens to people and the environment during and after an incident of flooding or erosion. Initially, the organisations involved depend on the source of the incident, for example surface water or river flooding. As the incident moves into recovery, and regardless of the source of flooding, the number of organisations helping people can grow considerably, and include insurance companies, health workers and waste disposal companies. Risk management authorities already have a duty to cooperate with and support one another. However, people expect this approach across all organisations.

The vital work some organisations do, particularly during recovery, isn't formally considered as part of incident management. For example: local mental health services helping people cope with the trauma and anxiety that follows flooding; the British Red Cross providing emergency support; local authorities re-homing families whose houses are uninhabitable; and the insurance industry providing repairs and finance.

The Multi-Agency Flood Plan Review, published in 2018, found that there are many good people and organisations engaged across the country in this work and the overall picture is reassuring. The review found there was room for some improvements in aspects of flood response planning. This largely involves reinforcing success, spreading existing good practice, extending national support measures and increasing resources devoted to flood emergency preparedness rather than more fundamental reform.

It recognised flood recovery can be even more challenging, with all the public agencies working together with flooded people, business and the third sector. The scale of flooding and coastal erosion can determine how long it takes people and infrastructure to recover, even if that means moving to a safer place. In major incidents, the scale of the incident can overwhelm local capabilities, and recovery can last for months, if not years.

The planning for and response to surface water flooding is led by lead local authorities. Other risk management authorities, for example the Environment Agency, support them in delivering their role. When flooding from surface water happens different organisations work together to manage the incident and support the people and businesses impacted. The government's surface water management action plan recognised that people's

understanding of surface water responsibilities can be blurred and placed an action on the Environment Agency to clarify roles through the development of the final strategy.

The role of the insurance industry in recovery is significant. For many people, their insurer will be the first organisation they speak to about the impact on their homes, business and life. We need to make every effort to ensure this is a positive and prompt experience that links all other organisations involved in the recovery process. The same minimum level of service needs to be provided across all insurers, so all people in a place, affected by the same flood, receive the same minimum level of support. As well as helping home insurance remain affordable in areas at risk of flooding, Flood Re has a role in helping manage a transition to home insurance prices that fully reflect flood risk by 2039. This means people benefiting from Flood Re need to better understand the impact of their flood risk and, if possible, take action to reduce it.

To achieve our objective we have the following measures:

Measure 3.3.1: By 2021 the Environment Agency will work with government and risk management authorities to clarify roles in relation to surface water flooding.

Measure 3.3.2: By 2022 the Environment Agency will have expanded their flood warning service to all places at a high risk of flooding from rivers and the sea.

Measure 3.3.3: By 2025 the Environment Agency will work with government to better join up the organisations involved in providing incident response and recovery to provide a consistent and coordinated service.

Strategic objective 3.4: Between now and 2030 the nation will be recognised as world leader in managing flooding and coastal change, as well as developing and attracting talent to create resilient places

The Environment Agency estimate that 117,000 people work in the flooding and coastal change sector. The sector offers well-paid, highly-skilled jobs. As the risks caused by climate change increase, the skills currently available will need to evolve to ensure we have the right professionals, able to help with, and advise on, flooding and coastal change.

This includes engagement specialists, engineers, natural capital and other environmental specialists. The need for skilled flooding and coastal change professionals, able to develop new approaches, will encourage universities and colleges to provide courses that meet this demand. In turn, better supporting the school curriculum will inspire young people to go into a supporting profession.

Flood and coastal engineering degree programme

The Environment Agency is continuing in its rich legacy in attracting and developing professionally qualified flood risk professionals for the sector. The programme is currently delivered through Brunel University London and HR Wallingford, providing students with the ideal mixture of academic study, and work based placements across England with both the Environment Agency and other risk management authorities. Through this partnership, we expect to develop around 250 professionally qualified flood and coastal engineers to embrace the challenges our sector faces over the coming years.

Figure 28: A student undertaking practical work as part of the flood and coastal engineering degree programme.

There is also the opportunity for organisations, such as the British Standards institute (BSi) and their equivalents, to continue to establish industry supported standards for resilience measures such as temporary and demountable defences, property level resilience measures and temporary flood barriers. Encouraging the use of flood resistant building materials for homes and businesses, supported by skilled professionals such as surveyors, developers and builders could ensure new properties and those needing repair after a flood, are built back better. This will increase resilience to flooding in the future. In turn this will drive competition and help England to become a base for world leading flooding and coastal change organisations that attract professionals with the right skills.

Adaptive approaches take this one step further, and allow flooding and coastal change professionals to think ahead to what the future challenges might be The flooding and coastal change sector, which includes government, supply chain and educational institutions, will be able to use this approach to create solutions that are more cost-effective, sustainable and acceptable to people.

To achieve our objective we have the following measures:

Measure 3.4.1: By 2022 the Environment Agency will continue to work with standards setting organisations to encourage flood resilience requirements to be incorporated into the building and materials standards for homes and businesses built in places at risk of flooding.

Measure 3.4.2: By 2025 the flooding and coastal change sector, including risk management authorities, will influence universities and colleges to ensure they develop the capabilities and skills required for both the public and private sectors.

Measure 3.4.3: By 2025 all public and private organisations in the flooding and coastal change sector, including risk management authorities, will support development programmes that enable their professionals to continue to develop their flood and coastal risk management knowledge.

Benefits, costs and funding

There are strong economic, social and environmental cases for investing in resilience to adapt to the impacts of future flooding and coastal change. The Environment Agency's long term investment scenarios 2019 study finds that the annual average investment need in flood and coastal change infrastructure is £1 billion per year, with an anticipated net present value of £100 billion over the next 100 years. The measures in this strategy are intended to make future investment more effective, efficient and co-ordinated. They will help us to realise the benefits set out in long term investment scenarios.

This section explores the potential costs and benefits of the measures up to 2026, and identifies where the funding for delivery may come from. We believe many of the measures are modifications to the existing activities and ways of working of risk management authorities. These should be cost neutral and sit within existing roles, responsibilities and statutory duties. There are other measures which have the potential to be more costly than these existing activities. These are set out below with an indication of the potential cost increases and economic benefits.

We anticipate that these costs can be funded by re-purposing existing flood and coastal expenditure by risk management authorities within current roles, responsibilities and funding arrangements. Risk management authorities receive funding from central and local government sources, agricultural drainage rates, plus private and third sector sources. Costs and funding will be considered in more detail as part of implementing the strategy. The costs avoided by investing in flooding and coastal change will also be considered during implementation.

In addition to the specific benefits which will be achieved, all of the measures should also realise a range of potential wider benefits, namely:

- the strengthening of links with and sharing information across risk management authorities, infrastructure providers, spatial planners and emergency responders to ensure that people, places and infrastructure are more resilient to flood and coastal risks, whilst seizing opportunities to improve the environment
- the encouragement of engagement with a broader a group of people to become more motivated to invest their time and resources in managing these risks, to ultimately become a nation more resilient to climate change

To achieve the aims of this draft strategy and to keep building the nation's resilience to flooding and coastal change, especially in the face of a changing climate, we will need to invest more money over time. At a time where there are many competing demands on government money, much of that investment may need to come from new sources other than the taxpayer. The draft strategy recognises that to achieve greater resilience to flooding and coastal change risk management authorities will need to use funding and finances from new sources. These are likely to include innovative and green financing sources.

Measures that may extend existing roles and responsibilities

Measures supporting the "Climate resilient places" ambition may have additional costs of between £10 million and £20 million up to 2026 depending on choices around implementation. These measures should encourage the development and delivery of tools and adaptive approaches to manage flooding and coastal change, particularly in priority areas. They should also encourage the maintenance of up to date local strategies and the use of future agricultural funding and regulation.

The related measures are:

Measure 1.2.1: By 2021 the Environment Agency and risk management authorities will identify frontrunner places for developing adaptive approaches for a range of different scales and social contexts, working with local places and partners.

Measure 1.2.3: By 2024 the Environment Agency will develop a national framework to help risk management authorities, people, businesses and public bodies identify the steps and decisions needed to take an adaptive approach to planning for flood and coastal resilience in a place.

Measure 1.2.5: By 2026 lead local flood authorities will update their local flood risk strategies to incorporate adaptive approaches to planning for flood and coastal resilience in a place.

Measure 1.3.2: From 2021 the Environment Agency will work with farmers, landowners and others to identify opportunities for using agricultural practices (through funding, advice and regulation) to manage flooding and coastal change.

Measure 1.5.2: By 2025 risk management authorities will test whether it is feasible to use upfront financing to deliver an adaptive approach in a place which will need very significant investment in future.

Measures supporting the ambition "Today's growth and infrastructure resilient to tomorrow's climate" may have additional costs between £10 million and £20 million up to 2026 depending on choices around implementation. These measures should secure improvements in the capabilities of all risk management authorities as well as improve the resilience to flooding and coastal change or homes and businesses

The related measures are:

Measure 2.1.1: From 2021 risk management authorities will invest in planning skills and capabilities to ensure they can advise planners and developers effectively to enable climate resilient places.

Measure 2.2.1: From 2021 all risk management authorities will achieve biodiversity net gain in all programmes and projects.

Measure 2.2.2: From 2021 all risk management authorities will seek to work with developers and planners to achieve environmental net gain as part of strategic development proposals.

Measure 2.4.1: By 2025 the Environment Agency will work with government, insurers and financial institutions to review the legal, policy and behavioural changes needed to 'build back better and in better places' and improve the resilience of homes and business.

Measure 2.5.2: By 2024 the Environment Agency will require risk management authorities to report on the resilience of their flood and coastal change infrastructure in a nationally consistent way.

Measures supporting the ambition "A nation of climate champions, able to adapt to flooding and coastal change through innovation" may have additional costs between £20 million and £50 million depending on choices around implementation. As well as helping to realise the benefits of increasing resilience, these could also bring wider benefits to businesses and society. They could potentially generate between 4 and twelve pounds of benefit for every one pound invested. These measures should secure improvements in the nation's knowledge and awareness of flooding and coastal change issues, particularly within the educational sector which will lead to the development of more people with the relevant skills.

The related measures are:

Measure 3.3.1: By 2021 flooding and coastal change materials will be provided to help teachers deliver existing elements of the national curriculum.

Measure 3.4.2: By 2025 the flooding and coastal change sector, including risk management authorities, will influence universities and colleges to ensure they develop the capabilities and skills required for both the public and private sectors.

Measure 3.4.3: By 2025 all public and private organisations in the flooding and coastal change sector, including risk management authorities, will support development programmes that enable their professionals to continue to develop their flood and coastal risk management knowledge.

Measure 3.2.2: By 2021 all risk management authorities will develop and use digital tools to better communicate flooding and coastal change. This will help achieve greater awareness and responsibility of the risks people face.

Measure 3.3.3: By 2025, the Environment Agency will work with government to better join up the organisations involved in providing incident response and recovery to provide a consistent and coordinated service.

Glossary

This glossary is intended as a reference tool.

A

Appraisal guidance

The Environment Agency provides appraisal guidance, which sets out ways to investigate opportunities to reduce flood risk and secure funding. Appraisal is the process of; defining the problem; setting objectives; examining options, assessing outcome benefit (including benefit: cost ratio); weighing up costs, impacts, (positive and negative) risks and uncertainties, in order to make a decision.

Adaptation

In the context of this draft strategy, it refers to adapting to future changes in our climate.

Adaptive approaches

An adaptive approach enables flood and coastal erosion risk management to be carried out in a way that is agile to the latest climate science, growth projections and other changes to the local environment. Looking out to 2100, adaptive approaches give local places ‘decision points’ to help navigate through an ambiguous future in collaboration with local partners and communities.

Asset

A flood defence asset is defined as any structure that would by its failure or removal or modification, increase the likelihood of flooding. An asset can be a defence, a structure, a watercourse channel or a beach.

B

Benefits

A benefit is any additional value to people, the environment or the economy arising from managing flooding and coastal change. The positive quantifiable and unquantifiable changes a risk management project is expected to produce.

Biodiversity net gain

Net gain is an approach to development that aims to leave the natural environment in a measurably better state than beforehand. Development that adopts a biodiversity net gain approach seeks to make its impact on the environment positive, delivering improvements through habitat creation or enhancement after avoiding or mitigating harm as far as possible. Based on a standardised approach, biodiversity net gain delivers measurable improvements by comparing habitat losses and gains and steering mitigation and compensation accordingly.

C

Catchment

The area from where water is collected by the natural landscape, and will eventually flow to a spring, river, lake or sea. For rivers and lakes, this includes tributaries and the areas they drain.

Climate change

The changes, both current and predicted, in the trend in weather patterns over a long period of time.

Climate future

In the context of this draft strategy, it means the world's climate in the future. This acknowledges that there are a number of climate scenarios to consider involving different predictions of what our climate might be like in the future.

Coastal cell

A length of coastline and its associated near-shore area within which the movement of sand and shingle is largely self-contained, with no significant effect on adjacent cells.

Coastal change

Within this document we use the term coastal change to refer to the risks of coastal erosion and sea flooding.

Coastal groups

Coastal groups are partnerships composed of coastal local authorities, the Environment Agency and other organisations with coastal management responsibilities. They provide a forum both for showcasing local initiatives and for strategic coastal management, principally by developing Shoreline Management Plans (SMPs).

Coast protection authorities

Local authorities in coastal areas have responsibility for managing coastal erosion and are called coast protection authorities. These authorities are represented on coastal groups alongside other organisations responsible for managing changes along our coastline, such as the Environment Agency and Natural England.

Collaboration

In the context of this draft strategy, it describes the way everyone needs to work together to successfully manage risk from flooding and coastal change.

Contributions

This is funding from sources other than the UK government as part of partnership funding projects.

Cost-effective

In the context of this draft strategy, it describes the least cost option. For example, where there are several potential things that could be done to reduce flood risk, the option that achieves the objective for the least overall cost is the more cost-effective option.

D

Department for Environment, Food and Rural Affairs (Defra)

Government department responsible for safeguarding our natural environment and setting environmental policy. The Environment Agency is an executive non-departmental public body of Defra.

Defences

A flood defence refers to the drainage of land and the provision of flood warning systems. Coastal defence is a term used to cover both coast protection against erosion and sea defence against flooding.

E

Environmental net gain

Improving all aspects of environmental quality through a scheme or project. Achieving environmental net gain means achieving biodiversity net gain first, and going further to achieve increases in the capacity of affected natural capital to deliver ecosystem services and make a scheme's wider impacts on natural capital positive.

F

Flooding

Within this document we use the word flooding to refer to flood risk management.

Flood plain

Area of land adjacent to a water-course, which is partly or wholly covered with water during floods.

Flood Re

Launched in April 2016, Flood Re is a re-insurance scheme. Homeowners don't deal with them directly. Homeowners can search for and buy home insurance in the usual way. Insurers can then pass responsibility of the flood risk part of the policy to Flood Re if necessary, and cap the cost of premiums based on the council tax band of the property in question.

Flood and coastal erosion risk management

Flood and coastal erosion risk management manages the risks of flooding and coastal erosion to people, property and the natural environment. The work focuses on minimising, predicting and managing the risk and it is one of the primary roles of the Environment Agency.

Flood Risk Management Plans

Flood Risk Management Plans (FRMPs) highlight the hazards and risks of flooding from rivers, the sea, surface water, groundwater and reservoirs, and set out how risk management authorities work with communities to manage flood risk.

G

Green Finance

Green finance is anything financial (instrument or investment) which is given in exchange for benefit to the environment in addition to what normally happens.

I

Investment

Traditionally, investment has referred to investment in flood and coastal infrastructure as well as maintenance of river channels. In the context of this draft strategy, it refers to funding or improving other measures such as natural flood management, and the preparedness to help communities recover after a flooding or coastal event.

Infrastructure

Roads, railways and other transport, communications and utilities assets, flood and erosion defences.

L

Local authority plan

This sets out local planning priorities and policies. These plans are useful to determine what land should be used for and to make decisions about what development might be built in certain places.

Local enterprise partnerships

These partnerships are voluntary but encourage local agreement of economic priorities and growth. The partnerships are normally between local businesses and local authorities.

Local flood strategies

These are a statutory strategies developed by lead local flood authorities to manage local flood risk in their area. The Flood and Water Management Act 2010 requires that lead local flood authorities in England must develop, monitor, apply and maintain a local flood risk management strategy. The strategy must cover local flood risk (surface water, ordinary watercourses and groundwater flooding) including interactions with main rivers and the sea. It may also cover other sources of flood risk and coastal erosion too.

Long term investment scenarios (LTIS)

LTIS 2018 brings together understanding of long term investment scenarios for flood and coastal erosion risk management. It uses new climate change, population and mapping data to set out potential future scenarios, assessing the costs and benefits of long term investment to meet these challenges. LTIS is evidence which government and others will use to consider future policy and investment choices.

M

Main rivers

Main river means all watercourses shown as such on the statutory main river maps held by the Environment Agency and the Department of Environment, Food and Rural Affairs (Defra), and can include any structure or appliance for controlling or regulating the flow of water into, in or out of the channel. The Environment Agency has permissive powers to carry out works of maintenance and improvement on these rivers.

N

Natural flood management (NFM)

Natural flood management measures can help slow, store and filter floodwater, and are often used in conjunction with more traditional engineering techniques. Environmental, social and other benefits (such as reduced soil erosion) can be provided simultaneously with reducing flood risk. Along with making existing flood defences more resilient to climate change, it can help us achieve Water Framework Directive, Floods Directive and biodiversity goals at the same time.

Neighbourhood plan

The concept of neighbourhood planning was first set out in The Localism Act (2011). These plans act as a catalyst to enable communities to get more involved in planning for their area. They focus on local policy setting for new development and enable the people that understand and take an interest in their area, to plan for it. They are created by the residential and business community and not the local authority and should promote the 'building of neighbourhoods' rather than stifling growth. If these plans are adopted by the local authority, they gain planning 'weight' and become part of the material planning framework for the community.

Net present value (NPV)

Future benefits minus future costs, adjusted using HM Treasury Green Book discount rates.

O

Ordinary watercourses

A watercourse that does not form part of a main river.

P

Partnership funding

Flood and coastal erosion resilience partnership funding is Defra's current policy. It provides a system of funding that applies to all flood & coastal erosion risk management (FCERM) projects seeking FCERM grant in aid Capital funding in England. It's a way of increasing overall investment in flood and coastal erosion risk management by encouraging external contributions as a means to obtain GiA. GiA is capped based on the number of outcome measures a project will achieve, with each project having a partnership funding score for prioritisation. Regional flood and coastal committees have a key role in working with partners and communities to maximise contributions, and also to raise and allocate local levy, which can also be used as an external contribution.

Property level resilience

These are measures people can take to help keep flood water out of their home or business. This includes stopping water getting into a property, for example by using sandbags. It can also include helping to minimise the damage flood water can cause if it does get into the property, for example having tiled floors or raised plug sockets.

R

Regional flood and coastal committees (RFCCs)

The RFCCs are committees established by the Environment Agency under the Flood and Water Management Act 2010. They bring together members appointed by government, the Environment Agency and lead local flood authorities (LLFAs) with relevant experience for 3 purposes:

1. to ensure there are coherent plans for identifying, communicating and managing flood and coastal erosion risks across catchments and shorelines

2. to promote efficient, targeted and risk-based investment in flood and coastal erosion risk management that optimises value for money and benefits for local communities

3. to provide a link between the Environment Agency, LLFAs, other risk management authorities, and other relevant bodies, to engender mutual understanding of flood and coastal erosion risks in its area

Resilient places

Resilience in places should be made up of a combination of tools that reduce the likelihood and consequence of flooding. These tools include: asset resilience (delivering a standard of protection through construction of new defences and maintenance of existing defences), catchment solutions (e.g. natural flood management) and community or business resilience measures (e.g. property level resilience, warnings and recovery plans).

S

Sustainable drainage systems (SuDS)

A system of management practices and control structures designed to drain surface water in a more sustainable way than some conventional techniques.

Shoreline management plans

Shoreline management plans (SMPs) provide a long term framework for dealing with coastal flooding and erosion over a specific stretch of coastline. These plans take into account risks to people and the developed, historic and natural environment as well as climate change. The aim of the plans is to provide the basis for sustainable shoreline management policies, and set out how they should be achieved over the next 100 years.

Sea level rise

The global rise in sea level, which is likely to increase in the future.

V

Voluntary sectors

Self-governing organisations, some being registered charities, some incorporated non-profit organisations. They deliver work for the public benefit using volunteers.

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