Chapter 8: Adapting to climate change

AIM

London and Londoners will be resilient to severe weather and longer-term climate change impacts. This will include flooding, heat risk and drought.

INTRODUCTION

As a growing city, London faces increasing pressure on housing, infrastructure, services, environment, and Londoners' wellbeing and prosperity. Climate change will increase these existing pressures. It will make flooding more frequent and severe, threaten water resources, and increase the risk of overheating for buildings and infrastructure.

Global average temperatures have risen by over 1°C since 1850. If the world continues emitting greenhouse gases (GHGs) at today's levels, then average global temperatures could rise by up to five degrees Celsius by the end of this century and average temperatures in London are already getting higher. The total amount of rainfall over a typical year is likely to remain broadly similar to current levels. However, there are likely to be seasonal changes, with summers generally becoming drier and winters wetter (though there will be more variability in weather patterns). The rainfall that does occur is likely to be in more intense storms. This will increase the risk of flooding, especially surface water flooding. London is likely to be at higher risk of drought as there will be less water to be captured in the summer and the groundwater will not be replenished during winter, and possibly more demand for water during hotter periods.

Climate change will disproportionately affect those least able to respond and recover from it. Poorer Londoners will find it more difficult to recover from flooding, may be less able to afford air conditioning to keep cool in hotter summers, and will suffer more from the effects of the urban heat island effect which results in urban areas being warmer than surrounding rural areas.

The challenge is how to manage these complex, and often interactive, pressures to ensure London and Londoners can adapt to climate change and stay resilient to any severe weather events that do occur.

Adaptation requires managing risks for the longer term, but to focus solely on risk management would be to overlook the many additional benefits of adaptation. For example, adaptation provides an opportunity to consider climate change alongside wider social, demographic, economic, environmental, and political priorities. This will help create a fairer, more prosperous, healthier, and more resilient city.

BOX 31: CLIMATE ADAPTATION AND RESILIENCE DEFINITIONS[100]

Adaptation is the process (or outcome of a process) that leads to a reduction in harm or risk of harm, or realisation of benefits associated with climate variability and climate change.

Resilience is the ability of a system to recover from the effect of an extreme load that may have caused harm.

Adaptation policies can lead to greater resilience of communities and ecosystems to climate change.

[100] UK CIP (2003), Climate adaptation: Risk, uncertainty and decision-making. Accessed from: http://www.ukcip.org.uk/wp-content/PDFs/UKCIP-Risk-framework.pdf.
OECD (2006), Adaptation to Climate Change: Key Terms. Accessed from: http://www.oecd.org/env/cc/36736773.pdf.

In order for London to adapt to climate change and be resilient to severe weather events the following actions are required:

- London's infrastructure providers and businesses must understand and manage climate change risks and impacts to deliver resilient growth and services
- the risk of flooding must be reduced through appropriate flood defences and increased awareness
- London's water supply must be efficient, secure, resilient and affordable
- people, infrastructure and public services must be better prepared for extreme heat events and increased temperatures

LONDON'S ENVIRONMENT NOW

The key evidence to support the Mayor's ambitions for London to adapt to climate change is summarised below. You can find out more about the evidence behind the policies and proposals in Appendix 2.

The Climate Change Act 2008 sets the statutory framework for addressing climate change risks in the UK, and the GLA Act 1999 (as amended) requires the Mayor to consider the impact of climate change and potential mitigation proposals for adaptation for Greater London. For more details on the legislative and policy background see Appendix 4, and for information on the main responsibilities of various organisations see Appendix 3.

There have been two main assessments of climate change risks that are relevant for London. One from the London Resilience Partnership and another from the Adaptation Sub-Committee of the Committee on Climate Change.

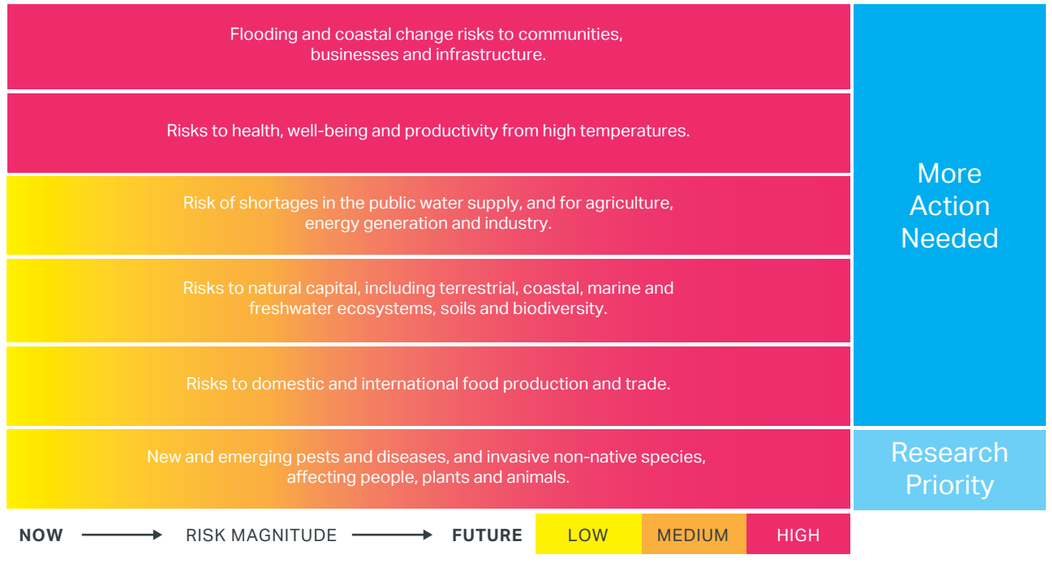
The London Resilience Partnership brings together more than 170 organisations (including fire, police, local authorities, utilities, transport) that have specific responsibilities for preparing for, and responding to, emergencies. It has published a register of the main risks that London faces, including from climate change.[101]

The Adaptation Sub-Committee published the UK's second Climate Change Risk Assessment evidence report in July 2016.[102] This recognised the major risks for the UK as a result of heat, flooding, and water scarcity. These were grouped into six categories where the climate risks pose a threat to human and ecological systems (Figure 43).

The Adaptation Sub-Committee's description of the major risks from climate change is helpful in making the risks specific in terms of their practical impacts and implications.

This assessment can be a useful starting point indicating how London can work with a range of sectors to reduce the risks from climate change. However, whilst the national risks broadly align with London's priority risks, there will be local variation. As such, they need to be understood in the context of the different characteristics, needs, and priorities across the city.

Figure 43: Top six areas of inter-related climate change risks for the United Kingdom. Source: Adaptation Sub-Committee



Source: Committee on Climate Change Adaptation Sub-Committee (2016), UK Climate Change Risk Assessment 2017 Synthesis report:priorities for the next five years.

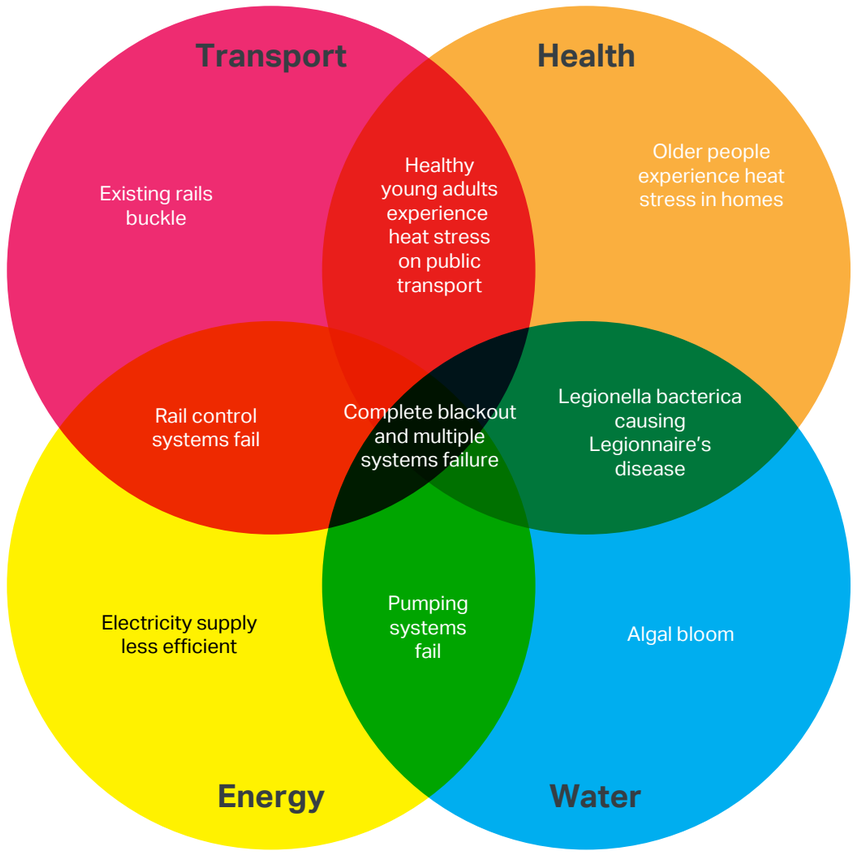
[101] London Resilience Partnership (2017) London Risk Register. Available from: https://www.london.gov.uk/about-us/organisations-we-work/london-prepared/identifying-risks-london
[102] Adaptation Sub-Committee of the Committee on Climate Change (2016) UK Climate Change Risk Assessment 2017. Available from: https://www.theccc.org.uk/tackling-climate-change/preparing-for-climate-change/uk-climate-change-risk-assessment-2017/synthesis-report/

Interconnected risks and responses

Hundreds of thousands of people across England and Wales were affected by flooding in June and July 2007. It was the most serious inland flood since 1947. Around 48,000 households and 7,300 businesses were impacted. The floods also affected infrastructure, including water and food supply, power, telecommunications, and transport, as well as agriculture and tourism. The Environment Agency estimated the overall costs of the flooding at £3.2bn.[103]

Cities are complex and interdependent systems. Adapting to climate change will depend on recognising the possible knock-on effects caused by disruption due to climate related impacts. These must be considered in combination with other pressures and challenges, including population growth, development, and non-climate related risks. Figure 44 shows an example of this using a severe heat incident.

Figure 44: Venn diagram of heat-risk-related interdependencies between four urban systems



Source: London Climate Change Partnership & Environment Agency (2012), Heat Thresholds Project.

[101] Environment Agency (2010), Delivering benefits through evidence: The costs of the summer 2007 floods in England. Accessed from: www.gov.uk/government/uploads/system/uploads/attachment_data/file/291190/scho1109brja-e-e.pdf

Flood risk

The Thames Barrier, tidal walls and embankments provide London with a high level of protection against tidal flooding. Yet, standards of protection in the western Thames and its tributaries are lower.

Almost a fifth of London is in the Thames floodplain. Most of this area is very well defended by traditional hard-engineered flood defences. However, the upstream part of the Thames and many of the tributaries to the Thames have lower standards of protection. Traditional flood defences can only protect London from predictable fluvial and tidal flood risk.

Currently 37,359 existing homes are at high or medium risk of tidal or fluvial flooding in London and 1.25 million people are living and working in areas of tidal and fluvial flood risk. Left unmitigated, the tidal flood risk to London is increasing as sea levels rise. Between 2000 and 2100, a 0.9 metre rise in mean tide levels is projected. For London to stay protected from tidal flood risk, the defences must be upgraded and effectively maintained.

The city is also vulnerable to less predictable surface water and sewer flooding from heavy rainfall events. This is due to increasing areas of impermeable surfacing (such as roads, roofs and pavements). London also has to cope with a Victorian drainage system that wasn't designed to cope with the demands of the current and future population (Figure 45).

Figure 45: Number of properties at risk of surface water flooding in London

Residential Properties	Commercial Properties
High (1 in 30 year event) **68,499**	High (1 in 30 year event) **12,148**
Medium (1 in 100 year event)) **164,546**	Medium (1 in 100 year event)) **25,623**

Source: GLA modelling based on: The GeoInformation Group (2016), UKMap; and Environment Agency (2017), Risk of Flooding from Surface Water.

Years of pollution from road run-off and water treatment work, sewer infrastructure problems, and poorly managed river maintenance and modification work have left London's rivers in a poor state. The EU Water Framework Directive aims for 'good' status for all rivers (and other water bodies). This is measured through a range of chemical, biological and physical indicators. Of the 47 river water bodies in London, five are 'bad', nine are 'poor' and the rest are 'moderate', with the exception of two which are 'good'. The main reasons for the failure of London's rivers to meet EU Water Framework Directive standards are:

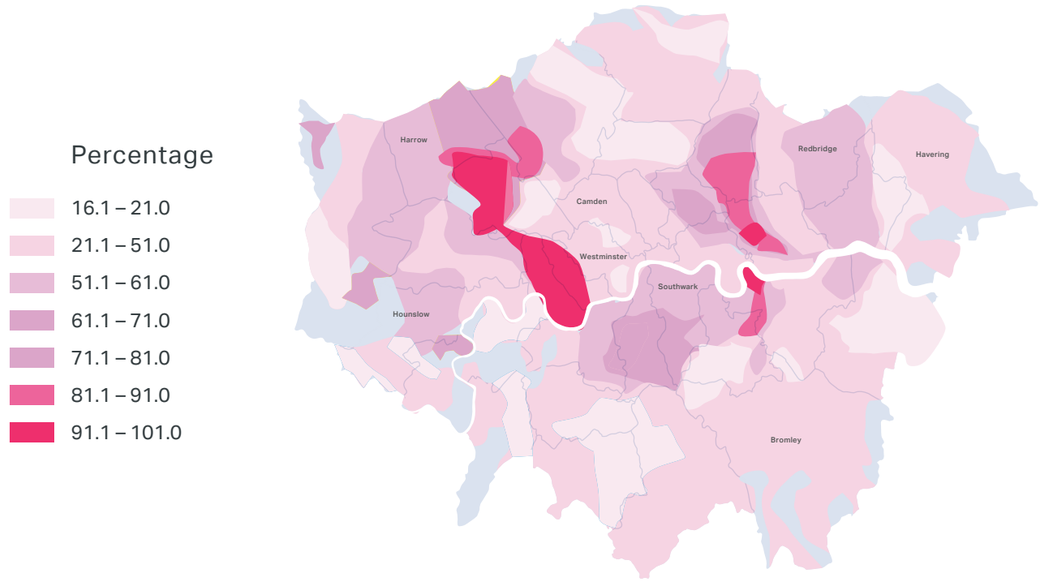
- diffuse pollution from road run-off (this reaches rivers through heavy rainfall causing flooding)
- foul water misconnections to the surface water drainage system
- pollution from treatment works

The modification of many of London's rivers by culverting, canalisation, and so on, also contributes to the failure of rivers (and other water bodies) to achieve 'good' status.

Parts of London's combined sewer system have limited capacity. Many of London's tributary rivers suffer from heavily polluted urban run-off and artificial flow patterns, further worsening river ecology and water quality. This limits their biodiversity and amenity value. Sustainable drainage systems can help reduce all of these issues.

Figure 46 shows the available capacity in London's drainage and sewerage network. The red areas highlight there is very limited capacity available which will lead to increased risk of surface water and sewer flooding. This map reflects the predicted capacity on the network in 2050 but does not include projected growth in London.

Figure 46: Capacity of the drainage network – Thames Water



Source: Thames Water (2017), Flow Capacity Utilisation 2050.

London has been fortunate to have a comprehensive and well-engineered sewerage system since the later 1800s. Due to increased pressure on this system as a result of population growth, the £4bn Thames Tideway Tunnel is being developed to reduce sewer overflows into the river. There are also proposals to build a smaller scale, but still sizeable, sewer tunnel in the Counters Creek catchment in inner west London. This would prevent sewer flooding to a large number of properties. This scale of sewerage intervention is becoming increasingly complex, expensive and disruptive. In the long-term, the widespread use of sustainable drainage will reduce pressures by making incremental reductions in surface water flows to the drainage network.

Once complete, the Thames Tideway Tunnel will improve the water quality of the Thames. However, it won't improve the water quality of London's tributary rivers. Drainage in outer London is made up of mostly separate sewer and surface water drainage systems. The main causes of poor water quality in London's tributaries are due to polluted surface water run-off reaching rivers via surface water drains and plumbing misconnections.

Drought

London's growing population and business base is demanding more water. London is within the driest part of the country and is potentially at risk of drought if reservoirs and groundwater aquifers are not re-filled by regular rainfall. The cost of a severe drought[104] to London's economy is estimated by Thames Water to be £330m per day, and would have severe economic, social and environmental consequences. This figure may be even higher when all cumulative and knock on impacts of a severe drought are considered.

London's water supply comes from a combination of groundwater and surface water sources. Water companies extract water from rivers and groundwater and store it in reservoirs or artificially recharge the groundwater aquifer during times of surplus. They are able to move water around the network as required which means that London has a relatively adaptable and resilient water supply.

[104] A severe drought would lead to widespread residential and non-residential water restrictions, water supply source failures, emergency drought measures, widespread incidents covering various sectors. Ref: Environment Agency London Area Drought Plan (2016)

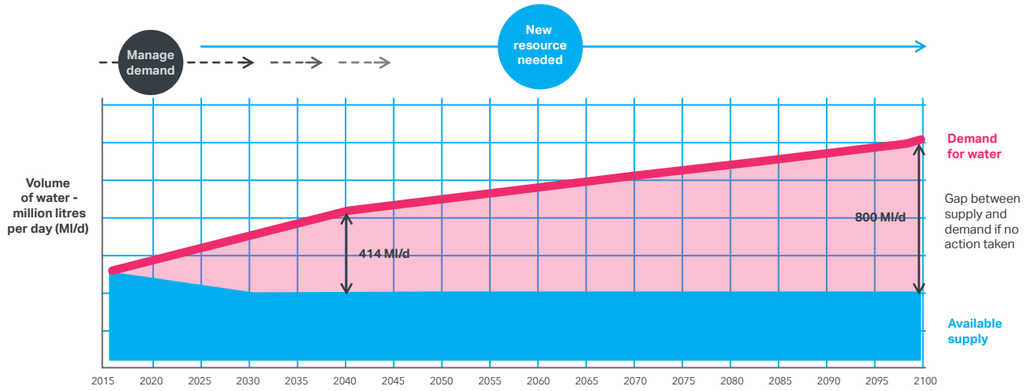
However, regardless of the flexibility of the infrastructure in place, below average rainfall, particularly over the winter, puts pressure on London's water resources. London is at risk of drought following two dry winters. Winter is the season where the majority of groundwater recharge occurs, and the aquifers that supply London are replenished. Many people remember the drought of 1976. However London was very close to a drought as recently as 2012 in the lead up to the Olympics, before London experienced one of the wettest summers on record.

When faced with the prospect of water shortages, water companies work closely with the regulator, the Environment Agency. A phased approach starts with information provision, awareness raising and voluntary measures to restrict water usage. It then escalates to compulsory measures if resource pressures worsen.

Average water consumption in London is 156 litres per person per day – which is just over ten per cent higher than the national average of 139 litres per person per day.[105] London's water distribution network is ageing and this can cause problems in addressing leakage as the network is difficult and expensive to upgrade. Over recent years, considerable effort and investment has been made to reduce leakage rates and increase water efficiency. There has been some success, with reduced leakage rates across London between 2000 and 2015, and just over seven per cent reduction in per capita consumption over the same period. These programmes must continue and be stepped up, as the average leakage rate in London is still 21 per cent of all supplies.

With the continuing trend of growth expected to continue for the foreseeable future, new water resources are needed. Even with projected water efficiency gains, London is forecast to have a water resource 'gap' of over 100m litres per day by 2020, rising to a deficit of over 400m litres per day by 2040. This means that there won't be enough water to meet London's needs (Figure 47).

Figure 47: Water deficit projections, Thames Water



Draft baseline forecast resource deficit in London water resource zone (April 2017) – Thames Water

[105] Defra (2017), The government's strategic priorities and objectives for Ofwat, Draft for consultation. Accessed from: https://consult.defra.gov.uk/water/consultation-on-a-new-sps/

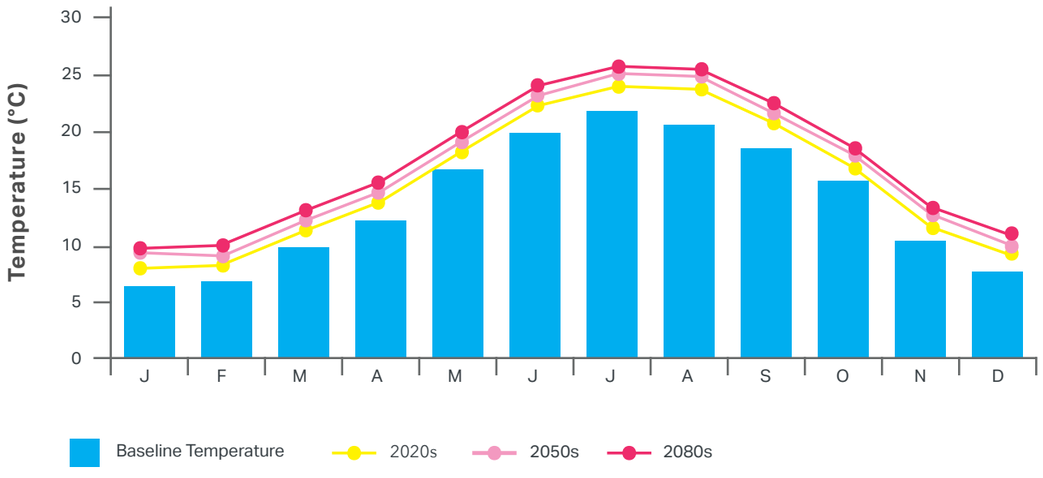
London is already extracting a large percentage of the available water from its surrounding rivers and groundwater. This leads to environmental impacts such as low river flows which damage ecology and water quality problems from lack of dilution. Water companies are working to improve demand management by reducing leakage, increasing water efficiency and increasing the use of water meters, including smart water meters.

Water companies are also looking at new water resource options and water supply infrastructure for London. Four options proposed by Thames Water include a new reservoir outside London, a water transfer pipeline from the west of England, effluent re-use (treating wastewater to a potable standard so it can be re-used as drinking water), or additional desalination plants to make saline river water safe to use.

Heat risk

Projected increases (Figure 48) in average monthly temperatures in London until 2050 show a 5-6°C increase in summer and winter averages. This will have an impact on health, infrastructure, comfort and the operation of the city.

Figure 48: Average monthly temperatures (°C) in London over the century, under a medium emissions scenario, compared to baseline period [UCP09]



Source: Generated from UK Climate Projections 2009 data

Even a small rise will disrupt services and affect people living in London. As the temperature increases, the heat thresholds described below are likely to be breached more often:[106]

- 24°C – London Underground puts in place overheating plans including public health communications and measures to prevent tracks from buckling
- 24.7°C – over two days leads to greater incidences of morbidity, mortality and hospital admissions in London
- 33°C – softening of tarmac, asphalt and bitumen road surface generally begins to occur
- 36°C – power sources begin overheating, extreme precautions may need to be introduced to prevent rail lines buckling, such as speed restrictions,

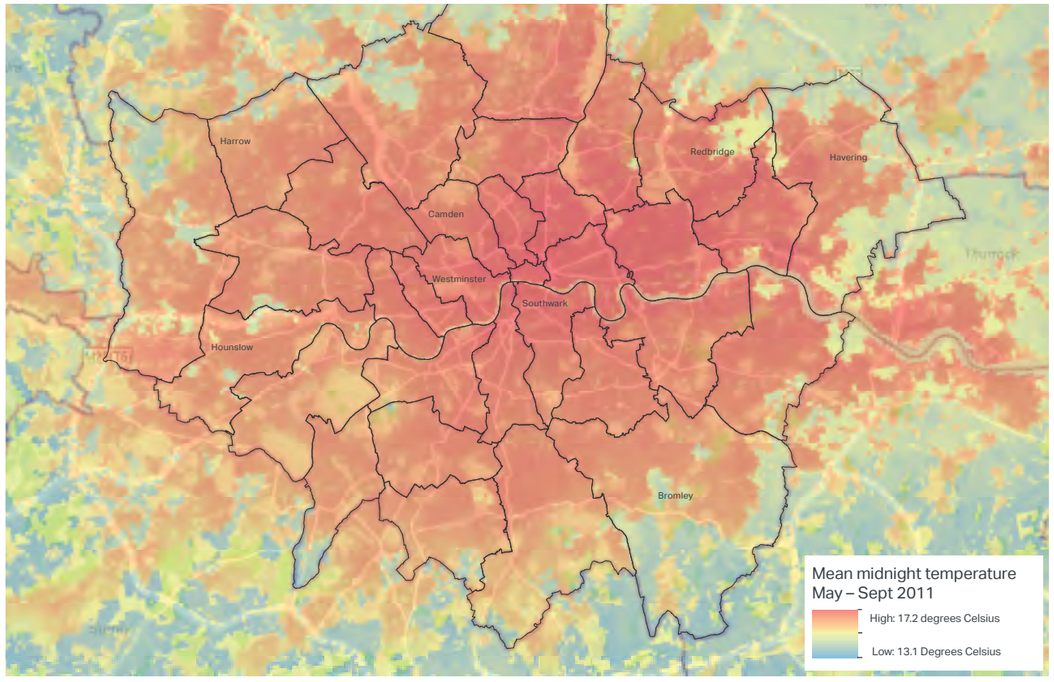
Impacts will not be equal or fair, and are likely to increase existing inequalities especially for at risk groups including older people and very young children. Others at risk include isolated people, rough sleepers and seriously ill people. Those who are more exposed, less able to regulate their body temperatures, or less able to move to cooler places are also at risk. Socially isolated people with physical or mental limitations are also less likely to have a support network available for help during a heat episode.

The urban heat island (UHI) effect means that the centre of London can be up to 10°C warmer than the rural areas around the city. The temperature difference is usually larger at night than during the day. This is because the height of buildings and their arrangement means that while more heat is absorbed during the day, it takes longer to escape at night. Urban heat risk is greater for those living in high-rise buildings with little access to green space, which is often cooler than its surroundings. Increased development and urbanisation intensify the UHI effect.

Figure 49 shows the UHI in London. It models the difference in night-time temperature across the city with 'hot spots' in more densely developed inner London compared with outer London.

[106] http://climatelondon.org.uk/wp-content/uploads/2013/01/LCCP_HeatThresholds_final-report-PUBLIC.pdf

Figure 49: Mean midnight temperature (°C), May-September 2011



Source: VITO (2016), London's Urban Heat Island - Average Summer.

Roles and legal duties

The Mayor has a legal duty to set out policies and proposals in this strategy for adapting to climate change and a duty to take action on climate change. Part of this involves ensuring that climate change adaptation policies are included in the other relevant Mayoral strategies, such as the London Plan and the draft Mayor's Transport Strategy.

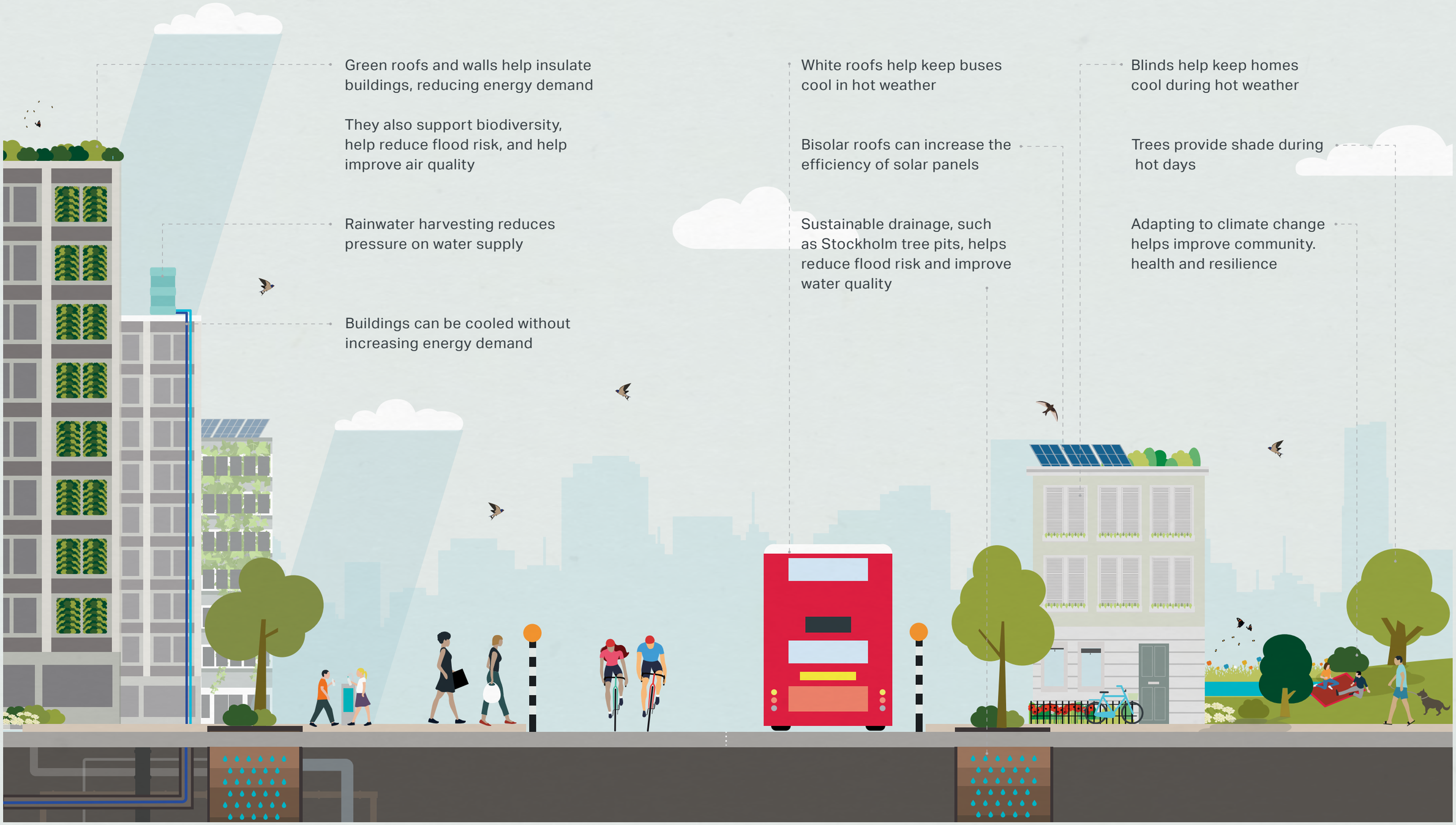
The GLA is not a flood risk management authority. However, the Mayor produces a Regional Flood Risk Appraisal that sets out the general nature of flood risk across London and how it affects existing and proposed development. The Mayor also includes climate change adaptation policies in the London Plan.

The Mayor has no statutory responsibilities in relation to water resources and their associated supply and distribution infrastructure. However, the Mayor can influence water use and supply, to some extent, through the London Plan. It is also essential that the GLA maintains an oversight of strategic water resource planning and demand management measures to ensure a resilient and affordable supply for Londoners.

There is no single authority responsible for managing heat risk in London.

The other organisations that have a role to play in increasing London's adaptation and resilience to climate change are described in Appendix 3.

ADAPTING TO CLIMATE CHANGE



Objectives, policies and proposals

OBJECTIVE 8.1 UNDERSTAND AND MANAGE THE RISKS AND IMPACTS OF SEVERE WEATHER AND FUTURE CLIMATE CHANGE IN LONDON ON CRITICAL INFRASTRUCTURE, PUBLIC SERVICES, BUILDINGS AND PEOPLE

It is vital that sectors including transport, digital, energy, water and buildings are able to adapt to the impacts of climate change to ensure that services can continue to be delivered even through periods of severe weather.

There is not a complete understanding of what will happen if risks from climate change are not addressed as social and environmental impacts are difficult to quantify. However, the insurance and financial sectors have tried to measure the potential economic losses if greenhouse gas emissions are not reduced. A Nature Climate Change study by the London School of Economics[107] found that climate change could reduce the value of world's financial assets by £2.5 trillion, and possibly up to ten times that figure in a worst-case scenario. The losses would be caused by the direct destruction of assets by increasingly extreme weather events, and a loss of earnings for those affected by high temperatures, drought and other climate change impacts. In a World Economic Forum survey in 2016,[108] some 750 experts found that a catastrophe due to climate change would be the biggest potential threat to the global economy. They believed it to be more of a risk than weapons of mass destruction, water crises, mass involuntary migration and a severe energy price shock. The report concluded the connections between climate change and other risks, like involuntary migration, are getting stronger.

In order to monitor London's ability to adapt to climate change and remain resilient during severe weather events it is necessary to establish a baseline and then monitor and measure the progress being made. In order to understand how climate change may affect the critical functions of the city. The Mayor wants to work with different sectors in London to do this rather than solely focussing on individual risks. This work will include developing indicators, identifying thresholds that indicate severe disruption as a result of climate change for example during heatwaves in London and developing plans for how to deal with it if and when they do occur.

Policy 8.1.1 Priority sectors understand the impacts of severe weather and climate change, prioritise the key risks, and identify mitigation measures where appropriate

Proposal 8.1.1a The Mayor will work with the main infrastructure providers in transport, energy, water, and buildings to identify thresholds for disruption and produce integrated plans for addressing long-term climate risks

Thresholds are points at which, given certain conditions, disruption to services, infrastructure, or people's wellbeing occurs. For example, vulnerability of buildings to power failures increases when external temperatures reach 30ºC. External air temperatures of 36ºC result in rail track temperatures of 48ºC to 52ºC. At such times, Network Rail puts in place extreme precautions like speed restrictions to prevent the buckling of rails.

Identifying thresholds is crucial for planning to prevent disruption. Climate projections can be used to understand how the risk of disruption is expected to change into the future with climate change.

The Mayor, through the London Climate Change Partnership (LCCP), will convene sectoral partners and relevant experts from the research community to share knowledge, identify thresholds, and collaborate around resilience planning.

Progress will be assessed through monitoring indicators and qualitative review of plans across sectors developed as part of this activity.

Proposal 8.1.1b The Mayor will promote ways to continually improve resilience in infrastructure among priority sectors to ensure that London remains a leading global city

The Mayor, through the LCCP, will work with critical sectors to identify adaptive pathways for managing severe weather and longer term climate change risks. As these sectors will be developing large-scale infrastructure that will have long lifespans, they can benefit from adaptive pathways, which allow for flexibility in decision-making so that we don't cut off options for the future. The approach helps us time decisions in order to accommodate changing information in an uncertain future.

[107] Dietz, S., Bowen, A., Dixon, C., Gradwell, P. (2016) 'Climate value at risk' of global financial assets. Nature: climate change [online]. Accessed from: www.nature.com/nclimate/journal/v6/n7/full/nclimate2972.html
[108] World Economic Forum (2106), World Economic Forum Global Risks Report 2016, 11th Edition. Accessed from: www3.weforum.org/docs/GRR/WEF_GRR16.pdf

Adaptive pathways are already used to manage London's tidal flood risk. They can help to manage the uncertainly of climate change. Adaptive pathways set out thresholds and decision points so mitigation measures can be adjusted in response to new information - including climate change forecasts.

While adaptation should be incorporated into existing sector plans, varying levels of capacity within sectors make it harder to identify actions that need to be taken across sectors in a systematic way. London Resilience's Anytown approach helps identify interdependencies and potential cascading failures from disruption to infrastructure. The Mayor will use interdependency mapping to highlight potential risks of cascading failures and identify opportunities for infrastructure sectors to work together to improve resilience.

Policy 8.1.2 Develop, refine and monitor plans and indicators of London's resilience to severe weather and longer term climate change impacts on flooding, heat risk and water pollution

Proposal 8.1.2a Through the London Climate Change Partnership, the Mayor will agree indicators with priority sector representatives and establish a baseline for regular monitoring

There is currently no systematic collection of data to illustrate how well the city is adapting to the impacts of severe weather and longer-term climate change.

Such data collection, largely drawn from existing data sets, would help London adapt to climate change and become more resilient. It would capture evidence of good and poor performance, identify adaptation priorities and highlight knowledge gaps. Where possible, this would include assessing financial costs of severe weather to support the business case for adaptation.

Indicators will be developed in collaboration with partners and stakeholders from priority sectors that have key roles to play in London adapting to climate change. These include transport, digital, energy, water and buildings. The indicators will be collected, maintained, and monitored on a regular basis and will largely be drawn from existing sources of data and will cover climate change, social vulnerability, environmental and financial impacts.

OBJECTIVE 8.2 REDUCE RISKS AND IMPACTS OF FLOODING IN LONDON ON PEOPLE AND PROPERTY AND IMPROVE WATER QUALITY IN LONDON'S RIVERS AND WATERWAYS

London is vulnerable to flooding from five sources: tidal, river, surface, sewer and groundwater.

Over centuries, London has grown on the banks of the Thames, encroaching on the natural floodplain. As the city has become more built up the river walls have been raised incrementally. Part of London (approximately 15 per cent) sits in the natural tidal floodplain on land that would flood on virtually every high tide, were it not for the Thames' flood defences. The current flood risk to London is highest when a peak spring tide coincides with a North Sea tidal surge. This is caused by a specific set of meteorological conditions, including low pressure over the North Sea and a northerly wind resulting in raised sea levels. The highest water levels occur when the peak of the tide coincides with peak surge.

London had major flooding from an east coast tidal surge in 1928. It narrowly escaped a major flood in 1953, when serious flooding struck the outer estuary in Kent and Essex. This latter event provided the push for building the present day Thames Tidal Defences. The Thames Barrier is the iconic centrepiece of this system of river walls, embankments and gates and barriers that stretch out into Kent and Essex. This system gives London one of the highest levels of tidal flood protection in the world, currently modelled to provide more than one in 1,000 year protection. The flood defences protect many thousands of homes, critical infrastructure, including many tube and rail stations, and property worth over £200bn.

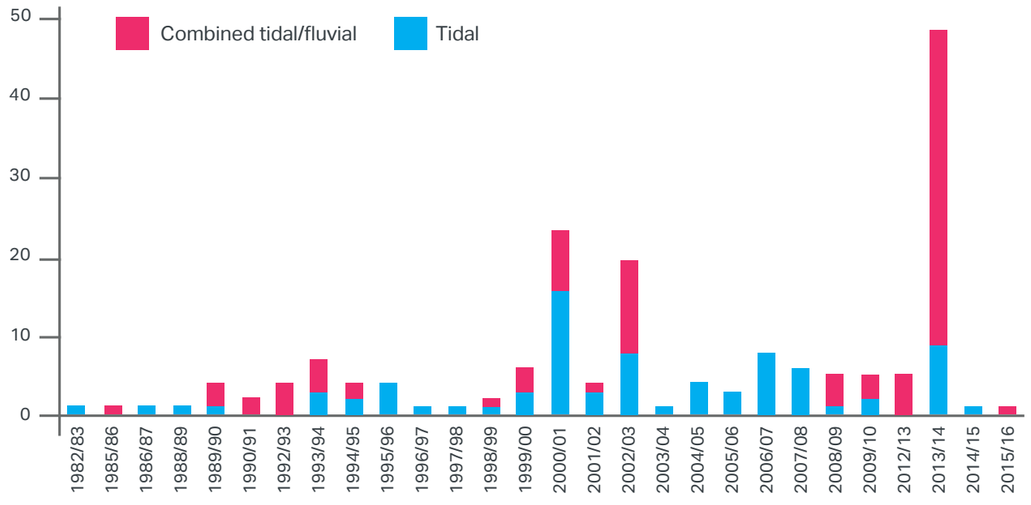
At present the Thames Barrier also protects west London from fluvial

"Flood defences protect many thousands of homes, critical infrastructure, including many tube and rail stations, and property worth over £200bn."

flooding during high flows by holding the tide back and preventing the river backing up. There were a large number of barrier closures in 2013-2014 (Figure 50). Many of these were to prevent fluvial flooding. Each barrier closure reduces its lifespan through wear and tear. Rising sea levels mean the barrier is used more and more for tidal flood protection. That means it may become unfeasible to continue to close it for fluvial flooding. This protects relatively small parts of London but comes at the expense of much larger areas of London at risk of tidal flooding. Therefore, flood management schemes must be planned and put in place to protect outer west London to reduce the reliance on the Thames Barrier for managing non-tidal flood events.

The Environment Agency owns and operates the Thames Barrier. It also inspects and maintains the other river structures. Most defences are in good condition, thanks to investment and liaison with landowners to improve any defences in poor condition.

Figure 50: Thames barrier closures by flood season



Source: Environment Agency (2016), Thames Barrier Flood Defence Closures by Flood Season.

There are already many Londoners and businesses and properties in flood risk areas. These areas tend to include a higher proportion of people on low incomes. For these households, a flood can often be even harder to cope with and recover from. This is because poorer people and small businesses may lack appropriate insurance cover or the funds to properly repair the premises. They may also lack a wider support network to help them cope and recover from flooding. In many cases the physical and mental health impacts of being flooded can last for many years. It is not uncommon for flood victims to report being anxious every time it rains. Londoners' awareness about flooding varies widely. Information should be given based on accurate data. Where possible, timely warnings can be an important part of managing flood risk.

Flood risk management authorities should further improve how they work together to make sure that flood risk is managed sustainably. They must reduce the number of potential impacts on properties at high risk. At the same time, they must also acknowledge the impact on properties in areas at low risk, such as those protected by the Thames tidal defences, as London grows.

Policy 8.2.1 Reduce the risk and manage the impacts of surface water, sewer, fluvial, reservoir and groundwater flooding in London

Proposal 8.2.1a The Mayor will work with partners to increase awareness of all forms of flood risk across London and develop options for targeting areas at particular risk from surface water flooding

There are many Londoners who are at risk of, or have experienced, surface water flooding for example those living in basements in heavily urbanised parts of London. Some of these residents are likely to be classed as vulnerable. As such, they would be disproportionately and potentially dangerously impacted by a surface water flood event. Surface water flooding occurs when the drainage system becomes overwhelmed and rain cannot get into local drains, sewers or watercourses. It can be caused either by the sheer intensity of rainfall or by infrastructure failure such as blockages within the drainage network.

The sporadic and intense nature of heavy rainfall makes it very hard to accurately predict when and where surface water flooding will occur. This means it is difficult to provide a reliable warning or alerts system. As a result, those at risk of surface water flooding may have little or no knowledge of the extent of the potential risk they face. The Mayor, flood risk management authorities[109] and other partners in London have done research into this area. This has helped get a better understanding and mapping of surface water flood risk in the London boroughs. It is less clear whether residents in surface water flood risk areas know what risk they face or how to reduce the risk and respond.

The Mayor will bring all partners together, including the London Resilience Forum and flood risk authorities in London. This will help identify those most at risk of or most vulnerable to surface water flooding. They can also work to increase their understanding of the risk and how to respond. This should include providing information to help build their capacity to adapt and become more resilient.

The Mayor will continue to work with Lead Local Flood Authorities and the Environment Agency through the Drain London project and the London Drainage Engineers Group to promote a consistent approach to managing surface water more sustainably and reducing the risks where surface water flooding happens often. The Mayor will expect Thames Water to continually reduce the number of properties at risk from sewer flooding.

Proposal 8.2.1b The Mayor will support flood risk management authorities in London to manage fluvial flood risk and promote best practice approaches in hard and soft-engineered flood management

The Mayor will expect the Environment Agency to improve flood defences on London's fluvial (river) networks through supporting them in making sure owners of river walls play their part in maintaining defences. The Mayor will work with the Environment Agency to develop 25-year flood risk management strategies for each river catchment. These will account for the need for new development within those catchments and opportunities to manage flood water in the most sustainable cost-effective ways. This is a chance to increase London's green cover using green infrastructure to help manage flood risk, including sustainable drainage systems (SuDS).

BOX 32: NATURE-BASED APPROACHES TO MANAGING FLOOD RISK

Sustainable Drainage Systems (SuDS) are measures to help capture, use, delay the dispersal of, discharge or absorb surface water. There is a preference towards maximising the use of green infrastructure solutions to achieve this, due to the additional benefits beyond water management that SuDS can deliver.

Natural Flood Management involves managing flood risk by protecting, restoring and emulating the natural regulating function of catchments and rivers; often through a series of smaller interventions in the upper sections of a river catchment, closer to source, to slow or delay flows downstream.

Sustainable drainage and natural flood management techniques need to be used at a strategic scale alongside hard engineered flood defences. Together, this can manage rainwater at source and slow the flow of water reaching the rivers. Sustainable drainage and natural flood management can, for example, potentially reduce the need for new hard flood defences downstream. It can also be a way to reduce flood risk where hard defences are undesirable or undeliverable. For example, multiple small schemes could be located strategically. This means when combined they can reduce flood risk downstream or in an area susceptible to flooding. The catchment based approach to flood management in the River Thames could over time reduce the number of properties at risk in west London. By so doing, it could also reduce the need for fluvial Thames Barrier closures. This would help to extend the barrier's life as a tidal flood defence for London.

The Mayor will support and work with partners including the Thames Regional Flood and Coastal Committee and the flood risk management authorities and river catchment partners in order to reduce flood risk in London and establish the appropriate approach to funding for fluvial flood risk management including fair allocation of the cost.

[109] In London the Risk Management Authorities are: Environment Agency, Lead Local Flood Authorities (London boroughs and City of London), Regional Flood and Coastal Committee, Highways England and water and sewerage companies.

Proposal 8.2.1c The Mayor, through the London Plan will manage flood risk for new developments

Through the new London Plan the Mayor will consider policies to manage flood risk for new development. He will ensure that it is located, designed and managed in ways that are appropriate to the level of flood risk present.

The Mayor will consider Integrated Water Management Strategies in areas where this is appropriate. These include where considerable new development will occur, where there are particular flood risks or water-related constraints such as limited sewer capacity on new development. This is a good way to integrate the provision of infrastructure to collectively manage all flood risks to a site and plan for water infrastructure, green infrastructure and improve water quality in London's rivers and canals.

The Mayor will play a role in helping prioritise areas for flood risk intervention across London. He will support cross-boundary working between the Lead Local Flood Authorities to help ensure flood risk is managed in the best way. The Mayor's Regional Flood Risk Appraisal, set to be revised for the new London Plan, will be part of the evidence base to inform this.

Policy 8.2.2 Ensure London maintains its standard of protection from increasing risk of tidal flooding

Proposal 8.2.2a The Mayor will support delivery of the measures in the Thames Estuary 2100 Plan

The Environment Agency has in place the Thames Estuary 2100 programme (TE2100). This plan sets out options for managing tidal flood risk this century in response to different scenarios for sea level rise and other projected changes to the climate and weather. The climate scenarios were produced by the Met Office Hadley Centre for Climate Science.

The TE2100 plan is a flexible and adaptable approach to managing increasing flood risk in London and the Thames estuary. It avoids committing to costly and potentially intrusive flood defence infrastructure which may either prove unnecessary due to lower than predicted sea-level rise, or be made quickly redundant by acceleration in climate change impacts.

The Mayor supports the TE2100 plan to ensure that London is protected until the end of the century. He will support strategic investment that may be required, including potential investment

outside London. The Mayor will also look for suitable alternatives to managing fluvial flood risk in outer west London. In addition, the Mayor will work with flood risk management authorities to increase awareness of tidal flood risk.

The Mayor supports riverside strategies which meet the requirements of the TE2100 Plan and provide the required future standard of protection from tidal flood risk. This will involve several different parties including, but not limited to the GLA, the riverside boroughs, the Environment Agency and the Port of London Authority. The Mayor will coordinate these agencies and identify the most appropriate forum. This will ensure the right balance is struck between flood protection and preserving the heritage and improving the appeal of London's riverfront.

Proposal 8.2.2b The Mayor will support the safeguarding of sites for a new Thames Barrier east of London

Through the TE2100 Plan, it is anticipated that a new Thames Barrier will be required to maintain London's tidal flood defence to 2100 and beyond. Based on current projections this will be required by around 2070 to keep the current standard of protection. However, this date is dependent on the rate of sea level rise, which is being monitored as part of the plan process. If a new barrier is required, detailed planning will need to start by 2050 to ensure delivery by 2070. The location for the barrier will need to be safeguarded well in advance of this. It is likely that a new barrier will be situated outside of London, but will be working to protect the city. The Mayor will work with the Environment Agency and local authorities outside of London to ensure that the best safeguarding approach is identified.

Policy 8.2.3 Increase the amount of sustainable drainage prioritising greener systems across London in new development, and also retrofit solutions

Proposal 8.2.3a Through the new London Plan, the Mayor will consider more ambitious requirements for sustainable drainage in relation to new development

Sustainable drainage systems can provide a range of benefits. These include reducing surface water flood risk, treating polluted run-off, preventing pollution from entering tributary rivers and streams and opportunities to save water through reuse.

Sustainable drainage can be 'green' or 'grey.' Green systems use natural vegetation to treat and store water. Grey systems use hard engineering such as oversized pipework or underground tanks to store water for slow release back to the drainage system once there is space available. Both types are effective. However, green systems also offer further benefits by increasing green cover and creating more pleasant landscapes and healthier, more attractive streets in London.

The current London Plan policy on sustainable drainage has been effective in increasing the amount of sustainable drainage delivered as part of new developments. However, most systems being installed are underground storage tanks. These do not provide the wider range of benefits that some other sustainable drainage options can. Also, attenuation rates and storage volumes achieved by new development are frequently lower than could be achieved. Through the new London Plan, the Mayor will consider policies that encourage green infrastructure sustainable drainage systems where possible.

"Sustainable drainage systems can provide a range of benefits. These include reducing surface water flood risk, treating polluted run-off, preventing pollution from entering tributary rivers and streams and opportunities to save water through reuse."

Proposal 8.2.3b Implement the actions in the London Sustainable Drainage Action Plan to retrofit more sustainable drainage for London

The London Sustainable Drainage Action Plan was published in December 2016. Its main focus is to enable and mainstream the retrofitting of sustainable drainage to existing buildings, land and infrastructure. A lack of funding available in this area limits opportunities for large-scale drainage improvement programme. Instead, opportunities to incorporate sustainable drainage into planned maintenance, repair or improvement works should be identified and carried out. This way sustainable drainage can be introduced at a much lower cost. These measures can save money, for example where 'harvested' rainwater replaces large scale water supplies used for irrigation, toilet flushing or vehicle/plant cleaning. Many of the actions are designed to be delivered by the Mayor in partnership with the Risk Management Authorities and the sector partners and focus on generating funding and opportunities for increased retrofitting of sustainable drainage.

Providing guidance and identifying funding will be the initial areas of focus for the action plan.

Proposal 8.2.3c The Mayor will consider a range of mechanisms to encourage sustainable drainage retrofit on large non-residential properties

Currently, there are limited incentives to encourage property owners to disconnect their properties from the drainage networks and manage surface water onsite using sustainable drainage which would help to reduce the pressure on drainage. Large non-residential land owners with large impermeable areas such as car parks could make a contribution to reducing surface water going into the drains. The automatic right to connect to the drainage system means water companies must accept surface water drainage, regardless of whether the local network has capacity.

In addition, we have a billing system which charges customers in London, including large commercial/non-residential customers, for disposing of their surface water based on the rateable value of the property. This has a limited relationship with the size of the site and means there is no extra incentive for larger sites to better manage their surface water. This exacerbates the problem. The current system means small sites of higher land value (for example inner city premises) may be subsidising larger (for example outer London sites) in terms of surface water drainage charges. A fairer way to pay might be charging linked to the land area drained. This could give an incentive to use alternative ways of managing surface water drainage to keep drainage costs for large sites down.

Proportionally the biggest gains can be made for large sites that are most likely to see increases in charges. These areas are more likely to have the land area to install significant sustainable drainage features. However, any move to such a system would need to safeguard certain non-commercial sectors that occupy large sites and could be financially disadvantaged by a new charging approach. These could include certain educational establishments, community or charity facilities.

Offsetting is another mechanism that should be looked at. This would consider providing, or funding a reduction of surface water flows elsewhere in the same catchment, if not possible onsite, in exchange for a reduction in drainage charge. Other models for using offsets to encourage more sustainable approaches to drainage are being put in place internationally and may provide a model for London. This requires further investigation to establish whether these are feasible approaches to encouraging increased installation of sustainable drainage in certain sectors of the economy. The Mayor will work with Thames Water, Ofwat and other stakeholders to investigate this.

Policy 8.2.4 Work with stakeholders to improve London's sewerage system so it is sustainable, resilient and cost effective and makes best use of innovation

Proposal 8.2.4a Through the new London Plan, the Mayor will consider a policy to support appropriate and sustainable new sewerage infrastructure. He will encourage suitable new technologies and intensify existing treatment works to help meet future needs

To accommodate growth in London, we also need to expand and further develop sewage treatment works. A number of the works have been upgraded the past ten years. Some such as Deephams sewage treatment works are currently having a major upgrade. By the middle of the century, more upgrades will be required to boost capacity at London's sewage treatment works and meet the needs of a growing population.

Given London's projected growth, even if the amount of surface water entering the sewage system is cut, we will still need to expand London's sewage treatment capacity in the future. At some point in the next 20-30 years it is likely that several if not all of London's major strategic sewage treatment works will require upgrades to increase capacity.

In parts of London a range of issues can cause foul drainage and raw sewage to reach the surface water drainage systems and tributary rivers. In areas of London where there are separate foul and surface water drainage systems, as is the case in much of outer London, misconnections can cause network capacity issues and lead to pollution of London's tributary rivers. This is often caused by domestic plumbing misconnections, where household plumbing is incorrectly connected to the surface water drain; rather than to the sewer network. The result is untreated wastewater and sewage draining directly to local rivers. Or conversely, surface water drainage pipework is connected into the foul system which then creates capacity issues where the network is sized to cope only with wastewater flows. Furthermore, combined manholes often lead to raw sewage going into surface water. Misconnections can be caused by lack of awareness both from the public and in the relevant trades. In some cases, wastewater is knowingly and illegally drained.

The Mayor will work with Thames Water, boroughs and other stakeholders to raise awareness of misconnected drains and combined manholes from household and business premises.

To reduce cases of misconnections of surface water and foul sewer systems in London requires several actions. Specifically, we need to focus on the plumbing and construction industry, including the trade retailers. There are opportunities to increase collaboration with relevant trade organisations and educational institutions and bodies that certify these industries and better understand where the problems lie and untangle the complex plumbing faults.

The Mayor will increase collaboration with trade organisations and support awareness raising schemes working with stakeholders on London's rivers, including catchment hosts. The Mayor will also investigate the feasibility of how changes to legislation can target misconnected properties at point of let or sale. This could be done for example through point of let/sale plumbing certification to help reduce the problem.

OBJECTIVE 8.3 ENSURING EFFICIENT, SECURE, RESILIENT AND AFFORDABLE WATER SUPPLIES FOR LONDONERS

In order to ensure an efficient, secure, resilient and affordable water supply for London, water demand must be managed through water efficiency, leakage reduction and metering and increased public awareness of water usage.

London faces increasing water scarcity in future without action. Demand for water will grow with London's growing population and climate change is predicted to increase the risk of drought. As London's water supply is mostly drawn from the River Thames, the River Lee and groundwater from the hills around London, it is crucial that we balance the demand for more drinking water with the needs of the environment. Over abstraction, be it from groundwater or rivers, damages ecosystems by reducing flows in rivers and can impact on water quality, navigation and recreation.

In some cases controlling some level of over abstraction may be necessary during drought, but is not sustainable or cost effective in the long-term. It is therefore essential that there is a twin track approach of improving water efficiency and enhancing London's water resources and supply network.

New mechanisms in the water market can also help London achieve an efficient, secure, resilient and affordable water supply. The retail water and wastewater market was established for non-residential customers in April 2017. Ofwat state that 1.2 million customers in England are now eligible to choose their water retailer. This is expected to bring efficiency savings through companies with multiple sites nationally being able to streamline their billing process, by dealing with a single retailer rather than multiple geographically specific water companies.

Potential water market benefits could include lower bills, helping people use less water, improved services as new offers emerge.

Potential environmental benefits include:

- an expected reduction in water use through increased water efficiency
- reduced environmental impact from abstraction through reduced use
- reduced carbon emissions from reduced water supply pumping and treatment

Policy 8.3.1 Reduce London's water consumption and leakage rate

Proposal 8.3.1a Holding to account London's water companies on the need to further reduce leakage rates and reduce the likelihood of major water mains bursts

Leakage from the water supply network is stubbornly high in London, Thames Water has experienced a series of major mains bursts that have resulted in major property flooding, culminating in those in Islington and Stoke Newington in late 2016. These triggered an independent forensic assessment of the mains bursts which made a series of recommendations to Thames Water on how to reduce further incidents. It is clear that additional monitoring and improved early detection is required.

"The Mayor will expect all water companies operating in London to set out measures to reduce leakage rates and risk of major mains bursts."

The Mayor will expect all water companies operating in London to set out measures to reduce leakage rates and risk of major mains bursts and regularly report progress.

Proposal 8.3.1b Work with London's water companies to promote water metering, encouraging wise water usage and a reduction in leaks

The Mayor supports London's water companies in increasing the number of properties that have smart water meters. Water metering ensures people are charged proportionally for the amount they use.

Water meters, especially new smart meters, can help customers better understand their water use behaviour and so contribute to reducing household consumption. Smart meters also provide customers and water companies with the ability to quickly identify leaks in their household. Thames Water estimates that up to a third of total network leakage can be attributed to leaks in the customer's pipework. Current estimates suggest one in ten households that have a meter installed have identified a previously undetected leak. Smart meters also provide useful data for water companies to identify local network leaks.

Water pricing has a significant effect on household consumption. In Berlin, water is priced at about twice London prices and per capita household consumption is about 115 litres per person per day. Conversely, the average consumption in Milan where water is far cheaper than in London, is over 220 litres per person per day. Of course, there are climatic variations between the regions which may influence behaviour, but the relationship between the price of water and household water use is significant across many cities. Charging customers proportionally to the amount used will encourage people to use less and save money on their bills but mechanisms need to be in place to ensure 'water poverty' is not created.

More work needs to be done to ensure Londoners are aware of the role and benefits of smart water metering, for example, through public engagement and effective communication. Synergies between the energy smart meter programme and that of the water sector should also be explored, with view to delivering efficiencies, however there are differences in the current smart meter technologies being delivered and the sectors use different communications networks and transmitter technologies, so requires further investigation.

Proposal 8.3.1c Support delivery of water saving measures through Energy for Londoners

Domestic hot water heating accounts for approximately 25 per cent of household energy consumption. If Londoners reduce their household hot water consumption they will see an associated reduction in their energy bills. This is a significant incentive to reduce water consumption. It is likely that this is fairly well understood by the public yet there is scope to further reiterate this message as part of including water saving initiatives in Energy for Londoners.

There are marked differences in the way different communities, cultures and religions, as well as different age groups, use water. More research is needed into the scale of differences and what measures or advice/information may be appropriate to reduce water use in these specific groups or areas.

A better understanding of how effective new water efficient development measures have been is needed. The Mayor will work with relevant stakeholders to review the water efficiency performance of these developments and share lessons learnt and best practice and shape future policy.

Proposal 8.3.1d Through the new London Plan the Mayor will consider policies to require new housing development to be more water efficient

New homes will need to be more water efficient than London's existing housing stock to minimise the increase in future demand. Specifying high water efficiency standards at the planning and development stage through strategic planning policy is an effective means of achieving more water efficient homes. Through the new London Plan, the Mayor will consider a policy that requires new developments to, as a minimum, meet 105 litres per person per day for household water consumption and encourages developers to better that standard for example incorporating water reuse systems.

Policy 8.3.2 Support the planning for a new strategic water resource appropriate for London

Proposal 8.3.2a The Mayor will support plans for a new strategic water resource to serve London and will assess whether the preferred options are appropriate for London and Londoners

The Mayor supports, in principle, the need for major new water resources for London and the south east of England, but wants to ensure the solution or solutions are acceptable to London in terms of scale, flexibility and compatibility with the Mayor's wider priorities for London including being a zero carbon city by 2050. Thames Water is currently researching variants of four main options for a new water resource to establish which, or a combination of which will be best placed to serve London into the future. The Mayor will review Thames Water's research, once it is available, taking into account water companies' performance on leakage targets. The Mayor will also consider how the delivery of more local water distribution infrastructure, including new local reservoirs, mains and water treatment capacity, can play a part on securing London's future water supply.

Defra has committed to releasing a water supply National Policy Statement which is likely to be adopted within two years. Any National Policy Statement will recommend that strategic water supply infrastructure over a given size/capacity threshold be eligible for Nationally Significant Infrastructure Project (NSIP) status and it is likely that delivery of a new strategic water resource for London would be given this status. Agreement would be through a Development Consent Order whereby the Secretary of State grants NSIP approval. It replaces the need for a conventional planning application and generally reduces the time it takes to receive approval. The Mayor will ensure that London's interests are protected during this process.

OBJECTIVE 8.4 LONDON'S PEOPLE, INFRASTRUCTURE AND PUBLIC SERVICES ARE BETTER PREPARED FOR AND MORE RESILIENT TO EXTREME HEAT EVENTS

Extreme heat events will impact on many aspects of Londoners lives. For this reason the Mayor will take a series of actions from providing timely and accessible information for Londoners during heatwaves, planning for minimising the risk of overheating in new and existing developments and managing heat risk on London's transport.

Policy 8.4.1 Ensure Londoners can prepare, respond to and recover from the impacts of extreme heat events in London

Proposal 8.4.1a Develop a communications protocol for Londoners in times of an extreme heat event

So that organisations are prepared for extreme heat events, the Mayor will help to develop and promote a communications plan for severe heat events to keep Londoners safe. This will involve working with the GLA group, Public Health England and the London Resilience Forum to agree on the how best to respond to an extreme heat event and build into usual emergency planning responses.

Through providing accessible and timely information Londoners should be able to reduce the impacts of extreme heat events in their homes, workplaces and on journeys around the city. Currently Londoners receive information from a number of sources and the Mayor wants to take the lead in convening the necessary partners to ensure Londoners are safeguarded.

"Through providing accessible and timely information Londoners should be able to reduce the impacts of extreme heat events in their homes, workplaces and on journeys around the city."

Policy 8.4.2 Ensure critical infrastructure providers of homes, schools, hospitals and care homes are aware of impacts of increased temperatures and the Urban Heat Island to protect health and reduce health inequalities

Proposal 8.4.2a Provide locally specific data and modelling to demonstrate and evidence the impacts and the effects of the Urban Heat Island

The Mayor will work with academic institutions, the Health Protection Research Unit, boroughs and Public Health England to develop mapping to show how the UHI effect impacts on critical infrastructure and vulnerable groups in London.

This will include supporting the UCL Institute for Environmental Design and Engineering research with boroughs to explore how heat risk indexes which combine social, health and climate change impacts can support local policy and interventions for the most vulnerable. The outputs of this research will be shared with boroughs and more widely, as appropriate.

Policy 8.4.3 Minimise the risk of new development overheating

Proposal 8.4.3a Through the new London Plan, the Mayor will consider policies to minimise the risk of new developments overheating and reduce their impact on the urban heat island effect

The Mayor will consider policies through the new London Plan that encourage developers to carry out overheating modelling against extreme weather scenarios which will provide the necessary detail for developers to design developments with the appropriate mitigation measures installed.

Developers will be required to follow the cooling hierarchy (see Box 33) to reduce the risk of developments overheating and reduce the impact on the UHI effect through avoiding mechanical cooling where possible and promoting passive cooling measures. Where mechanical cooling is proposed, developers will need to consider the use of low global warming potential refrigerants to reduce harmful emissions.

BOX 33: COOLING HIERARCHY

The cooling hierarchy is:

- minimise internal heat generation through energy efficient design
- reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls
- manage the heat within the building through exposed internal thermal mass and high ceilings
- providing passive ventilation
- providing mechanical ventilation
- active cooling systems

The Mayor will also consider the impacts of further urbanisation of London on the UHI effect. This will lead to guidance on how new developments can be designed to minimise the amount of heat absorbed by the development which is then released at night, warming the surrounding area.

It is vital the when existing buildings are retrofitted for energy efficiency purposes that this does not lead to the unintended consequence of overheating. More information on how this will be achieved in available in Objective 6.1 in the Energy and Climate Change Mitigation chapter of this strategy.

Policy 8.4.4 Reduce the impacts of heat on streets

Proposal 8.4.4a The Mayor will work with TfL and the boroughs to provide shaded areas for Londoners to enjoy

Through the Healthy Streets Approach, the Mayor will consider how to create shade and shelter on London's streets to provide refuge for Londoners during times of high temperatures and cool the urban environment. This will include working with TfL and the boroughs to retain existing trees and plant new ones to protect canopy cover which will provide shade.

Proposal 8.4.4b The Mayor will work with TfL to put in place initiatives that will minimise heat on the underground and bus networks

The Mayor, through TfL will continue to minimise heat on the London Underground by following the cooling hierarchy detailed below:

- recycle – focus on using and optimising train regenerative braking to recycle heat rather than release it (allows trains to generate electricity to power other trains)
- resilience - map and manage heat impact on the network whilst considering future factors such as climate change
- reduce – focus on minimising energy use, for example, optimising train performance
- recover – focus on the use and optimisation of waste heat energy recovered from tunnel ventilation, station ventilation and station cooling systems. This could for example include local reuse or creating opportunities for beneficial uses such as supplying low grade waste heat to nearby district heating networks
- remove – manage the thermal environment of the network via the targeted introduction of appropriately sized cooling infrastructure (low energy and whole life cost methods prioritised.

The Mayor, through TfL will continue to take actions to cool the bus network. These include: painting bus roofs white to help reflect heat; tinted windows to reduce heat gain from solar rays and insulating buses to reduce the heat from the engine.

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CONSULTATION QUESTIONS: ADAPTING TO CLIMATE CHANGE

1. Do you think the Mayor's policies and proposals are sufficient to increase London's resilience to climate change?
2. Do you agree with the Mayor's policies and proposals to make Londoners, more aware of the risks of climate change, like overheating in buildings and flooding following heavy downpours?
3. Do you agree with the Mayor's policies and proposals to reduce water demand and leakages in London?
4. What do you see as the biggest opportunities to tackle climate change risks in London and how can the Mayor support this?
5. Please provide any further comments on the policies and programmes mentioned in this chapter.

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