Department
for Environment
Food & Rural Affairs

The National Adaptation Programme and the Third Strategy for Climate Adaptation Reporting

Making the country resilient to a changing climate

July 2018

This publication is available at www.gov.uk/government/publications

Any enquiries regarding this publication should be sent to us at climate@defra.gsi.gov.uk

ISBN 978-1-5286-0758-2

CCS0718089334 07/18

Printed on paper containing 75% recycled fibre content minimum

Printed in the UK by the APS Group on behalf of the Controller of Her Majesty's Stationery Office

HC1403

Contents

Ministerial foreword

It is ten years since the UK's landmark Climate Change Act came into force. Much progress has been made since then, both in reducing our emissions of greenhouse gases and adapting to the unavoidable impacts of climate change across the country.

In January, we published our 25 year plan to improve the environment, setting out how we will achieve our ambition to leave our environment in a better state than we found it. In the six months since the plan was published, we have already made progress in a number of areas, including publishing the Tree Health Resilience Strategy, launching the National Planning Policy Framework consultation, which includes proposals to strengthen biodiversity net gain, and improving the resilience of properties at risk of flooding.

The 25 Year Environment Plan recognises that, in order to achieve our 25-year goals, we need to adapt to climate change and ensure that all policies, programmes and investment decisions take into account the possible extent of climate change this century. In the five years since the publication of the first National Adaptation Programme we have made significant progress in embedding consideration of climate change risks across all policies and programmes.

This, our second National Adaptation Programme report, builds on the first, setting out our strategy for adapting both to the climate change that we are already seeing, and that which we might see in the future. Its focus is on the set of actions we and others will be undertaking over the next five years to address the most urgent risks, as identified in our 2017 Climate Change Risk Assessment, in order to make the country more resilient to climate change.

An important aspect of adaptation is communication and we will work to ensure that across society people understand the challenges and risks which may lie ahead. Government will look to improve communication channels and work with professional bodies to widen and deepen understanding of climate change risk and engage ever more people to take action to adapt.

The future may be uncertain, and our climate and weather particularly so. It is therefore a cornerstone principle of resilience preparation that we plan for a 'reasonable worst case

scenario', in parallel with taking actions to reduce the likelihood of that scenario becoming reality. So, while we continue to play a leading role in international efforts to keep global temperature rises well below 2C (by reducing our own emissions and supporting the developing world to do the same), our resilience will only be robust if we prepare for worse climate change scenarios.

Later this year we will be launching a revised set of UK climate projections ('UKCP18'), replacing the current 2009 set and providing the most up to date and scientifically robust estimations of climate scenarios out to the end of this century. These projections are a key tool to enable everyone to future proof policies and activities to ensure our resilience to possible future climate change.

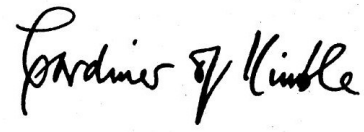
The Climate Change Act is a prime example of UK leadership. We are working to deliver a Green Brexit so that we take back control of our fisheries and agriculture, restore nature and care for our land, rivers and seas. Using a natural capital approach ensures that we take account of all the many benefits our environment provides, and we will develop policies that ensure our seas and lands are healthy and productive and resilient to climate change.

Achieving long term goals does not happen overnight, but the aim set out in the first National Adaptation Programme in 2013 still stands:

"A society which makes timely, far-sighted and well-informed decisions to address the risks and opportunities posed by a changing climate".

We will continue to work with the devolved administrations in achieving our shared goal of ensuring the whole of the UK is resilient to a changing climate.

Climate change affects us all and adapting to it is not something government can do alone: we need the engagement of all from outside government – industry, local government, the public – as we all work together to strengthen the resilience of our nation.



Lord Gardiner of Kimble

Executive summary

This second National Adaptation Programme (NAP) sets out government's response to the second Climate Change Risk Assessment (CCRA), showing the actions government is, and will be, taking to address the risks and opportunities posed by a changing climate. It forms part of the five-yearly cycle of requirements laid down in the Climate Change Act 2008 to drive a dynamic and adaptive approach to building our resilience to climate change.

Achieving long term goals in the face of uncertainty requires many steps along a pathway that cannot be fully laid out from the start. The nature of the Act's framework allows for iteration and evaluation as we progress. This means we can build on the achievements of, and learn lessons from, the previous cycle of assessment and reporting and set out a flexible pathway that will enable us to adapt as risks evolve in the future. This report focuses on the key actions we will be taking over the next five years to strengthen our resilience to climate change. The NAP is intended to communicate the extent, nature and immediacy of different climate risks and what we are doing to address them, which will help inform a more mature debate on how we adapt as a society.

The first NAP contained over 370 actions addressing some 100 risks identified in the first CCRA. These included actions such as embedding adaptation into delivery of the Natural Environment White Paper and Biodiversity 2020 and developing a strategic plan for coastal realignment. In preparing the second CCRA and NAP report, government sought to follow the recommendations of the Adaptation Sub-Committee (ASC), our statutory advisers on climate adaptation, to set more focused priorities and specific and measurable objectives that clearly contribute to adaptation outcomes, and to be clear on how these will be monitored and evaluated.

For the first time we have integrated within the NAP the important work which will be done by reporting organisations under the Adaptation Reporting Power. We set out how government's strategy for the third cycle of reporting contributes to and links up with our overall programme of work on adaptation. We illustrate the contributions from a range of reporting organisations in infrastructure sectors, and reporting public bodies, including those responsible for water, energy, transport, communications, environment, fisheries, heritage, health and finance, and how they are addressing many risks across the CCRA.

The NAP explains the range of climate risks which affect our natural environment, our critical infrastructure services, our communities and buildings, local government and businesses. The importance of adapting to these climate challenges and transitioning to a low carbon economy is set out, drawing on a large body of ongoing work across government. This NAP builds on this work, including the incorporation of Natural Capital approaches in HMT guidance and the announcement of successful bids for the peatland grant scheme. The government's £2.6 billion six-year capital investment programme to reduce flood and coastal erosion risk will provide over £30 billion in economic benefits. We

are also working with key infrastructure sectors on a wide range of climate risks, and greater integration of climate in the health and planning systems.

In the CCRA evidence report the ASC identified six priority areas of climate change risks for the UK. In general, government endorsed the conclusions of the ASC, with the exception of the level of severity of some of the food security risks. The actions we are taking which together move us towards addressing these risk areas are set out in the NAP and in the actions table in Annex 2. Key actions include:

Flooding and coastal change risks to communities, businesses and infrastructure is a high risk now and is expected to remain a high risk in the future. In this NAP we set out the objectives and actions that will be taken to:

- make sure everyone is able to access the information they need to assess any risk to their lives, livelihoods, health and prosperity posed by flooding and coastal erosion;
- bring the public, private and third sectors together to work with communities and individuals to reduce the risk of harm – particularly those in vulnerable areas;
- make sure that decisions on land use, including development, reflect the level of current and future flood risk;
- boost the long-term resilience of our homes, businesses and infrastructure;
- take action to reduce the risk of harm from flooding and coastal erosion including greater use of natural flood management solutions; and
- include flood risk as a key feature of adaptation reporting from infrastructure reporting organisations.

Risks to health, well-being and productivity from high temperatures is also a high risk now and is expected to remain a high risk in the future. In this NAP we set out the actions that will be taken to:

- work with infrastructure operators included in the third cycle of adaptation reporting to outline risks posed to their productivity from climate impacts;
- deliver more, better quality and well-maintained local Green Infrastructure; and
- adapt our health systems to protect people against the impacts of climate change, such as ensuring all clinical areas in NHS Trusts have appropriate thermal monitoring in place.

Risks of shortages in the public water supply for agriculture, energy generation and industry. In this NAP are the actions that will be taken to:

- work to restore natural processes within river systems to enhance water storage capacity; and
- work towards setting challenging and ambitious goals to reduce water leakage.

Risks to natural capital including terrestrial, coastal, marine and freshwater ecosystems, soils and biodiversity. In this NAP are the actions that will be taken to:

- introduce a new Environmental Land Management scheme which will deliver environmental outcomes;
- develop and start to implement a Nature Recovery Network, linking habitat restoration and creation to improved access, flood protection and water quality;
- incentivise good soil management practices that enhance soil's ability to deliver environmental benefits through future environmental land management schemes;
- introduce a sustainable fisheries policy as we leave the Common Fisheries Policy and prepare marine plans that include policies for climate adaptation;
- build ecological resilience on land, in our rivers and lakes and at sea; and
- protect soils and natural carbon stores.

Risks to domestic and international food production and trade. In this NAP are the actions that will be taken to:

- Ensure a food supply chain which is resilient to the effects of a changing climate; and
- review and publish the updated UK Food Security Assessment.

New and emerging pests and diseases and invasive non-native species affecting people, plants and animals. In this NAP we set out the actions that will be taken to:

- Manage existing plant and animal diseases and lower the risk of new ones; and
- tackle invasive non-native species.

This NAP has been organised in chapters to mirror the second CCRA evidence report so that there is a clear line of sight from CCRA assessments to NAP actions. This will facilitate the ASC's future biennial statutory evaluations of progress on the NAP, the first of which will be published in June 2019. There are, inevitably, some crossovers (for example on flooding) and these are signposted throughout the document.

Chapter 1: Scene setting

1.1 Our climate is changing

Our climate is changing and the impacts will affect us all in some way during our lifetimes. There have always been natural fluctuations in climate but observational records show that we are seeing rates of change far greater than those experienced historically. Globally, each of the last three decades has been warmer than any preceding one since 1850 and 17 of the 18 warmest years on record have all occurred since 2000. The oceans are warming at all depths and glaciers and ice sheets are melting which, together with thermal expansion of the oceans, is causing sea level to rise at an accelerating rate.

In the UK we are experiencing a warmer and wetter climate. All of the top ten warmest years on record have occurred since 1990 with eight of those since 2000. The UK's hottest year on record was 2014 and the chances of the UK breaking its temperature record are now at least 10 times higher compared to the time before we started burning fossil fuels[1]. Extremely warm summers, such as the European heat wave of 2003 which was responsible for 2000 excess deaths in the UK, are now expected to happen twice a decade compared to twice a century in the early 2000s[2]. Seven out of the top ten wettest years in the UK have occurred since 1998 and the winters of 2014 and 2016 have been the two wettest on record[3]. An extended period of extreme winter rainfall in the UK is now about seven times more likely than in a world without human emissions of greenhouse gases[4].

The current set of UK Climate Projections (UKCP09) tell us that the UK will continue to warm in the future and more so in summer than winter. UK winters are also expected to become wetter while summers could be slightly drier. Later this year we will launch updated UK Climate Projections (UKCP18) based on improved climate models and up-to-date observational records. UKCP18 will inform the Government's third and fourth Climate Change Risk Assessments (due for completion in 2022 and 2027) and subsequent cycles of the National Adaptation Programme. UKCP18 will also be an important source of information for other UK organisations that have to manage climate risks and impacts on their assets and operations.

[1] King, A.D et al. 2015. Attribution of the record high Central England temperature of 2014 to anthropogenic influences. Environmental Research Letters URL: http://iopscience.iop.org/article/10.1088/1748-9326/10/5/054002

[2] Christidis, N et al. 2014. Dramatically increasing chance of extremely hot summers since the 2003 European heatwave. Nature Climate Change 5, 46-50. URL: https://www.nature.com/articles/nclimate2468

[3] Kendon, M., McCarthy, M., Jevrejeva, S and Legg, T. (2017): State of the UK Climate 2016, Met Office, Exeter, UK. URL: https://www.metoffice.gov.uk/news/releases/2017/state-of-the-uk-climate-report-2016

[4] Christidis, N et al. 2015. Extreme rainfall in the UK during winter 2013/14: The role of atmospheric circulation and climate change. Explaining Extreme Events of 2014 from a Climate Perspective. URL: https://journals.ametsoc.org/doi/10.1175/BAMS-D-15-00094.1

1.2 Legislative framework on climate change

The Climate Change Act 2008 provides the framework both for mitigating climate change by reducing greenhouse gas (GHG) emissions and for adapting to climate change. For the latter, it includes a requirement to complete a Climate Change Risk Assessment (CCRA) every five years, followed by a National Adaptation Programme setting out how the risks identified in the CCRA will be addressed. Additionally the Act provides Government with the power (known as the 'Adaptation Reporting Power') to require public bodies and infrastructure operators that provide key services, to report on what actions they are taking to address climate impacts. The strategy for the next round of adaptation reporting is laid out in Chapter 7 of this document. The ASC is responsible for evaluating progress on the adaptation programme, reporting to Parliament every two years.

1.3 UK climate change risk assessment 2017

The Government commissioned the ASC to prepare the Evidence Report for the second CCRA, drawing on the best available evidence and independent expert advice. The ASC were asked to set out clear priority risks which needed to be addressed over the five year span of the second NAP, based on the latest understanding of current, and future, climate risks and opportunities, vulnerability and adaptation.

Government has also sought to address ASC recommendations of areas to strengthen: consideration of interdependencies; public communication of risks and steps to reduce vulnerabilities; and the evidence base for policy decisions and evaluation.

The second CCRA identified six priority risk areas where action is needed in the next five years:

1.4 National adaptation programme

Adaptation, by its very nature, needs to be seen in the context of a changing climate over a long period of time. It is recognised that the process to adapt takes place over decades.

This NAP addresses the priority risks identified in the CCRA2017, setting out the actions that government is taking, outcomes we want to achieve, and the means by which we will be measuring the progress made towards achieving our objectives.

Whilst this NAP primarily sets out the work and approach of government, as required by the Climate Change Act, it also sets out some of the significant actions that we expect those outside of government to be undertaking in parallel over the period of this NAP. This includes the work of organisations, such as infrastructure operators and public bodies responsible for key services, which are reporting on their work on climate change adaptation, in line with the Adaptation Reporting Power.

Like the first NAP, there is a mixture of policies and actions to help us to adapt successfully to future weather conditions, by addressing the risks and making the most of the opportunities. The document has been organised to mirror the second CCRA evidence report so that there is a clear line of sight from CCRA2017 to areas of action in the NAP. This will facilitate the ASC's biennial statutory evaluations of progress on the NAP, the first of which will be completed by June 2019.

In recognition of the uncertainty of future climate impacts, we continue to take a flexible and risk-based 'pathways approach'. By sequencing implementation of actions to focus on those that have the greatest benefit for all future scenarios, we strengthen resilience whilst keeping options open to be able to respond in an iterative way as the future develops. Effective monitoring and evaluation is particularly important when there is uncertainty over what exactly the future will look like, in order that adaptation strategies can be reviewed and adjusted to remain within an accepted level of risk. Consistent monitoring can provide early warning of adaptation tipping points where irreversible and/or severe impacts may occur if alternative routes of investment and adaptation are not explored.

Within this report, government is also setting out its third strategy for exercising the Adaptation Reporting Power over the next five years. Government consulted from February to March 2018 and received 59 responses. In line with the views received in the consultation which supported voluntary reporting, the Secretary of State does not intend to direct organisations to report. Government considers that a voluntary reporting process is the most constructive and collaborative approach for engaging reporting organisations and would allow the greatest flexibility and innovation to address climate risk and enable efforts to increase resilience. In line with the collaborative approach government has taken to the NAP as a whole, reports will be invited from organisations across sectors, such as transport organisations, water companies, stakeholders from the energy sector, public bodies, data centres and telecommunications, regulators and heritage environment.

1.5 Improving the evidence base

As well as identifying priority climate risks in the UK, the second CCRA evidence report[5] identifies approximately 200 evidence gaps. Each risk or opportunity in the CCRA2017 is assigned an urgency category based on the expert judgement of the ASC in consultation with CCRA report authors and reviewers. The 'research priority' category is reserved for those risks and opportunities where further evidence is needed to determine the urgency category that risk/opportunity falls into. The ASC continue to engage with others to find ways to address the evidence gaps highlighted in the second CCRA. They, and the Department for Environment, Food and Rural Affairs (Defra), have secured funding for research projects for the third CCRA and are influencing other avenues of research to more closely address the highlighted gaps.

Research Councils fund a significant amount of research relevant to climate change adaptation – such as the 2017 Marine Climate Change Impacts report cards[6]. Currently the majority of relevant research is supported by the Natural Environment Research Council (NERC), the Engineering and Physical Science Research Council (EPSRC) and the Economic and Social Research Council (ESRC). The launch of UK Research and Innovation (UKRI) offers new opportunities for co-ordinating research across different academic disciplines and for multidisciplinary issues such as climate change.

Following the recommendation to enhance communication of government research priorities in Sir Paul Nurse's review of the UK Research Councils, the Defra Group published its areas of research interest in 2017[7]. This document sets out the collective high level priority research questions across Defra and its agencies and public bodies and includes several relevant to climate risks and opportunities.

The Met Office Hadley Centre Climate Programme (MOHCCP) was established by government (co-funded by BEIS and Defra) to provide world-leading scientific evidence on climate variability and change. The new 2018-2021 work plan has been designed around key questions that government has agreed with the climate science community need answering over the next five years and beyond. The new programme will make substantial advances in the prediction and projection of regional climate change with a greater focus on climate risks. It will also develop prediction and monitoring systems to enable rapid delivery of advice to government before, during and in the aftermath of extreme climatic events that affect the UK and other regions worldwide. The MOHCCP is also delivering the

[5] Climate Change Risk Assessment, 2017, URL: https://www.theccc.org.uk/tackling-climate-change/preparing-for-climate-change/uk-climate-change-risk-assessment-2017/

[6] Marine Climate Change Impacts, URL: http://www.mccip.org.uk/impacts-report-cards/full-report-cards/2017-10-year-report-card/ accessed 05/07/2018

[7] Defra Group Areas of Research Interest URL: https://www.gov.uk/government/publications/defra-group-areas-of-research-interest accessed 05/07/2018

updated 2018 UK climate projections (UKCP18) which will provide an important building block for enhancing the evidence base for the third CCRA, due in 2022.

1.6 Raising awareness and promoting action

Adapting to our changing climate cannot be done by government alone. It will require collaboration across civil society, local authorities, private and public sectors and infrastructure providers. Communication of the risks, the impacts and the actions to take is an important part of this.

Government will work to ensure that across society, people will be empowered with a full understanding of the climatic challenges and opportunities ahead. The 25 Year Environment Plan includes a goal to see more people from all backgrounds involved in projects to improve the natural world. We will make 2019 a year of action for the environment, putting children and young people at its heart. This "Year of Green Action" will provide a focal point for organisations that run environmental projects, and will encourage wider participation across society. The challenges and opportunities of a changing climate will inform the activities envisioned over the course of this year of green action.

Government will also promote climate action within the business community and civil society. As committed to in the Clean Growth Strategy in 2017, government will work with businesses and civil society to introduce a Green Great Britain week in 2018. This will promote clean growth, showcase the latest climate science, and demonstrate our progress and successes on climate action and air quality issues.

Under the 2018-2021 MOHHCP the Met Office will increase their commitment to communicating climate change to a wider range of audiences. The Met Office's climate observations, predictions and projections will be made more accessible online. The new Climate Programme will continue to focus on exploring innovative ways to visualise and communicate climate data, in a way more likely to resonate with a public audience.

Engagement with stakeholders will also take place within the context of climate projections work. Regular stakeholder engagement through user groups has been an integral part of the UKCP18 project. This will ensure that, when the new UK climate projections are released later this year, the data is useful and used both by government and wider organisations to ensure assets and operations are resilient to future climate and weather extremes.

In addition to the engagement described above, there are several initiatives in the research community that are seeking to improve public engagement on climate science and impacts. For example, as part of the wider 'Engaging Environments' initiative[8] NERC

[8] Engaging Environments initiative. URL: https://nerc.ukri.org/press/releases/2017/35-peprojects/ accessed 05/07/2018

are funding two projects to improve public engagement on climate change: the Climate Communications Project[9] and Climate Stories[10]. The former is led by University of Leeds and aims to develop the national infrastructure to deliver high impact public engagement. The latter is led by University of Exeter and focuses on developing the narrative skills of scientists and evaluating the use of storytelling as a method to engage a diverse range of community groups.

Government is also exploring how existing communication channels can be reinforced and we will continue working with professional bodies such as the Royal Meteorological Society to identify risks and actions to increase resilience and reduce vulnerability.

1.7 Devolved administrations

Climate adaptation policy is a devolved matter: Scotland, Wales and Northern Ireland have each established their own adaptation programmes. This NAP is primarily for England as well as covering UK reserved matters. The UK Administrations are committed to working closely together to share best practice and develop UK wide initiatives where appropriate.

1.7.1 Scotland

Scotland's first statutory Climate Change Adaptation Programme *Climate Ready Scotland* was launched by Scottish Ministers in May 2014 under the Climate Change (Scotland) Act 2009. The Programme has around 150 individual policies and proposals. Scotland's second five-year Programme is under development and due to be published in 2019.

Scotland is making significant investments in flood risk management; the water industry; improving the energy performance of housing; and increasing forest planting and restoring large areas of peatland. Other important developments include: public bodies climate reporting duties; climate adaptation indicators; a National Centre for Resilience; mapping flood disadvantage; Scotland's National Coastal Change Assessment; risk assessment of Historic Environment Scotland's estate; risk assessment by the NHS Scotland estate; adaptation research fellowships; regional adaptation partnerships (Climate Ready Clyde, Edinburgh Adapts and Aberdeen Adapts); specialist support for the Programme by sustainability charity Sniffer under contract to the Scottish Government; and Glasgow's hosting of the European Climate Change Adaptation conference in 2017.

1.7.2 Wales

Wales has strengthened its legislative requirements to build resilience to the impacts of climate change through the Wellbeing of Future Generations (Wales) Act 2015 and the Environment (Wales) Act 2016. Climate change is integral to all of the Well-being Goals and there is specific reference to a resilient Wales, which includes resilience to the effects

[9]The Climate Communications Project. URL: http://theclimatecommsproject.org/ accessed 05/07/2018
[10] Climate Stories. URL: http://climatestories.virb.com/ accessed 05/07/2018

of climate change. Climate change is also a key element of the Future Generations Commissioner for Wales' role and the Future Trends Report and Public Service Board well-being assessments will need to take into account the latest Climate Change Risk Assessment.

Welsh Government's current Adaptation Delivery Plan was published in 2010, under the Climate Change Strategy for Wales. However, in light of the new legislation and emerging evidence such as the Climate Change Risk Assessment Evidence Report prepared by the Climate Change Committee, Welsh Government is now developing a new Climate Change Adaptation Plan for Wales which will be published in 2018. In addition, Wales is already taking significant steps in response to the latest Climate Change Risk Assessment. The Welsh Minister for Environment announced a £56m programme in March 2018 to improve flood and coastal erosion defences and support flood risk management activities across Wales over the next financial year.

1.7.3 Northern Ireland

In Northern Ireland, the Department of Agriculture, Environment and Rural Affairs (DAERA) takes the lead on climate change issues[11]. It works closely with Defra and the Devolved Administrations of Scotland and Wales.

The current Northern Ireland Climate Change Adaptation Programme, produced in 2014, focuses on three adaptation principles:

- Integrating adaptation into relevant key policy areas;
- developing the evidence base; and
- communication and cooperation.

A second Northern Ireland Climate Change Adaptation Programme is being developed, as required by section 60 of the UK Climate Change Act 2008. It will contain the response of the Northern Ireland government to the risks and opportunities identified in the Northern Ireland Summary of the 2017 UK Climate Change Risk Assessment.

[11]DAERA climate change. URL: https://www.daera-ni.gov.uk/topics/protect-environment/climate-change accessed 05/07/2018

Chapter 2: Natural environment

Vision

The natural environment with diverse and healthy ecosystems, is resilient to climate change, able to accommodate change, and valued for the adaptation services it provides.

Profitable and productive agriculture and forestry sectors that take the opportunities from climate change, are resilient to its threats and contribute to the resilience of the natural environment by helping to maintain ecosystem services and protect and enhance biodiversity.

The 25 Year Environment Plan sets out our goals for improving the environment within a generation and leaving it in a better state than we found it. We will ensure that resources from nature, such as food, fish and timber, are used more sustainably and efficiently. Maintaining a healthy environment will mean that it is more resilient to the impacts of climate change.

2.1 Climate change risks

Our lives and livelihoods depend on our natural environment and the benefits it provides – from timber, food and clean water to pollination, carbon storage and the cultural benefits of landscapes, archaeological sites and wildlife. CCRA2017 identifies significant risks to this natural capital from the scale and rate of climate change, which may be too much for some natural systems to adapt to.

As signalled in our Industrial Strategy[12] and our 25 Year Environment Plan, the UK is using a 'natural capital' approach as a tool to help us make key choices and long-term decisions, reflecting the full value of the benefits offered by the environment. We have already begun to change the way we think about the environment throughout government policy, and in March 2018 the Treasury Green Book was updated in line with advice from the Natural Capital Committee to encourage across government the use of a natural capital approach.

What is natural capital?

Natural capital is the sum of our ecosystems, species, freshwater, land, soils, minerals, our air and our seas. These are all elements of nature that either directly or indirectly bring value to people and the country at large. They do this in many ways but chiefly by providing us with food, clean air and water, wildlife, energy, wood, recreation and by capturing and storing carbon and helping to protect us from hazards like flooding.

We will work with academic partners to further develop the evidence base on issues affecting natural capital, with relevance to climate change adaptation.

We are seeing changes to ecosystems due to temperature, sea level rise or extreme events, of which the latter are predicted to increase in frequency and severity. These all impact on the benefits the environment provides.

We are also seeing shifts in the distribution and abundance of some terrestrial, freshwater and marine species due to higher temperatures. There is evidence that some species are already moving northwards and to higher altitudes, tracking where suitable climates are now found. Where species are unable to move in response to climate change there is a risk they will continue to decline.

Such risks from climate change are heightened because the natural environment is already under pressure. Pollution, habitat loss and fragmentation, diseases and invasive non-native species, the continuing drainage of wetlands and the unsustainable use of soil, water and marine resources all reduce the natural resilience of species and ecosystems and their ability to adjust and adapt.

[12]Industrial Strategy. URL: https://www.gov.uk/government/publications/industrial-strategy-building-a-britain-fit-for-the-future accessed 05/07/2018

There are potential opportunities that arise from a modest level of climate change, through extended growing seasons and improved productivity in agriculture, forestry and fisheries. These opportunities will, however, only be realised if limiting factors such as water availability, soil health and pests and diseases are managed.

Key risks identified in CCRA2017 where further action is needed are:

Risks to species and habitats due to inability to respond to changing climatic conditions	Risks to agriculture and wildlife from water scarcity and flooding	Risks to soils from increased seasonal aridity and wetness and risks to natural carbon stores and carbon sequestration	Risks of land management practices exacerbating flood risk	Risks to habitats in the coastal zone from sea-level rise; and loss of natural flood protection

2.2 Building ecological resilience

One of the objectives in the first NAP was to build the resilience of wildlife, habitats and ecosystems (terrestrial, freshwater, marine and coastal) to climate change, to put our natural environment in the strongest possible position to meet the challenges and changes ahead. Building ecological resilience to address risks to species and habitats (and the benefits they provide) is a key recommendation of CCRA2017.

We remain committed to delivering ecological resilience and building on the actions delivered as part of the previous NAP, as we take forward action aligned to the wider environmental goals of the 25 Year Environment Plan. Within this document, actions to build ecological resilience have been grouped by broad environments: on land and in lakes and rivers; and at sea.

Taking a targeted approach

To address the risks of climate change we will target our interventions across urban and rural areas so that they restore, expand and link our existing ecosystems and wildlife habitats. Defra and its delivery bodies will increasingly use spatial analysis of where interventions are likely to have the greatest benefits for wildlife and people to underpin this targeted approach with evidence.

For ecosystems, habitats and species on land and in our rivers and lakes, we have set out clear commitments in the 25 Year Environment Plan. We will continue to maintain a coherent network of protected sites and to take action to improve their condition. We will also develop a Nature Recovery Network to complement and connect our best wildlife sites. This will be an expanding area of increasingly connected wildlife-rich habitat to help build resilience to climate change.

NE, working with other delivery bodies and with external partners, will increasingly operate at a catchment or landscape scale, seeking to connect areas of existing habitat. We will also work to deliver multiple benefits in urban and rural areas, by restoring landscapes, including woodland, peatland, wetland and coastal habitats that provide benefits for water quality, natural flood management, carbon capture and public enjoyment alongside wildlife gain.

NE's new Conservation21 strategy reinforces government's commitment to developing resilient landscape and seas, and includes focus areas and landscape scale delivery pilots, where we are focussing our resources and engagement. Climate change adaptation will be an important part of these plans.

2.2.1 On land and in lakes and rivers

Our approach to building ecological resilience on land and in lakes and rivers is to:

1. **Protect and improve our protected sites and other areas of important wildlife habitat;**
2. **restore degraded ecosystems**, for example by restoring ecological and hydrological functions and **expand and connect high quality wildlife-rich habitat**; and
3. **reduce pressures from other sources** such as water and air pollution and invasive non-native species

In some cases it will not be possible to build resilience through the management of sites and habitats, or by reducing other pressures and we will need to take specific action for species and habitats at particular risk. For example, we will need to address sea-level rise through a programme of coastal re-alignment (see section 2.5). We may also need to consider translocations for rare and isolated populations of climate-sensitive species and will consider this as we develop our code of practice on re-introductions. In some cases, impacts are unavoidable, and we will have to accommodate change, updating, for example, our protected sites common standards assessment criteria to take account of climate change.

Our approach to building ecological resilience on land and in lakes and rivers is reflected in the long-term goals and commitments in the 25 Year Environment Plan, as set out below.

1. Protect and improve our protected sites and our other areas of important wildlife habitat

25YEP Goal: Restore, by 2042, 75% of our terrestrial and freshwater protected sites to favourable condition, securing their wildlife value for the long term

Protected sites networks are globally recognised as a key nature conservation tool, to protect important natural habitats and the habitats of rare, threatened and/or vulnerable species, including migratory species, so as to contribute to their long term survival. Our protected sites will also form a core component of our planned Nature Recovery Network and act as a focus for action to expand and link our best sites for wildlife. There are a range of national and international designations[13] affording high levels of protection, principally achieved through a consenting regime that enables planning and other authorities to control activities that may adversely impact sites.

Targeted action will be required to maintain and restore their condition to contribute both to the current target in Biodiversity 2020[14] (95% in favourable or recovering condition and 50% in favourable condition), and as a contribution to our long term goal in the 25 Year Environment Plan (75% in favourable condition by 2042).

Working with Natural England (NE), Defra will continue to support the management of our protected sites through the delivery of agri-environment schemes and supporting other project based-approaches, funded through a range of programmes or other external funding mechanisms.

NE will maintain an active partnership with major landowners and other stakeholders to deliver a programme of improvements for protected sites, ensuring that climate change is

[13] Special Areas for Conservation, Special Protection Areas, Ramsar sites, Sites of Special Scientific Interest and National Nature Reserves.
[14] Biodiversity 2020 is the Government's current strategy for Biodiversity and Ecosystem Services.

considered as one of the pressures in site management. For our most important sites, this will be informed by Site Improvement Plans (SIPs).

NE will progressively incorporate adaptation planning into assessments of the condition of Sites of Special Scientific Interest (SSSIs) and the conservation objectives on new sites. NE will also continue to assess the climate change vulnerability of all National Nature Reserves that they manage and include appropriate responses in site management plans by 2023.

Government will also work to restore protected freshwater sites to favourable condition, and will remove or reduce other anthropogenic pressures (e.g. overfishing, over-abstraction, damming, pollution, habitat destruction etc.).

Defra will work to make sure that our management of protected sites facilitates the appropriate travel of species across habitat ranges, whilst at the same time working to ensure their survival in existing locations.

Over time, habitats and species composition on protected sites will change in response to climate and other factors. Defra will work to make sure that our management of protected sites takes such changes into account, informed by periodic reviews of parts of the network (such as for Special Protection Areas).

2. Restore degraded ecosystems and expand and connect high quality wildlife rich habitat

25YEP Goal: Create or restore, by 2042, 500,000 hectares of wildlife-rich habitat outside the protected site network, focusing on priority habitats as part of a wider set of land management changes providing extensive benefits

To deliver the 25 Year Environment Plan's goal of 500,000 hectares of wildlife-rich habitat, we will develop a Nature Recovery Network: an expanding network of wildlife habitat to link our existing protected sites and landscapes more effectively.

The Network will comprise a series of Nature Recovery Areas and we will explore options for delivering up to 25 of these at landscape or catchment scale over the next 25 years. In addition to these defined areas, we will also take a targeted approach within the wider fabric of our countryside and urban areas. This will create both an improved buffer between, and better connect, our protected and local sites. It will deliver on the recommendations from Professor Sir John Lawton for more numerous, bigger, better and more joined-up sites for nature that are better able to adapt to the challenges they face, including climate change.

NE and the wider Defra Group will work with a range of external partners during the five year period of the NAP to design and start to deliver the Network. NE will provide advice, resources and support to ensure that climate change resilience is enhanced in landscapes and habitats that are vulnerable to climate change, and throughout the Network. This will

include the development of ecological networks and the restoration of natural processes, soils and hydrology.

The Network will be delivered through a range of funding streams. Although agri-environment schemes are likely to be a key source of funding, Defra will seek to broaden the funding base for the Network, and maintain effective partnerships by working with delivery partners and with charitable and private sector funders. NE, advising Defra, will regularly review the evidence base to ensure the approach delivers resilience in the context of climate change.

Agri-environment schemes have been the principal mechanism for improving the condition of habitats both on and off the protected site network and for creating new habitats. Government will develop a new Environmental Land Management System that will deliver benefits such as increased biodiversity and climate change mitigation and adaptation.The system will be introduced in the next Parliament.

The 25 Year Environment Plan contains separate goals on woodland[15], and this will also provide opportunities for developing our Nature Recovery Network. Further detail on plans in these areas is given in section 2.5, 2.6 and 2.7 of this report.

3. Reduce pressures from other sources

The 25 Year Environment Plan contains a range of goals and commitments on reducing environmental pressures such as water, air quality and invasive non-native species.

Further detail on plans to increase resilience to disease and invasive non-native species is given in section 2.3 of this report.

4. Take actions for species and habitats at particular risk from climate change

This section primarily deals with species conservation actions. Section 2.5 provides information on action to address risks to habitats from sea level rise.

Our species conservation action from the 25 Year Environment Plan is:

> *25YEP Goal: Take action to recover threatened, iconic or economically important species of animals, plants and fungi, and where possible to prevent human induced extinction or loss of known threatened species*

As a party to the UN Convention on Biological Diversity (CBD), the UK has committed to preventing extinction of known threatened species and improving their conservation status, particularly of those most in decline.

[15] Increase woodland in England in line with our aspiration of 12% cover by 2060 (planting 180,000 hectares by end of 2042)

This commitment is reflected in our current Biodiversity 2020 strategy, which implements the CBD in England, and in our new 25 Year Environment Plan. Government has committed to developing and publishing a new strategy for nature, to take forward our international commitments at home and to replace Biodiversity 2020. It will also be aligned with the existing UK marine strategy. Defra will set out further details on our plans for species in this strategy, including consideration of climate adaptation measures.

Alongside the development of this new strategy, the Defra Group will continue to take action for our threatened species such as red squirrel, grey long-eared bats, cirl bunting, stone curlew and bittern. We will do this through our agri-environment schemes, species recovery programme and partnerships with farmers, landowners and conservation organisations.

In 2018/19, NE will develop and consult on a code and best practice guidance for assessing the merits and risks of species reintroduction and translocations projects, taking account of climate change as well as their contribution to global and domestic conservation priorities, community engagement and wider social and economic impacts.

The Centre for Environment, Fisheries and Aquaculture Science (CEFAS) and the Environment Agency (EA) will continue to develop methods to improve stock assessments and to quantify and manage human and natural impacts on fish populations, towards securing them in safe biological limits supporting sustainable levels of exploitation. Examples of progress include delivering eel management plans and adopting the Salmon 5 Point Approach.

2.2.2 At sea

In the first NAP, Defra committed to protecting and restoring marine habitats to increase their resilience to climate change. This action was led by the designation of Marine Protected Areas and utilising conservation zones as a network of habitats to aid the movement of species affected by climate change and decrease threats such as over-fishing.

Looking forward, as we leave the Common Fisheries Policy we will introduce a sustainable fisheries policy. Government has published a Fisheries White Paper ahead of the new Fisheries Bill, setting out our future approach to ensure sustainable use of fish stocks, a healthy marine environment and a prosperous fishing industry as we leave the EU.

The 25 Year Environment Plan sets out our commitment to:

1. **Increase and improve our management of the seas;**
2. **ensure productive and extensive seafloor habitats** which can support healthy, sustainable ecosystems; and
3. **Recover and maintain fish stocks at levels that can produce their maximum sustainable yield.**

Increase and improve our management of the seas

The Marine Management Organisation will, by 2021, have prepared 10 marine plans, covering the whole of the English marine area, which will include policies for climate adaptation. The preparation of new plans will include horizon scanning to evaluate the potential longer term risks and opportunities from climate change.

We will continue to establish Marine Conservation Zones to contribute to an ecologically coherent network of Marine Protected Areas (MPAs). Completion of the network and, where appropriate, introduction of new management measures, will take account of

25YEP Goal: Increasing the proportion of well managed seas and better manage existing protected sites.

anticipated impacts of climate change. The Foreign and Commonwealth Office will continue to work to create a Blue Belt around the UK's 14 Overseas Territories, subject to local support and environmental need, supported by £20 million of funding between 2016 and 2020.

On 8 June, World Oceans Day, we started a consultation on the third tranche of Marine Conservation Zones. Forty one new sites were proposed, to add to the 299 Marine Protected Areas already established in UK waters. The aim is that once these are designated our contribution to the international ecologically coherent network will be substantially complete.

1. **Ensure productive and extensive seafloor habitats which can support healthy, sustainable ecosystems**

25YEP Goal: Ensuring seafloor habitats are productive and sufficiently extensive to support healthy, sustainable ecosystems; reversing the loss of marine biodiversity and, where practicable, restoring it.

Government will continue to support the United Kingdom Marine Climate Change Impacts Partnership (MCCIP), which brings together scientists, government, its agencies and NGOs to provide co-ordinated advice on climate change impacts and adaptation around our coast and in our seas Through its 'Climate Smart' working initiative, the MCCIP will continue to collaborate with selected marine sectors to develop adaptive capacity, using the best available evidence on climate impacts. MCCIP will work with the EA, Public Health England (PHE), CEFAS, and the Food Standards Agency (FSA) to improve understanding of and responses to climate change impacts on water-borne pathogens and harmful algal blooms.

Government will continue to support ocean acidification research in order to provide a robust baseline assessment which can be used to examine long-term changes.

2. **Recover and maintain fish stocks at levels that can produce their maximum sustainable yield**

25YEP Goal: Ensuring that all fish stocks are recovered to and maintained at levels that can produce their maximum sustainable yield, while protecting the wider marine environment.

Seafish, the industry body with a remit to support the profitability and sustainability of the seafood industry, will publish a climate change adaptation report during this NAP period. This will describe the steps that the fisheries and aquaculture sectors are taking to respond to climate change, focussing on risks and opportunities associated with climate change in the UK aquaculture sector (such as new species that can be cultured in warmer waters). Seafish will also continue to produce annual climate change updates for the wild-capture fishing industry to provide surveillance of new fishing opportunities.

Action to address impacts of coastal sea level rise is set out in Chapter 4: People and the built environment.

2.3 Enhancing biosecurity: increasing resilience to disease and invasive non-native species

Pests, diseases and invasive non-native species are a threat to the environment and the services and benefits it delivers, as well as being problematic for our homes, gardens and the wider landscape. These pressures are likely to be exacerbated by climate change. We remain committed to our objective in the first NAP to increase resilience to natural hazards, pests and diseases so as to help protect biodiversity, maintain agricultural and forestry productivity and protect the UK's ability to export products.

As set out in the 25 year environment plan we aim to:

1. **Manage existing plant and animal diseases and lower the risk of new ones; and**
2. **tackle invasive, non-native species.**

1. Manage existing plant and animal diseases and lower the risk of new ones

There is already a robust system of horizon scanning and international monitoring for animal disease threats. This ensures that we have a reliable early warning system that enables us to implement targeted active surveillance for high impact diseases to supplement our system of passive and scanning surveillance for new and emerging diseases. For example, the bacterial pathogen of plants Xylella fastidiosa has been detected in a number of countries in continental Europe and presents a threat to numerous plant species in the UK. Defra has successfully argued within the EU for stricter measures to be taken to reduce the risk of this pathogen being moved to the UK. Defra is also

monitoring developments in Europe in order to determine whether additional measures are necessary.

PHE has a targeted surveillance programme to monitor invasive disease vectors (organisms such as mosquitoes which transmit disease or parasites). This programme aims to develop and update our understanding of the status, distribution and abundance of potential vector species. There is now a cross-government contingency plan in place for dealing with invasive mosquitoes and this will be enhanced to cover other veterinary and medically important insect vectors.

Defra and the Animal & Plant Health Agency work closely with the Met Office, PHE and UK reference laboratories to identify and model areas of the UK which are at most risk of notifiable exotic vector borne diseases and have the capability to model potential disease spread if a disease incursion takes place.

Future research projects on plant health will make use of the forthcoming UKCP18. This work will help to ensure that the plant health risk register reflects the risk posed by pests as the climate changes.

Since the publication of the first NAP, the mechanism by which the UK assesses plant health risk has been updated, with the creation and deployment of the UK Plant Health Risk Register (UKPHRR). The UKPHRR allows not only for the characterisation of risk but also prioritisation, via a scientifically based process to decide on the key actions to be taken to reduce risks, such as research and contingency planning.

External stakeholders (e.g. groups representing agriculture, horticulture, forestry and environmental protection) will continue to play an important role in contributing to plant health risk assessments, to help determine the scale and impact of current and possible future threats.

Industry and private veterinarians also have a role to play in scanning surveillance for new and emerging threats, including those resulting from climate change. We are working across the industry to better utilise data held by business, private labs, veterinarians and animal keepers. This data will enable us to develop a more comprehensive surveillance system in the future.

Pest specific contingency plans are being drafted for high priority plant health pests.

See section 2.7 for more detail on forestry.

2. Tackle invasive non-native species

25YEP Goal: Tackling invasive non-native species by continuing to implement the GB invasive non-native species strategy.[1]

We will continue to implement a programme of invasive non-native species surveillance and risk analysis across Great Britain, coordinated by the GB non-native species secretariat. We will continue action to prevent the establishment of novel, and the spread of established, invasive species by building on our successful contingency planning and rapid response action, working across government to contain outbreaks and prevent species such as the Asian hornet gaining a foothold in the UK.

We have a dedicated alert system which allows the public to report Asian hornet sightings which are then identified by the National Bee Unit (NBU). There is also a network of sentinel apiaries that carry out active surveillance for the species. Over 4500 sightings were reported (including emails, online and through the app) in 2017 (compared to 2700 in 2016). We remain vigilant, working closely with the National Bee Unit and their nationwide network of bee inspectors to monitor for further outbreaks.

Volunteers play a key role in supporting government to implement the GB invasive non-native species strategy. Between 2011 and 2015 Defra provided £1.5 million in grants to help establish Local Action Groups (LAGs) to tackle aquatic and riparian invasive non-native species in England. Since 2015, Defra has been funding the role of the LAG Co-ordinator to facilitate increased collaboration across the LAG network and develop a regionally based approach to tackling invasive non-native species.

We will seek to eradicate high priority invasive non-native species identified by risk analysis, establishing contingency plans for high priority new arrivals, and implementing management plans for priority established species where eradication is not feasible. We will develop pathway action plans to reduce the risk of invasive species introduction into England from all high priority pathways. We will continue to support initiatives that compile and analyse species data so that we can track trends in species distributions.

2.4 Water availability and quality

In this section we set out our objectives to:

1. **Reform our approach to water abstraction**; and
2. **improve water quality**, reverse the deterioration of groundwater and reduce emissions of harmful substances.

2.4.1 Abstraction

Water abstracted from our environment provides essential water for public water supply, agriculture and industry. Protecting groundwater levels and adequate flow in our rivers is also essential for supporting healthy ecology, enhancing natural resilience to drought, and ensuring that rivers continue to support wellbeing and recreation.

Our objective in the first NAP was to manage water resources effectively to maintain environmental resilience whilst meeting the needs of society, agriculture and industry.

In the 25 Year Environment Plan, we set out our goal to reform our approach to water abstraction. This will be achieved in a number of ways:

1. By making sure that water companies take a leading role in addressing unsustainable abstraction as part of the Water Industry National Environment Programme;
2. regulating all significant abstractions that have been historically exempt; and
3. updating 10 abstraction licencing strategies to capture agreed solutions to environmental pressures in catchments.

Since 2008 the EA has made changes to over 270 abstraction licences to prevent over 30 billion litres of water per year being removed from the environment where abstraction is unsustainable. Currently, environmental actions are focused on meeting targets set for water bodies in the River Basin Management Plans and improving resilience to future pressures from climate change. Actions in catchments may include:

- introducing controls on more licences to improve environmental protection, particularly at low flows;
- capping licences to prevent increased abstraction damaging the environment; and
- adjusting the use of surface water and groundwater sources to make the best use of water when it is available while protecting the environment.

The government's abstraction plan[16] sets out in more detail how we will improve the way we manage water abstraction, to protect the environment and improve access to water.

The plan has three main elements:

- *Addressing unsustainable abstraction*: the EA will change abstraction licences to protect the environment where there is the greatest impact;
- *stronger catchment focus*: bringing together the EA, abstractors and catchment groups to develop local solutions to existing pressures and to prepare for the future; and
- *modernisation*: making sure all significant abstraction is regulated and bringing regulations in line with other environmental permitting regimes. Improving the online service provided to abstractors to reduce administrative burdens and provide real-time information about the availability of water for abstraction.

[16] Water abstraction plan 2017. URL: https://www.gov.uk/government/publications/water-abstraction-plan-2017 accessed 05/07/2018

Defra will report to Parliament in 2019 on progress made on delivering abstraction reform.

We believe that working collaboratively at a catchment scale will improve understanding of local challenges and help identify the right solutions to make better use of the water available. The EA will work with abstractors and existing local groups, such as catchment partnerships, in catchments facing the greatest challenges. It will produce updated abstraction licensing strategies that capture agreed solutions to environmental issues and set out approaches to help abstractors access the water they need.

2.4.2 Water quality

Water quality runs throughout the 25 Year Environment Plan and is discussed in more detail in the agriculture and forestry sections 2.7 and 2.8.

NE will implement our Site Improvement Plans (SIPs), including actions arising from the climate change theme plan we have developed for Natura 2000 sites. Furthermore, we will work to restore natural processes within river systems. This will enhance water storage capacity to buffer against drought and will provide semi-natural habitat with a valuable role to play in increasing resilience of wildlife to a changing climate.

The EA produces Catchment and River Basin Management plans which set out the actions we will take to improve the condition of our water environment. These take account of the value of the natural environment and the pressures on it including the potential impacts of climate change. The EA will continue working with external partners (particularly catchment partnerships) to ensure that third cycle RBMPs take account of pressures from long term climate change, and try to ensure that projects delivered in second cycle plans are also resilient to long term climate change.

As set out in the Clean Growth Strategy[17], we will work with industry in the agricultural sector to encourage the use of low-emissions fertiliser. We will explore the potential for new innovative and sustainable fertilisers, such as bio-stimulants, to improve nutrient use efficiency; and explore the viability of fertiliser production by recovering nutrients from wastes and other organic materials. Smarter targeting of fertiliser type and application will reduce the potential for negative impact on water quality and air quality. We will review the levels of take-up over the next five years using data from the British Fertiliser Practice Survey. This will provide evidence to shape our future policies.

2.5 Natural flood management and protection of coastal habitats

Our objective in the first NAP was to work with individuals, communities and organisations to reduce the threat of flooding and coastal erosion, encouraging natural flood

[17]Clean Growth Strategy. URL: https://www.gov.uk/government/publications/clean-growth-strategy accessed 05/07/2018

management solutions, including that resulting from climate change, by understanding the risks of flooding and coastal erosion, working together to put in place long term plans to manage these risks and making sure that other plans take account of them.

As set out in the 25 Year Environment Plan we aim to:

1. **Explore greater use of natural flood management techniques where these are appropriate**

Natural flood management (NFM) approaches and/or working with natural processes can, in the right place, provide opportunities to manage water flow, potentially reducing the risk of flooding to our communities. NFM measures alone will not offer protection to areas of greatest risk or in the face of the most significant flood events. Good integrated flood management will see these incorporated alongside conventional defences.

The evidence for Natural Flood Management interventions is growing year on year, and in 2017 the EA published a comprehensive assessment based on a study of some 65 case studies which gives communities the tools to make Natural Flood Management interventions[18]. We recognise that more is needed to fully understand the effectiveness of these interventions at scale and for medium to large flood events. We will continue to support NFM approaches, strengthening the evidence base on the effectiveness, and use these findings to encourage increased use of natural flood management where appropriate, and alongside engineered defences. We want to see the principles of NFM integrated into a holistic approach to flood risk management and will be looking how this informs future funding arrangements. In support of this, by 2020 the EA will publish an industry standard NFM design manual to assist in selecting appropriate NFM measures.

Beyond flood risk management, this government also recognises the additional value that NFM interventions can bring to improving the resilience of wildlife sites, biodiversity and clean water, We expect NFM to be included in options appraisals when considering opportunities for addressing flood risk to maximise benefits of better catchment management across a wide range of objectives

As we continue to explore and refine the role of NFM schemes, we will monitor and evaluate their effectiveness, allowing us to improve future programmes. Historic England are undertaking research to use understanding of the history of catchments to inform natural flood management. A report is due at the end of 2018.

There is an established network of habitat compensation programmes around England that continue to identify coastal habitat creation opportunities. Over the 5-year period of this NAP, work will continue working to maintain coherence of internationally protected

[18] Working with natural processes to reduce flood risk. URL: https://www.gov.uk/government/publications/working-with-natural-processes-to-reduce-flood-risk accessed 05/07/2018

coastal habitats through a programme to restore historic habitat loss and address anticipated losses. For more information on the protection of coastal habitats, see chapter 4.3 on protection of coastlines.

2.6 Protecting soils and natural carbon stores

The CCRA highlights the risks posed to soils from increased seasonal aridity and wetness as a result of climate change and risks to natural carbon stores. It describes more action being needed to reduce existing pressures on soils, increase uptake of soil conservation measures and restore degraded soils.

2.6.1 Soils

Healthy and fertile soils provide the foundation for farming and forestry. The quality and type of the soil, in part determined by underlying geology, also influences the distribution of plant species and provides a habitat for a wide range of organisms. We need to ensure healthier soils by addressing the cause of soil degradation such as erosion, compaction and the decline in organic matter. Addressing these issues will have a range of co-benefits for managing a wide range of climate and non-climate related risks and avoid future loss of the UK's most fertile and carbon-rich soils. Many soil conservation actions are also cost-effective to implement now, especially when accounting for non-market values such as carbon and water quality.

Our ambition as outlined in the first NAP is that by 2030 all soils will be managed sustainably.

The 25 Year Environment Plan sets out our goals:

1. **Improved management of soils** using natural capital thinking
2. **Improved soil health**

1. Improved management of soils

25YEP Goal: Improving our approach to soil management: by 2030 we want all of England's soils to be managed sustainably, and we will use natural capital thinking to develop appropriate soil metrics and management approaches.

We will be working with the industry to update guidance on crop establishment and optimal tillage choice to ensure that farmers choose the best practices for their soils to reduce the rate of loss of soil and carbon. In addition, our new environmental land management system will aim to deliver benefits such as improved soil quality.

To track our progress in achieving our ambition Defra will be investing at least £200,000 to help develop soil health metrics and innovative soil monitoring solutions.

2. Improved soil health

25YEP Goal: Improve soil health and restore and protect peatlands – this will include developing a soil health index and ending the use of peat in horticulture.

Agricultural and forestry soils are currently protected through outcome-based cross-compliance soils rules and the UK Forestry Standard's Forests and Soils Guidelines. Funding is provided to protect soil and water through the Countryside Stewardship scheme. Good practice for protecting soils is also included in the 'farming rules for water' which came into force in April 2018. Soils in the wider and urban environment are considered in the National Planning Policy Framework

We are developing a soil health index that will make it simpler for farmers and land managers to monitor the quality of their soil, using indicators such as the level of humus and biological activity in the soil. This will allow us to assess whether management practices are having a beneficial impact on soil health and greenhouse gases mitigation, and provides the opportunity to consider how to utilise this data to develop a picture about the 'population' of national soils and trends.

2.6.2 Peat

Our peat bogs and fens are important habitats that provide food and shelter for wildlife, help with flood management, improve water quality and play a part in climate regulation. UK peatlands store at least 3.2 billion tonnes of carbon. Most peat soils support ecosystems that are sensitive to human activities such as drainage, grazing, liming, burning and afforestation. This makes them susceptible to degradation. The best available evidence suggests that less than 20% of the UK's peatlands are undamaged[19].

The UK Forestry Standard[20] was revised in 2017 and underpins forestry incentives, regulations and management planning. Its Forests and Climate Change Guidelines include requirements that aim to protect carbon stores and peat habitats.

We are working towards strengthening protection for our peatlands. Measures such as the Peatland Code[21], peatland restoration through agri-environment schemes, area designations and targets for the reduction of peat use in horticulture will help to achieve

[19] Bain, C.G et al (2011) IUCN UK Commission of Inquiry on Peatlands. URL: http://www.iucn-uk-peatlandprogramme.org/sites/www.iucn-uk-peatlandprogramme.org/files/IUCN%20UK%20Commission%20of%20Inquiry%20on%20Peatlands%20Full%20Report%20spv%20web_1.pdf

[20] The UK Forestry Standard, 2017. URL: https://www.forestry.gov.uk/pdf/FCFC001.pdf/$FILE/FCFC001.pdf accessed 05/07/2018

[21] Peatland Code. URL: http://www.iucn-uk-peatlandprogramme.org/peatland-code accessed 05/07/2018

this ambition. A Peat Strategy will be published in late 2018 and the peatland grant scheme commenced in April 2018. We also aim to end peat use in horticultural products by 2030.

Restore and protect peatlands

25YEP Goal: Restore and protect peatlands – this will include ending the use of peat in horticulture.

We will create and deliver a new ambitious framework for peat restoration in England covering both upland and lowland peat. Where taking lowland peat soils out of production and restoration to semi-natural habitats is not the preferred option, we will develop new sustainable management measures to ensure that the topsoil is retained for as long as possible and greenhouse gas emissions are reduced. We will improve the representation of peat soils in the greenhouse gas emission inventory to enable the effectiveness of emission mitigation action to be tracked more accurately.

We are funding peatland restoration. In July 2017, we launched a £10m grant scheme and funding was made available from April 2018 to be spent on 4 peatland restoration projects over 3 years. The scheme will improve the condition of 6,580 hectares of upland and lowland peatlands in England thereby reducing carbon emissions (by an estimated 23,000 tonnes of carbon dioxide per year once restoration is completed) and delivering multiple environmental benefits.

We will continue to work with the horticultural industry to support their transition to peat alternatives. However, if we do not see sufficient progress by 2020 we will explore the introduction of further measures. Further detail on this will be set out in the England Peatland Strategy.

2.7 Forestry

Our objective in the first NAP was to increase the resilience of the forestry sector by increasing the level of management in England's woodlands and the uptake of adaptation good practice in woodland creation and restocking.

Our goals in the 25 year environment plan build on this: we will increase woodland management and timber supplies, increase tree planting by creating new forests and incentivising additional planting on private land. We will promote urban tree planting through actions supporting Community Forests, both as part of the Northern Forest and in wider partnerships to bring trees and green infrastructure to towns and cities across England. This reflects the role of 'the Urban Forest' and 'green infrastructure' more generally in improving the urban environment and helping it adapt to the changing climate.

Our goals for this NAP are the following:

1. Woodland resource is expanded and better linked to enhance its resilience at stand and landscape level;
2. existing woodlands are more resilient to the impacts of climate change and pests and diseases;
3. adaptation is embedded within future forestry policy (post-CAP) to contribute to long term reductions of climate change risks; and
4. woodlands are more resilient to natural hazards.

1. Woodland resource is expanded and better linked to enhance its resilience at stand and landscape level

The creation of new native woodland will enhance the resilience of the woodland resource to future climatic conditions and maintain habitat for woodland flora and fauna. Over the course of this NAP, we will embark on an annual planting rate of 5,000-10,000 ha of new woodland habitat (including new native woodland), keeping us on course to achieving 12% woodland cover by 2060 as set out in the 25 Year Environment Plan. Our goal of bringing more existing woodland into active management will also promote regeneration and improve the quality of the woodland habitat.

As announced in the 25 Year Environment Plan, we will kick start the planting of a new Northern Forest, which will cross the country using the M62 corridor as its spine. With £5.7 million of government funding, we will support the existing partnership of the Community Forests and the Woodland Trust to accelerate and further develop the Northern Forest. This will deliver accessible community woodland to a large swathe of England and at the same time contribute to meeting carbon budget commitments. We will also implement other policies to accelerate planting rates, including the introduction of a Domestic Carbon Offset Unit to strengthen carbon markets and Forestry Investment Zones to support woodland planting.

2. Existing woodlands are more resilient to the impacts of climate change and pests and diseases

The UK Forestry Standard (UKFS) recommends species diversification and the planting of more southerly provenances as adaptation measures, particularly where timber production is an important objective. The Forestry Commission, in conjunction with the Woodland Trust, has commissioned an evidence report to support appropriate action across all woodland types and reflecting different management objectives. The outcomes of this report will inform future policy development.

Though guidance is in place, evidence indicates that there is insufficient uptake of adaptation measures, particularly relating to choice of planting stock, due to perceived impacts on levels of timber production. We are addressing this through clearer evidence,

supported by the Science and Innovation Strategy for Forestry in Great Britain, together with leadership from the sector from the Public Forest Estate.

3. **Adaptation is embedded within future forestry policy (post-CAP) to contribute to long term reductions of climate change risks**

As we exit the European Union, the successor to CAP will need to consider adaptation requirements in the context of the forestry sector. For example:

- New policies that aim to accelerate the rate of woodland planting in England;
- continuing to support resilient landscapes through targeted woodland creation; and
- taking forward the sector's Climate Change Action Plan which focuses on adaptation but also aims to protect and enhance forest carbon stocks and sequestration rates.

These actions will contribute to a long-term reduction of risks through increasing the area of woodland and improving woodland condition and ability to adapt to the changing environment.

4. **Woodlands are more resilient to natural hazards**

This is about making sure that contingency planning and prevention training is delivered to the right people in order to ensure resilient woodlands when faced, for example, with an increasing threat of wildfires.

For more information see Annex 2.

5. **The evidence base is enhanced**

All of the above must be underpinned with a strong evidence base, with any gaps addressed. Defra, working with the Forestry Commission, will ensure that the refreshed/replaced Science and Innovation Strategy for Forestry in Great Britain continues to support the implementation of adaptive actions across the forestry sector

For more information see Annex 2

2.8 Agriculture

Agriculture has a vital role to play in managing the UK's land and landscape, with more than 70% of England being managed as farmland. Farmland can make an important contribution to adaptation, including through support for biodiversity, mitigation of flood risk, and improved soil management. Changes may be needed to the crops grown, taking advantage of resource efficiencies, ensuring that the knowledge gained from R&D is transferred to changes on the ground, and taking up new technologies. Sustainable soil management will be critical to ensuring farm systems are resilient. While much of the

planning will rightly fall to individual farm businesses, government will continue to support research, and will be introducing a new environmental land management scheme underpinned by natural capital principles. Our new Environmental Land Management Schemes will contribute to the delivery of the environmental outcomes outlined in the 25 Year Environmental Plan, such as adaptation to the effects of climate change.

Our objective in the first NAP was to increase the resilience of agriculture by effectively managing the impact of volatility in the occurrence and severity of rainfall events on water availability, flooding, soil erosion and pollution due to runoff.

Many other policy areas will have an impact on, or be impacted by, agriculture. The 25 Year Environment Plan outlines goals across other policy areas which are addressed elsewhere in this document: to tackle soils degradation, improve soils management and monitor soil health (see section 2.6.1); to protect and restore vulnerable peatlands (see section 2.6.2); and to ensure sustainable use of water resources and resilience of supply (see section 2.4.1)

We have also been working towards embedding climate change adaptation into agriculture, horticulture and forestry research programmes, in order to improve knowledge of likely climate impacts and contribute to the development and uptake of climate resilient crops, tree and livestock species as well as relevant technologies.

In the 25 Year Environment Plan we have committed to support farmers to turn over fields to meadows rich in herbs and wildflowers, plant more trees, restore habitats for endangered species, recover soil fertility and attract wildlife back. Alongside this we will ensure that food is produced sustainably and profitably.

In working to increase resilience, government will work to ensure that the right actions are targeted in the right locations. Our plans will balance competing and conflicting demands to ensure that land is used in the best way to safeguard long-term sustainability, safety and productivity.

Our new Environmental Land Management schemes will aim to deliver a range of environmental benefits such as mitigation and adaption to climate change. We are working closely with farmers, food producers and environmental experts across Britain to design a ‘user friendly’ scheme for farmers and land managers, which reduces prescription, encourages scheme uptake, and could incentivise collaboration and landscape scale working.

We will continue to support farmers and land managers in delivering the outcomes and to help them to work together to achieve benefits at landscape and catchment level.

Agriculture is a key consumer of water, most notably during what tend to be drier months, when there is an increased public demand for water. We are working with farmers and other abstractors to ensure that abstraction licences are sustainable (see section 2.4.1) and that the agriculture sector has access to water and uses it efficiently.

In February we published a consultation paper setting out options for supporting farming once we have the left the European Union. We will work closely with the devolved administrations on a framework that works for the whole of the UK and reflects the needs and individual circumstances of Scotland, Wales, Northern Ireland and England. As part of this, we will continue to engage regularly with all the devolved administrations to explore options on the design and appropriate extent of the forthcoming Agriculture Bill.

The government actively promotes awareness of flood risks to farm businesses and encourages action to improve flood resilience – these actions are expanded on in section 4.3.

Government is also stimulating industry-academia collaboration, for example through the Agri-tech catalyst, which will help improve agricultural productivity and contribute to more environmentally sustainable agricultural systems.

The Countryside Productivity scheme offers grants for farmers to invest in cutting edge technology and new equipment. Grants are available to help livestock, dairy, arable and horticulture farmers improve productivity through investing in new technology to reduce cost or improve product quality.

In partnership with industry, we will encourage widespread adoption of precision agriculture, pioneer new approaches to crop protection and encourage more commercial research to improve plant breeding and agronomic techniques through schemes such as the ISCF Transforming Food Production programme which was launched in February 2018. New approaches, such as vertical farming, can harness the combined power of robotics, photonics, artificial intelligence and smart energy management systems, as well as plant biotechnology.

Chapter 3: Infrastructure

Vision

"An infrastructure network that is resilient to today's natural hazards and prepared for the future changing climate

3.1 Climate change risks

Infrastructure operators provide fundamental services which ensure the proper functioning of our society and economy. Climate impacts on those services require careful management, underpinned by an evidence-based understanding of the likely implications.

The CCRA identifies significant risks to infrastructure from flooding, rising sea levels and increases in the frequency and severity of extreme weather. The CCRA sets out that infrastructure networks near rivers will become more vulnerable to higher flows and, along with coastal infrastructure, could become impacted by greater levels of erosion. Increases in maximum wind speeds would have significant implications for many infrastructure networks. Changes in temperature and rainfall will place additional pressures on infrastructure across all sectors. Climate change combined with population growth may also put greater pressure on water availability and increase risk of drought. Interdependencies, where infrastructure providers rely on each other in order to provide their services, are not well understood. It is important to build a clearer picture of what the risks are and how these are mitigated.

The key risks to infrastructure identified in the CCRA are:

Risks to infrastructure from river, surface/ groundwater flooding and coastal flooding and erosion	Interdependency risks to infrastructure asset management	Risks to transport networks from embankment and bridge failure	Risks to infrastructure from high winds, lightning, storms, and high waves

The National Infrastructure Commission's National Infrastructure Assessment is considering the major challenges that Britain's infrastructure must overcome if it is to meet the needs of future generations. The interim assessment[22] was published in 2017 and sets out three priorities for national infrastructure – tackling congestion, lack of capacity and carbon emissions. It identified that focus was required on seven key priorities including reducing the risks of extreme weather to make sure the UK can stand up to drought and flooding.

[22] Interim National Infrastructure Commission. URL: https://www.nic.org.uk/publications/congestion-capacity-carbon-priorities-for-national-infrastructure/ accessed 05/07/2018

To meet these priorities we need to ensure that infrastructure is located, planned, designed and maintained to be resilient to climate change, including increasingly extreme weather events. In order to reduce the risks of cascade failures which could be exacerbated by climate change, we need to improve our understanding and systems management of these interconnected and interdependent services.

In general, infrastructure operators are private businesses, accountable directly to their customers, stakeholders and regulators, and as such are responsible for their own business continuity measures, including the provision of essential services which enable them, and their customers, to function. Government has a responsibility to ensure that there are no policy or regulatory barriers which prevent infrastructure operators from jointly or collectively managing interdependent risks arising from climate change. We also recognise that more action is needed to encourage information sharing between infrastructure operators to improve overall risk management.

Different infrastructure sectors are affected differently by climate risks. Action to address the risks are set out on a sectoral basis below. Risks associated with the water sector are covered in Chapter 4 – People and the Built Environment. All infrastructure providers will be reporting in the third round of Adaptation Reporting.

3.2 Energy sector

The electricity sector has a well-developed understanding of the risk faced by flooding and a high level of mitigation is in place, and gas and electricity companies will again be completing ARP reports for the sector. Electricity network companies spent £130 million on flood defence work from 2010-15, with a further £100 million due to be spent on flood defence by networks before 2021. The Department for Business Energy and Industrial Strategy (BEIS) continues to monitor the network companies on their build programmes to make sure progress across the sector remains on track. Where defences are not yet built, all sites have been surveyed for suitability for temporary defences.

Electricity network companies have continued to manage surface water flooding. Funding for this work is obtained by the Downstream Gas and Electricity sectors through the RIIO (Revenue = Incentives + Innovation + Outputs) price control. This is a ceiling on the amount companies can earn from charges to use the networks. Industry provides regular updates to BEIS, detailing their progress on addressing risks from surface water flooding.

A cross-government and electricity network companies' group assessed the resilience of electricity sub stations and the suitability of current substation flood protection guidance. They determined that guidance needed to be strengthened further in line with National Flood Resilience Review (NFRR) recommendations and this will be implemented in the current and next price control period. Building on the energy sector's good understanding of relevant interdependent networks, BEIS will continue to work collaboratively with other departments to ensure further cross-sector understanding of interdependencies as part of resilience planning and risk management strategies.

The gas sector also has a well-developed understanding of the risks posed by climate change. There is an inherent resilience of the gas networks due to most distribution assets being located underground. There could be an impact on some key above-ground assets, however these are expected to be localised and unlikely to lead to a loss of supply or result in a risk to gas supply.

River and coastal erosion continue to be monitored around infrastructure that is recognised to be at risk and investment strategies are implemented where needed.

For downstream oil, BEIS is currently investigating the benefits of further investigation into climate change adaptation and will discuss this with relevant stakeholders.

For nuclear installations including operating reactors, the Office of Nuclear Regulation's (ONR) Safety Assessment Principles[23] underpin the regulatory oversight and scrutiny of licensees' safety submissions throughout the lifecycle of the installation. The submissions must reflect internal and external hazards including the reasonably foreseeable effects of climate change over the lifetime of the facility as well as other factors such as coastal erosion, extreme weather and flooding. This approach is also reflected in joint guidance[24] ONR has produced with the national Environment Agencies for nuclear new build.

High winds are a significant cause of disruption to electricity networks with the majority of damage and disruption to power and transport lines caused by falling trees and branches. CCRA recommended that greater understanding was needed on the implications of increased vegetation growth rates on future risks of damage from falling trees during storms.

This is not a current research priority in view of the maturity of the Electricity sectors' programmes to manage vegetation growth. It is expected that these arrangements reflect any impacts from future climate change

The CCRA also recommended that further research is carried out to understand climate risks to existing and planned offshore renewable energy infrastructure. The Energy National Policy Statements (in particular EN-1 Overarching Energy NPS and EN-3 Renewable Energy Infrastructure NPS) require applications for consent for new offshore renewable developments to take into account the potential impacts of climate change using the latest UK Climate Projections to ensure they have identified appropriate mitigation or adaptation measures. Offshore wind developers/operators, offshore transmission operators, turbine manufacturers, foundation fabricators, offshore transmission equipment manufacturers and installers consider and evaluate the impacts of the marine environment on the operating life of their equipment.

[23]ONR Safety Assessment Principles. URL: http://www.onr.org.uk/saps/saps2014.pdf accessed 05/07/2018

[24] Joint guidance. URL:http://www.onr.org.uk/documents/2017/principles-for-flood-and-coastal-erosion-risk-management.pdf accessed 05/07/2018

3.3 Telecommunications sector

The telecommunications sector considers flooding to be its most significant climate risk. The sector responded comprehensively to the NFRR, with all major providers surveying their estates and putting significant investment in both temporary and permanent defences.

The Department for Digital, Culture, Media and Sport (DCMS) continues to work with the telecoms industry via the industry run Electronic Communications Resilience and Response Group which leads on resilience in the sector. They monitor the programme of remaining permanent defence improvements and tackle surface water flooding, which is of particular interest to the sector.

Ofcom's revised security guidance[25] (published December 2017) contains explicit requirements for telecoms providers to ensure they meet NFRR obligations and to ensure all sites (not just those in scope of the NFRR) are adequately protected from flooding. Similar direction is also included with regard to protection from power failure. Revised industry guidelines on resilience will also reference flood risk.

In relation to managing key interdependencies, the industry is also working with the energy sector in the context of co-ordinating power recovery in the event of a significant power outage as power loss is a major underlying cause of telecoms incidents.

3.4 Transport sector

The first NAP outlined the vulnerability of certain parts of the transport network and set out the Department for Transport's (DfT) embedded measures to mitigate climate risks within road and rail strategies. DfT is continuing to work with the transport sector to increase climate resilience in the planning and design of transport infrastructure. DfT will keep incorporating adaptation into its major plans and strategies, thereby ensuring that infrastructure project management and appraisals take adaptation into account and ensure sustainable economic growth.

3.4.1 Airports

The location of most UK commercial airports, at higher elevation and on well-drained sites, means that the risk of flooding is reasonably low. Gatwick Airport lies in close proximity to river and stream networks and liaises closely with local authorities and the EA to mitigate and reduce its flood risk. The aviation industry has responsibility for developing and monitoring their own resilience strategies.

[25] Ofcom review of security guidance. URL: https://www.ofcom.org.uk/consultations-and-statements/category-1/review-security-guidance accessed 05/07/2018

Flood management strategies are included within larger airports[26] resilience plans. Should an airport be severely affected by flooding, contingency measures are in place to ensure that services can be diverted to non-affected airports via standard air traffic control procedures. The UK Civil Aviation Authority (CAA) is the UK's independent aviation regulator, with responsibility for economic, safety and consumer protection regulation, and airspace policy. CAA has responsibilities under the Civil Aviation Act 2012 to monitor resilience strategies at the regulated airports of London Heathrow and Gatwick. DfT liaises regularly with major airport operators and airlines and relevant surface access operators in relation to their preparedness to handle all potential weather related disruptions.

Airport operators and air traffic control centres, as private companies, have responsibility to ensure their infrastructure remains resilient, and to work with the relevant national and local agencies to enable this. Since airports work as a network, the sector is resilient to the failure of one asset. Likewise, the UK's two air traffic control centres are able to cover some aspects of each other's operational functions if necessary, but there is an ongoing major IT programme which will enable much greater resilience. The new aviation strategy will consider the challenges for the wider resilience of the airport system that will need to be addressed by the aviation sector's continued growth. In parallel, the government must ensure that growth is sustainable and is balanced with local and global environmental concerns.

3.4.2 Ports

At present around 95% of all goods entering and leaving Britain are moved by sea and the port sector directly contributes £1.7 billion to the UK economy. Ports are therefore of strategic importance to our country and we need to ensure their assets are protected and prepared for a changing climate. Ports are inherently susceptible to coastal flooding and as a result have established procedures for handling and monitoring current and future flood risk, including well-rehearsed flood plans. DfT has also set up 'tidal surge' workgroups across the UK which work with local resilience forums to understand and assess the local risk of coastal flooding and develop mitigating measures. Since the tidal surge of 2013 a number of ports have taken additional measures such as fitting larger lock gates and increasing the height of their flood defences to protect against the potential damage of future sea level rise.

DfT has published a study on port connectivity[27] on 24 April 2018 setting out the importance of a

[26] Defined as those with over 5 million passengers per annum
[27] Transport connectivity to ports, 2018. URL: https://www.gov.uk/government/publications/transport-connectivity-to-ports-review-of-the-current-status-and-future-infrastructure-recommendations accessed 05/07/2018

successful ports industry to the economic health of the country, and makes recommendations that focus on freight connectivity to ports. Effective road and rail links are a key component of that connectivity, so the preparedness and adaptability of the road and rail networks to climate change could be an important operational factor for ports in the future. Disruption to these key access routes, either short or long term, can have an impact on the success of ports, but also on trade and economic growth.

3.4.3 Rail

The rail network is an important driver of UK economic growth, connecting our towns and cities with each other and enabling them to tap into large and diverse labour markets. It is also a mature network, much of which is over 100 years old and some of which is approaching 200 years old. Adverse weather, flooding, landslips and high winds can have substantial and far-reaching impacts on the rail network, as recent events such as those in South West England in 2014 and at Watford Tunnel in 2016 demonstrate. For these reasons, the Government places high importance on ensuring that the rail network can adapt to changing climate conditions, in order to safeguard its continued future operation.

DfT has ultimate responsibility for ensuring that the rail network remains resilient to climate change. It relies principally on Network Rail, as the owner, operator and infrastructure manager of most of the UK rail network, to do this on its behalf. Government provides Network Rail with funding and with guidance on its strategic priorities, through the five-yearly Periodic Review process.

Government has announced that it will make significantly more funding available for investment in the Rail Network over the period 2019-24 (Control Period 6). The allocation of Control Period 6 funding is still being finalised, however, the Government is planning to increase Network Rail's budget for renewals during this period, which is expected to deliver significant improvements to the resilience of the rail network.

DfT's High Level Output Specification for both the 2014-19 and 2019-24 periods contains specific requirements on Network Rail to "*manage the resilience of the network to severe weather, taking account of the impacts of climate change, and to other potential threats*".

In response Network Rail has now published resilience and climate change adaptation plans for eight core routes. These plans assess the potential impacts of climate change, and outline the action it will be taking to mitigate theses impacts on the route infrastructure. In addition, Network Rail published its Weather Resilience and Climate Change Adaptation Policy in 2017[28].

Examples of work Network Rail is carrying out in the period 2014-2019 to support adaptation and improve resilience include:

[28] NR Weather Resilience and Climate Change Adaptation Policy 2017. URL: https://www.networkrail.co.uk/wp-content/uploads/2018/02/Network-Rail-Weather-Resilience-and-Climate-Change-Adaptation-Policy.pdf accessed 05/07/2018

- **to reduce flood risks** - building pumping stations in flood-prone locations and installing infrastructure at higher levels when renewing infrastructure in flood prone areas;

- **to reduce the risk from landslides** – introduce a programme aimed at identifying sites at risk, trialling remote condition monitoring to detect potential earthwork failures, and using this data to take targeted remedial action before failures occur. Remedial action could include stabilising the slope through improved drainage or re-profiling a slope adjacent to a railway. Network Rail is also funding research into novel slope stabilisation techniques and the scope for using new technologies to tackle slip-slope type failures; and

- **to reduce disruption caused by high winds** – Network Rail have comprehensive procedures in place to manage vegetation in lineside locations, where vegetation can impact passenger services. Any vegetation removal is conducted in accordance with Network Rail's environmental policy, which aligns with industry best practice. This requires Network Rail to consider surrounding wildlife and where possible, mitigate the impact of de-vegetation work so as to minimise the impact it may have on the environment. Network Rail have also established wind monitoring stations at key locations on the network. This enables Network Rail to monitor and prepare in advance of potentially dangerous weather conditions, allowing guidance to be disseminated to drivers so that they may limit their speeds, if necessary.

In addition to its involvement with Network Rail, DfT encourages train operators to improve the resilience of their rolling stock, through the guidance the rail industry publishes on the specification and manufacture of new trains. The document, *Key Train Requirements*[29], which is used to inform franchise specifications and train design, contains advice on how to ensure trains' performance can be maintained throughout the vehicles' lives in a wide range of climate conditions.

The rail industry (including Network Rail and London Underground) have also implemented measures to manage the risks to passengers associated with high temperatures on public transport. For example, Network Rail have developed guidelines for the management of hot (and cold) weather events to mitigate variations in temperature, which are followed by all trains operating companies Network Rail also monitor rail temperatures so that speed restrictions can be imposed should there be a risk of rails moving due to temperature rises. London Underground similarly exercises various precautions including a system for ensuring critical station assets are in good functioning condition prior to hot weather (e.g. cooling systems in control rooms) and has progressively introduced air-conditioned rolling stock on all its sub-surface railway lines. DfT continues to work with infrastructure managers to extend the provisions for regulating temperatures at stations and on public transport across the country.

[29] Key Train Requirements. URL: https://www.rssb.co.uk/Library/improving-industry-performance/2016-08-key-train-requirements.pdf. Accessed 05/07/2018

3.4.4 Roads – strategic road network

The economic and strategic value the Strategic Road Network (SRN) provides, makes it one of the most important assets in the UK as it carries nearly a third of all road traffic and two-thirds of heavy goods traffic. There are numerous interdependencies that exist between the strategic network and the wider transport and infrastructure systems. Climate change poses risks of severance of links or limits on the safe use of roads infrastructure. DfT officials work closely with Highways England (HE) on ensuring that strategic road network planning interacts well with other transport infrastructure developments, such as airports and High Speed Rail developments.

HE are embedding resilience to climate change across business activities to maintain a fit for purpose SRN and increase safety. As part of ongoing work, HE is taking action to safeguard against flooding on the road network as set out in their climate change adaptation risk assessment[30]. Current activities include reducing flood risk to communities adjacent to the network; focussing on addressing all identified high priority flood risk locations recorded in the Drainage Data Management System. HE are in the process of finalising a Flooding Action Plan under their Environment Strategy. This will set out the approach to dealing with flood risk for the remainder of Road Period 1 (to 2020). In addition to this, HE are increasing drainage asset inventory and condition data coverage to better understand the condition of drainage assets on the SRN. HE will also ensure the consideration of coastal flooding and erosion risks as part of their strategy and future planning to the road network.

HE has also begun a number of specific actions to mitigate flood risks at vulnerable points of the SRN in the first Road Investment Strategy (2015-20), including on the A66 in Cumbria and Junction 10 of the M6. Additionally, 37 flooding hotspots will be mitigated via major road schemes and over 160 flooding hotspot improvements will have been delivered.

HE has identified a number of factors associated with climate change which could affect slope stability in their climate change risk assessment work. These factors include risks to increased erosion and instability at the base of embankment from flooding. In addition, increased precipitation is linked to increased water levels and pore pressures (pressure of groundwater held within soil or rock), which can lead to a greater risk of failure. Slope stability is well understood and regular inspections to evaluate stability are in place. A number of tools are in place to deal with hazard assessment on slopes. For example, the Design Manual for Roads and Bridges (HD22/08) sets out the standards for assessing and analysing the stability of earthworks such as cuttings and embankments, including any conditions that may contribute to future stability, such as drainage and groundwater conditions. Work is currently underway to update the requirements and advice document.

[30] Highways England, Climate Adaptation Risk Assessment Progress Update 2016. URL: (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/596812/climate-adrep-highways-england.pdf)

In addition, to guide decision making, hazard guidance notes and hazard guidance maps have been developed, including for slope stability.

Current arrangements for managing risks of falling trees through winds and storms are set out in HE's Asset Maintenance and Operation Requirements (AMOR) which has a specific section covering tree safety and states to "minimise the risk of trees or vegetation falling on the Area Network that could represent safety risk, obstruction or nuisance. This includes, but is not limited to, trafficked or pedestrian areas". Compliance is validated by sample audits as specified by the service manager and a performance level of 100% is required.

HE is now developing its plans for delivering the second Road Investment Strategy (2020-25) with DfT. As part of this, HE will consider resilience to climate change across business activities to maintain a fit for purpose SRN and reduce its vulnerability to climate change events.

3.4.5 Local roads

Severe weather events in recent years have highlighted vulnerabilities in our highway network. These events demonstrate the need for action to be taken not just by HE but also at a local level. Local roads form 98% of our national highway network. Local highway authorities have a duty under the Highways Act 1980 to ensure highways, and the assets associated with them such as lighting and bridges, are well maintained.

Overall, government is providing over £6 billion to highway authorities from 2015 to 2021 for highways maintenance. Planning for the impacts of climate change, rather than reacting to it, is the best way to ensure the resilience of our networks and highway infrastructure, which in turn will help reduce costs. Climate change risks should be embedded in everyday work, such as planning for roads and maintaining highways. Resilience to extreme weather and climate change should also form part of every authority's capital and maintenance programmes as well as their decision making processes. Guidance is provided to authorities to help them ensure they are mitigating risks caused by severe weather events that may be encountered.

Since 2013 DfT has undertaken action to help in this process. This includes publishing the revised Asset Management Guide which highlights the importance of applying asset management principles to help achieve a more structured long term approach to maintaining networks, including considering climate change. The effects of extreme weather events on highway infrastructure assets should be risk assessed and ways to mitigate the impacts of the highest risks identified. In addition, we have also asked highway authorities to ensure that they have a resilient network as recommended in the 2014 Transport Resilience Review. In October 2016 DfT published a revised Code of

Practice: Well Managed Highway Infrastructure[31]. Climate change resilience features throughout the code and it asks authorities to:

- ensure infrastructure is located, planned, designed and maintained to be resilient to climate change, including increasingly extreme weather events; and
- better understand the particular vulnerabilities facing local infrastructure from extreme weather and long term climate change to determine actions to address the risks.

In 2016 DfT introduced an incentive element into the funding allocated to local authorities for local highways maintenance[32]. This enabled local authorities to identify and use a local resilience network on transport infrastructure. Many local authorities are now working in close collaboration through highway alliances ensuring to share information and best practice locally on resilience and climate change adaptation which are published on a regularly[33]. In addition, DfT stays in close contact with Local Highway Authorities on a number of issues with regards to resilience of the local road network. For example, the department follows up ahead of every winter season on preparations in place to deal with severe weather events the country may encounter.

3.4.6 Interdependencies – strategic roads network and local roads

Interdependencies between the SRN and local roads are a specific issue HE have identified for further adaptation planning as their climate change risk assessment is being updated. An Infrastructure Operators' Adaptation Forum (IOAF) working group has made progress on developing a tool to help identify and assess infrastructure dependencies and interdependencies. There is now IOAF agreement that a matrix-based approach could provide a practical means of identifying and mapping interdependencies, and of capturing supporting evidence towards identifying solutions (e.g. adaptation measures). HE is a member of IOAF which shares knowledge about adaptation planning activity between infrastructure operators.

3.4.7 Other infrastructure services

DfT is undertaking work as part of the NFRR to identify bridges that could potentially become a single point of failure for other infrastructure operators (for example by carrying telephone or power cables) and could be at risk in a severe flood event. This work will ensure that other sectors, including utility providers, can develop mitigating actions to help protect services. This work is continuing and is expected to be completed by summer

[31] UK Road Liaison Group, "Well Managed Highway Infrastructure" URL: http://www.ukroadsliaisongroup.org/en/codes/

[32] Local Highways Maintenance Incentive Fund. URL: https://www.gov.uk/government/publications/highways-maintenance-funding-incentive-element accessed 09/0718

[33] Derbyshire Council, Creating a resilient highway and transport network. URL: https://www.derbyshire.gov.uk/transport_roads/transport_asset_management/creating_a_resilient_highway_and_transport_network/default.asp

2018. DfT have identified bridges that could be vulnerable to flooding on the local highway network and is working with local highway authorities to ensure appropriate mitigation measures are adopted where feasible.

DfT is also exploring ways new technology can help reduce the risk of damage to key infrastructure such as bridges and is taking forward the trials in association with both Cumbria County Council and the private sector. This work includes:

- testing the use of new technology such as deploying specialist monitoring cameras at key bridges to remotely monitor river levels in real time. A trial is underway in Cumbria and the outcome will determine whether this initiative could be adopted in other areas of the country where there is a high risk of flooding; and
- DfT also launched an innovative trial in December 2017 called "BridgeCat" – a Mobile Bridge Inspection System - that allows safe and rapid assessment of the prevalence of bridge scour[34] inherent in the national bridge stock. In a flood event this system will help ensure that any bridges are assessed for damage quickly thus allowing the highway authority to decide on safety grounds whether it can be open to traffic or not. The trial is being undertaken in Cumbria during 2018. Depending on the success of these trials, the system could be developed for use by other highway authorities to provide assistance in identifying scour and structural damage. DfT and BEIS are also considering a trial to look at whether this system can also be used to identify the condition of gas pipe crossings in rivers.

3.5 Cross-sectoral

The Cabinet Office has established a National Infrastructure Resilience Council (NIRC) to bring together utilities companies to share information about the locations of their assets and to take a coordinated approach to flood resilience. As part of this, work to share data on locally significant infrastructure sites gathered for the NFRR with Local Resilience Forums is near completion, with a number of sectors using the Resilience Direct online platform. Cabinet Office continues to work with the utilities companies and other government departments to capture the information which remains outstanding.

Priority actions that we commit to (detailed milestones, data-streams and metrics relating to these priority actions and further underpinning actions are set out in Annex 2).

[34] Bridge scour is the removal of sediment such as sand and gravel from around bridge abutments or piers. Scour, caused by swiftly moving water, particularly when a flooding event happens, can compromise the integrity and safety of a structure thus having to close the bridge whilst inspections of the abutment is undertaken.

Chapter 4: People and the built environment

Vision

"To promote the development of a healthy, equitable and resilient population, well placed to reduce the harmful health impacts of climate change, and able to capitalise on the potential health gains associated with tackling it".

"A health service, a public health and social care system which are resilient and adapting to a changing climate."

''Buildings and places (including built heritage) and the people who live and work in them are resilient and organisations in the built environment sector have an increased capacity to address the risks and make the most of the opportunities of a changing climate.''

"Emergency services and local resilience capability take account of and are resilient to, a changing climate."

4.1 Climate change risks

The health and wellbeing of the nation are of fundamental importance and to that end communities and the built environment they inhabit need to be resilient to heat and cold. Climate change will impact areas that support our wellbeing and health, including planning, community development, emergency response, health and social care system, historic places and cultural heritage.

The CCRA identifies flooding and high temperatures as posing the greatest risks to people and the built environment, which interact across communities, buildings, landscapes, health systems and individuals. Sea level rise could make some coastal flood defences in England highly vulnerable to failure in storm conditions. It could also make it increasingly difficult and costly to maintain current sea defence lines in some areas.

Flood risks to the NHS and social care assets are likely to increase. Future projections indicate an increase in the number of GP surgeries, care homes, emergency service stations and hospitals in the flood risk zone, with the largest risk change generally shown for care homes.

Higher average and higher extreme temperatures are likely to have adverse impacts on the UK population. There are also potential opportunities for health, wellbeing and tourism from warmer weather, including taking more journeys by foot. However, the benefit from climate warming and milder average winters is unlikely to eliminate the need for public health interventions for cold. With an ageing population the numbers of people vulnerable to both heat and cold will increase.

Higher temperatures may lead to an increase in the number of diseases which are transmitted to humans through insect bites and changes in the ranges for certain diseases.

Key risks identified in the CCRA 2017 include:

Risks to health and wellbeing from high temperatures	Risks to people, communities and buildings from flooding	Risks to the viability of coastal communities from sea level rise	Risks to health and social care delivery from extreme weather

4.2 Planning

The Ministry of Housing, Communities and Local Government (MHCLG) remain committed to the spatial planning aim set out in the first NAP- to provide a clear local planning framework to enable participants in the planning system to deliver sustainable new development. The National Planning Policy Framework (NPPF) sets out how Local Planning Authorities (LPAs) are expected to consider and address the range of impacts arising from climate change. Each local authority must have an up to date local plan to set out a vision and a framework for the future development of the area. Development should be steered away from areas of flood risk. The NPPF supports the use of green infrastructure, and is underpinned by planning guidance to help secure effective local implementation.

The NPPF is designed so that local authorities are able to react to the latest climate change information when they update their plans. Planning authorities, such as LPAs, should refresh their strategic plans every 5 years.

In March 2018 MHCLG issued a consultation paper on revisions to the NPPF. The aim is that there will be a greater emphasis on planning authorities taking account of climate change in their decisions. There is also a need to ensure that practical implementation occurs. The proposed changes would:

- refer to the risk of overheating from rising temperatures and make clear that planning policies should support measures to ensure the future resilience of communities and infrastructure to climate change;
- clarify that plans should have regard to the cumulative impacts of flood risk, rather than to or from individual development sites; and
- clarify policy on the exception test that may need to be applied when considering development in locations at risk of flooding.

The revised NPPF is due for publication in summer 2018.

The draft revised text of the NPPF includes stronger wording on biodiversity net gain. Defra is working to build on proposals set out in the 25 Year Environment Plan and help set a clear direction of travel for industry and local government. NE is working to update the Defra metric used for biodiversity net gain, develop industry standards for biodiversity net gain and explore how new metrics can support the delivery of natural capital benefits alongside biodiversity net gain. The consultation on mandatory net gain implementation, as referred to in the 25 Year Environment Plan, will also be crucial in the identification of opportunities and risks that might arise through future implementation of net gain policy.

4.3 Flood and coastal erosion risk management

Climate change is likely to increase flood risk in England from the four main types of flooding - fluvial (river), coastal, surface water, and groundwater. Sea level rise and potential changes in storm patterns are likely to increase coastal erosion rates in many areas.

Flooding and coastal erosion can cause deaths and injuries, though due to the effectiveness of existing response and defence arrangements, these are uncommon. There is emerging evidence that impacts on mental health are significant and long lasting and there can be significant social consequences for individuals from the disruption of months spent out of their homes, or of losing their homes entirely.

There can be damage to buildings and heritage assets and disruption to transport and communication infrastructure (telecoms, energy, roads and rail) as well as businesses, schools, and hospitals. Research demonstrates that traditional building materials and techniques may be more resilient and recover more quickly from flooding than modern buildings. Historic England is undertaking research to map these risks. Flooding and coastal erosion cannot be entirely eliminated and many landscapes have evolved based on regular flood and erosion patterns.

25YEP Goal: to reduce the risk of harm to people, the environment and the economy from natural hazards including flooding and coastal erosion by taking appropriate action.

We will achieve this by:

- Making sure everyone is able to access the information they need to assess any risk to their lives and livelihoods, health and prosperity posed by flooding and coastal erosion;
- bringing the public, private, and third sectors together to work with communities and individuals to reduce the risk of harm – particularly those in vulnerable areas;
- making sure that decisions on land use, including development, reflect the level of current and future flood risk;
- boosting the long-term resilience of our homes, business and infrastructure; and
- Taking action to reduce the risk of harm from flooding and coastal erosion including greater use of natural flood management solutions.

Flooding and coastal erosion cannot be entirely eliminated and many landscapes have evolved based on regular flood and erosion patterns. Government's objective is to manage

floods and coastal erosion to save lives, better protect communities, and support economic growth. We need to prepare for climate change through timely action to manage flood and coastal risk which can help reduce costly impacts later and manage the risks to people's homes and businesses across the country.

Adaptation is integrated within all our flood and coastal erosion risk management policies and programmes. Our aim is to plan for early adaptation so we will be better equipped and the potential impact of climate change on those most affected will be less. This includes constantly reviewing our policies in the light of the most up-to-date evidence and building resilience to climate risks; minimising the damage and disruption to economic activity and homes from flooding; for example supporting individuals to make their properties more resilient to flooding. There is evidence that the cost of installing property flood resilience measures will pay for themselves in terms of reduced damages if there is further flooding and people are able to return to their homes more quickly.

Government's £2.6 billion six year capital investment programme to reduce flood and coastal erosion risk will provide over £30 billion in economic benefits. The capital projects supported by this funding already include a combination of engineered interventions, resilience measures and working with natural processes/natural flood management; and we have earmarked £15m to specifically encourage natural flood management projects, which will further expand the evidence on how these can reduce the impact of flood events and complement more structural hard defences for flood mitigation.

In winter 2018, government will publish a policy statement on Flood and Coastal Erosion Risk Management (FCERM), setting out government's future expectations for managing flood risk. This will be followed by the EA updating the national flood and coastal erosion risk management strategy by 2019. This will include strengthening the joint delivery of risk management activities across organisations.

We have also begun to deliver our pledges under the 25 Year Environment Plan to:

- look at current partnership arrangements ahead of a review of funding needs beyond 2021, seeking to attract more non-public sector investment, and make sure all relevant agencies are able to respond quickly and effectively to support communities if and when flooding occurs;
- strengthen the relevant protections in the NPPF;
- increase the uptake of sustainable drainage systems, especially in new developments;
- improve the resilience of properties at risk of flooding and the time it takes them to recover should flooding occur; and
- support an industry-owned voluntary code of practice to promote consumer and business confidence in measures to reduce the impact of flooding on buildings, and on those who live and work in them.

4.3.1 Our approach

We have a holistic approach to flood and coastal erosion risk management, addressing the aspects of prevention, protection, adaptation, response, and acceptance as set out below:

Prevention

Using land-use planning policy and working with LPAs and developers to minimise new building in areas at high flood and erosion risk. There are already strong safeguards in place to avoid inappropriate development in areas at risk of flooding whilst delivering the homes this country needs and Coastal Change Management Areas being increasingly adopted as part of the local planning system. Actions supporting prevention are covered under land use planning and increased flood protections in the NPPF.

Protection

Supporting increased protection from flooding and erosion where appropriate by investing in defences such as flood walls, sea defences, and embankments and in soft engineering which works with natural and erosion processes to manage the volume, timing and speed of water flowing through particular areas.

Government has worked to improve protection through its six year investment programme, which is providing improved protection to 300,000 households. This programme runs from 2015-2021 and Government is now considering funding arrangements after 2021.

Surface water flooding presents unique challenges. Government has identified key areas to strengthen the current surface water management framework. It will publish a Surface Water Management Action Plan which includes actions for these.

Sustainable drainage systems (SuDS), such as permeable surfaces, storage tanks and ponds, reduce the risk of surface water flooding. SuDS and natural flood management can also deliver water quality, biodiversity and amenity benefits while helping communities adapt to climate change. Planning policy prioritises the provision of SuDS in all new major developments and new developments in flood risk areas.

MHCLG have reviewed the effectiveness of planning policy for SuDS and found that the majority of planning applications for new (major and minor) development includes SuDS. In the 25 Year Environment Plan, government committed to amending Planning Guidance to clarify construction and ongoing maintenance arrangements for SuDS and tighten links with planning guidance for water quality and biodiversity.

The 25 Year Environment Plan also set out commitments to consider changes to the NPPF and Building Regulations in the longer term to encourage SuDS. Government's strategic priorities and objectives for Ofwat set out how we expect water and sewerage companies to be challenged to develop a mix of solutions to meet current and future water management needs. These include managing flood risk by the adoption and maintenance of SuDS.

Adaptation

Supporting adaptation which reduces the damage to homes, infrastructure and local services so that costs to government, industry (including insurers), and individuals are reduced and recovery is quicker. This includes designing properties, infrastructure, and communities to withstand flooding when it happens and speed recovery where it does. These can be simple measures such as installing flood gates or air brick covers or more substantial works such as fitting a pump, having solid floors or raising electrics in buildings.

Defra and the EA are supporting the insurance industry in the development of a flood resilience voluntary code of practice due to be published in late 2018/early 2019. It will promote and provide advice on property-level resilience measures for new and existing

developments. We are also filling research gaps and supporting the industry led Property Flood Resilience Roundtable which is addressing the remaining gaps that prevent property flood resilience being normal practice for properties at high flood risk.

Response

We are working with partners to ensure there are robust arrangements in place to forecast and respond to a flooding incident. This includes warning and informing communities and local responders so that they are in a position to take appropriate preventive action whilst also having robust incident management arrangements in place in the event of a flood occurring. The establishment of Flood Re has also provided affordable insurance to households at high flood risk who would otherwise have struggled to obtain affordable cover.

Acceptance

Flood plains managed well can provide temporary flood storage areas for rivers and the sea at times of high flow or tide, minimising the risk elsewhere.

Shoreline Management Plans include areas of managed realignment of the coastal-terrestrial boundary (which may be a 'soft' boundary), and of no active intervention. Where property is affected by these management approaches – which are agreed by local authorities and statutory agencies including the EA, in consultation with the public – immediate measures may be required to manage risk locally. The approach chosen should reduce risk elsewhere and be more sustainable in the longer term. With improved information on coastal flooding and erosion risk and its long term management from the EA and local authorities, people should be able to buy, rent and use property at the coast with greater acceptance of the risk involved.

4.3.2 Protection of coastlines

NE have developed good practice for managing protected wildlife sites on the coast. This accepts the increasingly dynamic nature of habitats on our coastlines.

A number of research projects delivered under the EA's 2013 framework for Coastal Research, Development and Dissemination have improved our understanding of coastal flood and erosion risk and are developing tools to support coastal management (for example the guide to morphological modelling developed in the iCOASST project). Future planned projects include research focused on engagement on adaptation options with coastal communities, and developing a consistent and improved habitat change. We will carry out research utilising the forthcoming new UK climate change projections (UKCP18) to produce updated coastal erosion indices and better understand the impact of sea level rise for coastal flooding. Details of ongoing projects and outputs from the joint research programme are available online.[35]

The EA will continue to explore how to value natural capital assets on the coast and use that understanding to help make choices about the best coastal management approaches to take, including possible natural flood and coastal management.

[35] EA, Flood and Coastal Erosion Risk Management Research and Development. URL: http://evidence.environment-agency.gov.uk/FCERM/en/Default/FCRM.aspx accessed 09/07/2018

4.4 Water supplies and resources

The impacts of climate change are predicted to have a significant effect on the future of water supply and resources in England. Coupled with demographic changes, in particular a forecasted population growth in the South East of England, there will be strain on our water supply and our environment. Government is committed to mitigating these effects and ensuring a plentiful supply of water for all water users, whilst protecting our environment for future generations.

In 2016 government published its roadmap[36] to improving long term resilience of the water sector. The roadmap highlights the challenges the sector is facing from the changing climate and the impacts this may have. It laid out the enhanced policy framework in which future decisions and actions regarding long term water resilience would be taken.

25YEP Goal: to provide 'clean and plentiful water' for future generations. To increase water supply and incentivise greater water efficiency to maintain a plentiful supply as demand increases and climate change impacts availability

We will work towards achieving this goal by:

- Encouraging companies and individuals to take a responsible approach for water saving and reducing wastage and create behaviour change; and
- strengthening the resilience of supply whilst managing demand.

4.4.1 Water resource management plans – encouraging companies to take a responsible approach

Water companies are required by law to produce Water Resource Management Plans (WRMPs) every five years, setting out how they will deliver secure public water supplies and manage supply and demand for water in their region. In 2016 Defra strengthened the WRMP guidance to water companies to reflect the need for greater resilience as a result of the changing climate and growing population.

The new guidance requires companies to take a longer term strategic approach to protecting and enhancing resilient water supplies, covering a minimum period of 25 years. Some companies are going beyond this and are considering scenarios into 2080. The extension of time frames obliges companies to consider more thoroughly what actions they need to take in the short term to minimise risks to water supply in the long term. The refreshed guidance sets out a bold expectation for water companies to properly examine the value of resilience with their customers and ensures greater transparency around levels of service. This enables customers to understand and express their views on a potential trade-off between securing long term resilience to drought and potential water use bans, versus a potential increase in bills.

[36] Creating a great place for living: Enabling resilience in the water sector URL: https://www.gov.uk/government/publications/water-sector-improving-long-term-resilience accessed 05/07/2018

In addition to increasing resilience, the WRMP guidance also requires companies to consider other environmental impacts of their proposals. For example, options identified within the WRMP include consideration of carbon emissions and undergoing strategic environmental assessments to disincentivise high carbon schemes and reduce environmental impacts.

When the next WRMP guidance is produced in 2024, it will further encourage water companies to improve resilience and consider water efficiency.

4.4.2 Drought

The goal to provide clean and plentiful water for future generations may be made more difficult to achieve since we are likely to see more instances of drought throughout the country over the next 25 years, and an increasing frequency of worse droughts. This poses a significant risk to public water supply, business and industry, and agriculture.

Water companies have a statutory obligation to produce drought plans every five years which set out the short term operational actions a company will take during a drought period to maintain supplies to customers. These plans are tested annually to ensure that they remain fit for purpose. With the threat of drought becoming more likely these drought plans are an important tool for government to hold water companies to account over their preparedness for such situations. Additionally as part of the WRMP process water companies are required to plan how they will work to increase resilience against drought and ensure security of supply. We are working with water companies to further improve the level of resilience against drought and we will work with other sectors to understand their drought risks and how these can be mitigated.

Summer heatwaves can lead to a spike in demand for water at the same time as restrictions on water use are in place. If this is preceded by or accompanied by a period of low rainfall drought triggers may be reached earlier. There are also issues regarding the mitigation of the effects of heatwave, if the heatwave coincides with a drought. For example, green infrastructure is an important mechanism in reducing the effect a heatwave has, but if the heatwave is accompanied by a drought there will be restrictions on how much (and potentially if any) water can be used to maintain the green infrastructure. During drought, the priority will be maintaining the public water supply for public health and critical national infrastructure.

4.4.3 Strategic policy statement

A new strategic policy statement[37] (SPS) to Ofwat, published in September 2017 sets out government's policy priorities ahead of the regulator finalising the methodology for its 2019 price review (PR19) which instructs water companies as to what they will be able to charge customers from 2020 onwards. The SPS will influence over £40 billion of water company investment in water and wastewater services. The statement has put long term resilience at the front and centre of business planning.

[37] Strategic Policy Statement to Ofwat. URL: https://www.gov.uk/government/publications/strategic-policy-statement-to-ofwat-incorporating-social-and-environmental-guidance accessed 09/07/2018

Ofwat's final PR19 methodology[38] reflects the priorities laid out in the SPS. Ofwat have challenged companies on their resilience both through targets and performance commitments. A clear target, which was endorsed and welcomed by Defra and the EA, was for companies to ensure a 15% reduction in leakage by 2025, a challenge to which most water companies have risen. Additionally, reducing per capita consumption is a common performance commitment for all companies, as is reducing customer water supply interruptions, which covers periods of drought. Ofwat, Defra and the EA will continue to push these commitments and incentivise companies to go further.

The SPS prioritised the need for the water sector to be able to protect customers from climate change risks and flooding of water and wastewater infrastructure. It steered Ofwat to challenge water companies to make sure that they assess the resilience of their system and infrastructure against the full range of potential hazards and threats and take proportionate steps to improve resilience where required. In particular companies should assess the extent to which their major water treatment works and sewage treatment plants are appropriately resilient against extreme flood events (as described in the NFRR) and include provision for additional resilience where required. Government has also placed a new statutory duty on Ofwat to secure the long-term resilience of water undertakers' supply systems and sewerage undertakers' sewerage systems to environmental pressures, population growth, and changes in consumer behaviour.

Following the NFRR water companies reported that the flood resilience of their key local infrastructure assets were being assessed on a risk basis and enhanced using a range of approaches, including temporary defences, network rezoning plans and small-scale adaptation measures, such as raising electrical equipment. Water company assessment of flood risk will continue to feature in reports submitted under the Adaptation Reporting Power – the Adaptation Reporting Power is discussed in more detail in chapter 7.

4.4.4 Twin track approach – strengthening the resilience of supply whilst reducing demand

The twin track approach is the idea of reducing demand, whilst also working to strengthen the resilience of supply in order to meet our goal of providing clean and plentiful water for future generations.

We want water companies to develop and implement robust long-term plans that use this 'twin track' approach to improve the resilience of water supplies when faced with a changing climate. The twin track approach demonstrates the importance of not only undertaking ambitious initiatives to reduce demand for water, but also taking bold strategic decisions to secure new water supplies, such as new reservoirs and water transfers. It is only with the combination of reducing demand coupled with increasing infrastructure that we can ensure a secure, long-term supply of water in a changing climate, whilst protecting the environment and maintaining affordability.

The National Infrastructure Commission published its report on England's water infrastructure needs in April 2018[39]. This supports government's twin track approach to

[38] Ofwat PR19 methodology. URL: https://www.ofwat.gov.uk/wp-content/uploads/2017/12/Final-methodology-1.pdf accessed 09/07/2018

[39] Preparing for a drier future: England's water infrastructure needs. URL: https://www.nic.org.uk/publications/preparing-for-a-drier-future-englands-water-infrastructure-needs/

making water resources more resilient. Government will respond to the recommendations in due course as part of the response to the wider National Infrastructure Assessment due to be published in summer 2018. However, Defra expects water companies to take account of the report's findings as they finalise their WRMPs over the next few months.

Recognising that the scale of some of the infrastructure to provide transfers and additional new resources will be significant, government is committed to delivering a National Policy Statement (NPS) for Water Resources to streamline the planning process for large water resource infrastructure. This will make sure that such infrastructure can be delivered when needed. Defra commenced the relevant parts of the Planning Act 2008 in January 2018 and expects to lay before Parliament, and consult on, a draft NPS in autumn 2018 with the final document designated in summer 2019.

Water trading is a key part of making water supplies resilient to droughts. In particular, transfers of water from the north and west to the south and east of the country are especially important as the south and east are predicted to be most impacted by drought, and will see the greatest increases in population. Currently, only around 4% of water supplies are transferred between water companies - equivalent to nearly 500 million litres of water each day. Water UK's 2016 report[40] on long-term water resources suggested that this should rise to one billion litres by 2040 to ensure resilience, providing the right incentives are in place. To encourage greater water trading, Ofwat have powers in England to intervene in negotiations between companies on bulk water supply where parties cannot reach an agreement. We are working with Ofwat, water companies and the EA to reduce barriers to trading and support the long term supply of water.

Managing demand is a vital aspect of securing long term resilience against drought. Defra has demonstrated its continuing commitment to managing demand and increasing water efficiency in the 25 Year Environment Plan, and this ambition is supported by the NIC's report into future water needs.

We want to see individual water use fall - currently, the average per capita consumption (PCC) is approximately 140 litres per day[41]. Defra is working with the water industry to set an ambitious PCC target which will be announced at the end of 2018.

Defra fully supports Ofwat's challenge of a reduction in leakage of 15% by 2025 by all water companies. We have reiterated this challenge in our guidance for WRMPs, and have been pushing companies hard to commit to this target. We want to be more ambitious and continue to challenge companies to reduce their leakage further over the next 25 years. We want to see a year on year reduction in the volume of water lost to leakage.

We are working with the water industry, Waterwise, Water UK, and other groups to investigate a variety of other tools and techniques to support the reduction in individual water consumption. We are evaluating the efficacy of adopting either a voluntary or mandatory water label on products which use water; encouraging the greater penetration of water meters across the country, not just in certain companies or regions; investigating

[40] Water UK, water resources long-term planning framework. URL: https://www.water.org.uk/water-resources-long-term-planning-framework accessed 09/07/2018
[41] https://www.statista.com/statistics/321380/water-consumption-per-head-and-household-united-kingdom-uk/

behavioural change and the perception of the value of water; and the water efficiency of domestic properties.

4.4.5 Drainage and wastewater management plans

Water UK's 21st Century Drainage Programme is driving work to improve the new long-term planning of drainage and wastewater services with the development of a number of tools. This includes the development of a new planning framework for the production of water company Drainage and Wastewater Management Plans (DWMPs). DWMPs will help provide a more consistent basis for planning across the sector, enabling companies to target investment on drainage and wastewater more effectively and provide customers with better information about these services. The framework is being developed in partnership with water and sewerage companies and Defra Group. DWMPs will help water companies manage their assets over the long-term and ensure that they are resilient to climate change. DWMPs have also been recognised as helping to deliver the ambition in the 25 Year Environment Plan on improving surface water management and are part of a mix of solutions to meet current and future water management needs. A key component of the framework is engagement and involvement of other risk management authorities, facilitating a more joined up approach to future surface water drainage services. The framework is due to be finalised in September 2018.

4.5 Overheating in buildings

We want to ensure that homes and other buildings are well-insulated for winter, while not overheating in the summer. Achieving this aim is likely to require a number of actions, including changes in construction practices, in occupier behaviour and in greater use of green spaces, including historic parks and gardens, whose role in reducing overheating in urban environments is well documented.

4.5.1 Green infrastructure

Green Infrastructure (GI) offers multiple benefits and this is recognised in the 25 Year Environment Plan.

> *25YEP Goal: to green our towns and cities by creating green infrastructure and planting one million urban trees. Create more, better quality and well maintained green infrastructure and embed an environmental net gain principle for development, including housing and infrastructure.*

GI plays an important connectivity role across cities, towns, coast and countryside at a local and landscape scale, forming an integral component of ecological networks and building more resilient landscapes. Multi-functional GI innovations offer a way to combat resilience challenges and also address stresses of urban living to improve health and wellbeing.

NE will develop a set of GI standards that can be easily used by local GI planners, designers and managers and communities to help them deliver more good quality local GI,

in particular for disadvantaged urban populations, where impacts of climate change can compound other environmental deprivation factors. We will also work to embed the environmental net gain principle (see section 4.2 on Planning) into development, including housing and infrastructure.

Higher temperatures will increase the risk of overheating in many types of buildings (including homes, hospitals, care homes, schools, prisons, and offices) leading to adverse impacts on health and poor thermal comfort. The proportion of buildings experiencing overheating is very likely to increase with climate change. Occupancy patterns greatly influence exposure to overheating. Individuals who remain at home during the day are more likely to be inside at the times of highest external and internal temperatures, and themselves contribute to internal heat gains (e.g. from using appliances and metabolic heat).

Safe upper temperature thresholds for health are difficult to establish and there is currently no standard method to quantify the risk and health impact of overheating in buildings. This poses challenges to communication of the risk to the public. There is evidence that people lack a basic understanding of the risks to health from indoor high temperatures, and are therefore less likely to take measures to safeguard their and their dependents' wellbeing. The Heatwave Plan for England[42] aims to reduce summer deaths and illness by raising public awareness and triggering actions in the NHS, public health, social care, and other community and voluntary organisations to support people who have health, housing or economic circumstances that increase their vulnerability to heat (see section 4.6).

4.5.2 Homes

Buildings need to be designed and built to take account of the risk of a warmer climate. To better understand the risk of overheating in new homes, MHCLG commissioned a piece of research, due to be completed in summer 2018. This is being informed by an expert working group consisting of CIBSE, architects, house-builders, academics and PHE. The research is investigating the impacts of overheating in homes on occupants both now and in the future.

In the project the overheating risk in new homes in England is being quantified using dynamic thermal building models. The variation in the new-build housing stock is being modelled using eight property types, including both flats and houses, in five geographical settings.

The research is also evaluating the effectiveness of overheating mitigation techniques, including shading and ventilation, in a sub-set of these homes. Five mitigation packages ranging from low to high cost are being modelled, these include different methods of reducing solar gains and removing excess heat. Overheating mitigation strategies are being assessed by their ability to both reduce excess mortality and reduce sleep disruption, with its related productivity impacts.

The outputs of this research will help to inform any future policy on including climate adaptation in new homes to reduce overheating. Any policy will need to be considered in

[42] Heatwave Plan for England 2018. URL: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/711503/Heatwave_plan_for_England_2018.pdf

the light of the Hackitt Review of Building Regulations and Fire safety following the Grenfell Tower fire tragedy.

Housing policy also needs to consider addressing large-scale refurbishment of existing housing stock to reduce the burden of overheating, alongside decarbonising domestic heating. Many traditionally constructed buildings, if well maintained, will already cope well under a warming climate. There has been much work to determine cost-effective adaptation responses at the house scale, but scaling up to population-wide changes to housing stock is a complex issue and industry guidance is needed if maladaptation is to be avoided. Mitigation and adaptation measures need to be combined when promoting the implementation of energy efficiency and ventilation interventions.

Occupier behaviour can also substantially reduce the risks as there are many measures that can be taken to keep homes thermally comfortable. Awareness raising by government and others, including technical experts, is also necessary to ensure the profile of overheating in homes continues to be maintained.

4.5.3 Hospitals and care homes

Currently new hospitals are more at risk of overheating during hot weather compared with older, traditionally built blocks, although maladaptation of older buildings can lead to a loss of this adaptive capacity. A study of care homes[43], indicates that these may also be at risk from high temperatures, due to building design and management issues. The Department of Health and Social Care (DHSC) is working with its arm's length bodies to develop measures to improve patient safety and increase resilience to heatwaves in health and social care buildings. Patients in hospital and care homes may be more vulnerable and less able to adapt because of age, reduced ability of their body to sense and react to changes in temperature, immobility or difficulties in making their own environmental adjustments and accessing fluids.

From April 2017, the NHS has required Trusts and commissioners to submit data on the percentage of clinical areas covered by thermal monitoring; the number of overheating events in clinical areas; the presence of an organisational adaptation plan; an expectation of coverage of adaptation in mandatory Sustainable Development Management Plans (SDMP); and an expectation of coverage of adaptation in trusts' annual reports. This data will enable Trusts to understand, and address overheating risk.

The first year of data collection shows there is still a need for work on improving data quality. Some significant outliers in reported levels of overheating suggest that not all Trusts are recording and reporting in the same way. The PHE/NHS England-supported Sustainable Development Unit (SDU) are working with NHS Improvement to identify if it is possible to incorporate this data into the Model Hospital to enable benchmarking. The data will help to inform the sector wide Adaptation Report.

In 2017 the SDU embedded adaptation as a core module in the SDMP guidance for Trusts. In October 2017 the SDU launched the Sustainable Development Assessment Tool, to support SDMP development and adaptation is one of the 10 key strands. To ensure that progress is recognised as well as expected, April 2018 will see the launch of a national Sustainable Health and Care awards programme run by NHS Employers in

[43] Report at: https://www.jrf.org.uk/report/care-provision-fit-future-climate

partnership with the SDU to recognise progress in sustainable development, with adaptation as one of the 10 categories.

The health sector aims to embed adaptation into daily practice by 2023, by including it as a key element of SDMPs for which there has been set a requirement of 100% coverage for NHS providers. This will be supported by guidance from the SDU and NHS Improvement. This will help ensure that adaptation has a higher profile in health and care organisations and that this is considered as an impact on infrastructure, supply chain, staff and patients.

PHE and DHSC will work to strengthen the evidence for impacts of climate change including an updated Health Effects of Climate Change in the UK report using the UK Climate Change Projections which will be available in late 2018.

4.5.4 Schools

The Department for Education (DfE) and the Education Skills Funding Agency (EFSA) plan to publish a revised Building Bulletin[44] in late 2018, which will use the latest adaptive thermal comfort calculation methods to prevent summertime overheating.

ESFA has adopted adaptive thermal comfort criteria as the basis for design of new and refurbished buildings to prevent summertime overheating problems. The methodology follows British Standards[45] and the design criteria are included in the contractual requirements for ESFA funded capital projects. School designs must be modelled against the 2020 Design Summer Year (DSY)[46]. This design methodology ensures greater resilience against increased summertime temperatures due to climate change. PHE has also published heatwave guidance for teachers and for early years settings produced in consultation with DfE.

DfE will carry out further modelling in 2018 and 2019 of school designs, building on previous studies on the adaptation of existing school stock, using the CIBSE 2020 and 2050 DSY weather files and the latest adaptive thermal comfort criteria. DfE will model a new build baseline design, some existing building typologies[47] including refurbishment scenarios and new modular designs. This work will enable understanding of the most effective adaptation measures for school buildings.

4.5.5 Prisons

The Ministry of Justice (MoJ) designs, constructs and maintains prisons aimed at providing a decent, safe and secure environment for staff and prisoners. MoJ keeps the design of

[44] Building Bulletin 2014. URL: https://www.gov.uk/government/publications/building-bulletin-101-ventilation-for-school-buildings

[45] BS EN 15251 - Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics and CIBSE TM52 https://www.cibse.org/getattachment/Networks/Regions/South-Wales/South-Wales-Past-Presentations/TM52-The-limits-of-thermal-comfort-Cardiff.pdf.aspx

[46] Design Summer Year (DSY) is one of a number of different weather data sets produced by CIBSE. It is used as a climate input into building simulation software and is used for overheating analysis. Technical briefing: http://www.cibse.org/getmedia/ce7a77e8-3f98-4b97-9dbc-7baf0062f6c6/WeatherData_TechnicalBriefingandTesting_Final.pdf.aspx accessed 09/07/2018

[47] categorising buildings into groups based on their function

prisons under continual review, looking to improve its provision by incorporating emerging best practice. This review includes identifying what can be done to mitigate the risks of overheating in prison buildings.

MoJ is working with client and design advisers to incorporate Centre for Climate Change Scenarios, in line with UKCP09 projections, to allow designs to be future-proofed to the predicted changes in temperature, wind and rainfall within Prison Estate Transformation Programme (PETP) modelling. This aims to ensure that summertime overheating is not a significant problem, and that the energy used by future cooling demands is minimised through the design stage. PETP is also incorporating BREEAM requirements[48] to ensure that new prisons sites are assessed for flood risks, rainfall and orientation. On the existing prison estate both natural (solar shading and natural cooling) and mechanical means (building management systems and thermostatic controls) are used to control temperature and guard against overheating. MoJ anticipate that a number of new features will be incorporated into the final designs of new prisons addressing the risk of overheating and lessons will be applied to the maintenance and development of its current buildings.

4.6 Delivery of health and social care services

More severe weather, both flooding and extreme temperatures, pose risks to the delivery of health and social care. Flood risks to NHS and social care assets are likely to increase under climate change. Future projections indicate an increase in the number of GP surgeries, care homes, emergency service stations and hospitals in the flood risk zone, with the largest change in risk generally shown for care homes.

In addition to increased extremes of temperatures, heatwaves are likely to become more common. The Heatwave Plan for England, published since 2014, sets out what should happen before and during periods of severe heat in England. It spells out what preparations both individuals and organisations can make to reduce health risks and includes specific measures to protect at-risk groups. Local authorities have an important role to play in implementation of the plan. An independent evaluation of the Heatwave Plan for England is currently underway and is due to report in 2018/19.

Although average temperatures are expected to increase, cold is likely to remain a significant public health problem. There are currently between 35,800 and 49,700 cold-related deaths per year. Hard to heat homes are the major determinant of the burden of cold-related mortality and morbidity. The effect of climate change on cold-related mortality and morbidity is beneficial, but projections suggest that the total number of cold-related deaths per year is unlikely to decline significantly due to the ageing population, increasing the number of vulnerable people at risk.

Guidance for managing the risks from cold weather exists through the Cold Weather Plan for England[49] and associated public and professional facing resources. An independent evaluation of the Cold Weather Plan for England was published by the Policy Innovation Research Unit in 2015.

[48] A sustainability assessment method for master planning projects, infrastructure and buildings.
[49] Cold Weather Plan for England. URL: https://www.gov.uk/government/publications/cold-weather-plan-cwp-for-england accessed 09/07/2018

Building on these two plans PHE, DHSC, NHS England and the Local Government Association (LGA) will develop a single adverse weather and health plan (including cold and hot weather, drought, flooding and thunderstorm asthma) by 2022. This will act on the recommendations of the independent evaluations and stakeholder feedback. Potential approaches include bringing together and improving existing guidance in order to inform action across the health system and local communities, reduce health risks associated with adverse weather, address the CCRA health risks, and bring consistency and coherence of approach to the impacts of adverse weather on health.

PHE and DHSC will continue to undertake research to understand the health consequences of climate change more comprehensively and the health interventions which are effective at minimising preventable harm. The evidence base for health impacts of climate change will be strengthened through publication by 2023 of a UK focused report ('Health Effects of Climate Change in the UK') based on the upcoming revised UK Climate Projections (UKCP18) which will be launched in late 2018.

PHE and DHSC will also review and update relevant climate change and health research strategies by 2020 to ensure CCRA research priorities, including air quality and vector-borne pathogens are addressed, as well as supporting risk management where the CCRA has specified that more action is needed (e.g. cold and hot weather and flooding).

The National Study of Flooding and Health, owned by PHE, is generating new evidence on the-medium term mental health impacts associated with flooding. The results will enhance our understanding of the health costs of flooding and inform flood preparedness, response and recovery practices.

4.7 Emergency services, local responders and community resilience

An increase in the severity and frequency of extreme weather conditions across the UK will have an impact on emergency services, local responders and communities who may need to amend the plans they currently have in place to ensure preparedness for future 'reasonable worst case scenarios'.

The Civil Contingencies Act (CCA) 2004[50] provides a framework for responder agencies, as categorised under the Act, to deliver appropriate emergency planning, response and recovery. Responsibilities for coordination within and between Local Resilience Forums (LRFs) is clearly set out in Emergency Preparedness (practical framework for civil protection taken from the CCA 2004) [51].

The responsibilities set out in the Emergency Planning Guidance are regularly tested by LRFs and their constituent responder organisations through a schedule of testing and exercising in order to validate capability and provide assurances.

[50]Civil Contingencies Act. URL: https://www.legislation.gov.uk/ukpga/2004/36/contents accessed 09/07/2018
[51]Emergency Preparedness Guidance. URL: https://www.gov.uk/government/publications/emergency-preparedness accessed 09/07/2018

The Communities Prepared National Group (CPNG), co-ordinated and sponsored by the Cabinet Office, supports the development and local implementation of community resilience policy across England. This is outlined in the Community Resilience Framework for Practitioners[52]. It does this by:

- providing a forum for local managers and government to share good practice and lessons learned in community engagement and capability building across the country;
- advising government on policy and projects relating to community resilience; and
- identifying opportunities for co-ordination of community resilience related work.

The CPNG is refreshing the framework to enable more strategic local delivery, and a more coordinated approach nationally.

The Cabinet Office supports consistent risk assessments, planning and preparedness activities by providing the local level with guidance on how to approach risk assessment and information about national risks. This approach encourages consideration of reasonable worst case scenarios that the UK might face whilst preserving local autonomy in planning and preparing according to the local context.

Local Risk Management Guidance is developed by the Cabinet Office to assist LRFs with risk management, such as by identifying reasonable worst case scenarios and conducting contextually-specific local risk assessments. National level assessments are also made available to LRFs through the (classified) National Risk Assessment, which provides comprehensive detail on potential scenarios over the next five years and their consequences, and encourages consistency in understanding and approach. The Cabinet Office reviews and updates the National Risk Assessment every two years to take account of the latest evidence and expertise.

Long-term the CPNG aims to increase the number of strategies for community resilience at LRF level and enable greater coordination and collaboration amongst practitioners across the country. This is particularly important when considering emergency planning for floods at strategic planning and planning application stages. This will ensure that there is greater awareness of preparedness measures being taken locally and that all those involved in the preparedness and response to, and recovery from, an extreme weather event are working closely together.

[52] Community Resilience Framework for Practitioners. URL: https://www.gov.uk/government/publications/community-resilience-framework-for-practitioners accessed 09/07/2018

Chapter 5: Business and industry

Vision

"UK businesses are resilient to extreme weather and prepared for future risks and opportunities from climate change"

5.1 Climate change risks

Climate change will present risks to businesses (for instance from flooding and extreme weather events such as drought which damage assets and disrupt business operations) and provide opportunities through changes in demand for existing and new products and services.

Business operations depend on the resilience to climate change of a range of related services and activities such as local infrastructure including energy, transportation and telecoms; supply chains and distribution channels; and impacts on staff. Particularly for small businesses, these can be as damaging as the direct impacts of severe weather.

Through their international supply chains, distribution networks and global markets, UK businesses are exposed to the risks of extreme weather around the world. Climate change is expected to increase the risk of weather-related disruptions, particularly for supply chains and distribution networks that involve more vulnerable countries.

The increased risk of drought is likely to disrupt businesses, particularly those who run water intensive businesses, and may lead to disruption of production and services, not least when diminishing supplies need to be prioritised elsewhere, including for public health and safety. Water intensive businesses may need to consider locations which are less water stressed to mitigate their risk.

Key risks identified in the CCRA 2017 include:

Risks to business sites from flooding (This is covered in Chapter 4: People and the built environment)	Risks to business from loss of coastal locations and infrastructure (This is covered in Chapter 4: People and the built environment)	Risks to business from reduced employee productivity due to infrastructure disruption and higher temperatures in working environments

As explained in the box above, most risks identified by the CCRA on businesses are dealt with in other chapters of the NAP. The Business and industry chapter will focus on the following three priority areas:

- Loss in productivity;
- supply chains; and
- access to capital and risks and opportunities associated with changing demand for goods and services.

5.2 Loss in productivity

The CCRA2017 identified a potential risk to productivity from disruption caused by higher temperatures or infrastructure disruption which are attributable to climate change, although there is scant evidence on the relationship between temperature and productivity. CCRA2017 therefore outlines a need for further research to understand better the key interdependencies between business and infrastructure; the types of employment at greatest risk; and the effectiveness of planned or autonomous adaptation. Collecting business continuity information on productivity and extreme weather is critical to understanding this risk better.

On infrastructure disruption, we propose that as a first step this information is collected from infrastructure operators and their regulators under the third cycle of adaptation reporting. Please refer to chapter 7 for more information on the Adaptation Reporting Power.

On risks to business from reduced employee productivity, due to higher temperatures in working environments, government takes the impact of heatwaves very seriously. We have acknowledged the risk identified in the Climate Change Risk Assessment and are working to ensure the appropriate departments, including BEIS, MHCLG and DHSC, take this commitment forward.

5.3 Supply chains

Food supply is one of the 13 Critical National Infrastructure sectors[53]. Defra produces an annual Sector Resilience plan[54] and is currently carrying out a review of the UK Food Security Assessment (last fully updated in 2010), due to complete later this year with a view to publication in 2019. Climate change will be considered and highlighted as a risk (and possible opportunity) throughout the review.

Although the assessment has not yet been completed, the UK's openness to trade combined with a robust domestic production sector has brought a very impressive diversity to UK food supply, and this will continue after we leave the EU. The UK imports food from over 180 countries and this openness ensures that UK food supply is very resilient to

[53] Centre for the Protection of National Infrastructure, Critical National Infrastructure. URL: https://www.cpni.gov.uk/critical-national-infrastructure-0
[54] Cabinet Office, Sector resilience plans, 15 January 2014. URL: https://www.gov.uk/government/collections/sector-resilience-plans

supply interruptions from specific countries and also from disruption to domestic UK production. In particular retailers and large food service operators are able to switch sources of supply rapidly if required (as demonstrated during a range of crises including severe weather, transport disruption and Industrial Action). Even where the volume of trade is relatively small with certain countries, the indicator highlights the potential to import in the event of shortfalls domestically or in other trading partners.

5.4 Access to capital and risks and opportunities associated with changing demand for goods and services

5.4.1 Non-financial reporting

25YEP Goal: to ensure that all policies, programmes and investment decisions take into account the possible extent of climate change this century

Implementing the 25 Year Environment Plan, Defra will work with the Council for Sustainable Business (CSB), which will act as a sounding board, challenger, critic, innovator and advisor to the Secretary of State, Ministers and Defra policy teams. The Council will work with business leaders to:

- identify environmental innovation and entrepreneurialism that will advance 25 Year Environment Plan ambition and goals;
- strengthen the financial case for sustainable business;
- advise on the development of the right regulatory frameworks, fiscal policies and support structures to achieve these ambitions

Work will extend across all ten of the 25 Year Environment Plan goals.

The 25 Year Environment Plan sets out some of the areas on which the CSB could act and provide advice, including:

- actions by government to create the right conditions for private sector innovation and investment in environmental goods;
- developing and articulating the business case for natural capital reporting, addressing risks and opportunities in operations and supply chains;
- positioning the UK as a world leader in natural capital knowledge-based services and goods;
- the development of new natural capital markets – like the creation of new revenue streams to make natural capital assets investable; and
- cultivating and acting on consumer environmental trends.

This will build on the Green Finance Taskforce to further explore opportunities for the financial sector to fulfil opportunities in natural capital and environmental protection.

It is important to note that the Non-Financial Reporting Directive was transposed into UK regulations in December 2016. These regulations require large public interest entities to report on environmental matters (including the impact of the company's business on the environment) and a description of the principal risks in this area. The non-financial information statement is to be included within the strategic report which is filed at Companies House as part of a company's annual report. The first reports, including this statement, are now being filed (for financial years starting 1 January 2017) and will form an important part of our evidence base. With respect to the further reporting on climate adaption, please refer to chapter 7 on the Adaptation Reporting Power.

5.4.2 Green Finance

Green finance, defined as the mobilisation of private investment in environmental and sustainable projects and infrastructure, is essential to meeting the UK's domestic and international climate change commitments.

Government has endorsed the recommendations of the Taskforce on Climate-related Financial Disclosures (TCFD) and encouraged all listed companies to implement them. Over 250 businesses worldwide have endorsed/backed these recommendations, including eight of the ten largest asset managers and twenty of the largest banks. Many companies in the UK have also committed to implementing the TCFD recommendations, and this increase in climate-related financial disclosures could further build the evidence base in this area, particularly from the financial sector.

BEIS and HMT convened the Green Finance Taskforce, bringing together leading experts from the financial sector, academia and civil society to provide recommendations to support the delivery of our strategic objectives in green finance:

- Help deliver the investment needed to meet the UK's Industrial Strategy and Clean Growth Strategy;
- further consolidate the UK's leadership in financing international green and sustainable investment; and
- maximise the opportunities to be had for UK businesses in this rapidly growing area.

The UK is widely recognised as the world's leading global financial centre, and also leads the world in green finance, with nearly 80 green bonds already listed on the London Stock Exchange raising more than US$24bn[55]. The Taskforce was convened to build on these strengths.

[55] As of May 2017. Source: London Stock Exchange Group

The Taskforce published its Report at the end of March 2018, outlining a set of wide-ranging and ambitious recommendations for Government and the private sector[56]. These were formulated in consultation with over 140 organisations and are grouped in to 10 key themes:

1. Relaunch UK green finance activities through a new unified brand;
2. improve climate risk management with advanced data and analytics;
3. implement the recommendations of the Task Force on Climate-Related Financial Disclosures (TCFD);
4. drive demand and supply for green lending products;
5. boost investment into innovative clean technology;
6. clarify investor roles and responsibilities;
7. issue a sovereign green bond;
8. build a green and resilient infrastructure pipeline
9. foster inclusive prosperity by supporting local actors; and
10. integrate resilience into the green finance agenda.

Green finance is about both clean growth and resilience; in addition to maximising the opportunity presented by the global transition to a low-carbon economy, the UK must also be resilient to the physical threats of climate change. The Taskforce highlighted resilience throughout the report and considered it explicitly in Theme 10.

The report was well received across the financial services sector, and Sir Roger Gifford the chair of the Taskforce commented that the report marked a 'significant starting point for truly propelling green finance onto the national agenda'.

Government is now considering the Taskforce's recommendations and will respond in due course.

5.4.3 Greening government commitments

In addition to this, the government continues delivering its ambitious Greening Government Commitments[57]. These commitments require departments to report

[56] 'Accelerating Green Finance: Green Finance Taskforce Report', 28th March 2018, https://www.gov.uk/government/publications/accelerating-green-finance-green-finance-taskforce-report

[57] HMG, Greening Government Commitments, 14 December 2016. URL: https://www.gov.uk/government/collections/greening-government-commitments

transparently each year on the actions they are taking to address climate change adaptation on their estates and in their operations. Their compliance is reported in the Annual Report on the Greening Government Commitments. HMT's Sustainability Reporting Guidance for Public Sector Annual Reports[58] also requires organisations to provide a general statement giving assurance that action has been taken to ensure that policies with long term implications are robust in the face of changing weather, extreme events and sea level rises from climate change.

5.4.4 Climate adaptation standards

Government has engaged with the British Standards Institution and key stakeholders to consider the possibility of developing a standard in climate adaptation and business resilience. A standardised approach to long term decision making in adaptation will have relevance for the management of risks in the natural environment, built environment, business and infrastructure. Government will continue engaging in discussions with the British Standards Institute and different stakeholders on this issue. Among other things, we will consider Adaptation Pathways for businesses.

Government has also commissioned the British Standards Institution to develop the world's first green and sustainable finance management standards

[58] HMT, Public sector annual reports: sustainability reporting guidance 2017 to 2018, 31 October 2017. URL: https://www.gov.uk/government/publications/public-sector-annual-reports-sustainability-reporting-guidance-2017-to-2018

Chapter 6: Local government

Vision

"Local Government plays a central role in leading and supporting local places to become more resilient to a range of future risks and to be prepared for the opportunities from a changing climate"

6.1 Climate change risks

Local government plays a major role in shaping local places by taking decisions and providing guidance, through the local democratic process, on the urban landscape, the built environment, green and blue natural spaces, and public health.

Many of the risks identified in CCRA2017 and set out in chapters 2-5 of this NAP and many of the impacts arising from climate change are relevant to the responsibilities and functioning of local government. Many of the impacts arising from climate change will affect their communities, infrastructure and assets, and the provision of services. Impacts are likely to vary from location to location. Insufficient local decision-making on how infrastructure funding is prioritised is a concern - this can be a barrier to an effective response to increased flood risk. And at a rural level higher temperatures, droughts and heavy rainfall aggravate the ongoing degradation of agricultural, forest and pasture ecosystems. This could have a negative effect on food security. Food supply is discussed in more detail in Chapter 5: Business and Industry.

Local government as community leaders, working with a wide range of infrastructure and other local delivery partners, are at the forefront of local action to protect communities and businesses and safeguard growth from risks posed by severe weather events and a changing climate. They recognise the need to take adaptation action to minimise climate change risks to services they provide and are already taking actions. Local councils already have a range of duties and reporting requirements on flood risk management, planning, emergency planning, and biodiversity which negates the need for further adaptation reporting. They are involved in significant investment, service delivery, procurement and business continuity activities, and in relation to climate impacts and extreme weather, are central to long term planning, infrastructure management, emergency response and recovery work. Involving local government in national climate change strategy from an early stage will be valuable in supplying local granular insight to national policy, and central government climate expertise to local government.

There is a need for, and statutory obligations on, councils, to prepare for and minimise the longer term impacts of climate change. This is reinforced by expectations for community resilience and business continuity by residents and businesses. Local government can also play a valuable role in raising the public profile of climate change mitigation and adaptation, as a central and long-term government priority.

There are a wide range of legislative and policy drivers to enable local action on climate change. Local government has obligations that contribute to resilience, although not all local authorities will have the same responsibilities in an area. These include flood risk

management, under the Flood and Water Management Act 2010, and commitments to prepare and plan for emergencies under the Civil Contingencies Act 2004. Local Planning Authorities (LPAs) are also required under the Planning Act 2008 to adopt proactive strategies to mitigate and adapt to climate change. They need to take full account of flood risk; coastal change; and water supply and demand considerations. There are also funding requirements to consider adaptation as part of criteria for the Local Growth Fund.

6.2 Local delivery of the 25 year environment plan

Mitigating and adapting to climate change is one of 10 goals of the 25 Year Environment Plan. Defra is committed to improving partnership working at a local level with local authorities, Local Enterprise Partnerships, Local Nature Partnerships, Defra Group bodies and other key local decision makers to help deliver the Plan's goals.

Many organisations and partnerships pursue their own plans, across different areas and boundaries. In places there is good coordination between them, but in others there are opportunities for joining up and integrating environmental work. Activity within an area could be better coordinated and aligned if all the relevant delivery organisations came together to create a single plan.

Defra intend to facilitate this coordination through the development of 14 local natural capital plans. These plans will be developed from existing Defra Group Area Integrated Plans, which are joint statements between the EA, NE and the Forestry Commission – the bodies that coordinate Defra's activity in an area. Local natural capital plans will go beyond the Defra focus of Area Integrated Plans to include all relevant delivery in the area, ensuring greater coordination and integration of activities that impact on the environment. These plans will be created by bringing together key local partnerships and organisations whose actions impact on the environment to prioritise local environmental opportunities and issues and identify actions to address these. Stakeholder engagement will begin in autumn 2018 to flesh out what a local natural capital plan will look like.

Under this natural capital approach, local authorities' existing climate change adaptation work will be more closely aligned with other strands of delivery in the area, exploiting synergies where they exist. This will enable local organisations, such as local government, to tie climate change adaptation in with economic and social policy in the area. For instance, building green infrastructure into local plans could have positive socio economic impacts on areas such as public health and urban flood risk, as well as potentially providing climate change adaptation benefits.

As part of implementing the 25 Year Environment Plan, Defra will work with partners to develop metrics to assess progress against all the goals set out in the Plan

6.3 Raising awareness, building capability and making the case for action.

Government works with local government networks, including the Local Adaptation Advisory Panel (LAAP), to identify opportunities and address priority risks. Over the period covered by the first NAP the LAAP and Climate Local played a significant role in promoting, leading, and coordinating work with local authorities on climate change

adaptation. One of the key outputs has been the development and rollout of a *Business Case for Climate Ready Councils for managing the impacts of severe weather and a changing climate.* This was produced and published jointly by the LAAP and Climate Ready Support Service in 2015.

Building on this the LAAP is now working on a project to demonstrate the extent of climate change adaptation across local authorities. This will help identify what would constitute model adaptation action across the range of responsibilities of a local authority in England. It will have examples of where this is happening. The LAAP will consider how this can be disseminated and implemented. The project will clarify:

- the role and obligations of local government in addressing climate change risks and the minimum activities that local authorities can be expected to undertake;
- what further actions or good practice on climate adaptation local government should be considering to bring them up to good status; and
- the development and improvement of current coordination and networks to better support the integration of climate change adaptation across local government's activities and programmes.

The LAAP is working to promote climate adaptation and best practice, including the current business case and further tools developed over the course of this NAP. This includes working with other organisations such as the Local Government Association (LGA) and the Association of Directors of Environment, Economy, Planning and Transport (ADEPT) to review progress and promote capacity building through targeted engagement with particular LG sectors on climate change adaptation that local government is making.

In doing this the LAAP will explore with partners how to stimulate further cooperation on climate change adaptation across local government. This includes the potential for an informal network of local authorities to drive, inspire and support local government action to improve resilience of their communities and services to climate change impacts.

6.4 Local authorities, including mayors, cities and city regions

There are risks of severe weather events that are common to local authorities of all sizes, for example, managing surface water flooding, and heatwaves. In terms of enhancing and protecting the local environment there can also be some common aims for all authorities, such as the environmental landscape, built environment and green natural spaces. Town and parish authorities do not have the resources of city or county authorities, and may adapt at a different rate to their larger counterparts. They may, however, be able to influence larger local authorities to address climate change as a strategic priority.

6.4.1 Mayoral combined authorities (MCAs)

These provide a new scale of governance for local government in seven areas. They bring new powers and budgets (such as the Transforming Cities Fund) to bear across politically cohesive, functional economic geographies. The MCAs are potentially valuable partners in driving locally led and informed adaption plans in their areas. Many of them have already made environmental goals central to their plans, and Mayors provide high profile figures that can help champion this agenda. For example:

- Mayor Andy Burnham and the Greater Manchester Combined Authority launched a Green Summit in March 2018; have established a £15m low carbon fund; are exploring a possible European Regional Environment fund[59] and will produce a Natural Capital Investment Plan;
- Mayor Andy Street and the West Midlands Combined Authority published a 2014-2019 environment strategy addressing climate change resilience, sustainable infrastructure and raising environmental awareness; and
- Mayor Steve Rotheram is championing a Mersey tidal barrage hydropower scheme, while Liverpool City Region Combined Authority and Local Enterprise Partnership launched the report: " Building Climate Resilience: Good Practice Case Studies in Liverpool City Region" in September 2017.

6.4.2 The core cities group and London

The Core Cities Climate Resilience and Adaptation Working Group provides a crucial platform for sharing and support between cities on climate adaptation areas. This aims to meet and, where possible, go beyond the commitments to action set out in the Core Cities Commitment in the first NAP. London sets out a robust range of adaptation policies and proposals in the London Environment Strategy, which was published in May 2018, with additional work done to embed adaptation into transport, health inequalities, planning, housing, and other mayoral strategies. London is taking a sector-based approach to adaptation, building on the wealth of valuable evidence to help sectors understand their risks and opportunities, to develop plans to address them, and to monitor sector progress in adapting. The Core Cities Group and London undertake a range of activities to promote climate change adaptation, raise awareness and foster leadership.

These include:

- Being active participants in a range of national and international commitments[60] which demonstrate awareness, commitment and leadership. These commitments need to be monitored and progress on climate adaptation communicated more widely;
- all English members and London make disclosures reporting their environmental impact under the Carbon Disclosure Project. Bristol and Greater Manchester are signatories to the Under2Mou initiative[61] and participate in the Rockefeller 100 Resilient Cities campaign; and
- wider work to promote sustainability, providing platforms and activity around climate adaptation issues. Examples are Bristol's Green Capital initiative and Manchester City Council's climate change agency, which was launched in September 2015.

In 2018 Defra will set up a formalised working group with the Core Cities Group to develop the work on air quality and climate change resilience. This will commit to effectively promote adaptation in cities, work to progress action and disseminate best practice and accelerate action between the Core Cities Group, London and other city region areas more widely, and look to deliver a programme of actions.

[59] Greater Manchester Combined Autority, Multi-million pound fund to make Greater Manchester a greener city-region, 14/06/2017. URL: https://www.greatermanchester-ca.gov.uk/news/article/151/multi-million_pound_fund_to_make_greater_manchester_a_greener_city-region
[60] Includes Mayors Adapt, Compact of Mayors, and Covenant of Mayors.
[61] Under2Mou initiative. URL: http://climateinitiativesplatform.org/index.php/Under_2_MOU

6.4.3 Cities commitment

The first NAP Cities Commitment set out an agreement between the Core Cities Group, London Councils and the Greater London Authority to work together on climate change adaptation. Progress in the key areas of that commitment is shown below.

Embedding climate risk management in the built environment:

- Core Cities Group members are developing spatial plans. Devolution and Cities Deals have meant a strengthening and continuation of that process. Greater Manchester Combined Authority consulted on its GM Spatial Framework[62] between October 2016 and January 2017. A second version of the plan, which aims to make the most of Greater Manchester's brownfield sites and reduce the impact on greenbelt, is being developed;
- Core Cities Group members are actively developing standards around sustainable development, especially Sustainable Drainage Systems; and
- ongoing local work to understand and promote property level protection includes Liverpool City Council seeing a number of installations on the back of local development. Under the Flood Resilient Community Pathfinder initiative Liverpool has enhanced property-level flood protection and energy efficiency upgrades to residents of the Woodlands Estate.

Strengthen the climate resilience of infrastructure:

- Core Cities Group work with infrastructure providers and the emergency planning process via the established Local Resilience Forum (LRF) and civil contingencies process. Cities which have experienced recent severe fluvial and surface water flooding are providing information to government on the response and recovery process;
- With the ongoing process of engagement on the National Flood Resilience Review, which the Core Cities Group initiated with the government, there is potential to engage in a wider dialogue on some of the emerging and future risks. To support this Core Cities Group are undertaking a flood resilient evidence baselining process. This will try to understand what studies, reports and information is held and where, and to what extent this looks at future flood risk in a changed climate.

Address and build resilience to the health and wellbeing impacts of climate change:

- Core Cities undertake considerable work on flood resilience with at risk communities. There are emerging practices around severe weather and winter warmth as well as a considerable amount of work via emergency planning and community flood risk resilience work. Core Cities recognise climate change issues with heatwaves, or overheating in buildings, and will need to respond to the former, as a category 1/first line responder as required by the Civil Contingencies Act 2004. LRFs will consider risks via the risk assessment process they do. Further information on community response to emergencies, including severe weather events, is in section 4.7 of the People and Built Environment chapter.

[62] Greater Manchester Combined Authority, Draft Greater Manchester Spatial Framework, 2016. URL: https://www.greatermanchester-ca.gov.uk/downloads/20018/greater_manchester_spatial_framework

Address climate impacts on Business and Services:

- A wider programme of work is underway around business resilience. Leeds City Council continues to grow its Leeds Alert system, which allows West Yorkshire Police and Leeds City Council to send out emergency alert messages on emergencies and disruptive events to registered businesses. There is a specific severe weather group contact list for alerts currently being established;
- Greater Manchester Combined Authority is working with its LRF to prepare businesses and is adapting its existing guide for small business 'Weathering the Storm'[63] to its purposes and trialling direct SME resilience;
- Newcastle City Council is using a €100,000 Technical Assistance Grant from the European Investment Bank to undertake a climate risk and vulnerability assessment for two Accelerated Development Zone sites.

Development of Business Case work:

The "Business Case for Climate Ready Councils for managing the impacts of severe weather and a changing climate" was published in 2015. Since then there has been collaborative work to develop a business case. The Core Cities Group has been considering how to understand and communicate the economic impacts of climate change. There has been a proposal to focus work on high level risk assessment of strategic development/investment sites, but this will need agreement by Core Cities members and how it is resourced.

In 2017 Greater Manchester Combined Authority was selected as an 'urban pioneer' to test certain issues and approaches around natural capital accounting and ecosystem services as part of the 25 Year Environment Plan. This provides an opportunity to work to understand, develop and share some economic value information on the climate resilience services provided by natural assets.

Leeds City Council developed a vulnerability mapping tool under the first NAP Cities Commitment. It prioritised which mapping layers would be most useful and it is making use of some of them to plan its health work. The methodology gave Leeds a better idea of its mapping resources and how they could be used to plan for climate change adaptation and severe weather. The tool was disseminated throughout the Core Cities Group.

EU Work:

In 2015, the European Commission merged two Covenant of Mayors initiatives on climate change adaptation (Mayors Adapt) and mitigation to promote an integrated approach to climate and energy action. From 2017 onwards adaptation was entirely integrated into the Covenant of Mayors for Climate and Energy. This aims to increase support for local activities, provide a platform for greater engagement and networking by cities, and raise public awareness about adaptation and mitigation and the measures needed. There are 36 UK cities signed up to Mayors Adapt. They have utilised the expertise and opportunities that this, and other, initiatives have provided, but there is uncertainty as to what similar support may be available after EU Exit.

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[63] Claps and Greater Manchester Resilience Forum, Weathering the Storm, 2017. URL: http://media.claspinfo.org/sites/default/files/Weathering%20the%20Storm%20Manchester%20Final%20250820 17.pdf

Chapter 7: Adaptation reporting

This section sets out the government's strategy for implementing the third round of climate change adaptation reporting.

It is presented to Parliament pursuant to Section 65 of the Climate Change Act 2008

7.1 Background

The Adaptation Reporting Power (ARP) was introduced under the Climate Change Act 2008. The ARP helps ensure that 'persons or bodies with a function of a public nature' and 'statutory undertakers' (reporting organisations) are taking action to adapt to climate change by reporting on how they are addressing current and future climate impacts. These reports also provide vital intelligence on the resilience of key sections of society.

Since the Act entered into force the adaptation reporting process has been through two cycles. First, in 2009, when the Secretary of State laid before Parliament a strategy for exercising the statutory power. The strategy focused on major infrastructure providers from the energy, transport and water sectors and 91 organisations were directed to report. A number of other organisations were invited to submit voluntary reports. Statutory guidance was published to guide reporting organisations on the content of their submissions and a formal evaluation of reports was carried out. In total, 105 organisations took part.

The second cycle of adaptation reporting started in 2013, when the government laid before Parliament its second strategy. This strategy set out a voluntary, light touch and flexible approach to reporting. This, contrary to the first cycle of reporting, was a 'bottom-up' approach to reporting and no formal guidance was offered to reporting organisations. In total, 86 organisations took part.

This chapter sets out government's strategy for the third cycle of reporting. It was finalised following the consideration of responses to a public consultation held on the proposals from February – March 2018. The consultation asked for views on the voluntary and mandatory nature of reporting, the principles and objectives for future reporting and the scope of the reporting exercise. The responses to our consultation endorsed the proposed approach to the third round strategy for the Adaptation Reporting Power. The majority of respondents supported the continuation of voluntary reporting and there was overwhelming support for the principles and objectives for reporting, the sectorial or organisational template approach, timing and other circumstances in which the reporting power should be used.

7.2 The approach to the third cycle of adaptation reporting

A key consideration for the operation of reporting was whether there was a case for using the Climate Change Act's statutory power to direct organisations to report.

Government acknowledges that the majority of respondents to the consultation favoured the continuation of voluntary reporting, including the vast majority of reporting organisations. We consider that a voluntary reporting process is the most constructive and collaborative approach for engaging reporting organisations and would allow the greatest flexibility and innovation in approaches to address climate risk and enable efforts to increase resilience.

Government will not issue directions under the third round of the ARP, but we will invite reporting on a voluntary basis, in line with the 2008 Climate Change Act.

7.3 Objectives and principles for the third cycle of adaptation reporting

The ARP was introduced to help reporting organisations take appropriate action to adapt to the current and future climate impacts. Our experience from the first two cycles of adaptation reporting suggests it is important that expectations for reporting to be clear, both for reporting organisations, government and the Adaptation Sub-Committee.

Our evaluation of previous reporting cycles found that reporting presented a number of benefits to organisations. It supported organisations to take appropriate action to address climate risks, directly, through engaging organisations in the process and raising the profile of climate resilience work; and indirectly, through raising awareness, building capacity, ensuring risks are identified, assessed and properly managed thereby reducing vulnerability and also by making examples of good practice publicly available.

In order to clarify expectations and ambitions for reporting, we consider the primary objective for reporting in the third round is to support the ongoing integration of climate change risk management into the work of reporting organisations.

A secondary objective for reporting is that reports contribute to government understanding of the level of preparedness of key sectors to climate change, at a sectoral and national level, and feed into the ASC's reports to Parliament.

Government recognises that with such a diverse range of reporting organisations with different regulatory frameworks and businesses process (some of which embed the consideration and management of climate risks), it is crucial to avoid a one size fits all approach. Government also recognises that reports from the previous cycles of reporting did not provide sufficient information to assess resilience efforts in a given sector and that

the consistency of reporting must improve. The principles which will guide our approach to facilitating reporting in the third round will be:

- proportionate, risk-based and streamlined to minimise burdens or duplication; and
- built on previous rounds of reporting to improve report quality and participation.

7.4 Establishing report content

In order to achieve the objectives and adhere to the principles of reporting we will develop reporting templates in line with the requirements set out in the Climate Change Act, which says that adaptation reports should contain:

- an assessment of the current and future risks to that organisation presented by climate change; and
- a programme of measures to address the risks, including policies and practices that are already being implemented.

Feedback from reporting organisations indicated a need for a clearer indication from government on the information which should be provided in ARP reports, as well as recognition of sectorial differences, regulatory cycles and degree of maturity on climate risk management.

We will collaborate with organisations using a sectoral grouping (or individual organisations where there is no sectoral grouping), to agree content for reporting. This approach is effectively a hybrid between the top-down directed approach of the first round and the bottom-up flexible approach in the second round. This approach will better reflect the differences between organisations across and within sectors, the different business and regulatory pressures and the diversity of approaches and experiences on climate change risk management across all reporting organisations.

We expect that templates will give a clearer indication of the information which reports would include and will allow for a more consistent method for reporting risk assessments and logging actions to allow for effective monitoring over successive reporting cycles. Government is also mindful of the need to improve report content and quality in the third round and we will work with the ASC to ensure expectations on the information and detail needed is clearly articulated. We will also ensure ARP reports respond to the risks set out in the CCRA (see section 7.7), as well as ensuring that the reporting organisation's commentary on addressing organisational or asset level risks continues – this will effectively build on previous rounds of reporting to ensure we have a clear time series of effort made by reporting organisations to address risks which they face.

7.5 Criteria for identifying organisations in scope

A very large number of organisations are theoretically eligible under the adaptation reporting power. This is because the Act refers to eligible organisations as being either statutory undertakers (defined in the Town and Country Planning Act) or organisations which perform functions of a public nature. Government is committed to using the reporting power in a proportionate, risk based and efficient way. Not all potentially eligible organisations (of whom there are many thousands) will be asked to report. We will therefore apply the following criteria to ensure reporting in the third round is beneficial and adds value to organisations and government:

- identifying those organisations that are vulnerable to the projected impacts of climate change as according to the CCRA[64];

- preventing duplication by identifying organisations which are not already subject to other reporting requirements, or are not already covered by an existing voluntary agreement which cover management of climate risks; and

- targeting reporting organisations proportionately e.g. some of the sectors highlighted as vulnerable to climate change may be formed of many much smaller organisations. Government believes that including such organisations as reporting authorities would be disproportionate. Where appropriate, government will invite umbrella organisations to report on behalf of members. Determining proportionality must occur on case by case basis. Government has not defined a specific threshold for proportionality. The voluntary approach means that there is scope for discussion with government to ensure that the reporting process is proportionate and beneficial.

7.6 Organisations in scope

In applying the criteria above, the list of reporting organisations presented in our consultation was largely endorsed. We will therefore invite the following, with slight modifications explained below, to report in the third cycle of adaptation reporting:

- **Transport organisations** covering: strategic road, rail infrastructure, strategic airports, commercial ports and lighthouses authorities.

  Following feedback from British Ports Association and Major Ports' Group to update the list of commercial ports, we will make changes to the list of participating ports to reflect those of national importance in relation to imports.

- **Water companies** (those serving over 50,000 billed premises).

[64] The UK Climate Change Risk Assessment, 2017. URL: https://www.gov.uk/government/publications/uk-climate-change-risk-assessment-2017

This will include all the water companies which participated in previous cycles of adaptation reporting.

- **Energy sector**: electricity transmission and distribution, gas transportation and energy generators.

  Following feedback from Energy UK we will work with them to agree detailed scope of generator participation, in view of the changes to the generation fleet and the regulatory framework within which it operates (e.g. Industrial Emissions Directive and coal closure).

  We will also continue discussions with the oil sector on their likely participation.

- **Public bodies** covering environment, marine, fisheries and health.

  This will include all the public bodies which participated in previous cycles of adaptation reporting.

- **Data centres and telecommunications.**

  This will include the data centre trade body Tech UK and the grouping of telecommunications companies in the Electronic Communications Resilience and Response Group.

- **Regulators** for water, energy, communications and finance.

  This will include regulators OFWAT, OFGEM, OFCOM and the Prudential Regulation Authority.

  We will also invite the Financial Conduct Authority, the Financial Reporting Council and The Pensions Regulator to each produce a report on how they are incorporating the consideration of short and long term climate impacts into the operation of their objectives, statutory duties and powers. We will not invite the Pension Protection Fund as they will be reporting in line with the recommendations of the Taskforce on Climate-related Financial Disclosures.

- **Heritage environment** organisations.

  This will include inviting National Trust, English Heritage, and Historic England to report.

In view of the ongoing discussions with reporting organisations on their involvement, we will publish a list of participating organisations by the end of 2018.

7.7 Coverage of CCRA risks

In determining the content of reports with reporting organisations we will ensure reports support our understanding of how risks from the CCRA17 and in some cases CCRA12 are being managed. The following table sets out areas of risk we will ask reporting organisations to cover in their reports.

Reporting sectors	**CCRA risk areas addressed:**
Transport organisations	Cascade failures due to interdependencies; risks from flooding; heat; slope and embankment failure; risks to bridges from high river flows and bank erosion; risk from high winds and lightning; risks to productivity due to infrastructure disruption.
Water companies	Cascade failures due to interdependencies; risks from flooding; risks to public water supplies from drought and low river flows; risks to productivity due to infrastructure disruption.
Energy sector	Cascade failures due to interdependencies; risks from flooding; risks to pipelines from high river flows and bank erosion; risks from high winds and lightning; risks to offshore infrastructure from storms and high waves; risks to productivity due to infrastructure disruption.
Data centres and telecommunications	Cascade failures due to interdependencies; risks from flooding; risks from high winds and lightning; risks to productivity due to infrastructure disruption.
Regulators	Risks from climate change as they affect the operation of statutory duties/powers, responsibilities and objectives.
Public bodies	Will depend on duties, responsibilities and objectives of each public body and will address range of risks facing species and habitats, agriculture, forestry, soils, aquifers, marine species, fisheries and marine heritage, health and wellbeing, coastal communities.
Heritage environment	Risks to culturally valued structures and the wider historic environment

7.8 Additional circumstances in which the Power can be used

As required by Section 65 of the Climate Change Act 2008, the Secretary of State must outline the circumstances in which directions to report might be given that are not indicated within this document. This section outlines the circumstances which may result in requests to report being given to other organisations. These circumstances are:

- where a future event exposes vulnerability;
- where evidence is obtained of bodies' poor performance to reduce vulnerability to climate change;
- where a new body is created that fulfils the criteria for reporting; or,
- where an existing body's role changes so that it fits these criteria.

7.9 ARP timeline and next steps

Actions	Timescale
Publish list of participating reporting organisations	End 2018
Reporting proposals for sectors and organisations, setting out the scope of report, deadlines agreed and invitations submitted	End 2018
Reporting organisations prepare reports and submit to agreed deadlines	2019 – 2021
Draft reports submitted to the Secretary of State	Up to end 2021
Concerns surrounding commercial confidentiality submitted to the Secretary of State, with alternative reports for publication which take into account commercial and confidentiality proposals	Timescales will vary
Secretary of State notifies reporting organisations of commercial confidentiality decisions based on objections received under section 63 (7) of the Climate Change Act 2008	Within 3 months of receipt
Reporting organisation takes on board comments and submits final report to the Secretary of State	Within 3 months
Final reports published by the Secretary of State in accordance with section 63(6), and/or by the organisation themselves	Timescales will vary
Reports' findings feed into ASC's ongoing work to assess progress on adaptation	2019-2021

List of acronyms

ARP: Adaptation Reporting Power

ASC: Adaptation Sub-Committee

BEIS: Department for Business, Energy and Industrial Strategy

BREEAM: Building Research Establishment Environmental Assessment Method

CAA: Civil Aviation Authority

CBI: Confederation of British Industry

CCRA: Climate Change Risk Assessment

Cefas: Centre for Environment, Fisheries and Aquaculture Science

CIBSE: Chartered Institution of Buildings Services Engineers

Defra: Department for Environment, Food and Rural Affairs

DfT: Department for Transport

DHSC: Department of Health and Social Care

EA: Environment Agency

FC: Forestry Commission

FCERM: Flood and Coastal Erosion Risk Management

GLA: Greater London Authority

HA: Highways Agency

LAAP: Local Adaptation Advisory Panel

LGA: Local Government Association

LRF: Local Resilience Forum

MCCIP: Marine Climate Change Impacts Partnership

MHCLG: Ministry of Housing, Communities and Local Government

MOHCCP: Met Office Hadley Centre Climate Programme

NE: Natural England

NERC: Natural Environment Research Council

NFRR: National Flood Resilience Review

NHS: National Health Service

NPPF: National Planning Policy Framework

NPS: National Policy Statement

OFGEM: Office of Gas and Electricity Markets

OFWAT: Office of Water Services

PHE: Public Health England

UKCP18: UK Climate Projections 2018

Annex 1: CCRA 2 risks by urgency category

More action needed	Research priority	Sustain current action	Watching brief
Ne1: Risks to species and habitats from changing climate space	Ne3: Changes in suitability of land for agriculture and forests	Ne9: Risks to agriculture, forestry, landscapes & wildlife from pests/patho-gens/invasive species	Ne14: Risks & opportunities from changes in landscape character
Ne2: Opportunities from new species colonisations	Ne7: Risks to freshwater species from high water temperatures	Ne10: Extreme weather/wildfire risks to farming, forestry, wildlife & heritage	In7: Low/high river flow risks to hydroelectric generation
Ne4: Risks to soils from increased seasonal aridity and wetness	Ne13: Ocean acidification & higher water temperature risks for marine species, fisheries & marine heritage	Ne11: Saltwater intrusion risks to aquifers, farmland & habitats	In8: Subsidence risks to buried/surface infrastructure
Ne5: Risks to natural carbon stores & carbon sequestration	In5: Risks to bridges & pipelines for high river flows/erosion	In13: Extreme heat risks to rail, road, ICT & energy infrastructure	In10: Risks to electricity generation from drought & low flows
Ne6: Risks to agriculture & wildlife from water scarcity & flooding	In11: Risks to energy, transport & ICT from high winds & lightning	In14:Benefits for infrastructure from reduced extreme cold events	PB3: Opportunities for increased outdoor activity in warmer weather
Ne8: Risks of land management practices exacerbating flood risk	In12: Risks to shore infrastructure from storms and high waves	PB13: Risks to health from poor water quality	PB12: Risks of food-borne disease cases and outbreaks
Ne12: Risks to habitats & heritage in the coastal zone from sea level roses; loss of natural flood protection	PB2: Risks to passengers from high temperatures on public transport	PB14: Risk of household water supply interruptions	Bu4: Risks to business from reduced access to capital
In1: Risks of cascading infrastructure failures across interdependent networks	PB6: Risks to viability of coastal communities from sea level rise	Bu3: Risks to business operations from water scarcity	Bu7: Business risks/opportunities from changing demand for goods & services
In2: Risks to infrastructure from river, surface/groundwater flooding	PB7: Risks to building fabric from moisture, wind & driving rain	Bu5: Risks to business from disruption to supply chains	It7: Opportunities from changes in international trade routes
In3: Risks to infrastructure from coastal flooding & erosion	PB8: Risks to culturally valued structures & historic environment		
In4: Risks of sewer flooding due to heavy rainfall	PB10: Risks to health from changes in air quality		
In6: Risks to transport networks from embankment failure	PB11: Risks to health from vector-borne pathogens		
In9: Risks to public water supplies from drought & low river flows	Bu2: Risks to businesses from loss of coastal locations & infrastructure		
PB1: Risks to public health and wellbeing from high temperatures	Bu5: Employee productivity impacts in heatwaves & from severe weather infrastructure disruption		
PB4: Potential benefits to health and wellbeing from reduced cold	It2: Imported food safety risks		
PB5: Risks to people, communities & buildings from flooding	It3: Long-term changes in global food production		

More action needed	Research priority	Sustain current action	Watching brief
PB9: Risks to health & social care delivery from extreme weather	It5: Risks to the UK from international violent conflict		
Bu1: Risks to business sites from flooding	It6: Risks to international law & governance		
It1: Weather-related shocks to global food production and trade			
It4: Risks from climate-related international human displacement			

Annex 2: Detailed actions log

Objective	CCRA risk(s) addressed	Key actions and progress milestones	Timing	Monitoring and metrics	Owner
Chapter 2: Natural Environment *"The natural environment, with diverse and healthy ecosystems, is resilient to climate change, able to accommodate change, and valued for the adaptation services it provides."*					
Section 2.1 – Climate Change Risks: overarching evidence					
The evidence base on issues affecting natural capital, with relevance to climate change adaptation, is further developed	NE1	Updating the Climate Change Adaptation Manual and developing, reviewing and communicating the evidence base necessary to support climate change adaptation, publishing datasets, reports and papers on a rolling basis.	2023 and ongoing	Publication of datasets and reports Number of datasets published annually	Natural England
		Maintaining the Long-Term Monitoring Network and supporting other national monitoring schemes, assessing how best to evaluate the effectiveness of adaptation as well as monitor impacts of climate change.	ongoing		Natural England
		Putting in place regular and transparent reporting of progress against a set of metrics for goals in the 25 Year Environment Plan, including annual progress	Annual publications	Publication of 25 YEP progress reports	Defra

Objective	CCRA risk(s) addressed	Key actions and progress milestones	Timing	Monitoring and metrics	Owner
		and outcome indicator assessments and periodic more comprehensive assessments			
		Working with academic and other partners to develop candidate indicators and evidence summaries for tracking progress with adaptation actions, including habitat condition and extent.	ongoing	Ad-hoc reports and scientific publications	Natural England, in partnership with universities and research organisations
		Reports and papers on lessons learnt for delivering climate change adaptation through Environmental Stewardship and Countryside Stewardship will be published.	By 2020		Natural England; Defra
Section 2.2 – building ecological resilience on land and in our rivers and lakes					
1. Protect and improve our protected sites and our other areas of important wildlife habitat to enhance resilience to climate change and progress our long-term ambition to restore 75% of our protected sites to	NE1	Continue to target our agri-environment schemes and work with major landowners to secure improvements in site condition.	Ongoing	Condition of SSSIs (including European sites) Area of protected sites in favourable or recovering condition	Natural England and Forestry Commission working with landowners and managers
		Work with local delivery partners to make progress with implementing Site Improvement Plans (SIPs) for European Sites and the associated climate change theme plan.	Ongoing		Natural England

Objective	CCRA risk(s) addressed	Key actions and progress milestones	Timing	Monitoring and metrics	Owner
favourable condition.		Trial approaches to incorporating climate change adaptation into the designation of protected sites and assessment of favourable condition.	Ongoing	Number of sites with climate adaptation actions in place	Natural England
		Continue to assess the climate change vulnerability of all NE managed National Nature Reserves and include appropriate responses in site management plans. Assessments to date to be reviewed and any adjustments made if necessary.	The process for assessing vulnerability to climate change reviewed and reported by 2020 Where appropriate, climate change adaptation responses to be incorporated into all site management plans by 2023	NNR vulnerability assessments completed and incorporated into management plans.	Natural England
2. Restore degraded ecosystems, for example by restoring ecological and hydrological functions and expand and	NE1	Develop and start to implement a Nature Recovery Network, linking habitat restoration and creation to improved access, flood protection and water quality, ensuring its design is based on evidence of what works for climate change adaptation.	By 2023	Reports on the status of habitats of European Importance Extent of selected coastal, peatland and other wetland ecosystems under restoration management. Proportion of habitats of European Importance in favourable or recovering condition.	Defra; Environment Agency; Forestry Commission; Natural England

Objective	CCRA risk(s) addressed	Key actions and progress milestones	Timing	Monitoring and metrics	Owner
connect high quality wildlife-rich habitat, to contribute to our longer term ambition to restore or create 500,000 ha of wildlife-rich habitat.					
		Continue to target our current agri-environment schemes and maintain effective partnerships to expand and connect high quality habitats. [Regularly] review the evidence base to ensure our delivery approach delivers resilience in the context of climate change.	Ongoing	Priority habitat inventory Inventories of landscape scale and ecosystem restoration projects Proportion of habitats of European importance in favourable or recovering condition	Defra; EA; Forestry Commission; Natural England
		Continue to facilitate open habitat restoration by granting unconditional felling licences for the removal of woodland planted on former wildlife-rich habitat of exceptional biodiversity interest such as heathland, ensuring appropriate levels of re-planting to support Government's ambition to increase woodland cover from 10% to 12% by 2060.		Forestry Commission open habitat data Area of local sites or priority habitat under positive management Area of priority habitat and area under positive management Area licensed for unconditional felling to create priority open habitat, on and off the Public Forest Estate	Natural England; Forestry Commission
		Promote the restoration and management of ancient and native woodland		Forestry Commission data on woodland with sustainable management in place and progress in restoring plantations on Ancient Woodland Sites	Natural England; Forestry Commission

Objective	CCRA risk(s) addressed	Key actions and progress milestones	Timing	Monitoring and metrics	Owner
				Proportion of ancient and native woodland under management and annual area of PAWS restoration, on and off the public forest estate	
		Introduce a new Environmental Land Management scheme which will deliver environmental outcomes including mitigation of and adaptation to the effects of climate change (see agriculture section below)	Designed and implementation begun by 2022		Defra
3. Reducing pressures from spreading diseases and non-native invasive species *For further information on actions in this section, please see section 2.3*					
4. Take action for species and habitats at particular risk	NE1	Keep species vulnerability to climate change under review to identify species at particular risk and ensure that the reintroductions code of practice takes climate change into account	Ongoing		Natural England
		Establish and maintain a working group with major landowners such as CLA, RSPB and National Trust, to ensure that climate change is addressed in conservation and environmental land management			Natural England
Section 2.2 building ecological resilience at sea					
1. Increase and improve our	NE13	Introduce a sustainable fisheries policy as we leave the Common Fisheries Policy and prepare marine plans that include policies for climate adaptation.			Defra; MMO

Objective	CCRA risk(s) addressed	Key actions and progress milestones	Timing	Monitoring and metrics	Owner
management of the seas		The preparation of ten new Marine Plans for the whole of the English marine area will include horizon scanning to evaluate the potential longer term risks and opportunities from climate change.	2021		MMO
		Continue to establish Marine Conservation Zones to contribute to an ecologically coherent network of Marine Protected Areas			Defra
		Continue to work to create a Blue Belt around the UK's 14 Overseas Territories, subject to local support and environmental need, supported by £20 million of funding between 2016 and 2020.	£20million of funding up to 2020		FCO
2. Ensure productive and extensive seafloor habitats which can support healthy, sustainable ecosystems		Continue to support the Marine Climate Change Impacts partnership			Defra
		Continue to collaborate with selected marine sectors through the "climate smart" working initiative to develop adaptive capacity			MCCIP
		Improve understanding of and responses to climate change impacts on water-borne pathogens and harmful algal blooms			MCCIP working with EA, CEFAS and the FSA

Objective	CCRA risk(s) addressed	Key actions and progress milestones	Timing	Monitoring and metrics	Owner
		Continue to support ocean acidification research in order to provide a robust baseline assessment which can be used to examine long-term changes			Defra
3. Recover and sustain fish stocks at levels which can produce their maximum sustainable yield		Bring forward the new Fisheries Bill which will ensure sustainable use of fish stocks, a healthy marine environment and a prosperous fishing industry	By 2021		Defra
		Seafish will publish a climate change adaptation report describing the steps industry (fisheries and aquaculture) are taking to respond to climate change, focussing on risks and opportunities associated with climate change in the UK aquaculture sector	By 2023	Publication of the climate change adaptation report	Seafish
		Continue to produce annual climate change updates for the wild-capture fishing industry	Ongoing		Seafish
Section 2.3 – enhancing biosecurity: increasing resilience to diseases and invasive non-native species					
1. Manage existing plant and animal diseases and lower the risk of new ones	NE9	Use the Public Health England invasive vector surveillance programme to develop and update our understanding of the status, distribution and abundance of potential vector species	Ongoing	Monitor changes to status, distribution and abundance of potential vector species	PHE; APHA; Defra
		Enhance the cross-government contingency plan for dealing with invasive mosquitoes to cover other veterinary and medically important insect vectors	Ongoing	Continue to monitor the spread and establishment of invasive species	PHE; APHA; Defra

Objective	CCRA risk(s) addressed	Key actions and progress milestones	Timing	Monitoring and metrics	Owner
2. Tackle invasive non-native species	NE9	Work with partners to raise awareness of invasive non-native species and the need for strong biosecurity			Defra
		Maintain an alert system to detect high priority invasive non-native species and implement contingency plans to rapidly eradicate them where feasible			Defra
		Implement a programme of invasive non-native species surveillance and risk analysis across Great Britain	Ongoing	Species surveillance data Number of new arrivals of invasive species	Non-native species information portal project, supported by Defra; EA; NE; FC and JNCC
		Carry out risk analysis of invasive non-native species in Great Britain		Risk evaluation and prioritisation of species Number of risk analyses undertaken	GB non-native species Secretariat
		Continue to develop and implement pathway action plans to reduce the risk from all high priority pathways of invasive species introduction into England	Ongoing	Pathway Action Plans Number of plans agreed and actions implemented	GB non-native species Secretariat, supported by Defra

Objective	CCRA risk(s) addressed	Key actions and progress milestones	Timing	Monitoring and metrics	Owner
		Continue to raise awareness of invasive non-native species and the need for biosecurity, including the Check, Clean, Dry and Be Plant Wise campaigns	Ongoing?	Improved awareness of invasive non-native species and biosecurity measures	GB non-native species Secretariat, supported by Defra
		Compile and analyse species data so that we can track trends in species distributions		NNSIP database – change in number and extent of invasive non-native species established in Great Britain	Non-native Species Information Portal project, supported by Defra, EA, NE, FC and JNCC
		Take action to eradicate high priority invasive non-native species		Effective eradication campaigns have been implemented against high priority species'	APHA, EA, FC, NE, MMO, GB non-native species Secretariat
		Establish and implement contingency plans for high priority new arrivals		Number of high quality contingency plans Number of high priority new arrivals eradicated	Defra, APHA, EA, FC, NE, MMO, GB non-native species Secretariat

Objective	CCRA risk(s) addressed	Key actions and progress milestones	Timing	Monitoring and metrics	Owner
		Implement management plans for priority established species where eradication is not feasible		Number of management plans in place and actions implemented	APHA, EA, NE, FC, MMO
		Develop the evidence base on invasive species pathway prioritisation, pathway action planning and rapid responses			GB non-native species Secretariat
		Strengthen the evidence base on climate change and increased risk of invasive species incursions or establishment, identifying priority "sleeper species".			Non-native Species Information Portal project supported by GB non-native species Secretariat
Section 2.4 – water availability and quality					
1. To reform our approach to water abstraction	NE1; NE4; NE6	Reducing the damaging abstraction of water from rivers and groundwater. Implement the abstraction plan.	By 2021	Proportion of water bodies with enough water to support environmental standards should be 90% for surface water bodies and 77% for groundwater bodies Environment Agency to track a suite of metrics in the Sustainable Abstraction Dash Board, reporting quarterly.	Defra; Environment Agency

Objective	CCRA risk(s) addressed	Key actions and progress milestones	Timing	Monitoring and metrics	Owner
		Work with abstractors and existing local groups, such as catchment partnerships, in catchments facing the greatest challenges. Produce updated abstraction licensing strategies that capture agreed solutions to environmental issues and set out approaches to help abstractors access the water they need.	10 abstraction licensing strategies updated by 2021		Environment agency
		Supporting OFWAT's ambitions on leakage, minimising the amount of water lost through leakage year on year.	Water companies expected to reduce leakage by at least an average of 15% by 2025		Defra OFWAT
		Use River Basin Management Plans and work with catchment partnerships to improve resilience to future pressures from climate change.			Environment Agency
2. Improve water quality, reverse the deterioration of groundwater, and reduce emissions of harmful substances.		Implement the Site Improvement Plans (SIPs), including actions arising from the climate change theme plan we have developed for Natura 2000 sites.			Environment Agency
		Smarter targeting of fertiliser type and application in order to reduce the potential for negative impact of agriculture on waterways			Defra

Objective	CCRA risk(s) addressed	Key actions and progress milestones	Timing	Monitoring and metrics	Owner
		Explore the potential for new innovative and sustainable fertilisers, such as bio-stimulants, to improve nutrient use efficiency	Review levels of take up over the next five years	Data from the British Fertiliser Practice Survey	Defra working with industry in the agricultural sector
		Implement the Site Improvement Plans (SIPs), including actions arising from the climate change theme plan we have developed for Natura 2000 sites.			Environment Agency
Section 2.5 – natural flood management and protection of coastal habitats					
1. Explore greater use of natural flood management techniques where these are appropriate	NE6; NE11	Monitor the effectiveness of our current natural flood management projects and schemes and use the learning from this to further explore and refine the role of Natural Flood Management schemes	Ongoing		Defra
		Continue to assess the sustainability of managing protected freshwater habitats in light of sea level rise and storm surge events			Defra; Environment Agency
		Ensure updated Shoreline Management Plans incorporate the latest evidence on coastal habitat loss and sea level rise (from UKCP18), as well as the latest mechanisms to inform management approaches			Environment Agency

Objective	CCRA risk(s) addressed	Key actions and progress milestones	Timing	Monitoring and metrics	Owner
		Publish an industry standard NFM design manual to assist practitioner in selecting appropriate NFM measures.	By 2020		Environment Agency
		Undertake research to use understanding of the history of catchments to inform natural flood management.	A report is due in 2019		Historic England
Section 2.6 – protecting soils and natural carbon stores					
1. To improve our approach to soil management: by 2030 we want all of England's soils to be managed sustainably	NE4	Incentivise good soil management practices that enhance soil's ability to deliver environmental benefits through future environmental land management schemes to ensure soils are healthy and productive		A soil health index will be utilised at farm level to assess whether management practices are having a beneficial impact on soil health	Defra
2. To improve soil health	NE4	Support research and monitoring to give us a clearer picture of how soil health supports our wider environment goals	Ongoing	Defra will invest at least £200,000 to help develop soil health metrics and test them on farms across the country	Defra
3. To restore and protect our peatlands	NE1; NE5	Publish an England Peat Strategy	2018		Defra
		Develop new sustainable management measures to ensure that the topsoil is retained for as long as			Defra

Objective	CCRA risk(s) addressed	Key actions and progress milestones	Timing	Monitoring and metrics	Owner
		possible and greenhouse gas emissions are reduced where peat cannot be restored			
		Maintain and expand current peatland restoration programmes in semi-natural habitat		Condition and emissions	Natural England
		Support and develop the evidence base for the sustainable management of agricultural peatlands			Defra; Natural England
		Improve the representation of peat soils in the greenhouse gas emission inventory to enable the effectiveness of emission mitigation action to be tracked more accurately			BEIS
		Continue to work with the horticultural industry to transition to peat alternatives.	Review in 2020 and consider need for further measure		Defra
Section 2.7 – Forestry					
1. Woodland resource is expanded and better linked to enhance its resilience at stand	NE1	Plant 5,000-10,000 hectares of new woodland habitat (including new native woodland priority habitat) per year in England, helping to enhance landscape resilience, taking opportunities to establish a better adapted woodland resource and contributing to the Nature Recovery Network	Up to 38,000 hectares by 2023	Annual new planting statistics Landscape resilience indicator Woodland creation Forestry Statistics	Defra; Forestry Commission

Objective	CCRA risk(s) addressed	Key actions and progress milestones	Timing	Monitoring and metrics	Owner
and landscape level				Woodland planted through support from RDP-funded grant schemes reporting in FCE's CPI reports quarterly FC indicator of all woodland planting funded by government (progress indicator for 11 million tree commitment)	
		Support the planting of the Northern Forest using the M62 corridor as its spine working with the existing partnership of the Community Forests and the Woodland Trust			Defra
		Pilot Forestry Investment Zones and put a domestic carbon offset unit in place to attract private finance to woodland creation to accelerate the rate of planting	Domestic carbon offset unit in place by 2021	Number of Forestry Investment Zones established by 2023 (FC management data)	Defra; Forestry Commission
2. Existing woodlands are more resilient to the impacts of climate change and pests and diseases		Continue to support and advocate bringing a greater proportion of woodland area into management to improve its condition and provide opportunities for adaptive actions to be implemented	Ongoing	Percentage of woodland in management (FCE CPIs,) and management activity (NFI metric, reported every five years)	Forestry Commission
		Begin to implement the Action Plan set out in the 2018 Tree Health Resilience Strategy	2019		Defra

Objective	CCRA risk(s) addressed	Key actions and progress milestones	Timing	Monitoring and metrics	Owner
		Support the sector in taking forward its Climate Change Action Plan, helping to enhance woodland resilience	Publication in 2018; review in 2023	Sector Climate Change Action plan to be published summer 2018 looking out five years. British Woodland Survey likely to continue to be main metric for reporting progress in uptake of adaptation measures	Forestry Commission
		Public Forest Estate within England will improve its nursery infrastructure and build expertise required for the successful establishment of 'emerging species' for UK forestry	2018	Forest Enterprise England management information provided to ASC as adaptation progress indicator	Forest Enterprise England
3. Adaptation is embedded within future forestry policy (post-CAP) to contribute long-term		Develop new policies to accelerate the rate of woodland planting in England and increase the level of management, ensuring resilience of those woodlands through adherence to the UKFS's Forest and Climate Change Guidelines	Ongoing	Progress data on woodland planting FC management data on 'pipeline' planting proposals to be published from 2018	Forestry Commission; Defra
		Consider how to better integrate forestry and farming to enhance farm resilience and productivity as new policies and incentives are developed following the UK's departure from the EU	Ongoing		Defra
		Complete the review of forestry genetics and native species in the context of climate change and publish a policy paper	Review in 2018; policy paper in 2019		Forestry Commission

Objective	CCRA risk(s) addressed	Key actions and progress milestones	Timing	Monitoring and metrics	Owner
4. Woodlands are more resilient to natural hazards	NE10	Further develop approaches to contingency planning and embed across the forestry sector	2020-2023	Annual wildfire statistics collected by FRS and collated by FCE	Forestry Commission
		Provide wildfire prevention training to Fire and Rescue Services and Land Managers using the UK Forestry Standard's Practice Guide Building Wildfire Resilience into Forest Management Planning	2023	Number of trainees by 2023	Forestry Commission
		Working with research partners, develop a forestland wildfire risk and fuel map at the landscape scale level	2020 - 2023		Forestry Commission
		Enhance wildfire prediction systems to improve preparedness in advance of wildfire incidents on forestland	2020-2023		Forestry Commission
5. Evidence base enhanced	NE1;	Ensure that the refreshed/replaced Science and Innovation Strategy for Forestry in Great Britain continues to support the implementation of adaptive actions across the forestry sector	2020		Defra; Forestry Commission
Section 2.8 - agriculture					
Introduce a new environmental land management	NE1; NE8	Through a reformed agricultural and land management policy we will incentivise methods of farming which reduce flood risk			Defra

Objective	CCRA risk(s) addressed	Key actions and progress milestones	Timing	Monitoring and metrics	Owner
system which will aim to deliver environmental benefits such as mitigation and adaption to climate change.		Reduce and manage the risks to coastal habitats due to agriculture.			Defra

Objective	CCRA risk(s) addressed	Key actions and milestones	Timing	Monitoring and Metrics	Owner
Chapter 3: Infrastructure *"An infrastructure network that is resilient to today's natural hazards and prepared for the future changing climate*					
Section 3.2 - Energy					
Ongoing work to further cross sector understanding of energy interdependencies as part of resilience planning and risk management strategies	IN1	Next steps being considered for the Infrastructure, Resilience and Security Working Group (IRSWG). This sub group of the National Security Council tasked to produce a tested methodology by which HMG can identify cross-sector interdependencies.	Ongoing	The group has reviewed a number of models to ascertain whether these could be utilised for the purposes of the group. A number of key issues need to be clarified before this programme of work can begin - namely the high level of data input required by the models and security challenges due to the sensitivity of CNI data - and this is being worked through.	BEIS

Objective	CCRA risk(s) addressed	Key actions and milestones	Timing	Monitoring and Metrics	Owner
Increase the resilience of energy infrastructure from all forms of flooding	IN 2-4	Electricity network companies to spend a further £100 million flood defence before 2021.	All substations completed by 2023.	550 of 589 significant substations deemed at risk and in the current scope should be resilient to floods (93%) with permanent defences in place to meet Engineering Technical Report 138 by 2021. BEIS monitor build programmes to ensure progress across the sector remains on track	BEIS
		Update and implementation of guidance for electricity sub stations against flood risks. Revised design guidelines (ETR138) state that primary substations with over 10,000 connections should be defended against 1/1000-year flood events.	Ongoing		
		Ongoing work to address surface water flooding across electricity networks	Ongoing		
Section 3.3 - Transport					

Objective	CCRA risk(s) addressed	Key actions and milestones	Timing	Monitoring and Metrics	Owner
Increase the resilience of transport infrastructure from all forms of flooding	IN 2-4	Network Rail will continue to address flood risk across its network by: ongoing monitoring of adverse weather through visual and thermal imaging building pumping stations in flood-prone locations building in measures to address flood risk in new lines installing equipment at higher levels to avoid flooding	Control Period 6 (CP6) funding is still being finalised, therefore key dates cannot be confirmed. The control period will run from 2019 – 2024.	NR report on performance on a quarterly basis. This includes a running performance of each operator and the punctuality of its services. These are summarised in annual reports each year, allowing for yearly comparisons. DfT works closely with NR to identify and mitigate against risks on the network that could affect services, and to oversee improvements in infrastructure to reduce the possibility of delays due to climate change in the future.	DfT
		In view of the commercial nature of ports and the need to ensure the viability of their business, DfT will continue to liaise with the ports by feeding important and relevant climate risk information and evidence through groups such as the tidal surge workgroups.	Ongoing		DfT
		Flood risk will be assessed by Airports with over five million passengers per year through their annual resilience plans.	Annually	Monitored by the Civil Aviation Authority with oversight from DfT.	CAA and DfT
		Highways England (HE) will improve resilience to flooding and reducing flood risk to communities adjacent to the network by addressing all identified high priority flood risk locations recorded in the Drainage Data Management System	2020-2025	This will be monitored by the Office of Rail and Road (ORR) against any agreed metrics as part of RIS2.	DfT; Highways England

Objective	CCRA risk(s) addressed	Key actions and milestones	Timing	Monitoring and Metrics	Owner
		HE will produce a new Flood Risk Strategy	Planned for publication in 2019		
		HE will increase drainage asset inventory and condition data coverage to better understand the condition of drainage assets on the strategic road network	2020-2025		
		As part the second Road Investment Strategy (RIS2), the Government will consider more options to safeguard the English strategic road network against climate risks	2020-2025		
Increased resilience to the transport network through measures to reduce failures to embankments and slopes caused by heavy rainfall events	IN 6	Highways England undertakes programme of regular inspections to evaluate and manage slope stability	Ongoing	This will be monitored as needed by the Office of Rail and Road (ORR), with policy oversight from DfT	DfT
		Design Manual for Roads and Bridges (HD22/08), which sets out the standards for assessing and analysing the stability of earthworks is being updated to account for future climate change	Completion anticipated by March 2020	Office for Road and Rail monitors the roads being fit for purpose which would include climate change risks if necessary, with policy oversight from DfT	DfT
		The active programme of knowledge improvement and strategic monitoring activities by HE are planned to continue through RIS 2. This is alongside trialling and implementing the use of smarter monitoring techniques.		As part of this risks and procedures will continue to be monitored and assessed against Key Performance Indicators which are described in the Highways England Operations Metrics Manual (OMM) covering the period 2015/16 to 2019/20.	

Objective	CCRA risk(s) addressed	Key actions and milestones	Timing	Monitoring and Metrics	Owner
		Local highway authorities follow similar methods to Highways England in order to monitor the stability of slopes for which fall under their responsibility.	Ongoing	DfT will continue to work closely with local highway authorities. It will be for local highway authorities to ensure they regularly undertake slope stabilisation monitoring as part of their highways maintenance service inspections.	DfT and Local Highway Authorities
		DfT in association with Lancashire County Council and a private sector company are trialling a new method of monitoring of a number of slopes within Lancashire County Council using LIDAR technology	This trial has just commenced and will last 12 months until May 2019	DfT in association with Lancashire County Council are aiming as part of the trial to monitor 19 sites in total. It is expected the results could to help local authorities to undertake more efficient and effective monitoring of vulnerable sites on the local road network.	Private Sector (with oversight from DfT and Lancashire Council)
		Network rail will continue to comprehensively manage its assets against geotechnical faults as part of its Asset Management Excellence Model (AMEM), this will include: Ongoing identification of sites vulnerable to landslips with use of Light Detection and Ranging surveys, in-place motion sensors, CCTV and ground investigations; Slope stabilisation management via drainage, or steel rods, soil nails or slope re-profiling. Service continuity management by rerouting services which are likely to be affected by embankment failure (via CCTV monitoring)	Control Period 6 (CP6) funding is still being finalised, therefore key dates cannot be confirmed. The control period will run from 2019 – 2024.	NR report on performance to on a quarterly basis. This includes a running performance of each operator and the punctuality of its services. These are summarised in annual reports each year, allowing for yearly comparisons. DfT works closely with NR to identify and mitigate against risks on the network that could affect services, and to oversee improvements in infrastructure to reduce the possibility of delays	DfT; Network Rail

Objective	CCRA risk(s) addressed	Key actions and milestones	Timing	Monitoring and Metrics	Owner
		Ongoing engagement with academia to research possible slope stabilisation techniques, in addition to modelling the response of slopes under different meteorological conditions		due to climate change in the future.	

Objective	CCRA risk(s) addressed	Key actions and milestones	Timing	Monitoring and Metrics	Owner
Transport interdependencies Completion of national database of bridges critical for essential services	IN 1; IN 5	As part of the DfT response to the National Flood Resilience Review, it will: continue to work with Local Authorities to identify effective measures to assess and address flooding risks; test the use of new technology such as specialist monitoring cameras that are being installed at key bridges to get real time images and to remotely monitor river levels.	This work is continuing and is expected to be completed by summer 2018.	DfT use data from various datasets to identify potential bridge and other structures that could be vulnerable to failure in certain resilience scenarios. DfT is now in the process of refining this to identify the most high risk sites. Information will be shared with highway authorities to ensure appropriate mitigation and contingency measures are put in place as part of their of their ongoing resilience plans.	DfT
		Use innovative techniques (BridgeCat) that allows safe and rapid assessment of the prevalence of bridge scour inherent in the national bridge stock. DfT considering with BEIS implementation of a trial into whether this system can be used to identify the condition of gas pipe crossings in rivers. Identify bridges that could potentially be a single point of failure for other infrastructure operators and could be at risk in a severe flood event	This work is continuing and is expected to be completed by summer 2018.	BridgeCat is currently going through a series of initial tests prior to 12 months of deployment across Cumbria County Council highway network in winter 2018/19. This will allow results of the system to be compared with those from traditional bridge inspections in order to gauge whether the system could replace any or all of the traditional inspections. The BridgeCat trial will last until March 2019 and use of it across	DfT in association with Cumbria County Council and Private Sector

Objective	CCRA risk(s) addressed	Key actions and milestones	Timing	Monitoring and Metrics	Owner
				other sectors will also be considered.	
	IN 5	Network Rail's Safety, Technical and Engineering (STE) Horizon Scanning Group will continue to identify, assess and manage external risks to Network Rail throughout their regional Strategic Business Plans for Control Period 6.	Control Period 6 (CP6) funding is still being finalised, therefore key dates cannot be confirmed The control period will run from 2019 – 2024.	NR report on performance to on a quarterly basis. This includes a running performance of each operator and the punctuality of its services. These are summarised in annual reports each year, allowing for yearly comparisons. DfT works closely with NR to identify and mitigate against risks on the network that could affect services, and to oversee improvements in infrastructure to reduce the possibility of delays due to climate change in the future.	
Section 3.4 - Telecommunications					
Increase the resilience of telecommunications infrastructure from all forms of flooding	IN 2-4	Telecommunications sector to implement remaining programme of installation of permanent flood defences.	Ongoing	DCMS monitors via regular engagement with Electronic Communications Resilience and Response Group (EC-RRG), industry run group which leads on resilience and emergency response.	DCMS; Telecoms
		Revised Ofcom security guidance includes specific flood risk requirements. Revised industry resilience guidelines will also reference flood and other climate related risks.	Ofcom guidance published Dec 2017. Industry's own resilience guidelines to be		Ofcom; Telecoms

Objective	CCRA risk(s) addressed	Key actions and milestones	Timing	Monitoring and Metrics	Owner
			published by summer 2018.		
Section 3.5 – Cross-sectoral					
Enhance arrangements for information sharing between local infrastructure operators and improve understanding of critical risks arising from interdependencies	IN 1	Help ensure local arrangements are in place to share data effectively on locally significant infrastructure sites with Local Resilience Forums	Ongoing	Biennial survey of all local responders and Local Resilience Forums in England and Wales, which includes specific questions on data sharing on locally significant infrastructure The number of local responders that have a specific procedure in place to share data on locally significant infrastructure	CO

Objective	CCRA risk(s) addressed	Key actions and progress milestones	Timing	Monitoring and Metrics	Owner
Chapter 4: People and Built Environment *"To promote the development of a healthy, equitable and resilient population, well placed to reduce the harmful health impacts of climate change, and able to capitalise on the potential health gains associated with tackling it".* *"A health service, a public health and social care system which are resilient and adapting to a changing climate."* ''Buildings and places (including built heritage) and the people who live and work in them are resilient and organisations in the built environment sector have an increased capacity to address the risks and make the most of the opportunities of a changing climate.'' *"Emergency services and local resilience capability take account of and are resilient to, a changing climate."*					
Section 4.2 - Planning					
Embed environmental net gain for development, including housing and infrastructure	PB6, NE1	Strengthen planning policy to embed the principle of net gain for biodiversity. Consult on making net gain for biodiversity mandatory.	Ongoing	Explore the current evidence base around change in land use and impact on biodiversity. Consider the future monitoring and evaluation of strengthened net gain for biodiversity policies	Defra, Natural England
	NE1	Consider how net gain for biodiversity could be expanded to include wider natural capital benefits.	Ongoing	National changes in habitat cover (relating to development). NB. No confirmed method for analysing this agreed yet.	Defra Natural England
Section 4.3 – Flood and coastal erosion risk management					
	PB5, PB6	Publish a government policy statement on Flood and Coastal Erosion Risk Management (FCERM),	Winter 2018		Defra;

Objective	CCRA risk(s) addressed	Key actions and progress milestones	Timing	Monitoring and Metrics	Owner
Manage floods and coastal erosion to save lives, better protect communities and support economic growth		setting out government's future expectations for managing flood risk and coastal erosion.			
	PB5, PB6	Update the national flood and coastal erosion risk management strategy with the aim of strengthening joint delivery across organisations.	By 2019		Environment Agency
	PB6 PB6	Refresh of Shoreline Management Plans	By 2019	Progress against Shoreline Management Plan objectives is monitored annually and used in our reporting to Government on FCRM activity more broadly under s18 of the Floods and Water Management Act.	Environment Agency
	PB5	Update the National Coastal Erosion Risk Map and ensure this remains freely available as open data online.		Updated map published	Environment Agency
	PB5	Review current funding arrangements ahead of determining funding needs beyond 2021, seeking to attract more non-public sector investment. This includes working with others to consider long term investment needs and funding options after 2021.		Monitored via investment programme data collected by Environment Agency	Defra; Environment Agency, HM Treasury and National Infrastructure Commission
		Delivery of the recently published surface water management action plan. Progress on implementation of this plan will be monitored by the Inter Ministerial Group on flooding.			Defra; MHCLG

Objective	CCRA risk(s) addressed	Key actions and progress milestones	Timing	Monitoring and Metrics	Owner
	PB8	Undertake mapping of heritage at risk from coastal erosion			Historic England; DCMS
Enable households and businesses to increase their resilience to flooding	PB5, PB6	Work to ensure that national planning policy are effective in managing the risks and impacts of flooding and coastal erosion. [This includes strengthening flood protections in the National Planning Policy Framework to ensure that new development is flood resilient and does not increase flood risk.]	Ongoing		Defra; MHCLG
	PB5	Continue to support the industry-led Property Flood Resilience Roundtable, including supporting an industry-owned voluntary code of practice to promote consumer and business confidence in measures to reduce the impact of flooding on buildings, and on those who live and work in them.	Ongoing	The Chair of the Roundtable will publish an annual report each year with the outputs from the task groups.	Defra
	PB8	Historic England Appleby Heritage Action Zone. Flood resilience and recovery in historic and traditionally constructed buildings.	Due for completion 2022		Historic England
Section 4.4 – Water Supplies and Resources					
Provide a 'clean and plentiful water'	PB14	Produce effective guidance for Water Resource Management Plan 24 which further encourages water companies to improve resilience and consider water efficiency.			Defra; Environment Agency

Objective	CCRA risk(s) addressed	Key actions and progress milestones	Timing	Monitoring and Metrics	Owner
for future generations. Develop a culture of responsibility to water management/ usage, both organisationally and individually	PB14	Work towards setting a target for Per Capita Consumption (PCC) with Water UK and water companies.	By the end of 2018.		Defra; Water UK
	PB14	Work towards setting challenging and ambitious goals to reduce leakage	This will go beyond the current target of 15% by 2025, over the next 25 years.		Defra
	PB14	Increase the penetration of water meters in households.	Over the next 25 years.		Water companies
	PB14	Promote the use of an effective water label to allow customers to gauge the water efficiency of water using products.			Defra, Other Government Departments, Water UK
	PB14	Investigate alternative methods to reduce personal water consumption, including behaviour change.			Defra, Waterwise, Water UK, water companies and other groups.
	PB14	Work with water companies to increase the volume of water transfers.	Over the next 25 years.		Defra, Environment Agency, water companies
	IN14	Publish the National Policy Statement for Water Resources to accelerate the development of large water resource infrastructure by streamlining the planning process.	2019		Defra

Objective	CCRA risk(s) addressed	Key actions and progress milestones	Timing	Monitoring and Metrics	Owner
Section 4.5 – Overheating in buildings					
Deliver more, better quality and well maintained local Green Infrastructure that provides the multiple benefits local communities need and want, in particular for urban disadvantaged populations	PB3	Our towns and cities will be greened by the creation of Green Infrastructure and planting of one million urban trees and create more, better quality and well maintained green infrastructure.			Defra and others (Natural England, Forestry Commission)
	PB1, PB5, PB7	A set of Green Infrastructure standards will be developed to help local GI planners, designers, managers and communities deliver good quality GI. This includes: - Undertaking an Evidence Review and consulting stakeholders; - Developing a draft Model Framework of GI Standards; - Test draft Framework through pilots; - Producing guidance on planning and delivering Green Infrastructure, including applying the Framework of GI Standards; - Launching mainstreaming and support to Local authorities, developers and others monitoring and evaluation.	By 2023	Uptake of standards Number of Local Plans, GI Strategies and development s using the Framework of GI Standards	Natural England, Defra, Forestry Commission, MHCLG
Adapting health systems to protect people against the impacts of climate change	PB1	We will work to ensure that all clinical areas in NHS Trusts have appropriate thermal monitoring in place.	By 2023		NHS Sustainable Development Unit, NHS Improvement, DHSC
	PB1, PB9	We will work to ensure that all NHS Trusts have in place an adaptation plan, either stand alone or as part of their Sustainable Development Management Plan.	By 2023		NHS Sustainable Development Unit, NHS Improvement, DHSC

Objective	CCRA risk(s) addressed	Key actions and progress milestones	Timing	Monitoring and Metrics	Owner
	PB9	All NHS providers will be encouraged to use the Sustainable Development Assessment Tool to self-assess progress on Adaptation. The tool will support high quality adaptation plans, either stand alone or embedded into Sustainable Development Management Plans.			NHS Sustainable Development Unit, NHS Improvement, DHSC
	PB9	We will ensure that all NHS trusts are reporting consistently on risk assessment for overheating events.	By 2023		NHS Sustainable Development Unit, NHS Improvement, DHSC
	PB9	Adaptation measures, particularly thermal monitoring and numbers of risk assessments for overheating events, will be incorporated into the Model Hospital to allow benchmarking of performance.			NHS Sustainable Development Unit, NHS Improvement
	PB9	The NHS SDU will informally review the coverage of adaptation in mandatory provider trust and commissioners sustainability reports.	Annually		NHS Sustainable Development Unit
	PB9	System wide performance will be reported annually in the Healthcheck report, alongside other metrics of sustainable development and social value in health and care. The Healthcheck report is published on behalf of the National Cross System Group for Sustainable Health and Care.	The Healthcheck report is compiled annually by the SDU.	The Healthcheck report will demonstrate: • % NHS providers to have an adaptation plan (stand alone or as part of SDMP) • % of clinical areas in NHS trusts covered for thermal monitoring	NHS Sustainable Development Unit, National Cross System Group for Sustainable Health and Care.

Objective	CCRA risk(s) addressed	Key actions and progress milestones	Timing	Monitoring and Metrics	Owner
				• % of NHS providers reporting on adaptation in their annual reports • Number of overheating risk assessments undertaken in NHS trust clinical areas (required when temperatures exceed 26C)	
	PB9	Best practice in adaptation will be sought and recognised annually through the Sustainable Health and Care Awards- Adaptation category			NHS Sustainable Development Unit.
				Research and advice on avoiding maladaptation of older properties including heritage assets	Historic England
Section 4.6 – Delivery of health and social care services					
Protecting people from the impacts of heat and cold	PB4	We will tackle issues relating to excessively cold homes and seek to reduce the effects of cold weather on people's health.			MHCLG, BEIS, DHSC
	PB1, PB3	We will take measures to minimise overheating in homes, and other buildings including hospitals, care homes, schools, prisons and offices. We will complete research into overheating in new homes (flats and houses) to determine the extent of the current risk of overheating and whether it will worsen in the future.	Overheating research to be completed by the end of 2018	Research will evaluate the effectiveness of overheating mitigation techniques, e.g. shading and ventilation.	MHCLG, DHSC, SDU. NHSE, CQC, PHE, MoJ, DfE.
	PB1, PB9	We will develop a single adverse weather and health plan, bringing together and improving existing guidance. This will aim to mainstream action within the health system and local communities, reduce health risks associated with adverse weather and	B2022		DHSC, PHE, SDU, NHSE, Local

Objective	CCRA risk(s) addressed	Key actions and progress milestones	Timing	Monitoring and Metrics	Owner
		address the health risks identified in the second CCRA.			Government Association
	PB1	We will continue to undertake research to understand more comprehensively the health consequences of hot weather and the health interventions available to minimise preventable harm.	Ongoing		DHSC, PHE
	PB9	We will update the evidence base on the health impacts of climate change through the production of an UK focused report ('Health Effects of Climate Change in the UK') based on the latest Climate Change Projections, following publication of UKCP18.	2023		DHSC, PHE
Section 4.7 – Emergency services, local responders and community resilience					
Ensuring that emergency and local services are best prepared for extreme weather events.	PB1, PB5	Cabinet Office will continue to communicate with emergency services, local responders and communities so that they understand the risk of extreme weather conditions across the UK and develop appropriate plans.	Ongoing		Cabinet Office
	PB1, PB5	The Communities Prepared National Group will support the development and local implementation of community resilience policy across England, sharing good practice and lessons learned in community engagement and capability-building across the country and identifying opportunities for co-ordination of community resilience-related work.	Ongoing		Cabinet Office, CPNG

Objective	CCRA risk(s) addressed	Key actions and progress milestones	Timing	Monitoring and metrics	Owner
Chapter 5: Business and industry *"UK businesses are resilient to extreme weather and prepared for future risks and opportunities from climate change"*					
Section 5.2 – Loss in productivity					
Increase our understanding of impacts to business from productivity losses arising from climate change	BU1	Information will be collected through the third cycle of adaptation reporting, from infrastructure operators and their regulators on the scale of interruptions impacting on productivity.	2019 - 2021	ARP sector reports	Defra
Section 5.3 – Supply Chain					
A food supply chain which is resilient to the effects of a changing climate		Review and publication of the updated UK Food Security Assessment	2018-2019		Defra
Section 5.4 - Access to capital and risks and opportunities associated with changing demand for goods and services					
Increase understanding of risks associated with reduced access to capital and to changing demand for adaptation goods	BU4	Government will consider the recommendations of the Green Finance Taskforce and respond in due course.	Ongoing		BEIS, HMT, Defra
		Government will continue delivering the ambitious Greening Government Commitments	Ongoing	Data from annual GGC reports	Government
		Government will continue engaging with BSI on the consideration of a need of a potential new standard on adaptation for businesses.	Ongoing		Defra

Objective	Key actions and progress milestones	Timing	Monitoring and Metrics	Owner
Chapter 6: Local Government NB. We have not identified actions and progress for the Local Government sector with the relevant 56 risks set out in the Climate Change Risk Assessment, as per other sectors. Local authorities cover a large number of areas in the provision of their services, which are cross cutting, and it would be logistically difficult to make the links.				
Planning for and implementing climate change adaptation at local government level, and addressing relevant priority climate change risks affecting the sector, with government and local government working together. This will embed into activities undertaken by local authorities in the course of fully discharging their duties so that they can support and protect local communities.	In line with the 25 Year Environment Plan, Defra will facilitate partnership working by developing 14 local natural capital plans from existing Area Integrated Plans. Local natural capital plans will be co-designed and delivered by organisations in the area whose actions already impact upon the environment. This will rely on the organisations identifying shared priorities and coordinating activity to address them.	Commencing summer 2018.	We will develop a set of performance metrics to make sure we are delivering on the goal of mitigating and adapting to climate change. This will be part of a national picture on delivering on the 25 Year Environment Plan.	Defra
	The government, informed by advice from local government delivery partners, will ensure that, where a case is made, government legislation, policy and programmes are joined up to continue to enable and support councils to build resilience to the impacts of climate change through: • undertaking over the remainder of 2018 a scoping exercise of both gaps and opportunities for wider join up, evolution of the policy and the legislative landscape to support local and local government delivery; • developing a prioritised set of policy or legislative focus areas and map these to existing areas, such as planned consultations; • developing, where needed, new interventions to influence, or shape, and how and by who these will be progressed; and • agreeing a deliverable programme of work linked, as appropriate, to wider key groups and networks, including outside the Local Government sector.	Ongoing Spring 2019	Investigation of other city reporting mechanisms (Carbon Disclosure Project/Compact) and international or national standards. There are valid and local reporting and evaluation frameworks, for example Leeds City Council monitors progress against climate change adaptation actions through its environment programme board. Joint working to understand an efficient, effective and more consistent approach to monitoring and how this could operate within cities and the Local Government sector more widely.	Defra, Local Adaptation Advisory Panel, Local Government Association (LGA), Association of Directors Of Environment, Economy, Planning and Transport (ADEPT), Core Cities.

Objective	Key actions and progress milestones	Timing	Monitoring and Metrics	Owner
	The LAAP, working with relevant sector experts will respond to key government consultations and lobby national government through joint letters to ensure that the case is made that government legislation, policies and programmes are joined up to continue to enable and support councils to build resilience to the impacts of climate change.	Ongoing		Local Adaptation Advisory Panel, Defra, LGA, ADEPT, Core Cities.
	The LAAP will support improved resilience on adaptation amongst local authorities by providing easy to implement basic guidance for local authorities that clearly outlines the key priorities and minimum requirements for improved resilience in key sectors. This will be disseminated through the LAAP's networks; through meetings/ conferences, and using other sector specific networks' channels.	Ongoing		Local Adaptation Advisory Panel, Defra, LGA, ADEPT, Core Cities.
	Following the development of the Business Case for Local Authorities in NAP1, the Local Adaptation Advisory Panel will: • finalise an approach to demonstrating the level of implementation of climate change adaptation principles across local authorities; • develop, with government and others, an agreed process of roll out of the approach alongside appropriate processes of assessment/progress reporting for the sector; and • continue its strong collaborative approach on adaptation between central and local government and its partners to share best practice and accelerate delivery.	By 2019		Local Adaptation Advisory Panel, Defra, LGA, ADEPT, Core Cities.

Objective	Key actions and progress milestones	Timing	Monitoring and Metrics	Owner
To ensure that climate change adaptation is implemented most effectively at city level, including through partnership working.	The Core Cities group in partnership with Defra, will influence adaptation ambitions and delivery at local level through its current Low Carbon Energy and Resilience (LCER) policy hub through: • formalising a joint Core Cities group/Defra working group/compact to collaborate on air quality and promoting adaptation in cities; the Core Cities Climate Resilience and Adaptation Working Group delivering an agreed annual set of adaptation priorities and key actions across and within specific individual core cities; and Core Cities group reporting delivery and performance on adaptation to the LCER Policy Hub and the Core Cities group/Defra working group/compact, and, more widely, supporting sharing and acceleration of local adaptation best practice and progress reporting.	The working group will be set up in summer 2018	Terms of Reference will be agreed, and a programme for deliverables will be implemented	Core Cities Group, Defra, Greater London Authority