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# WHATEVER THE WEATHER

A PROGRESSIVE STRATEGY FOR CLIMATE  
RESILIENCE AND ADAPTATION

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# EXECUTIVE SUMMARY

Climate change is now a major risk to our health, homes and infrastructure. Flooding, heatwaves and drought are already more common than in the past, and they are projected to continue to become more frequent and severe.

- During 2022's heatwave summer, temperatures reached a record high of 40.3°C in parts of England. Scientists said this would have been almost impossible without human-induced climate change.<sup>1</sup> In this period there were an estimated 2,985 excess deaths.<sup>2</sup>
- Flood-related damage costs an average of £700m annually.<sup>3</sup> Warming could see the UK's annual flood damage bill rise by 20 per cent over the next century.<sup>4</sup>
- The UK's Climate Change Committee predict that the demand for water in England will exceed supply by between 1.1 and 3.1 billion litres a day by the 2050s.<sup>5</sup> 2022's summer of extreme heat and low rainfall led to 11 out of 14 areas in England remaining officially in drought into November, with some areas maintaining water restrictions on households.<sup>6</sup>

The Conservative government's most recent National Adaptation Programme (the UK-wide strategy on adaptation, published every 5 years) lacks substantive new plans or investment to prepare for future climate impacts. This leaves low-income households especially vulnerable. Those on low incomes are more likely to face the worst impacts of extreme weather events and are less likely to be able to adapt.

Investment in climate adaptation also delivers value for money, with every £1 invested in adaptation typically resulting in £2 to £10 in net economic benefits.<sup>7</sup> Many adaptation actions also have important social and environmental co-benefits, such as sequestering carbon or improving health and wellbeing in homes.

The next government should set out an action plan on climate adaptation. Future ministers should<sup>8</sup>:

- Introduce a specific maximum indoor working temperature law, including the ability to withdraw labour if workplace temperatures surpass 30°C (27°C if doing strenuous work).

- Require councils to activate the Severe Weather Emergency Protocol in extreme weather events and provide temporary accommodation for rough sleepers, for the duration of the severe weather alert, and for a minimum of three days / nights.
- Place a duty on landlords to prevent overheated homes, based on the existing requirements for landlords to prevent cold homes.
- Introduce tougher climate resilience requirements on infrastructure providers, including requirements to conduct stress tests and meet outcome-based standards, and make adaptation reporting mandatory for infrastructure providers and other key organisations.
- Ban burning on peatland and develop an immediate strategy for investing in the development and maintenance of flood defences to protect more homes.

# 1. INTRODUCTION AND CONTEXT

## Climate change is happening now

Climate change is happening. Human activities are estimated to have already resulted in average global temperature rises of around 1°C and we are hurtling towards a world in which global temperatures are 2°C above pre-industrial levels.<sup>9</sup> As global temperatures rise, the frequency and severity of heatwaves, flooding and drought in the UK are projected to rise too.<sup>10</sup>

- **Heatwaves.** Heatwaves are now 30 times more likely to happen in the UK because of climate change.<sup>11</sup> The 2022 heatwave in which temperatures reached 40.3°C in parts of the UK has been cited as near impossible without human-induced climate change.<sup>12</sup> Climate change is already making UK heatwaves more frequent, intense and longlasting.<sup>13</sup>
- **Flooding.** Scientists have warned that flooding in the UK is already becoming more frequent due to climate change.<sup>14</sup> Attribution studies indicate that extreme rainfall events are becoming increasingly likely, due to human-induced climate change: such events could be four times as frequent by 2080 as they were in the 1980s.<sup>15</sup> Winters are projected to be 30 per cent wetter in 2070 than they were in 1990.<sup>16</sup>
- **Drought.** There is a risk that droughts will become more frequent in the UK as global temperatures rise.<sup>17</sup> The Met Office projects that summers could be up to 60 per cent drier by 2070 compared to 1990, depending on the region.<sup>18</sup>

We need to adapt to climate change while also reducing emissions. It is too late to prevent some of the damage from human-induced climate change. Even if the world dramatically reduces its greenhouse gas emissions from now on, we will feel the impact of emissions to date, plus the additional emissions predicted under even the most optimistic decarbonisation scenarios.<sup>19</sup>

Climate change is already having an impact on our infrastructure, health, and housing, creating large social and economic costs that are predicted to get much worse in coming decades. While continuing to aim to reduce

emissions, we must also adapt to reduce the impacts of climate change on the UK.

## We must adapt

We must prepare for this future reality. The problem is that until now, adaptation has been left behind.

Often referred to as the ‘Cinderella’ of the climate change debate, adaptation is still too often overlooked when it comes to policy decisions.<sup>20</sup> While COP27, held in 2022, did move towards a focus on climate adaptation, with an emphasis on ‘loss and damage’ payments to climate-vulnerable countries, the UK’s domestic adaptation policy has not gained equivalent momentum. Conservative government policy in this area is sparse, under-resourced and lacking in urgency. The next government must do better to prepare for a climate-changed future.

### Box 1: Climate adaptation and resilience

**Climate adaptation** refers to changes in processes, practices and structures to moderate potential damages or to benefit from opportunities associated with climate change.<sup>21</sup>

**Climate resilience** describes the capacity or ability to anticipate and cope with climatic shocks, and to recover from their impacts in a timely and efficient manner.<sup>22</sup> Adaptation actions can help build climate resilience when implemented effectively.

Resilience to climate-based shocks can be impacted by ‘stresses’ that weaken the fabric of a community over time, such as a weak economy, deprivation, poor infrastructure, and recurrent flooding.<sup>23</sup> Specific demographic groups such as people with low household incomes tend to have a lower capacity to be resilient in the face of climate shocks. To build resilience requires strengthening the social fabric of a community, and ensuring that the social stresses communities face are considered in adaptation policymaking.

Too often in the UK people are told to be resilient to recurrent climate shocks without the necessary support to do so. This paper takes the view that a progressive strategy on adaptation must ensure that policy enables individuals and households to adapt, and where possible provides those who do not have the means to sufficiently adapt themselves with the resources to do so.

## The UK faces increased climate risks in three key areas: health and wellbeing, infrastructure, and housing

The risks of heat, flooding, and drought will affect the everyday lives of people in the UK in a multitude of different ways. But we have identified three key areas of life which will be severely impacted, where there is room for practical changes in government policy to make a significant difference.

These are:

- **Health and wellbeing.** Impacts include injury, illness or death from flooding, heatstroke, heat exhaustion, or dehydration from extreme heat. Being displaced from your home following a flood can cause significant mental health impacts.
- **Infrastructure.** Impacts include power outages, when extreme weather impacts electricity supply; disruptions to transport infrastructure and drought reducing the availability of water in reservoirs. One infrastructure system failing can lead to cascading failures in other infrastructure systems or services that rely on the former.
- **Housing.** Impacts include physical damage if homes are flooded, overheating of homes in heatwaves, and restrictions on household water usage in periods of drought.

TABLE 1: IMPACTS OF HEAT, FLOODING, AND DROUGHT ON POLICY DOMAINS OF INFRASTRUCTURE, HEALTH, AND HOUSING

|             | Infrastructure  | Health  | Housing   |
|-------------|---|---|---|
| <b>Heat</b> | <ul style="list-style-type: none"> <li>• Disruption to electricity system</li> <li>• Disruption to transport system</li> <li>• Schools and hospitals overheating</li> </ul> | <ul style="list-style-type: none"> <li>• Heatstroke and heat exhaustion</li> <li>• Increased risk of heart attacks, lung illnesses and other diseases</li> <li>• Heat rash, cramps, dizziness,</li> </ul> | <ul style="list-style-type: none"> <li>• Overheating of homes resulting in discomfort and health impacts</li> </ul> |



|                 |  |  |  |
|-----------------|--|--|--|
|                 |  | fainting and dehydration   |  |
| <b>Flooding</b> | <ul style="list-style-type: none"> <li>• Disruptions to electricity system</li> <li>• Disruption to transport</li> <li>• Disruption to public services</li> </ul>            | <ul style="list-style-type: none"> <li>• Drowning and physical trauma</li> <li>• Respiratory diseases, skin and gut infections</li> <li>• Mental health impacts</li> </ul> | <ul style="list-style-type: none"> <li>• Physical damage to homes</li> <li>• Contamination of drinking water and introduction of mould and bacteria</li> </ul> |
| <b>Drought</b>  | <ul style="list-style-type: none"> <li>• Disruptions to electricity system</li> <li>• Disruption to industry</li> <li>• Disruption to water supply infrastructure</li> </ul> | <ul style="list-style-type: none"> <li>• Reduced agricultural yields resulting in shortages of certain foods</li> </ul>  | <ul style="list-style-type: none"> <li>• Restrictions on household water use</li> </ul>  |

To minimise these impacts, we need to build climate resilience into government policy and adapt the UK to a changing climate. If we do not act quickly, the consequences will only get worse as extreme weather gets more frequent and severe.

#### Box 2: Climate risk is unequally distributed

People in low-income households tend to face higher risks from heatwaves, flooding and drought, but often have less capacity to adapt.

**Unequal impact of heat:** Low-income and ethnic minority people tend to face higher physical risks from heat, as they are more likely to live in inner urban areas which are subject to the urban heat island effect (where highly developed urban areas experience higher air temperatures than surrounding rural areas).<sup>24</sup> Low-income households are less likely to be able to pay for or have the ability to implement housing adaptations to reduce overheating.<sup>25</sup> Those who work in manual occupations, and those who work outside or in confined conditions are also more at risk.<sup>26</sup>

**Unequal impacts of flooding.** Poorer communities are more likely to face substantial risks from flooding. An Environment Agency study found that

people from areas classed as more deprived were at greater flood risk than those in less deprived areas (after flood defences were taken into account).<sup>27</sup> Inequalities facing deprived coastal communities are even more pronounced than those in inland communities.<sup>28</sup> Low-income households are also less likely to be able to pay for or implement measures such as property flood resilience.<sup>29</sup> The economic impact of a flood is also greater for low-income households – for example, they may be less likely to pay for home or contents insurance due to affordability concerns and more economically insecure residents may find it more difficult to absorb the cost of repairs.<sup>30</sup>

**Unequal impact of drought:** Drought can reduce agricultural yields both at home and abroad, causing food prices to rise.<sup>31</sup> This will hit those on lower incomes the hardest as food costs represent a higher share of their overall expenditure.<sup>32</sup>

**Intersectional identities** also play a role. For example, people with low incomes from black and minority ethnic backgrounds can face overlapping risks. They are more likely to live in inner-city areas that face high risks of surface water flooding and are more exposed to the urban heat island effect.<sup>33</sup> Certain ethnic minorities are also more likely to be private tenants or social renters<sup>34</sup>, which means they are at greater risk of living in housing prone to overheating and may lack the ability to sufficiently adapt their homes.

This disproportionate impact on certain communities rarely translates into policymaking on climate adaptation. The government's most recent National Adaptation Programme (NAP3) only mentions low-income households in the UK once in the entire 141-page report. It also makes no mention of the disproportionate risks faced by ethnic minorities.<sup>35</sup>

## The urgency of adaptation

It is vital that we adapt now to save costs further down the line. Urgent action on adaptation is needed for several reasons:

**To avoid future costs.** Expected losses to the UK economy from the continued impacts of climate change under current policies are considerable, reaching at least 7.4 per cent of projected future UK GDP by the end of the century.<sup>36</sup> By investing in adaptation now, we can limit the extent of these future costs.

**To avoid costly retrofit.** In the coming decades, a huge number of new homes, new infrastructure, new hospitals and new public buildings will be built. If these are not designed for the future climate, we risk 'locking in'

poor resilience in key sectors and the cost of retrofitting more buildings and infrastructure in the future.

**To take advantage of the net zero transition.** In the coming decade we will be undertaking large-scale societal change to reduce emissions. There is an unprecedented opportunity both to reduce emissions and to adapt to climate change at the same time. Pursuing two separate programmes would waste time and resources. Over the past three years, only four of the 15 major government announcements to address climate change have included integrated plans and goals on adaptation, alongside those on reducing emissions.<sup>37</sup> This must change.

**To gain economic, environmental, or social co-benefits.** Many adaptation actions have significant environmental, social, and economic co-benefits. For example, reintegrating nature into areas that typically lack it can help with flood management, but also boost tourism, restore biodiversity, and increase quality of life for residents. Actions that yield benefits even in the absence of climate change and where the costs of the adaptation are relatively low compared to the benefits of acting are referred to as ‘low-regret’ actions.<sup>38</sup>

Chapter 2 sets out the general policy context of adaptation, while the following chapters look in more detail at health, housing, and infrastructure. The final chapter makes a series of recommendations. As climate adaptation is a devolved matter, this report primarily refers to England.

# 2. NATIONAL AND LOCAL ADAPTATION POLICIES

Climate change poses risks that cut across traditional boundaries of public policy and government. Climate risk therefore requires a cross-cutting response involving different departments and tiers of government. This chapter maps the current policy response at central and local levels.

## UK government

In England, the responsibility for climate adaptation sits with the Department for Environment, Food and Rural Affairs (DEFRA). However, climate adaptation is a cross-cutting issue which is likely to affect several if not all government departments. Under the Climate Change Act 2008, the government is required to publish a UK-wide climate change risk assessment (CCRA) every five years, which should assess the risks for the United Kingdom from current and predicted impacts of climate change.<sup>39</sup>

It is then required to produce a National Adaptation Programme (NAP) which should address the climate risks identified in the CCRA and set out actions that government and others will take to adapt in the forthcoming period. Climate adaptation is a devolved matter, so Northern Ireland, Scotland and Wales produce their own adaptation plans, which respond to the risks and opportunities set out in the UK-wide CCRA.<sup>40</sup>

These programmes have consistently fallen short. In March 2023, the Climate Change Committee (CCC)<sup>41</sup> concluded that the 2<sup>nd</sup> National Adaptation Programme, published in 2018, had **not adequately prepared the UK for climate change**.<sup>42</sup> Subsequently the third edition of the NAP, more commonly referred to as 'NAP3', was published in July this year.

However, NAP3 similarly fails to deliver. It has been met with significant cross-industry criticism, including for a lack of new plans and investment and failing to move at the pace required to sufficiently adapt the UK to climate change, discussed in Box 3 below.<sup>43</sup>

#### Box 3: The Third National Adaptation Programme - 'NAP3'

The third National Adaptation Programme for England (NAP3) was released in July 2023.<sup>44</sup> While the strategy contains a number of small positive improvements, it has been widely criticised by experts for lacking sufficient commitments and pace to adapt to climate change.<sup>45</sup>

One positive announcement from the strategy is that the Cabinet Office and Defra, working with the Treasury, will convene a new climate adaptation board comprising senior government officials. It is hoped this will foster vital cross-government collaboration on adaptation.<sup>46</sup>

The programme also states that Defra will work with the CCC to shift to a systems-based risk assessment approach in the next climate change risk assessment, a change which infrastructure experts have long called for.<sup>47</sup> A systems-based approach would allow infrastructure operators to better understand risks across the whole infrastructure sector – which is vital for climate resilience action planning given the interconnected nature of infrastructure systems and potential for cascading failures.

However, the next CCRA will only be published in January 2027. To avoid the damage of cascading failures, it is important to embed systems thinking within government and translate it into joined-up policymaking much faster.<sup>48</sup>

NAP3 has further shortcomings. Aside from the commitments mentioned, the strategy mainly restates pre-existing policy rather than delivering the step-up needed, particularly with regards to new investment and regulation. There is little in NAP3 on adapting buildings and infrastructure to extreme heat (with the exception of transport). And there is also no firm commitment to make the reporting on climate risks mandatory for key infrastructure providers: instead, the government will review whether to do so by 2024-25.<sup>49</sup>

The next government must act fast to build on NAP3 and fill the large gaps left by this administration. They must also work on a much more ambitious programme in advance of the release of NAP4 in 2028.

The government has taken other actions to promote resilience. The UK Government Resilience Framework, published in December 2022 by the Cabinet Office, aims to "strengthen the systems and capabilities that underpin the UK's resilience to all civil contingencies risks", including

extreme weather.<sup>50</sup> The strategy contains several positive developments and represents an effort to think about resilience across government more holistically. But it is once again lacking on substantive action – referencing standards that are currently only voluntary and suggesting enforcing standards through regulation ‘only in the highest priority cases’.<sup>51</sup>

## Accounting for climate risk in government

The benefits of adapting to climate risk are currently accounted for poorly in government and this is a major obstacle to adaptation. The Treasury’s Green Book contains supplementary guidance which covers accounting for climate change. However the CCC argues that its methodology for discounting the long-term benefits of adaptation actions acts as a barrier to government investment.<sup>52</sup> The guidance also does not place the emphasis it should on the vital co-benefits of adaptation action. It briefly refers to the good practice of identifying possible no- or low-regret options that generate net social benefits regardless of whether climate change occurs – but does not emphasise the importance of these in increasing the return on investment for adaptation action.<sup>53</sup> Co-benefits must be much more clearly recognised in the Treasury’s calculations.

An alternative approach for calculating the benefits of adaptation action which takes full account of co-benefits has been proposed by a number of academics across the UK and Europe. This approach is called the ‘triple dividend of resilience’ or ‘TDR’ approach. The TDR approach considers the benefits of avoided losses, such as the avoided costs from not flooding properties (first dividend), induced economic or development benefits, such as increased tourism (second dividend), and additional social and environmental benefits, such as increased biodiversity or access to nature for local communities (third dividend). This sits in contrast to other calculation methods which may only take into account the first or second dividends.<sup>54</sup>

Using the TDR approach generally produces higher benefit-to-cost ratios, reflecting the full benefits of action and thereby making investments in climate adaptation more attractive. A case study from Felixstowe, a town on the east coast of England found that taking into account the second and third dividends more than doubled the benefit-cost ratio of the project, from 15.1 to 31.8.<sup>55</sup> If this methodology were to be applied in the Treasury’s Green Book and local authorities’ investment calculations, it could increase the likelihood of adaptation action being implemented.

## Government support for private sector investment

The third UK climate change risk assessment (CCRA3) highlighted a lack of investment in adaptation from the private sector as a key challenge.<sup>56</sup> It is estimated that around £10bn additional investment per year in adaptation may be needed this decade to sufficiently improve the UK's preparedness for climate change, and the private sector will need to play a key role in achieving this target.<sup>57</sup> But it is currently falling short. Previously ambitious programmes, such as the UK Climate Impacts Programme, have supported businesses and local authorities to adapt, but these have since waned. Firms argue that the core issue in investing in adaptation is not a lack of finance but a lack of targeted policy.<sup>58</sup>

The insurance sector also plays a role in climate risk and adaptation. Insurance helps business, the public sector, and households have greater financial protection from extreme weather, at the cost of a regularly paid premium. However, in areas of high climate risk, premiums will be higher and may be unaffordable for those on low incomes, or insurance may not be available at all due to these areas' high risk profile. Insurance companies also take a role as risk managers, and often invest in risk reduction projects as part of their business model. The specific role of insurance in household flooding is explored in chapter 5.

## Local, regional, and devolved government

### Councils

Councils have a set of powers that are highly relevant to adaptation. They are large employers and manage a large estate of their own and they have powers including planning, housing, parks and local roads. Climate change is a major and increasing priority – three out of four local authorities in the UK have declared a climate emergency and some have drawn up climate resilience plans.<sup>59</sup>

However, adaptation is not a major feature in council policy. Adaptation features in less than 12 per cent of climate emergency declarations.<sup>60</sup> And while several local authorities have already drawn up climate resilience plans, this is only on a voluntary basis - and the quality varies. Under-resourcing is a major barrier to adaptation and mitigation by local authorities – and local government in England faces an overall funding gap of almost £8bn by 2025.<sup>61</sup> Councils receive no core funding for climate action and are instead forced to compete for short-term pots of funding, which creates uncertainty and takes up vital resources.<sup>62</sup>

Many also face a shortage of skilled professionals in climate adaptation, which is having a detrimental effect on councils' ability to respond to climate change.<sup>63</sup> Only 12 per cent of local authorities surveyed by the Town and Country Planning Association felt they had sufficient expertise to take account of flood risk in current and future planning decisions.<sup>64</sup> Councils must take on a vital role in climate adaptation, but they will need the resources to do so.

## Mayoral combined authorities

Mayoral combined authorities have some powers over issues crucial to adaptation policy, such as housing, transport and skills. They also take a broader strategic role on the environment and some collaborate on spatial planning. These organisations are still relatively new but many have been producing good policy initiatives on adaptation, for example Greater Manchester's resilience strategy and resilience for communities programme.<sup>65</sup>

These bodies could be vital. 23 million people will be governed by a mayoral combined authority in 2024<sup>66</sup>, and the urban areas they tend to cover face a unique risk from surface water flooding and heat. However, unless they are required and resourced to act to adapt to climate change, change could be delayed to favour more urgent priorities.

## Greater London Authority

The Greater London Authority is the democratically elected strategic authority for London, comprising the Mayor of London and the London Assembly.<sup>67</sup> It has powers over important aspects of climate resilience policy such as housing, transport, planning, environment, and fire and rescue, among others.<sup>68</sup> London is projected to experience particularly intense periods of heat due to climate change: summer temperatures are predicted to resemble those of Barcelona by 2050, and central London temperatures could be as much as 10°C higher than those in the surrounding countryside because of the urban heat island effect.<sup>69</sup>

To reduce the risk of these impacts, the Mayor of London has launched a major project titled the London Climate Resilience Review. The review is intended to assess and recommend actions to protect Londoners, the environment and the economy from major climate risks including wildfires,



flooding and extreme heat.<sup>70</sup> It is currently scheduled to be published this month (December 2023).<sup>71</sup>

## Local resilience forums

Local resilience forums are another key local agency in extreme weather planning. These are multi-agency partnerships, classed as ‘category one responders’ under the Civil Contingencies Act, which work to identify and prepare for localised incidents and catastrophic emergencies, including extreme weather events. Each forum covers a geographical police area and is made up of representatives from local public services, including the emergency services, local authorities, the NHS, the Environment Agency and others.<sup>72</sup>

### Box 4: Consultation with local communities

Failure to consider and consult with local communities on adaptation policy can result in ‘maladaptation’. Local communities often have sophisticated knowledge about the consequences of climate change in their local area and the most effective steps that can be taken to adapt to these. But adaptation policies can reinforce existing vulnerabilities, rather than reducing them: this is known as ‘maladaptation’. Maladaptation can be the result of failing to include people in the process, and it tends to have a particularly adverse effect on marginalised and vulnerable groups.<sup>73</sup>

The Summit to Sea project shows the importance of involving local communities in adaptation action. The project aimed to restore nature (a key climate mitigation and adaptation action) across an area of Mid Wales. But there was a backlash from local farming communities – including calls from the Farmers’ Union of Wales for the project to be scrapped. This ultimately led to key funding partners pulling out. The project was eventually refunded by several organisations using a co-design process which allows local communities to agree the direction of the project.<sup>74</sup> The project is currently ongoing under a new name ‘Tir Canol’ which roughly translates as ‘middle ground’, reflecting the new vision of the project.<sup>75</sup>

# 3. INFRASTRUCTURE

Infrastructure is a vital consideration in adaptation policy for two reasons. First, infrastructure is at risk from climate change: our railways, our power networks, our hospitals and schools are all vulnerable to the impacts of heatwaves, flooding and drought. Second, infrastructure is a solution: it can help us to adapt and protect us from climate change, such as how flood defences, either natural or manmade, protect us from flooding.

This chapter first discusses the risks that climate change poses to our infrastructure, before discussing infrastructure as an adaptation measure.

## Infrastructure – risks and impacts

The UK's infrastructure is at risk from a number of climate related factors:

**Risks from heat.** Extreme heat can disrupt transport infrastructure, causing train lines to buckle, runways to lift, local roads to soften, and train carriages and buses to overheat, resulting in risks to public health.<sup>76</sup> During the 2003 heatwave, 137 incidents of rail buckling cost £2.5m in delays and repairs. It is predicted that by the 2080s, the annual cost of buckling and heat-related delays under a high climate change scenario could increase eightfold.<sup>77</sup>

Research has flagged the inequality of the impact of heatwaves on transport: people on lower incomes may be more likely to suffer from extreme heat when they travel as they often take buses, while people on higher incomes may be less likely to suffer, as they are more likely to drive or take trains, which tend to have air-conditioning.<sup>78</sup> Extreme heat can also disrupt electricity supply: analysts have found that the 2022 heatwave came very close to causing widespread power cuts.<sup>79</sup>

Heatwaves can also impact public services: if schools overheat, lessons are cancelled; and if hospitals overheat, operations are cancelled. Both have knock-on economic and social consequences, which can be significant: 18.5 per cent of UK hospitals had to cancel operations in the 2022 heatwave due to hospitals overheating. If the high temperatures had continued, researchers expect that a further third of hospitals would have had to cancel surgery.<sup>80</sup>

**Risks from flooding.** Flooding poses physical risks to electricity generation, transmission and distribution.<sup>81</sup> The UK's electricity infrastructure faces serious risks from flooding, as 178 power stations and 575 substations across the UK are in areas of significant surface water flood risk.<sup>82</sup> Transport also faces risks: if train lines are flooded this can cause major disruptions. There are more than 3500km of rail tracks in areas of significant risk of surface water flooding in the UK.<sup>83</sup> Flooding can also impact public buildings such as schools – by the 2080s, up to 1,800 schools could be exposed to a 'significant likelihood' of flooding (defined as a greater than 1 in 75 annual probability).<sup>84</sup>

**Risks from drought.** Drought can also have an impact on the power system. If the availability of cooling water for thermal plants is reduced, this can cause either a partial reduction in output or total shutdown of the plants, limiting electricity generation.<sup>85</sup> The drought in 2022 caused such stress on the electricity system that the National Grid had to trigger a capacity market notice to indicate that the safe margins for operating the grid were reduced.<sup>86</sup>

**Cascading risks and impacts.** Our electricity, telecoms, water and railway and road networks are interdependent – failure in one risks creating a cascading network of failures across other infrastructure sectors. The risk of cascading impacts is likely to increase as more of our infrastructure comes to rely on the electricity system in the net zero transition. If we increase our reliance on the electricity system without boosting its climate resilience, any disruption to electricity supply or transmission from extreme weather events will increase the risk of disruption to other infrastructure sectors that rely on it.<sup>87</sup> For example, BT's ongoing transition to digital landline telephone services, reliant on mains electricity, resulted in some customers being left without any means of communication, including calls to the emergency services, in 2021's storm Arwen.<sup>88</sup>

**Box 5: The role of natural infrastructure in adapting to climate change**

It is important to retain, restore and develop natural infrastructure to adapt to climate change. Using natural infrastructure, otherwise referred to as 'nature-based solutions' or 'blue-green infrastructure', involves making use of natural elements in land-use planning. This includes developing 'blue' elements such as rivers, ponds, and wetlands, and 'green' elements such as trees, forests, parks.<sup>89</sup> Other examples of natural infrastructure include peatland, mangroves and saltmarshes.<sup>90</sup>

Natural infrastructure has many advantages for climate adaptation. Trees and vegetation can reduce flood risk by intercepting rainfall and increasing drainage capacity of the land; and they can reduce heat risk by providing

shading and natural cooling via evapotranspiration. Natural infrastructure can also produce environmental and social co-benefits such as carbon sequestration and wellbeing benefits.<sup>91</sup> Upland peatland in particular has a significant role in both drainage and carbon absorption, and plays a key role in both mitigating and adapting to climate change when well-managed.<sup>92</sup> Blue-green infrastructure can also be cheaper to implement than traditional flood defences.<sup>93</sup>

## Current policy

### Protecting infrastructure from climate impacts

Infrastructure must be resilient to climate impacts. Climate change is already having a significant effect on critical national infrastructure, and this is projected to get a lot worse under all reasonable climate change scenarios.<sup>94</sup> The government's adaptation policies for infrastructure are relatively limited. They include:

- **The adaptation reporting power.** Under the Climate Change Act, the government can invite infrastructure organisations to report on the impacts that climate change may have on their organisation and how they are going to adapt to them. This is a power known as the adaptation reporting power or 'ARP'.

However, it is not mandatory for invited organisations to report, causing gaps in coverage, despite the CCC calling for it to become so.<sup>95</sup> In the NAP3, the government has committed to reviewing the power by 2023-24.<sup>96</sup> However many want immediate action. The ARP also lacks clear standards or formal feedback on reports submitted, despite a majority of organisations agreeing that this would help raise the profile of adaptation action within their organisation.<sup>97</sup>

- **The 'system-of-systems' approach.** Infrastructure sectors are interdependent – a connected 'system of systems'. Therefore, enhancing the resilience of individual systems/processes/activities does not automatically enhance the resilience of the whole system. There may be limited accountability when infrastructure systems fail, particularly as the causes can be so complex that it is hard to prove who was at fault.<sup>98</sup> To improve infrastructure resilience,

policymakers need to consider these interdependencies, the risk of cascading failures, and our increased reliance on electricity as we move away from fossil fuels.

One of the few successes of NAP3 was a commitment that Defra would work with the CCC to shift to a systems-based risk approach in the next climate change risk assessment (CCRA).<sup>99</sup> However, the next CCRA will only be published in January 2027 – and this is only a risk assessment, not a promise of any concrete action to improve whole-system resilience. This leaves the UK open to the risk of cascading failures for several years before any meaningful policy to address this can be put into practice.

## Infrastructure as an adaptation measure

### Flood and coastal defences

The government's flood risk and coastal management strategy has committed to investing £5.2bn to create around 2000 new flood and coastal defences between 2021 and 2027.<sup>100</sup> This is a substantial sum and is in line with the National Infrastructure Commission's recommendations. However due to significant underspending in the first two years of the programme, the Environment Agency will need to achieve record levels of investment in the remaining four years of the programme to spend the full £5.2bn allocated to the programme. It has removed 500 of the 2000 new flood defences originally promised, and the programme is now forecast to deliver protection to 40 per cent fewer properties than the government's original commitment - a total of 200,000 properties rather than 336,000.<sup>101</sup>

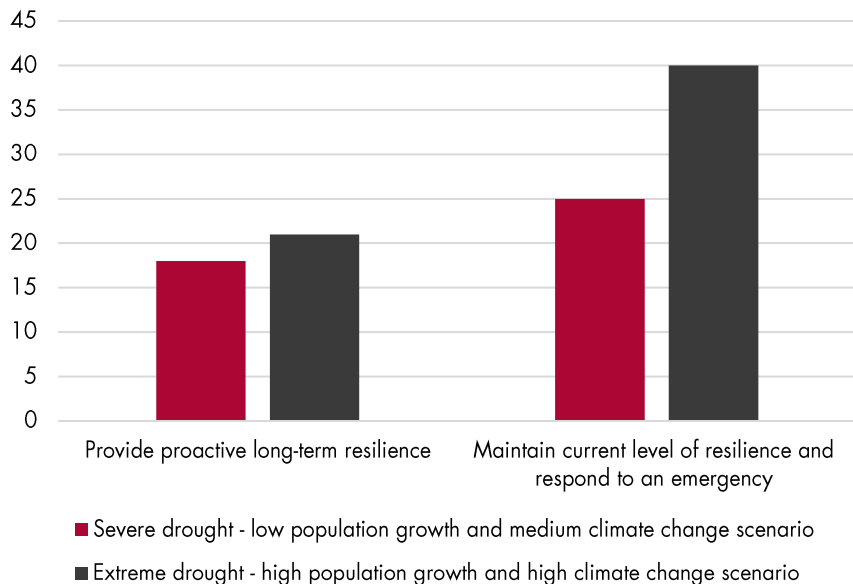
The maintenance of flood defences is a key issue which remains overlooked. 'High consequence defences' are those which prevent some of the worst flooding impacts, but in 2022, 4,204 of these (about one in 15) were in a poor or very poor condition.<sup>102</sup> Hundreds of poorly maintained defences were in areas hit by the recent storm Babet which killed at least seven people and affected around 1,250 homes.<sup>103</sup> While the Environment Agency regards 98 per cent of assets in high consequence systems being maintained at required condition as optimal, only 93.5 per cent remained in this condition in summer 2023.<sup>104</sup> Maintenance of flood defences is not just vital for social protection but makes economic sense – for every £1 increase in maintenance spending almost £7 is saved in capital spending.<sup>105</sup>

## Water supply

Water supply infrastructure in the UK is insufficient to cope with levels of demand and to be resilient to drought. No new reservoirs have been built in England in more than 30 years, since the water industry was privatised in 1989.<sup>106</sup> The National Infrastructure Commission has calculated we will need water supply from new infrastructure of at least an additional 1,300 megalitres per day from new infrastructure by the mid 2030s.<sup>107</sup> The cost of not acting to build drought resilience is significant: their analysis finds that the short-term emergency costs of providing water during a drought are greater than the costs of building long-term resilience in all key scenarios (see fig. 2).<sup>108</sup>

As our climate become more changeable, our water system also needs greater adaptability. A network of strategic transfers, which move water from areas with a surplus to those with a deficit, could potentially provide about 700 megalitres a day more capacity in the system, at costs comparable with other options, and a range of studies indicated this would have a good cost-benefit case.<sup>109</sup>

**FIGURE 1: THE COSTS OF PROVIDING LONG-TERM RESILIENCE ARE LOWER THAN THAT OF RESPONDING TO AN EMERGENCY**



*Cost of different drought resilience actions in £bn*

*Source: National Infrastructure Commission<sup>110</sup>*

## Environment Land Management Scheme

The current government's primary policy to fund the development of natural infrastructure is the environmental land management scheme (ELMS). This is intended to serve as a post-Brexit replacement for the EU's common agricultural policy (CAP). In contrast to the CAP, which offered subsidies based on acres of land farmed, ELMS offers 'public money for public goods'. This means it offers farmers payment for use of sustainable farming methods or provision of nature-based services, including vital climate mitigation and adaptation actions. ELMS is being gradually implemented as the government phases out the previous 'basic payments' scheme, with the different sub-schemes beginning pilots and implementation on various timescales from 2021 to 2024.<sup>111</sup>

ELMS has been met with significant criticism from the farming industry, which argued it was underfunded and that delays and uncertainty over payment rates reduced confidence and could affect take-up.<sup>112</sup> In January 2023, the government released further details on ELMS, indicating that some of the potential risks and opportunities of climate change had been considered within plans and funding.<sup>113</sup>

However, it is too soon to know what the rate of uptake will be and whether this funding will be sufficient. It is still unclear what land managers will be paid to do under ELMS, and the full range of adaptation actions that will be eligible. The CCC argues that more detail is urgently needed.<sup>114</sup> The NFU says that, despite the update, uncertainty remains, making it difficult for farmers to make long-term decisions on whether to pursue ELMS actions on their land.<sup>115</sup>

## Private investment in nature-based solutions

Investment from both the public and private sectors will be needed to build climate resilience on the scale needed to reduce climate risks. Government policy that facilitates investment in nature-based services can help achieve key adaptation outcomes, such as natural flood management. Currently in the UK there is only a nascent market for natural capital, with a limited number of small projects, often under £1m in size.<sup>116</sup> And there are several barriers to scaling up private investment in nature-based solutions.

One key barrier is a lack of confidence from stakeholders that environmental markets are high-integrity, and outcomes are measurable and transparent.<sup>117</sup> The Green Finance Institute notes other key barriers, including 'a lack of guidance around tax treatments and whether emissions have to be reduced

at a farm-level; the need for aggregation models to enable delivery of environmental outcomes at scale; and a lack of clarity on stacking different environmental credits, certificates or units together and with public sector funding'.<sup>118</sup>

The UK government has set out an ambition to create high-quality, internationally leading UK 'markets for nature'. In the 2023 green finance strategy and nature markets framework the government committed to creating a "green taxonomy" which aims to provide investors with definitions of which activities should be labelled as "green" and provide reliable information on sustainable activities including nature-based solutions.<sup>119</sup>

It also committed to working with the British Standards Institution to create a set of investment standards for nature markets.<sup>120</sup> Nature markets are especially reliant on credible standards, because services traded in these markets are often represented by a credit rather than a physical product that purchasers can inspect. Therefore these units are only as credible as the standards that underpin them.<sup>121</sup> Other ways to increase certainty in the market include accrediting independent brokers of nature-based services, or match-funding investments in early projects.<sup>122</sup>

However even with a well-functioning market, it is likely there will still be smaller-scale schemes where private finance may lack sufficient incentive to invest. Therefore, ELMS and private investment markets must be designed to complement one another, not compete – with ELMS still providing finance to these smaller-scale schemes.<sup>123</sup>

### Reintroducing nature into cities

Nature can be reintroduced into cities to reduce both overheating and flooding. Several cities abroad have successfully managed to reintegrate natural infrastructure, for example:

- Berlin has taken up the Chinese innovation of a 'sponge city' with its 2016 plan "StEP Klima KONKRET" that saw hard surfaces such as cement and asphalt on buildings, roads, and walkways replaced with trees, grass, green roofs and urban wetlands, which provide better absorption of water.<sup>124</sup>
- Paris developed a network of 'cool spaces' to provide respite to city residents in heatwaves. This involved developing blue and green infrastructure, but also implementing social policies such as extending the hours of municipal swimming pools and signposting residents to cool museums.<sup>125</sup>



Devolved governments, mayoral authorities and councils in the UK are now working to implement similar initiatives:

- Newcastle's declaration on blue and green infrastructure has been held up as a best practice example of reimplementing nature into cities.<sup>126</sup>
- Welsh Water (Dŵr Cymru) has been investing in sustainable drainage projects around Wales, working with local communities to successfully retrofit SuDS into existing urban areas while still leaving space for parking and other needs.<sup>127</sup>
- In 2018 the Mayor of London launched a campaign which connects people to places with free drinking water in the city via an app, which can help prevent dehydration in heatwaves.<sup>128</sup>

### Protecting upland peatlands

Upland peatlands can help both sequester carbon and prevent flooding. Good quality peatland grows sphagnum moss which can hold up to 20 times its weight in water, making it a key form of natural flood management while also storing huge quantities of carbon.<sup>129</sup> However, when peatland is damaged, it becomes dry and hard, causing rainfall to quickly run off, and increasing flood risk. It also begins to emit its stored carbon, becoming a net carbon source rather than a carbon sink. This is what is currently happening in the UK, due to practices such as burning for grouse production, overgrazing, and excessive draining. Now only 20 per cent of our peatlands remain in a near-natural state.<sup>130</sup>

And there is a lack of sufficient policy to protect or help restore peatlands. Grouse shooting remains predominantly unregulated and unlicensed, meaning that upland peatlands are often burned to provide optimum conditions for shooting. Currently, a burning license is only required for peatland in protected areas, where the burning areas is greater than 40cm in depth.<sup>131</sup> The Scottish government is planning to introduce licensing to make shooting estates more accountable for such practices, and environmental organisations such as the RSPB and Greenpeace have called for a comprehensive ban on peat burning, while the CCC have called for a ban on rotational burning.<sup>132</sup>

# 4. HEALTH

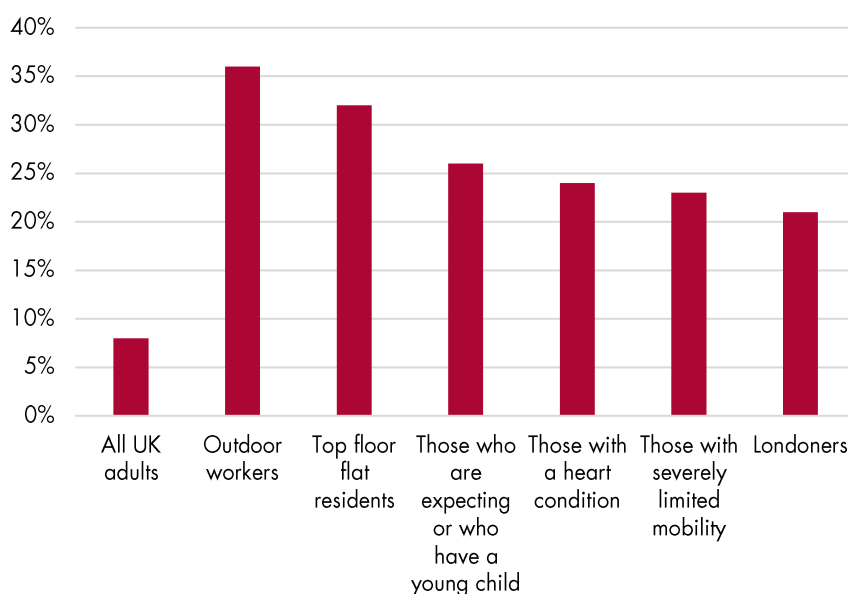
Extreme weather can cause ill health and even death. This chapter first discusses the risks heat, flooding and drought pose to our health, before summarising relevant policies and policy gaps.

## Risks and impacts

**Risks from heat.** The most severe effects of extreme heat are heatstroke, heat exhaustion and heart attacks.<sup>133</sup> At 25°C, excess deaths can start to occur in certain groups, such as older people – in the 2022 heatwave where temperatures reached 40.3°C, there were around 2,985 more deaths than in a usual summer, and 2,839 of these were among over-65s.<sup>134</sup> Excessive heat can also cause heat rash, heat cramps, dizziness, fainting and dehydration, as well as an increased risk of lung illnesses and other diseases.<sup>135</sup> Older people and young children, as well as those on certain medications, face higher health risks in extreme heat.<sup>136</sup> Disabled people also face disproportionate impacts: a 2023 YouGov poll found that 28 per cent of Londoners with a serious limiting disability or health issue did not feel confident that they could keep themselves cool in a heatwave, compared with only 17 per cent of all Londoners.<sup>137</sup>

The TUC find that occupation also plays a large role in heat health risk: non-unionised workplaces tend to have the worst health and safety standards, and are less likely to protect workers.<sup>138</sup> Low-paid workers often lack sufficient access to water, they can't easily escape the heat, and they often have to wear uniforms or personal protective equipment (PPE) designed for cooler temperatures.<sup>139</sup> Workers in manual or hospitality occupations are more likely to experience excessively hot conditions; but so can employees in education establishments and offices if they are working on higher floors or in areas with big windows and poor ventilation.<sup>140</sup> Workers in better-off households are less likely to work in jobs where they are at risk of overheating.<sup>141</sup>

**FIGURE 2: HEAT HEALTH RISK IS UNEQUALLY DISTRIBUTED IN THE UK**



Percentage who have had to use health services as a result of heat

Source: British Red Cross<sup>142</sup>

**Risks from flooding.** Severe floods can kill and injure people – 36 people have died from flooding in the last 10 years in England and Wales.<sup>143</sup> The most severe impacts on health and loss of life are drowning, or physical trauma caused by displaced objects, electrocution or fire. Other effects include respiratory disease from mould and damp, and skin and gut infections from exposure to contaminated water, among others.<sup>144</sup> Mental health impacts are also a large risk – in fact, most of the health burden associated with flooding in England is due to its impacts on mental health and wellbeing, rather than direct physical impacts.<sup>145</sup>

Increased risk of extreme rainfall also increases the risk of storm overflows. This is where sewerage systems become overwhelmed because a lot of rainwater runs into drains and the sewerage system in a short space of time, and so water companies release the extra wastewater into rivers and seas.<sup>146</sup> This can cause health impacts such as gastrointestinal illnesses for people bathing in the rivers and seas where wastewater has been released.<sup>147</sup>

Some groups are more exposed to flooding and its health risks than others. Socio-economically deprived citizens are more likely to live in areas of high flood risk, even when taking into account flood defences.<sup>148</sup> Those with language barriers or who have recently moved to an area may be less aware of flood risk and less likely to receive flood warnings.<sup>149</sup> Homeless people are also more exposed to flood risk and less likely to be able to access services designed to support residents following a flood.<sup>150</sup>

**Risk from drought.** Drought has a more indirect impact on health, via agriculture. The UK is unlikely to face water shortages so extreme as to affect cooking and hydration. But drought does affect crop yields and could lead to food shortages and price rises, affecting people's diets and household budgets. In 2022 the Environment Agency warned that up to 50 per cent of potato crops and 10 to 50 per cent of certain other vegetables could fail as a result of drought.<sup>151</sup> The Energy and Climate Intelligence Unit estimates that household monthly spending on food in 2022 increased by £14.24 as a result of climate change.<sup>152</sup> <sup>153</sup> This will affect those on lower incomes more significantly, as food costs make up a higher proportion of household expenditure.<sup>154</sup>

## Current policy

Policy can protect people's health from climate change in two ways. First, it can help prevent extreme heat, flooding and drought from affecting people's everyday lives, by developing and maintaining resilient infrastructure and housing, covered in Chapters 3 and 5 respectively. Second, targeted policy can ensure people are aware of the risks to their health from climate change, are aware of how to adapt, and have reasonable means to be able to adapt – addressed in this chapter.

### Public awareness

Leaflets providing advice on how to stay healthy in the cold are delivered every year to vulnerable households, identified as being in receipt of the Warm Homes discount scheme. The leaflets are titled Keep Warm, Keep Well and are created by a partnership between the NHS, UKHSA and Age UK.<sup>155</sup> However, no such scheme exists for hot weather and the UK lacks the public information campaigns that other countries have, such as signage in open spaces warning people to stay in the shade. The UK also lacks a 'culture of heat', where we are aware of the risks and what to do to respond to them – from wearing loose clothing to closing windows and blinds during the day.<sup>156</sup> And many UK residents are not aware of their personal flood risk, and what to do to prepare or act when flooding occurs – only 14 per cent of UK adults say they know what to do to prepare for a flood.<sup>157</sup>

## Early warning systems

When implemented well, alert systems can be very useful. Heat warnings have proven effective: 97 per cent of those in the red warning area for July 2022's heatwave were aware of the warning and 91 per cent felt that the warning was useful.<sup>158</sup> Flood warnings are used by the Environment Agency to warn of flood risk across England and since December 2022 it has been trialing a new automated system. However, members of the public who rely on it say that warnings have come after their homes are already inundated, or that they have received a number of false alarms. Even when warnings are accurate, users have said the level of detail on offer from the automated system is far less than the regular system, forcing people to guess the level of impact. The Environment Agency has said it is going to continue to use the new automated system despite these local concerns, and evidence that humans need to be in the loop.<sup>159</sup>

## Workers' rights

Other countries, such as Germany, Spain, and China, have clear health and safety at work rules setting maximum legal temperatures.<sup>160</sup> In the UK, there is a *minimum* legal temperature for indoor workplaces, but no maximum. The UK's law on high temperatures is weak and vague: employers are only required to make sure work temperatures inside a building are 'reasonable'.<sup>161</sup>

Similarly, there are no specific provisions employers must make to ensure the health of their employees. Current health and safety law only requires them to provide clean and fresh air and offers recommended (but not required) guidance on actions employers can take to ensure the health of workers in extreme heat.<sup>162</sup>

Workers' natural defence mechanism against heat stress is to slow down work, take more frequent and longer breaks and/or limit the number of working hours, all of which, in turn, may reduce productivity, output and earnings.<sup>163</sup> Adapting working hours to cooler times of day during heatwaves could help both health and wellbeing and productivity at work.<sup>164</sup> This would especially benefit outdoor workers and kitchen staff who face some of the most severe heat risks.<sup>165</sup> Similarly, compulsory provision of protective equipment could protect outdoor workers from short and long-term health risks from sun exposure such as sunburn and skin cancer.<sup>166</sup>

## Protecting homeless people

Homeless people face specific health and wellbeing risk factors from heat and flooding. More people experiencing homelessness died in the summer of 2021 than in the winter of that year.<sup>167</sup> Councils have the power to provide temporary shelter for homeless people in times of extreme weather: this is called the severe weather emergency protocol or 'SWEP'. SWEP accommodation can be in a hostel, night shelter or in a building owned by a community group.<sup>168</sup> However, there is currently no legal requirement for local authorities to activate SWEP and it is underutilised in events of flooding and extreme heat.<sup>169</sup>

An investigation found that only 53 per cent of councils put in any measures to respond to extreme heat in the period studied, and no councils were found to offer SWEP for extreme rain or flash flooding.<sup>170</sup> It is also often only deployed for one or two nights which diminishes its effectiveness and take-up – because people experiencing homelessness find it is not worth it for them to go inside for such a short period of time as they risk losing a good outdoor sleep site.<sup>171</sup> But there are examples of good practice: in the 2022 heatwave, Westminster council not only activated SWEP, but implemented further measures to protect the health of homeless people. These included providing water and sunscreen and running daily clinics to assess for signs of heatstroke.<sup>172</sup>

# 5. HOUSING

Heat, flooding and drought can damage homes or make them uncomfortable or even unbearable to live in. This chapter first discusses the risks climate change poses to our homes, before summarising relevant policies and policy gaps.

## Risks and Impacts

Our homes offer security, comfort, and protection from the elements, but these risk being undermined by the heat, flooding and drought that climate change causes:

**Risks from heat.** The UK has some of the least energy efficient homes in Europe.<sup>173</sup> Political and policy attention is mainly focused on insulating homes from the winter cold, but poor insulation can also cause overheating in summer.<sup>174</sup> Twenty per cent of homes in England (4.5 million) overheat even in cool summers.<sup>175</sup> Building experts warn that too much glazing, lack of shading, and insufficient ventilation in the home can also contribute to overheating.<sup>176</sup>

The poorest fifth of English households are three times more likely to live in a home at risk of overheating than the richest fifth (54 per cent compared with 18 per cent).<sup>177</sup> Homes in urban areas face disproportionate overheating risk due to the urban heat island effect and residents from black and minority ethnic backgrounds are four times more likely to live in areas vulnerable to heat compared to white people.<sup>178</sup> High crime rates in inner-city areas may also deter residents from opening their windows in the evening or at night to let in cool air, as has been the case in previous heatwaves internationally.<sup>179</sup>

**Risks from flooding.** Flooding can cause structural damage, destruction of electrical wiring, damage to gas and heating systems, contamination of drinking water, and the introduction of bacteria and mould into a home.<sup>180</sup> Across the UK, approximately 1.8 million people are living in homes which are in areas of significant river, surface water or coastal flooding (defined in the UK climate change risk assessment as a one in 75 or greater annual chance).<sup>181</sup> People with low incomes are more likely to live in flood-risk

areas<sup>182</sup>, and are less likely to have insurance or be able to afford repairs. Research by insurance company Aviva found that nearly three quarters (73 per cent) of low-income renters would struggle to meet an unexpected bill of £500 without help.<sup>183</sup> Similarly, people who have lived in an area for only a short time may be unaware of past floods and the potential for future flooding, so are unable to suitably prepare.<sup>184</sup>

**Risks from drought.** The increasing risk of drought and drier summers is unlikely to lead to water supplies being cut off completely, but it could mean more restrictions, such as hosepipe bans or limits on our ability to use water freely in our own homes. In 2022, three water companies continued localised hosepipe bans throughout the winter because resources were so low.<sup>185</sup> Drier and hotter summers also increase the risk of subsidence, which is likely to affect almost 11 per cent of properties by 2070.<sup>186</sup>

#### Box 6 – Social and private renters

Social and private renters face particular challenges in adapting to climate change. Because they do not own their homes, they can not make any significant alterations that might improve their climate resilience. Social tenants and private renters also tend to have lower incomes<sup>187</sup> and certain ethnic minorities are also overrepresented in social housing (eg Black African, Black Caribbean and British Bangladeshi).<sup>188</sup>

Privately rented accommodation has some of the worst insulation of all UK housing, and 57 per cent of private rented homes in England are at a high risk of overheating.<sup>189</sup> The government clearly defines what constitutes a 'cold home' and requires landlords to undertake a set of actions to prevent this. But there are no similar thresholds or requirements for an 'overheated home'.<sup>190</sup> Similarly, there are no standards landlords must meet on property flood risk. This leaves tenants with no clear rights to get their landlord to address overheating or flooding risks in their home.

The next government must retrofit social homes for both adaptation and mitigation. Social housing customers will not have the means to adapt themselves, and social housing is often lower in quality and less resilient to climate impacts. Sixty-nine per cent of social rented homes are at a high risk of overheating, compared to 57 per cent of private rented homes and only 17 per cent of owner-occupied homes.<sup>191</sup> Research found that a series of climate adaptation works in two London social housing blocks were met with an overwhelmingly positive reception from residents, with 89 per cent of residents feeling positive about the changes.<sup>192</sup>



## Current policy

Different policy measures are required for new housing and for our existing housing stock. Below we discuss each of these in turn.

### New housing

Both planning policy and building regulations are key levers in adapting the built environment to climate change. In planning policy: a 'climate duty' has existed in relation to local plan making since 2008. However, this remains only one of many duties, and so can easily be overridden to account for other planning priorities. Giving 'special regard' for adaptation and mitigation matters in local plan making and the NPPF, as is currently the case for preserving certain heritage assets, would give these additional weight in planning decisions.<sup>193</sup> An amendment to introduce such a 'special regard' clause into the Levelling Up and Regeneration Act was debated in the Lords and Commons, but was rejected by the government. The finalised act refers to 'having regard' to mitigation and adaptation of climate change in planning matters.<sup>194</sup> However, this is a much weaker form of words that does not give priority to climate adaptation and mitigation in the same way a 'special regard' would. The role of building regulations in adapting to specific climate risks such as overheating is discussed below.

#### Heat

In June 2022, an amendment to the 2010 Buildings Regulations came into force, containing a new requirement to mitigate risks of overheating (so-called 'Part O').<sup>195</sup> This legislation requires any new residential properties to both 'provide an adequate means to remove heat from the indoor environment' and 'limit unwanted solar gains in summer'. Importantly, it also states that 'mechanical cooling may only be used where insufficient heat is capable of being removed from the indoor environment without it'. This means that passive (eg natural ventilation or external shading) cooling rather than active cooling measures (eg fans or air conditioning) must be used wherever possible.<sup>196</sup>

These regulations are a positive step towards reducing overheating in new build homes, but fall short in several respects. They only require that a property be safe from overheating risk in the current climate – and therefore

do not factor in future climate change. Furthermore, commercial buildings do not need to comply with the regulations, and neither do buildings being renovated into domestic dwellings. The Greater London Authority has a stronger set of requirements which includes a 'cooling hierarchy'<sup>197</sup> that sets out the order in which different cooling measures should preferably be implemented, which is often used as best practice in other local and combined authorities.

## Flooding

There has been recent progress in protecting new housing from flood risk. Changes made in 2022 to the National Planning Policy Framework are designed to reduce the number of properties being built on floodplains, by steering new development away from areas at highest risk. Where exceptions are made, high risk homes must now meet 'recommended standards' on flood resilience, such as requiring architects to specify flood resilient building materials or use mitigation measures such as moving electric sockets higher up walls.<sup>198</sup>

The government has also recently pledged to implement Schedule 3 to the Flood and Water Management Act 2010, which will make sustainable drainage systems (SuDS) mandatory for new developments in England.<sup>199</sup> However, the government has been dragging its heels on implementation, with the policy still not put into place.<sup>200</sup> It is also important to ensure that there are stringent standards for SuDS to ensure this legislation has the greatest impact. Green SuDS (such as swales, or green roofs) are preferential over traditional 'grey' SuDS (such as underground pipes or tanks) due to their environmental and social co-benefits.<sup>201</sup> However there is currently little confidence among practitioners that green SuDs are being built in the majority of new developments.<sup>202</sup>

## Drought

Water efficiency standards in new-build homes are very weak. The government currently only 'encourages' local authorities to adopt an optional minimum building standard of 110 litres personal water consumption per day. This optional standard is also only present in areas where there is a clear local need, such as in water stressed areas.<sup>203</sup> The government is currently considering mandating a new minimum water efficiency standard of 105 litres per person per day and 100 litres per person per day in areas of serious water stress, however no commitment has yet been made.<sup>204</sup> Without compulsory standards, we risk locking in building design which makes reducing water demand much harder.

## Pre-existing housing

Eighty per cent of buildings which will be occupied in 2050 already exist, making retrofitting pre-existing housing a top priority.<sup>205</sup> Retrofit to mitigate climate change is already a key political priority, but retrofit for adaptation must be considered too. Current retrofit schemes include the government's 'great British insulation' scheme, which aims to insulate 300,000 homes a year over the next three years. However, the UK Business Council for Sustainable Development has calculated that the pace of the new scheme is such that it would take almost 200 years to complete the homes in need of upgrades.<sup>206</sup> Labour has gone further and pledged to insulate 19 million homes in a decade.<sup>207</sup> However neither scheme makes reference to integrating retrofit for energy efficiency with that for adaptation.<sup>208</sup>

Failure to consider both mitigation and adaptation in retrofit can result in undesired consequences. For example, insulation can be useful for keeping out heat as well as cold. But if homes are not also fitted with adequate ventilation, insulation can instead exacerbate overheating risk.<sup>209</sup> Conversely, adaptation can help with mitigation and vice versa. For example, reversible heat pumps can both heat and cool properties with lower carbon emissions than traditional heating and cooling systems.<sup>210</sup> Solar panels can both provide a source of clean power and cool homes by providing shade for roofs, cooling buildings by up to 38 per cent in some cases.<sup>211</sup> A holistic approach is key to achieving both mitigation and adaptation outcomes with the greatest efficiency and to avoid unintended consequences.

### Heat

Homes can be retrofitted to keep them cool in periods of intense heat. This includes fitting measures such as insulation, ventilation and external shading.<sup>212</sup> But home insulation rates have plummeted. In 2013 the coalition government cut energy efficiency programmes: by 2022, the rate of fitting home insulation was ten times lower than in 2010.<sup>213</sup> A lack of sufficient insulation can make it more difficult for households to keep cool in summer, as well as warm in winter. Again, there is an opportunity to combine retrofit that reduces emissions with retrofit that helps homes adapt to climate risk.

## Flooding

Property flood resilience measures can reduce repair costs in a flood by up to 73 per cent in some cases.<sup>214</sup> That makes these measures economical for many high-risk properties, because the cost of upfront investment is lower than the cost of repair for even a single flood event.<sup>215</sup>

However, flood resilience measures still have large upfront costs, meaning many households can't or won't invest – particularly if they do not perceive themselves as being at risk from flooding. The number of homes now projected to be at such a high risk of future flooding, that installing flood resilience measures will be cost-effective, is increasing faster than the projected uptake of property flood resilience measures. This suggests that many of those who need PFR measures are not implementing them.<sup>216</sup> It also makes sense to combine flood resilience measures with other renovations, notably retrofit for climate mitigation. But as noted above, neither the government's nor Labour's retrofit strategies seek to integrate climate mitigation and adaptation in this way.

## Drought

Water meters are an easy way to reduce usage, but uptake is not high enough. Customers can generally ask for the installation of a water meter<sup>217</sup>, but in practice a water company can only insist on installing one if they live in an area determined by the Secretary of State to be in 'serious water stress' and subject to a metering programme as a result of this.<sup>218 219</sup> A water meter can reduce average consumption by 15 per cent and smart meters by 17 per cent.<sup>220</sup>

There are barriers to voluntary uptake, such as concerns about increased costs, and the disruption of installation.<sup>221</sup> Awareness of the benefits of metering is vital: the vast majority (87 per cent) of unmetered respondents to a Waterwise survey said they would investigate getting a smart water meter if they knew it would save them money and be free to install.<sup>222</sup> The National Infrastructure Commission has recommended allowing companies to introduce compulsory water metering in all areas as a key way of managing water demand in a changing climate.<sup>223</sup>

Compulsory water metering has historically been a controversial issue in the UK, as some low-income households (typically larger households with children or those with high levels of essential water use because of medical reasons) can see increased bills after switching to a meter.<sup>224</sup> Social tariffs can help avoid such inequalities: for example, the Watersure scheme caps the water bills of those receiving certain benefits at the cost of the average metered bill for an area if they need to use a lot of water for medical reasons or have a certain number of school-age children.<sup>225</sup>

Water leakage is also a major issue in the management of water supplies. But the water industry has pledged to halve leakage by 2050.<sup>226</sup> Increased uptake of smart meters also helps to identify leaks, increasing water efficiency.<sup>227</sup>

#### Box 7: Home insurance

The insurance sector plays a key role in protecting homes against climate risks and supporting adaptation. Insurance gives business, the public sector, and households greater financial protection from extreme weather for the price of a regular premium. Insurance companies can also offer advice and support to customers and increase awareness of household climate risk. However, in areas of high climate risk, premiums will be higher and may be unaffordable for those on low incomes or insurance may not be available at all due to the large risk profile of these homes.

To address this problem, the government launched a reinsurance scheme called Flood Re in 2016.<sup>228</sup> In this scheme the flood element of home insurance policies for the 1 to 2 per cent of highest risk properties can be passed to Flood Re by insurers.<sup>229</sup> Flood Re is currently planned to last until 2039, after which it is hoped that the functioning of an effective flood insurance market for the highest risk homes can return.<sup>230</sup>

People in flood risk areas consider insurance essential to enable recovery, but many on low incomes can't afford it.<sup>231</sup> Polling by the British Red Cross suggests that financial barriers to insurance remain widespread: one in seven UK adults (15 per cent) are without buildings or contents insurance. Of these, more than half (53 per cent) put this down to affordability.<sup>232</sup>

One way in which households should be able to achieve lower insurance premiums is by reducing their risk profile for flooding, which can be done by installing property flood resilience measures. However, the insurance industry has said that it currently struggles to recognise the full benefit of property flood resilience measures in pricing.

To address this barrier, FloodRe has been working to create a scoring mechanism that reveals a property's resistance to flood damage, eventually hoping to produce a prototype 'flood performance certificate' for buildings.<sup>233</sup> As well as increasing incentives for homeowners to take-up flood resilience measures, this could help raise people's awareness of their own flood risk – currently only 27 per cent of UK adults say they have a good understanding of their flood risk.<sup>234</sup>

# 6. RECOMMENDATIONS

Climate change is happening. We must redouble our efforts to mitigate climate change and to prevent emissions and temperatures rising.

But unfortunately, we also now need to prepare for and adapt to its impacts on our everyday lives.

Mitigation and adaptation are not conflicting priorities: adaptation will cost less if we act to mitigate climate change more efficiently. And many interventions that mitigate climate change also help us adapt.

The current government has failed to prepare for the impacts of climate change. Their plans lack ambition, urgency, and investment.

The next government will need to make a step-change in adaptation action and take urgent action to put long-term processes in motion.

In this chapter we set out recommendations for how a new government can adapt our governance, infrastructure, health and homes to the challenges ahead. They are based on our own analysis, consultation with experts for this project and a review of previous proposals by organisations researching climate adaptation.

### Box 8: Recommendations supporting low-income households

Throughout this report we refer to the disproportionate climate risks felt by those in low-income households or deprived communities. Government policy should support these communities to adapt to climate risks where they may be unable to do so themselves. The following policy changes would achieve this:

- Low-income workers in particular occupations are more likely to be exposed to heat risk. A maximum workplace temperature would benefit them by allowing them to stop work in extreme heat, while increased employer responsibilities and worker protections should reduce heat health risk.
- Homeless people face a lack of protection from extreme weather, causing them to face some of the largest risks. Making the SWEP mandatory for local authorities would ensure homeless people would have access to shelter in extreme weather, reducing the risk to their health.
- Low-income households are more likely to be social renters and so would benefit from a retrofit strategy that prioritises the adaptation of social homes to extreme weather, alongside energy efficiency measures.
- Low-income people are also more likely to live in private rented accommodation. Increased duties on landlords should increase the resilience of private rented accommodation, reducing low-income households' climate risk.

## Governance & cross-cutting considerations

Climate change does not conform to departmental silos or neat tiers of governance. Government must work together – between departments and between central and local government – to adapt. The government should:

1. Increase the duties and resources of local authorities and mayoral authorities to prepare for climate risk

The government should:

- Require local authorities to draw up climate resilience and adaptation plans.
- Provide templates for these plans that local authorities must complete to improve consistency across local authorities and minimise data gaps. These should include a requirement to assess vulnerability to climate risk and include specific plans to reduce risks to low-income households. They should also include a requirement to assess risks for a variety of climate scenarios.
- Provide funding to local authorities to develop these plans.

Councils should:

- Develop these climate resilience plans, using the templates provided by government. As part of this, they should work closely with organisations already assessing and working to reduce climate risk, for example local resilience forums and risk management authorities.

Mayoral combined authorities and the Greater London Authority should:

- Draw up urban heat island effect plans and surface water flooding plans. These should be produced in close collaboration with councils to minimise duplication but set out targets for reducing heat and surface-water flood risk at a city-region level. These plans should pay particular attention to measures that would improve the resilience of vulnerable populations, such as low-income inner-city residents.
- Include in these plans, where possible, adaptation measures which have significant social and environmental co-benefits such as: developing networks of cool spaces following the Paris model; investing in blue-green infrastructure and developing sustainable drainage systems.

## 2. Review how climate risks are taken into account in government financial decision making

The government should:

- Conduct a review into how climate risk and the costs and benefits of climate adaptation action are treated in budgeting, financial appraisal and audit across government.
- Consider embedding the triple dividend of resilience approach in the Treasury's supplementary guidance to the Green Book on accounting for the effects of climate change.



- Consult with the insurance sector to gain a greater understanding of financial climate risks and actions that can be taken to mitigate these.

## Infrastructure

### 3. Introduce tougher climate resilience requirements on infrastructure providers

The government should:

- Make the adaptation reporting power (ARP) mandatory for all invited organisations, giving us a full picture of climate resilience across infrastructure sectors.<sup>235</sup>
- Extend 'invitations to report' to a wider set of organisations that have key societal responsibilities, such as NHS trusts and large social care providers.
- Amend the ARP to include a set of statutory outcome-based resilience standards. Infrastructure providers must develop plans to meet these or face financial penalties.<sup>236</sup>
- Introduce new obligations on infrastructure operators to undertake regular stress tests. The government should require operators to develop and implement plans to address vulnerabilities identified by such stress tests, including working across sectors to test the potential for cascading impacts.<sup>237</sup>

### 4. Develop and protect natural and hard infrastructure to reduce flooding

The government should:

- Continue to work with the British Standards Institution to produce a set of rigorous outcome-based standards for adaptation actions in nature-based services.
- Consider introducing a seller accreditation scheme that certifies providers of nature-based services in order to provide more certainty for buyers of these services.
- Provide further certainty on which adaptation actions are eligible for payment under ELMS.
- Introduce an outright ban on burning vegetation on peatlands and review how to better enforce regulations around protecting peatland.

- Develop an immediate strategy for investing in the development and maintenance of flood defences. This strategy must aim to meet the original targets set by the government of developing 2000 new flood defences and better protecting 336,000 homes, as well as developing a target to maintain flood defences that are currently in poor or very poor condition. The strategy should aim to fulfill these targets as soon as possible, however due to the underspend by the government in the first year of the programme, it is likely that a new timescale will need to be developed to avoid the risks that could occur from over-accelerating projects.<sup>238</sup>

## Health

### 5. Improve workers' rights in extreme heat

The government should:

- Introduce a specific maximum indoor working temperature law, including the ability to withdraw labour if workplace temperatures surpass 30°C (27°C if doing strenuous work). The measure should include appropriate exceptions, for example, foundries and kitchens.<sup>239</sup> This would bring the UK into line with other countries, such as Spain and Germany and reflects recommendations from the TUC.<sup>240</sup>
- Set out clear statutory responsibilities on employers if working temperatures reach 24°C.<sup>241</sup> These should include allowing a reasonable temporary relaxation of dress codes, as well as provision of water and more regular breaks. For outdoor workers, this should also include a responsibility to provide protective equipment from the heat and high factor sunscreen.<sup>242</sup>
- Work with unions to launch an awareness campaign of all new and existing rules, rights and regulations around working in extreme weather.

### 6. Make severe weather emergency protocol (SWEPE) activation a legal requirement on local authorities

The government should:

- Make it mandatory for local authorities to activate SWEP when an extreme weather alert such as an amber UKHSA heat health alert or a Met Office severe flood warning is issued.
- Work with local authorities to scope the cost of this requirement and provide the appropriate resources to ensure it can be effectively implemented. Given that there are currently record numbers of households living in temporary accommodation<sup>243</sup>, it is likely to be difficult for local authorities to fulfill these requirements immediately. Government should agree timescales with local authorities based on individual local circumstances.

Councils should:

- Provide temporary accommodation for rough sleepers in both day and night when the protocol is activated, for the duration of the severe weather alert, and a minimum of three days / nights.
7. Launch a targeted campaign to increase awareness of heat risk among vulnerable groups

The government should:

- Pilot a series of 'Keep Cool, Keep Well' leaflets, sent to households identified as being at high risk from extreme heat. These would draw upon the current NHS campaign of 'Keep Warm Keep Well' leaflets currently sent to vulnerable groups in winter using NHS data. These would: outline the risks of extreme heat and factors that increase personal vulnerability; provide guidance on how to adapt behaviour and your home to avert its impacts and show people what to do in an emergency.
- Replicating the 'Keep Warm, Keep Well' scheme, use NHS data to target the leaflets to demographic groups identified as having greater heat risk, such as older people, those with young children, and those on specific medications.
- Work with voluntary and community organisations to find alternate ways to direct this information to specific vulnerable groups by those who are trusted in their communities.
- Develop a set of posters warning of the risks of severe heat and how people can protect themselves. These should be ready to be launched at short notice across government online and social channels and electronic billboards if there is a severe heat health alert.

## Housing

### 8. Increase the resilience of new build homes through building regulations and planning legislation

The government should:

- Amend part O of the building regulations on overheating risk to be more rigorous by making the following changes. First, part O should use data on projected future overheating risk of a 2°C global climate change scenario, instead of current weather data. Second, it should also be amended to apply to all new buildings, including commercial buildings. Finally, it should include a ‘cooling hierarchy’ which sets out the order in which different cooling measures should preferably be implemented, based on the one currently included in the London Plan.<sup>244</sup>
- Work with experts in insurance and construction to define and grade property flood resilience clearly and robustly, and develop existing grading systems for flooding, heat resilience, and water efficiency to compile a comprehensive *climate resilience certification* for homes.
- Amend building regulations to decrease the household water consumption standard from 125 litres per day to 110 litres per day (currently the optional requirement in building regulations).<sup>245</sup>
- Pass legislation to give ‘special regard’ to adaptation and mitigation matters in local plan making and in the National Planning Policy Framework, to give them additional weight in planning decisions.

### 9. Require private landlords to minimise overheating and flood risk in their properties

The government should:

- Place a duty on landlords to prevent overheated homes, based on the existing requirements for landlords to prevent cold homes.<sup>246</sup> This duty should use the cooling hierarchy currently included in the London Plan, with active cooling used only in exceptional circumstances and where all passive measures have already been adopted.
- Introduce a requirement for rented properties to meet a specified grade of climate resilience in the proposed new grading system - similar to the requirement for rented properties to meet the EPC E standard for energy efficiency.

## 10. Retrofit homes for both climate mitigation and adaptation

The government should:

- Set out a retrofit strategy that covers adaptation as well as mitigation. The retrofit strategy should take a holistic approach that considers the implications of different combinations of mitigation and adaptation interventions at a household level to avoid interventions that may pursue one of these aims to the detriment of the other. The strategy should particularly encourage interventions that achieve both mitigation and adaptation aims simultaneously. For example, this would include home insulation and ventilation, solar panels, and reversible heat pumps – all of which can prevent overheating risk while also increasing energy efficiency or reducing reliance on fossil fuels (see section 5). It should ensure that all homes that are retrofitted for energy efficiency are simultaneously retrofitted for overheating risk, as defined by the CIBSE, and using the cooling hierarchy.<sup>247</sup>
- Prioritise social homes in the retrofit strategy, due to the increased vulnerability of their residents and their tendency to have lower climate resilience.
- Grant the power to all water companies to impose compulsory smart water metering, as recommended by the National Infrastructure Commission.<sup>248</sup> This would include requiring landlords to arrange for meters to be installed in their properties. Alongside this, add a requirement for water companies to provide a full range of water efficiency devices free of charge. Ensure water companies signpost the WaterSure scheme so those with large families or medical conditions do not lose out from switching to a meter and review the need for an expansion of this scheme.
- Promote the economic benefits associated with gaining climate resilience certification to make it more appealing for homeowners to retrofit their own homes with climate adaptation measures.

## Endnotes

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<sup>1</sup>Rannard, G, UK's 40C Heatwave 'Basically Impossible' Without Climate Change, BBC News, 29 July 2022

<sup>2</sup> UK Health Security Agency, Heat Mortality Monitoring Report: 2022, July 2023

<sup>3</sup> Gill, V, And Stephens, K, Warming Could Raise UK Flood Damage Bill By 20%, BBC News, March 2023

<sup>4</sup> ibid

<sup>5</sup> National Audit Office, Water Supply and Demand Management, 2020

<sup>6</sup> Water UK website, Winter Resources FAQs, accessed 08 December 2023

<sup>7</sup> Paul Watkiss Associates, Monetary Valuation of Risks and Opportunities in CCRA3, May 2021

<sup>8</sup> Climate adaptation policy is devolved, so our proposals primarily refer to England. However, where policy is reserved to the UK government for some if not all nations (eg employment law), we recommend our proposals apply to those nations.

<sup>9</sup> Allen, M, et al., Global Warming Of 1.5°C: Special Report: Summary for Policymakers, Intergovernmental Panel on Climate Change, 2018

<sup>10</sup> Press Office, Climate Change Shifting UK's High-Impact Weather, Accessed 12 July 2021

<sup>11</sup> Met Office Website, Effects of Climate Change, accessed 2 November 2023

---

<sup>12</sup> Rannard, G, UK's 40C Heatwave 'Basically Impossible' Without Climate Change, BBC News, 29 July 2022

<sup>13</sup> Met Office Website, Effects of Climate Change, accessed 2 November 2023

<sup>14</sup> Red Cross Website, What Are Floods and Why They're Happening in the UK, accessed 2 November 2023.

<sup>15</sup> Met Office Press Office, New Research Shows Increasing Frequency of Extreme Rain, March 2023

<sup>16</sup> Met Office Website, Climate Change in the UK, accessed 2 November 2023

<sup>17</sup> Met Office Website, UK And Global Extreme Events - Drought, accessed 2 November 2023

<sup>18</sup> Met Office Website, Climate Change in the UK, accessed 2 November 2023

<sup>19</sup> Allan, R, et al., Summary for Policymakers: Working Group I contribution to the Intergovernmental Panel on Climate Change Sixth Assessment Report, Intergovernmental Panel on Climate Change, 2021

<sup>20</sup> Climate Change Committee, Independent Assessment of UK Climate Risk, 2023

<sup>21</sup> United Nations Climate Change Website, Adaptation and Resilience, accessed 02 November 2023

<sup>22</sup> LSE Grantham Research Institute on Climate Change and the Environment Website, What is the Difference Between Climate Change Adaptation and Resilience?, September 2022

<sup>23</sup> Resilient Cities Network, What is Urban Resilience?, accessed 02 November 2023

---

<sup>24</sup> MIT Climate Portal Website, Urban Heat Islands, accessed 2 November 2023

<sup>25</sup> Climate Just Website, Adapting Buildings, accessed 2 November 2023; Benzie, M, Harvey, A, Burningham, K, Hodgson, N, Siddiqi, A, Vulnerability to Heatwaves and Drought: Adaptation to Climate Change, February 2011

<sup>26</sup> Unite Website, UK Heatwave: Unite Calls on Government to ‘Get a Move On’ With Clear Law on Working in Hot Temperatures, accessed 02 November 2023

<sup>27</sup> Environment Agency, Social Deprivation and the Likelihood of Flooding, 2022

<sup>28</sup> *ibid*

<sup>29</sup> Lindley, S, O’Neill, J, Kandeh, J, Lawson, N, Christian, R, O’Neill, M, Climate Change, Justice, and Vulnerability, Joseph Rowntree Foundation, November 2011

<sup>30</sup> British Red Cross, Every Time it Rains, 2022

<sup>31</sup> Energy And Climate Intelligence Unit, Climate, Fossil Fuels, And Food Prices, 2022

<sup>32</sup> Family Food 2019/20, Department for Food and Rural Affairs, January 2022

<sup>33</sup> Joseph Rowntree Foundation, Ethnic Minorities in the Inner City (Summary), 1998; Ogunbode, C, Kidwell, J, Heat Waves: Why Ethnic Minorities in the UK Are More Vulnerable, and What to Do About It, Phys Org, July 2022



---

<sup>34</sup> UK Government, Social Housing Lettings, August 2023; UK Government, Renting from a Private Landlord, February 2020

<sup>35</sup> Department for Environment Food and Rural Affairs, The Third National Adaptation Programme (NAP3) and the Fourth Strategy for Climate Adaptation Reporting, 2023

<sup>36</sup> Rising J et al. What Will Climate Change Cost The UK? A Study of Climate Risks, Impacts and Mitigation for the Net-Zero Transition, 2022

<sup>37</sup> Climate Change Committee, Independent Assessment of UK Climate Risk, 2021

<sup>38</sup> Climate Adapt Website, How to Factor in Uncertainty?, Accessed 28 November 2023

<sup>39</sup> CCC Website, Introduction to the CCRA, Accessed 2<sup>nd</sup> November 2023

<sup>40</sup> Department for Environment Food And Rural Affairs, the Third National Adaptation Programme (NAP3) and the Fourth Strategy For Climate Adaptation Reporting, 2023

<sup>41</sup> The CCC is the independent statutory body set up under the Climate Change Act to advise the government.

<sup>42</sup> Climate Change Committee, Progress in Adapting to Climate Change: 2023 Report to Parliament, Climate Change Committee, 2023

<sup>43</sup> Stallard, E, Climate Change Plan Will Leave UK Unprepared, Advisers Warn, BBC News, 17 July 2023

<sup>44</sup> Department for Environment Food and Rural Affairs, the Third National Adaptation Programme (NAP3) and the Fourth Strategy for Climate Adaptation Reporting, 2023

---

<sup>45</sup> Stallard, E, Climate Change Plan Will Leave UK Unprepared, Advisers Warn, BBC News, 17 July 2023

<sup>46</sup> Department for Environment Food and Rural Affairs, The Third National Adaptation Programme (NAP3) and the Fourth Strategy for Climate Adaptation Reporting, 2023

<sup>47</sup> Institution Of Civil Engineers, What the UK's New Climate Adaptation Plan Means For Infrastructure Resilience, July 2023

<sup>48</sup> *ibid*

<sup>49</sup> *ibid*

<sup>50</sup> Cabinet Office, The UK Government Resilience Framework, 2022;  
Dowden, O, Update on National Resilience, UK Parliament, December 2022

<sup>51</sup> National Preparedness Commission, The UK's New National Resilience Framework Establishes an Important Footing, But Does it Sidestep the Hard Questions?, 03 February 2023

<sup>52</sup> Climate Change Committee, Investment for A Well-Adapted UK, 2023

<sup>53</sup> Department for Environment Food and Rural Affairs, Accounting for the Effects of Climate Change: Supplementary Green Book Guidance, 2020

<sup>54</sup> Heubaum, H., C. Brandon, T. Tanner, S. Surminski, And V. Roezer. 2022, The Triple Dividend of Building Climate Resilience

<sup>55</sup> *ibid*

<sup>56</sup> Howard Boyd, E, Financing Climate Change Adaptation in the UK and Beyond, Grantham Research Institute on Climate Change and the Environment, March 2022

---

<sup>57</sup> Climate Change Committee, Investment for A Well-Adapted UK, 2023

<sup>58</sup> Ranger, N, Bremner, C, Brown, K, England, K, Fankhauser, S, Holmes, I, Howard Boyd, E, Misson Climate Ready - Unleashing Finance and Investment for A Prosperous Climate Ready Economy, Green Finance Institute, 2023

<sup>59</sup> Place-Based Climate Action Network Website, Adaptation Platform, Accessed 02 November 2023

<sup>60</sup> *ibid*

<sup>61</sup> Town And Country Planning Association (2022) - Rising to the Climate Change Challenge: The Role of Housing and Planning Within Local Councils; Watts, R, Statement on Local Government Funding Figures, Local Government Association, August 2018

<sup>62</sup> Rodwell, D, Williams, K, Corcoran, S And Nelmes, S, Joint Letter to Claire Coutinho MP on Local Climate Action, Local Government Association, October 2023

<sup>63</sup> Forsyth, S, Climate Resilience in Local Plans, Localis, 2023

<sup>64</sup> *ibid*

<sup>65</sup> Greater Manchester Combined Authority, Greater Manchester Resilience Strategy 2020 – 2030, 2020; Resilient Cities Network, Mayor Andy Burnham Announces a Collaboration to Enhance the Resilience of Communities in Greater Manchester, October 2023

<sup>66</sup> Office for National Statistics, Population Estimates - Local Authority Based by Single Year of Age, 2022

---

<sup>67</sup> Sandford, M, The Greater London Authority, House of Commons Library, 3 March 2022

<sup>68</sup> Paun, A And Hall, D, Mayor Of London And London Assembly, Institute For Government, 08 April 2021.

<sup>69</sup> Mayor Of London, London City Resilience Strategy, 2020

<sup>70</sup> London City Hall, Mayor Launches New Review Harnessing Technology to Help London Tackle Climate Threat, June 2023

<sup>71</sup> Talk London Website, Preparing London for Extreme Weather, Accessed 2 November 2023

<sup>72</sup> Cabinet Office, Local Resilience Forums: Contact Details, November 2023

<sup>73</sup> Pörtner, H et al., Summary for Policymakers: Working Group II contribution to the Intergovernmental Panel on Climate Change Sixth Assessment Report, Intergovernmental Panel on Climate Change, 2022

<sup>74</sup> RSPB, Summit to Sea to Enter a New Phase, accessed 02 November 2023

<sup>75</sup> Porter, B, Summit to Sea, Endangered Landscapes and Seascapes Programme, N.D.

<sup>76</sup> Topham, G, Why Do Britain's Roads Melt and Its Rails Buckle in Heat?, July 2022; Environmental Audit Committee, Heatwaves: adapting to climate change, 2018

<sup>77</sup> Environmental Audit Committee, Heatwaves: adapting to climate change, 2018

---

<sup>78</sup> Gates, S, Gogescu, F, Grollman, C, Cooper, E, Khambhaita, P, Transport and Inequality: An Evidence Review for the Department for Transport, Natcen, 2019

<sup>79</sup> Cuff, M, 40°C Heatwave Pushed UK Grid to the Brink of Blackouts with Electricity Demand Close to Outstripping Supply, I News, July 2024

<sup>80</sup> PA Media, Peak Of 2022 Heatwave Forced Fifth of UK Hospitals to Cancel Operations – Research, The Guardian, March 2023

<sup>81</sup> International Energy Agency, Climate Resilience, April 2021

<sup>82</sup> Climate Change Committee, Independent Assessment of UK Climate Risk, 2021

<sup>83</sup> *ibid*

<sup>84</sup> Black, R, Flood risk and the UK, Energy and Climate Intelligence Unit, February 2022

<sup>85</sup> International Energy Agency, Climate Resilience, April 2021

<sup>86</sup> Mcgrath, M, Climate Change: Drought Highlights Dangers for Electricity Supplies, BBC News, August 2022

<sup>87</sup> Climate Change Committee, Independent Assessment of UK Climate Risk, 2021

<sup>88</sup> Joint Committee on The National Security Strategy, Readiness for Storms Ahead? Critical National Infrastructure in an Age of Climate Change, UK Parliament, 2022

<sup>89</sup> Institute Of Civil Engineers, 5 Lessons Learned from Blue-Green Infrastructure Delivery, July 2021

---

<sup>90</sup> UN Environment Programme, Five Ecosystems Where Nature-Based Solutions Can Deliver Huge Benefits, November 2021

<sup>91</sup> Brown, K, Excessive Heat, Droughts And Floods – How Can ‘Blue-Green Infrastructure’ Help?, August 2018

<sup>92</sup> UK Centre For Ecology and Hydrology, Peatlands Factsheet, N.D.

<sup>93</sup> International Federation of Red Cross and Red Crescent Societies and Flood Resilience Alliance, From Grey to Green Infrastructure, 2022

<sup>94</sup> Joint Committee on the National Security Strategy, Readiness for Storms Ahead? Critical National Infrastructure in an Age of Climate Change, UK Parliament, 2022

<sup>95</sup> Climate Change Committee, Progress in Adapting to Climate Change: 2023 Report to Parliament, 2023

<sup>96</sup> Department for Environment Food and Rural Affairs, The Third National Adaptation Programme (NAP3) and the Fourth Strategy For Climate Adaptation Reporting, 2023

<sup>97</sup> Department for Environment Food and Rural Affairs, Climate Change Adaptation Reporting Power: Plans for the Fourth Round - Consultation Outcome: Summary of Responses and Government Response, July 2023

<sup>98</sup> National Infrastructure Commission, Anticipate, React, Recover, May 2020

<sup>99</sup> Department for Environment Food and Rural Affairs, The Third National Adaptation Programme (NAP3) and the Fourth Strategy for Climate Adaptation Reporting, 2023

---

<sup>100</sup> Department For Environment Food and Rural Affairs, Multi-Billion Pound Investment as Government Unveils New Long-Term Plan to Tackle Flooding, July 2020

<sup>101</sup> National Audit Office (NAO), Resilience to Flooding Press Release, November 2023; Davies, G, Resilience to Flooding, National Audit Office, 2023

<sup>102</sup> Sandler Clarke, J, Thousands of England's Flood Defences Were in Poor Condition Before Storms Hit, Unearthed, October 2023

<sup>103</sup> Seddon, S, Cooney, C, Storm Babet: Met Office Rain Warning Issued for Flood-Hit Parts of England, BBC News, October 2023

<sup>104</sup> Davies, G, Resilience to Flooding, National Audit Office, 2023

<sup>105</sup> Flood Re And ABI, Modelling the Impact of Spending on Defence Maintenance on Flood Losses, 2021

<sup>106</sup> Harvey, F, England Needs New Reservoirs or Food Supplies Will Be at Risk, Warns NFU Chief, The Guardian, February 2023

<sup>107</sup> National Infrastructure Commission, The Second National Infrastructure Assessment, October 2023

<sup>108</sup> National Infrastructure Commission, Preparing for a Drier Future: England's Water Infrastructure Needs, April 2018

<sup>109</sup> *ibid*

<sup>110</sup> *ibid*

- 
- <sup>111</sup> Department For Environment Food and Rural Affairs and Rural Payments Agency, *Environmental Land Management Schemes: Overview*, March 2021
- <sup>112</sup> Nature Friendly Farming Network website, *Is ELMS Fit for Purpose?*, accessed 08 November 2023
- <sup>113</sup> Climate Change Committee, *Progress in Adapting to Climate Change: 2023 Report to Parliament*, 2023
- <sup>114</sup> *ibid*
- <sup>115</sup> Harvey, F, And Horton, H, *Post-Brexit £1,000 Farming Payments ‘Too Little, Too Late’*, Says NFU, *The Guardian*, January 2023
- <sup>116</sup> Mcgavin, K, Williams, H, *The Role of UKIB in Natural Capital Markets*, UK Infrastructure Bank, November 2022
- <sup>117</sup> Green Finance Institute, *Financing a Farming Transition: Key Enablers and Recommendations*, March 2023
- <sup>118</sup> Green Finance Institute, *Financing a Farming Transition: Key Enablers and Recommendations*, March 2023
- <sup>119</sup> Department of Energy Security and Net Zero, *Mobilising Green Investment - 2023 Green Finance Strategy*, 2023
- <sup>120</sup> Department for Environment Food and Rural Affairs, *Nature Markets: A Framework for Scaling Up Private Investment in Nature Recovery and Sustainable Farming*, 2023
- <sup>121</sup> British Standards Institute, *A High-Integrity Standards Framework for UK Nature Markets*, 2023
- <sup>122</sup> Green Alliance and National Trust, *Natural Infrastructure Schemes Explained*, 2021



---

<sup>123</sup> *ibid*

<sup>124</sup> Berlin website, Urban Development Plan (Step) Climate 2.0, accessed 28 November 2023; C40 Cities Website, Heat Extremes, N.D.

<sup>125</sup> C40 Knowledge Community, Cities100: Paris is Using Blue and Green Infrastructure to Tackle City Heat, October 2019

<sup>126</sup> Anscombe, C, Leading the Way in Flood Resilience, University of Nottingham Blogs, March 2019

<sup>127</sup> Nature Based Solutions Initiative, Nature Based Solutions in UK Climate Adaptation Policy

<sup>128</sup> London City Hall Website, Cool Spaces, accessed 28 November 2023

<sup>129</sup> Mcgregor, A, Five Facts About Peatlands, RSPB, January 2020

<sup>130</sup> UCN UK Peatland Programme Website, Peatland Damage, accessed 28 November 2023

<sup>131</sup> Cockburn, H, Outrage as Peatlands on Grouse Estates Set on Fire Weeks Ahead of Crucial Climate Talks, The Independent, October 2021

<sup>132</sup> BBC News, Grouse Shooting Licence Move Sparks 'Dismay', November 2020; Rowlatt, J, Peat Soil Fires: Campaigners Say England's 'Rainforests' Illegally Burned, BBC News, May 2022; Committee on Climate Change, Land Use: Policies for a Net Zero UK, January 2020

<sup>133</sup> Berrang Ford, L, Moreira Sousa, A, Come Rain or Shine, Adverse Weather Matters for Our Health, UK Health Security Agency, June 2023

<sup>134</sup> UK Health Security Agency, Heat Mortality Monitoring Report: 2022, July 2023

---

<sup>135</sup> Berrang Ford, L, Moreira Sousa, A, Come Rain or Shine, Adverse Weather Matters for Our Health - UK Health Security Agency, June 2023

<sup>136</sup> TUC Website, Too Hot, Too Cold, accessed 06 November 2023

<sup>137</sup> Greater London Authority, Press Release Datasets: Climate Readiness, May 2023

<sup>138</sup> TUC Website, Too Hot, Too Cold, accessed 06 November 2023

<sup>139</sup> *ibid*

<sup>140</sup> *ibid*

<sup>141</sup> Marshall, J, It's Getting Hot in Here, Resolution Foundation, August 2023

<sup>142</sup> British Red Cross, Feeling the Heat, 2021

<sup>143</sup> Morgan Clark, UK Flood Statistics and Flooding Facts, July 2020

<sup>144</sup> Berrang Ford, L, Moreira Sousa, A, Come Rain or Shine, Adverse Weather Matters for Our Health - UK Health Security Agency, June 2023

<sup>145</sup> UK Health Security Agency, Flooding and Health: An Overview, October 2023

<sup>146</sup> Ofwat Website, Storm Overflows Explainer, accessed 28 November 2023

<sup>147</sup> BBC News, Why Is Sewage Released Into Rivers And The Sea?, October 2023

<sup>148</sup> Environment Agency, Social Deprivation and the Likelihood of Flooding, 2022

---

<sup>149</sup> UK Health Security Agency, *Flooding and Health: An Overview*, October 2023

<sup>150</sup> *ibid*

<sup>151</sup> Horton, H, *Drought Declared Across Eight Areas of England*, August 2022, *The Guardian*

<sup>152</sup> *Energy And Climate Intelligence Unit, Climate, Fossil Fuels, and Food Prices*, 2022

<sup>153</sup> As the majority of the UK's food is not produced domestically, this will include both UK and international climate impacts.

<sup>154</sup> *Department for Food and Rural Affairs, Family Food 2019/20*, January 2022

<sup>155</sup> UK Health Security Agency, *Adverse Weather and Health Plan, Protecting Health from Weather Related Harm*, 2023

<sup>156</sup> Howarth, C, Armstrong, A, Mcloughlin, N, Murtagh, E And Stuart-Watt, A, *The 2022 Heatwaves: England's Response and Future Preparedness for Heat Risk*, Grantham Research Institute on Climate Change and The Environment

<sup>157</sup> *British Red Cross, Every Time it Rains*, 2022

<sup>158</sup> *Met Office Press Office, The Importance of Evaluation for Early Warnings*, November 2022

<sup>159</sup> Gayle, D, *England's Automated Flood Alerts to Be Permanent Despite Inaccuracy Warnings*, *The Guardian*, April 2023

<sup>160</sup> *Minio-Paluello, M, We've Reached Boiling Point – Nobody Should Have To Work In Temperatures Above 30C*, *The Guardian*, July 2022

---

<sup>161</sup> Health And Safety Executive Website, Temperature in the Workplace, Accessed 02 November 2023

<sup>162</sup> *ibid*

<sup>163</sup> International Labour Organisation, Working on a Warmer Planet: The Impact of Heat Stress on Labour Productivity and Decent Work, 2019

<sup>164</sup> *ibid*

<sup>165</sup> TUC Website, Too Hot, Too Cold, accessed 06 November 2023

<sup>166</sup> Health And Safety Executive Website, Outdoor Workers and Sun Exposure, accessed 02 November 2023

<sup>167</sup> Museum Of Homelessness, Severe Weather Emergency, 2023

<sup>168</sup> Shelter website, Get a Place to Stay If You're Homeless and On The Streets, accessed 06 November 2023

<sup>169</sup> Homeless Link, Severe Weather Emergency Protocol FAQs, February 2020

<sup>170</sup> Museum Of Homelessness, Severe Weather Emergency, 2023

<sup>171</sup> *ibid*

<sup>172</sup> Snowdon, K, London Council Launches First Ever Heatwave Emergency Response to Help Homeless, Huffpost UK News, July 2018

<sup>173</sup> Sasse, H, Hodgkin, R, Tackling the UK's Energy Efficiency Problem, Institute for Government, September 2022

<sup>174</sup> Hilton, D, How to Prevent Overheating in Homes as Summers Get Hotter, Homebuilding and Renovating, August 2022

- 
- <sup>175</sup> Climate Change Committee, UK Housing: Fit for the Future?, 2019
- <sup>176</sup> Seabrook, V, Is Insulation Making Your House Hotter in Summer - and How Can You Cool it Down?, Sky News, July 2022
- <sup>177</sup> Marshall, J, It's Getting Hot in Here, Resolution Foundation, August 2023
- <sup>178</sup> Ogunbode, C, Kidwell, J, Heat Waves: Why Ethnic Minorities in The UK Are More Vulnerable, and What to Do About it, Phys Org, July 2022
- <sup>179</sup> EPC Resilience Website, Chicago Heatwave, Accessed 29 November 2023
- <sup>180</sup> Horsman, P, How to Minimise Flood Damage in Your Home, Direct Line, March 2020
- <sup>181</sup> Climate Change Committee, UK Housing: Fit for the Future?, 2019
- <sup>182</sup> Environment Agency, Social Deprivation and the Likelihood of Flooding, 2022
- <sup>183</sup> Oakley, M, Contents Covered: The Role and Importance of Home Contents Insurance for Low-Income Renters, WPI Economics and Aviva, 2019
- <sup>184</sup> UK Health Security Agency, Flooding and Health: An Overview, October 2023
- <sup>185</sup> Water UK Website, Winter Water Resources FAQs, accessed 29 November 2023
- <sup>186</sup> British Geological Survey, Maps Show the Real Threat of Climate-Related Subsidence to British Homes and Properties, May 2021

---

<sup>187</sup> Francis-Device, B, Poverty in the UK: Statistics, House of Commons Library, November 2023

<sup>188</sup> Mohdin, A and Aguilar Garcia, C, Black People in England and Wales Three Times as Likely to Live in Social Housing, The Guardian, March 2023

<sup>189</sup> Insulation and Energy Efficiency of Housing in England and Wales: 2022, May 2023; Marshall, J, It's Getting Hot in Here, Resolution Foundation, 2023

<sup>190</sup> Department For Levelling Up, Housing & Communities And Ministry Of Housing, Communities & Local Government, How to Rent a Safe Home, December 2020

<sup>191</sup> Marshall, J, It's Getting Hot in Here, Resolution Foundation, 2023

<sup>192</sup> London Climate Change Partnership, Your Social Housing in a Changing Climate, January 2013

<sup>193</sup> UK Green Building Council, Levelling Up and Regeneration Bill: Lords Report Stage Briefing, July 2023 (Unpublished)

<sup>194</sup> Legislation.gov.uk website, Levelling Up and Regeneration Act 2023, accessed 02 December 2023

<sup>195</sup> Department For Levelling Up, Housing and Communities, Overheating: Approved Document O, December 2021

<sup>196</sup> *ibid*

<sup>197</sup> London City Hall Website, Policy 5.9 Overheating and Cooling, accessed 28 November 2023

<sup>198</sup> RIBA Architecture, Government Announces Better Flood Protections for New Homes in England, September 2022

---

<sup>199</sup> Department For Environment, Food & Rural Affairs And Rebecca Pow MP, New Approach to Sustainable Drainage Set to Reduce Flood Risk and Clean Up Rivers, January 2023

<sup>200</sup> National Infrastructure Commission, The Second National Infrastructure Assessment, 2023

<sup>201</sup> Climate Change Committee, UK Housing: Fit for the Future?, 2019

<sup>202</sup> *ibid*

<sup>203</sup> Eustice, G, Reducing demand for water, UK Parliament, July 2021

<sup>204</sup> Department for Environment, Food, and Rural Affairs, Our Integrated Plan for Delivering Clean and Plentiful Water, 2023

<sup>205</sup> UK Green Building Council Website, Climate Change Mitigation, Accessed 29 November 2023

<sup>206</sup> Ambrose, J, UK Insulation Scheme Would Take 300 Years to Meet Government Targets, Say Critics, The Guardian, April 2023

<sup>207</sup> Huskisson, S, Families Could Save £500 On Energy Bills Under Plan to Insulate Millions of Homes, Mirror Online, April 2023

<sup>208</sup> Department For Energy Security and Net Zero, Great British Insulation Scheme, March 2023; Mission Climate, Labour Party, N.D.

<sup>209</sup> Climate Change Committee, UK Housing: Fit for the Future?, 2019

<sup>210</sup> Reuters Website, The Important Role of Heat Pumps in a Sustainable Future, N.D.

<sup>211</sup> UC San Diego, News Release - Solar Panels Keep Buildings Cool, July 2011

- 
- <sup>212</sup> Marshall, J, *It's Getting Hot in Here*, Resolution Foundation, 2023
- <sup>213</sup> Labour Party, *Mission Climate*, N.D.
- <sup>214</sup> Environment Agency, *Long-Term Investment Scenarios (LTIS) 2019*, July 2021
- <sup>215</sup> Flood Re Website, *Be Flood Smart Website*, accessed 02 November 2023
- <sup>216</sup> Climate Change Committee, *UK Housing: Fit for the Future?*, 2019
- <sup>217</sup> Tenants Have A Right To Ask For A Meter But Are Recommended (And If The Tenancy Agreement Is For Less Than 6 Months, Are Required) To Ask Permission From Their Landlord First.
- <sup>218</sup> They Can Also Install Compulsory Meters On Households If They Are The New Occupier Of A Property (Provided An Unmetered Bill Has Not Already Been Sent To That Occupier), Or They Have A Household Feature That Uses A Large Amount Of Water E.G. Power Showers Or Sprinklers.
- <sup>219</sup> Hutton, G, Priestley, S, *Water Meters: The Rights of Customers and Water Companies*, House of Commons Library, June 2019
- <sup>220</sup> National Infrastructure Commission, *Preparing for a Drier Future*, 2018
- <sup>221</sup> Waterwise, *Exploring Public Attitudes Towards Smart Water Metering*, 2021
- <sup>222</sup> *ibid*
- <sup>223</sup> National Infrastructure Commission, *Preparing for a Drier Future*, 2018
- <sup>224</sup> *Fairness On Tap, Making the Case for Metering*, 2011
- <sup>225</sup> Citizens Advice Website, *Watersure Scheme – Help with Paying Water Bills*, Accessed 29 November 2023
- <sup>226</sup> National Infrastructure Commission, *Progress Review 2023*, 2023
- <sup>227</sup> National Infrastructure Commission, *Preparing for a Drier Future*, 2018



---

<sup>228</sup> Flood Re Website, About Us, accessed 2 November 2023

<sup>229</sup> Jenkins, K, Surminski, S, Hall, J, Crick, F, Assessing Surface Water Flood Risk and Management Strategies Under Future Climate Change: An Agent-Based Model Approach, Grantham Research Institute on Climate Change and The Environment, February 2016

<sup>230</sup> *ibid*

<sup>231</sup> British Red Cross, Every Time it Rains, 2022

<sup>232</sup> *ibid*

<sup>233</sup> Rafferty, I, Flood Re Completes East Peckham Pilot to Score Properties' Flood Resilience, Insurance Times, March 2023

<sup>234</sup> British Red Cross, Every Time it Rains, 2022

<sup>235</sup> Climate Change Committee, Progress in Adapting to Climate Change: 2023 Report to Parliament, 2023

<sup>236</sup> National Infrastructure Commission, Anticipate, React, Recover, 2020

<sup>237</sup> *ibid*

<sup>238</sup> Davies, G, Resilience to Flooding, National Audit Office, 2023

<sup>239</sup> Trade Union Congress, Cool it! Reps Guide on Dealing with High Temperatures in The Workplace, July 2018

<sup>240</sup> Minio-Paluello, M, We've Reached Boiling Point – Nobody Should Have To Work In Temperatures Above 30C, The Guardian, July 2022; Trade Union Congress, Heat – The Case for A Maximum Temperature at Work, N.D.

---

<sup>241</sup> Excess deaths begin to occur at 24.5°C. Source: Howarth, C, Armstrong, A, Mcloughlin, N, Murtagh, E And Stuart-Watt, A, The 2022 Heatwaves: England's Response and Future Preparedness for Heat Risk, Grantham Research Institute on Climate Change and The Environment

<sup>242</sup> Trade Union Congress, Heatwave: Avoid Outdoor Work During Hottest Hours of Day, and Employers Must Provide Protection, Says TUC, July 2022

<sup>243</sup> Crisis, Households Trapped in Temporary Accommodation Reaches Record High - Crisis Response, November 2023

<sup>244</sup> London City Hall Website, Policy 5.9 Overheating and Cooling, Accessed 28 November 2023

<sup>245</sup> HM Government, Building Regulations 2010: Sanitation, Hot Water Safety and Water Efficiency, 2010

<sup>246</sup> Using the overheating definition set out in the CIPSE's TM59

<sup>247</sup> Ibid

<sup>248</sup> National Infrastructure Commission, Preparing for a Drier Future: England's Water Infrastructure Needs, April 2018