
London Assembly's call for views and information: London's response to severe weather and climate change

Here is the Environment Agency's response to this call for views and information.

Climate change and severe weather:

1. What do climate change projections tell us about the likely increase or decrease in different weather risks in coming decades (by 2050 to 2100 depending on available data)?

It has been projected that average summer temperatures could increase in the South East of England by 3.9°C by the 2080s. This scenario is based on a 'medium carbon emissions' pathway, which according to the Climate Change Adaptation Sub Committee¹ is currently a likely scenario.

In a large metropolis like London, the city generates its own micro-climate, known as the Urban Heat Island effect. The higher temperatures of this microclimate are caused by the surfaces of the densely built urban environment (road surfaces, pavements, walls, roofs) absorbing heat and then radiating this heat. During the 2003 summer heatwave, differences of up to 10°C between central London and rural temperatures were measured. London's urban heat island effect will exacerbate the impacts of projected increased summer temperatures.

At the same time, a 22% decrease in average summer rainfall in the South East is projected, which could increase the risk of water shortage. London is prepared to deal with water shortages in the current climate but there is a need for a better understanding of future impacts relating to different climate change scenarios.

Despite the innovation in climate change modelling in the last few years, there are still uncertainties when it comes to water resources. For example, current modelling does not accurately represent blocking high pressure weather systems, which generate drought and drive frequencies.

A Met Office study suggested that in a worst case carbon emissions scenario, we might have ten times as many significant droughts by 2100, with droughts like the one the UK experienced in 1976, occurring on average every ten years.

A case study by the Climate Change Adaptation Sub Committee in July 2011 pointed out that in a high emissions future scenario, even with substantial development of new water resource infrastructure, water availability could be under severe pressure by the 2080s. (can supply graphic)

Climate change will also bring wetter winters and more frequent heavy rainfall. London is already prone to flooding from all sources. We recently provided evidence to the London Assembly, to support the production of the Environment Committee's report [Flood Risks in London](#) (April 2014), so we will not duplicate the content in this response. Surface water flooding and sewer flooding events caused by heavy rainstorms are likely to increase if action is not taken to make London more resilient to these events.

¹ Committee on Climate Change is an independent statutory body that provides evidence-based advice to the UK Government and Parliament. The Adaptation Sub-Committee sets the direction for adaptation matters including independent advice on preparing for climate change..

2. Has the consensus about likely changes in the risks of severe weather changed in recent years (compared to the evidence base used to draw up the Climate Change Adaptation Strategy)?

Since the Adaptation Strategy was published in 2011, the Intergovernmental Panel on Climate Change (IPCC) has published its 5th Assessment report (2013). This considered new scientific evidence based on many independent scientific analyses from observations of the climate system, historical climate archives, theoretical studies of climate processes and simulations using climate models. The conclusion was that there is a 95% probability that human action is the dominant cause of climate change. This represents an increase in certainty from 90% in the previous report. In 2012 the IPCC also published a Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX). The report determined that a changing climate leads to changes in the frequency, intensity, spatial extent, duration, and timing of extreme weather and climate events, and can result in unprecedented extreme weather.

Together, the findings of these reports reinforce the position, set out in the Climate Change Adaptation Strategy, that London will face an increase in severe weather events, and it will need to adapt to these new risks.

3. What are the risks of severe weather? For different hazards, how many people are at risk, of what effects, at what risk level? For example, the Environment Committee has recently investigated risks of flooding from storms at various likelihoods – are there similar figures for other weather risks such as heatwaves, droughts, snow or cold snaps?

Regarding the increased likelihood of heatwaves, research indicates that the 2003 extremely hot summer cost the economy £500 million, plus loss of human life. In London there were an estimated 600 excess fatalities related to the heat wave. The London School of Hygiene and Tropical Medicine studies have shown that we see excess mortality in London when the temperature rises above 24.7C – way below the 32C threshold for heatwave².

Projected increases in summer temperatures will be a contributing factor to more air pollution episodes in London. Poor air quality is a serious health risk for the elderly and asthma sufferers. For example, in the 2003 hot summer it was estimated that air pollution alone was responsible for between 423 and 769 excess deaths in England and Wales during the first two weeks of August and these deaths were associated with the elevated ambient ozone and PM₁₀ concentrations.³

The London Climate Change Partnership has done some work on identifying overheating thresholds in London. See Appendix 1. (Overheating Thresholds report, London Climate Change Partnership 2012)

Future hotter, drier summers and projected population growth in London will put increasing pressure upon already limited water resources, potentially leading to more frequent drought management measures and negative impacts on the quality of London's rivers canals and wetland habitats.

Extreme weather would exacerbate an already water stressed London. London and the South East region is the driest area in the UK. Water demand in the capital is disproportionately high compared to other parts of the country. Londoners now consume an average of around 165 litres per person per day, compared to the national average of less than 150 litres per person per day. This is due to smaller households (flats) and low uptake of water metering.

Severe weather of climate change is expected to affect water availability by reducing river flows, reducing groundwater replenishment ('recharge'), increasing evaporation, and increasing demand for

² <http://blogs.lshtm.ac.uk/news/2013/07/18/premature-deaths-from-heatwave-in-england/>

³ <http://www.sciencedirect.com/science/article/pii/S1352231003010203>

water from Londoners as a result of population growth. While water companies are better prepared for droughts since the 1976 drought, our infrastructure would struggle to be resilient to the more extreme conditions that we might see under a changing climate, such as several consecutive very dry years.

Water supply shortage or interruption in supply would have a significant impact on Londoners, This could include disruption to health and social care systems and adverse impacts on critical infrastructure, putting vulnerable people at greater risk. The Adaptation Sub Committee's 2012 report *Climate Change – Is the UK preparing for flooding and water scarcity?* refers to a projected high level deficit of -1040 Mega litres/ day in the Thames river basin for the 2020s (in a medium greenhouse gas scenario).

It is not just extreme weather that will affect water supply availability. Population growth will also be an important factor. The latest predicted population figures indicate that London will be the first European city to reach a population of over 10 million by 2036. The Mayoral ambition to build 42,000 new homes every year as a minimum (currently around 25,000) will add to the water demand in Greater London.

Poor quality water also needs more intensive treatment to make it fit for public consumption, raising costs to water company customers and increasing energy use and carbon emissions.

There has been some analysis of other extreme weather events, but not any London focused analysis that we are aware of. Snow and icy conditions which defined the 2011 winter cost the economy an estimated £600 million per day (Federation of Small Businesses). 5 people in the UK died (17 in total across western Europe) following the St Jude storm event in October 2013. Willis Re estimated total UK insured losses at between 100 million and 150 million Euros in the aftermath of this storm. The Association of British Insurers and the Met Office have done some work on financial risks of climate change.⁴ Key findings for UK windstorms included;

- Annual event - Insured wind losses could rise by 25% to £827 million (valid for slight southward shift in storm track)
- 1-in-100-year event - Insured wind losses could rise by 14% to £7.3 billion
- 1-in-200-year event - Insured wind losses could rise by 12% to £9.7 billion (valid for a slightly southward shift in storm track)

The Environment Agency takes a strategic overview of all sources of flooding and we work with Lead Local Flood Authorities in London to support plans to manage local flood risk. We are an active partner of the Drain London partnership. We will not repeat here the information we provided to the London Assembly's Environment Committee in April for their Flood Risks investigation and report.

Significant impacts of climate change on biodiversity in England have already been observed (DEFRA 2008)⁵, and the potential changes to London's habitats and biodiversity as a result of climate change have also been well documented (LCCP 2009)⁶. Whatever action is taken now to reduce levels of greenhouse gas emissions, further impacts are inevitable because climate change will continue due to inertia in the climate system. Climate change, therefore, poses serious threats to biodiversity this century.

Adaptations:

4. How is London adapting to lessen or cope with the effects of severe weather and climate change? Are London's adaptations focussed on the greatest threats?

⁴ <http://www.metoffice.gov.uk/services/finance/abi-report>

⁵ England Biodiversity Strategy Climate Change Adaptation Principles (DEFRA 2008)
<http://www.lbp.org.uk/downloads/Publications/Climate%20Change/Adapting%20to%20Climate%20Change%20-%20Creating%20Natural%20Resilience%20Technical%20Report>

⁶ Adapting to Climate Change Creating Natural Resilience (London Climate Change Partnership 2009)

Flood risk is one effect of severe weather and climate change that London is addressing. The bullet points below outline some of London's adaptation measures to address increased risk of flooding:

- The Thames Estuary 2100 (TE2100) Plan is recognised as an example of a long term tidal flood risk management plan that takes account of climate change. This plan identifies adaptation options for different future climate change and sea level rise scenarios to the end of the century. This adaptability will ensure that the right actions are taken at the right time.
- Adapting to climate change is a process and can be built into our normal planning and risk management procedures, whether in business, government or services. For example, we provide information to local planning authorities to support planning decisions based on the Government's most up to date climate change projections. This will ensure that new development will be out of high risk flood zones or designed and built to be resistant and resilient to future flooding.
- Drain London are looking at developing a London wide adaptation pathway to cope with increases in the magnitude of rainfall events.
- River catchment management plans are in place for managing the risk of river flooding. These also take into account projected climate change and impacts on water levels.

London needs to integrate adaptation into its plans for new and retro-fitted developments. For example, the Mayor's RENEW programme is beginning to tackle this and provides holistic advice that will include adaptation as well as carbon saving advice. This is a very positive development. The house building programmes anticipated for London to address housing shortage, provides an opportunity to locate and design new developments that are 'climate ready'. The Mayor's Sustainable Design and Construction Supplementary Planning Guidance (2014) provides guidance to local authorities to support adaptation measures in new development.

There are also positive references in the draft Mayor's London infrastructure investment plan (2014) to the need for London's infrastructure being resilient to climate change. A welcome chapter on green infrastructure recognises the multi benefits of this resource, including climate change adaptation. This reflects London Plan policy and All London Green Grid guidance. The Mayor's urban greening and tree planting programmes supporting local projects, provide multiple benefits for climate adaptation. For example, cooling through natural vegetation, rainwater management in the landscape and local improvements to air quality.

The London Climate Change Partnership (of which we are a partner) is a key mechanism for supporting adaptation in London. It is a cross-sectoral partnership which enables collaborative analysis and action on the issues of climate change.

5. Is London ready to adjust its adaptations to cope with future weather changes?

Flood risk: The TE2100 plan is designed to be adaptable and includes a monitoring programme to ensure that decisions to manage Thames Estuary tidal flood risk take account of future weather changes and changes to projected climate trends. This is a national infrastructure project.

Water resources and infrastructure:

It is difficult to financially plan for climate ready infrastructure for water (for example, building reservoirs) due to current short-term planning/ funding cycles of the water industry. At the moment water resources are planned on a 25 year cycle and do not take a longer term view that would require the need to consider impacts of a changing climate. Taking a longer term adaptation pathways approach would mean we would have to significantly change current funding arrangements set by Ofwat. However, the pathways approach is recommended in the draft London Infrastructure investment plan.

6. What could be the costs and benefits of different adaptation approaches?

As already stated one example of an adaptation approach is the TE2100 plan. The benefits of this plan are significant and include the continuing protection of 1.25 million people and £200 billion worth of property from increasing tidal flood risk, through to the end of the century and beyond. The Plan sets out actions, at a cost of up to £9 billion pounds, by the end of the century.

The London Climate Change Partnership has provided costed guidance and advice as well as case studies to encourage investment in adaptation (see their publications on LCCP website <http://climatelondon.org.uk/resources/publications/>)

Economic impact:

7. How can London map its dependence on global supply chains that are at risk from climate change effects and severe weather overseas?

Environment Agency's 'Climate Ready Support Service' has developed a five-step framework to help businesses understand and manage the risks that severe weather and our changing climate present to increasingly complex supply chains of UK commerce. The guidance has been tested as part of ASDA's Sustain & Save Exchange (SSE) programme.⁷

8. What advice and information is available to London businesses about how they should respond to climate change and severe weather events? To what extent do firms use these services?

London Climate Change Partnership has a number of London businesses and business organisations in its membership, including London First. LCCP partnered with the City of London Corporation and Price Waterhouse Cooper, to hold a business resilience event in May 2014. This event was devised to test and refine support tools for businesses and identify opportunities for providing better support for Small and Medium-sized Enterprises.

Climate UK provides a Business Resilience Health Check, in Partnership with Business in the Community and the Environment Agency. This provides holistic advice to businesses regarding their resilience, including but not limited to, severe weather:⁸

9. To what extent do businesses in London have adaptation or continuity plans in place?

We do not have information on this. It is a potential area of work that we could look at with the London Climate Change Partnership.

10. Are there specific challenges for Small and Medium-Sized Enterprises (SMEs)? How can these be addressed?

We do not have information on this. It is a potential area of work that we could work with the London Climate Change Partnership.

⁷ To download the guidance go to <http://www.acclimatise.uk.com/resources?resource=202>

⁸ Find out more about the checklist at <http://www.businessresiliencehealthcheck.co.uk/>

Mayor's role:

11. What specific steps can the Mayor and GLA take to ensure London and its economy is prepared for and can adapt to the impacts of severe weather and climate change?

Projected population growth for London will place an additional strain on London's resources and infrastructure. The Mayor and the GLA will need to ensure that all new development is sustainable and that it is planned to be able to adapt to a changing climate. For example, Opportunity Areas apply London Plan policy and demonstrate sustainable design and build.

The Mayor and the GLA should continue with initiatives such as Greening the BIDs, RE:NEW and Drain London.

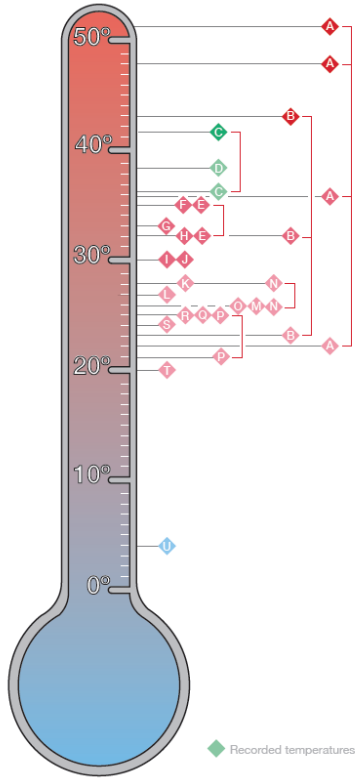
Surface flood risk management is the responsibility of the Lead Local Flood Authority (each London Borough). However we also recommend a London wide strategic approach that will support local delivery bodies and identify priority locations for investment for rainwater management. Retrofitting programmes into existing places will be as important as opportunities to install sustainable drainage into new development. The emerging London Sustainable Drainage Action Plan is a mechanism for applying a strategic approach.

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Appendix 1

Selected temperature thresholds relevant to London's urban systems. Extract from Overheating Thresholds Report (LCCP 2012)



Temp	Description
A	36°C External air temperature which results in rail track temperatures of 48°C-52°C. Extreme precautions, such as temporary speed restrictions, taken by Network Rail at this air temperature to avoid buckling of non-pre-stressed rails and overheating of power sources. 22°C Network Rail begin to implement staged preventative measures at this air temperature.
B	43°C Maximum internal air temperature advised for server rooms. 32°C Maximum internal air temperature advised for computer rooms. 23°C Maximum internal air temperature advised for IT equipment rooms.
C	41.5°C and 36.2°C Air temperatures recorded on the tube and on platforms respectively during the 2003 heatwave in London.
D	38.5°C Highest daytime temperature recorded in the UK (at Gravesend, Kent).
E	32°C and 35°C Internal air temperature thresholds to which Crossrail rolling stock and stations respectively are designed not to exceed.
F	35°C Heat stress risk for healthy adults begins at this internal air temperature combined with a relative humidity level of 50%.
G	33°C Softening of tarmac, asphalt and bitumen road surfaces generally begins to occur but is also dependant on direct solar exposure.
H	32°C The highest estimate for summer mean daily maximum temperatures by the 2080s.
I	30°C Vulnerability of commercial buildings to power outages increases when external air temperatures exceed this.
J	30°C Overhead power lines begin to experience a reduced rating factor above this air temperature.
K	28.1°C The highest estimate for summer mean daily maximum temperatures by the 2050s.
L	27°C Threshold temperature specified for overheating in well insulated housing.
M	26.2°C The central estimate for summer mean daily maximum temperatures by the 2080s.

Temp	Description
N	28°C Current CIBSE temperature threshold for living areas. If 1% of annual occupied hours exceed this temperature, internal spaces in a building have technically overheated. 26°C Current CIBSE temperature threshold for bedrooms.
O	26°C Threshold for air temperatures of internal cool areas required to be provided by hospitals.
P	25°C Suggested 'hot' temperature threshold for bedrooms. 21°C Suggested 'warm' temperature threshold for bedrooms.
Q	24.8°C The central estimate for summer mean daily maximum temperatures by the 2050s.
R	24.7°C over 2 days leads to greater incidences of morbidity, mortality and hospital admissions in London.
S	24°C London Underground implement overheating plans including public health communications and measures to prevent non-pre-stressed railtracks from buckling.
T	20°C Legionella bacteria begin to develop in potable water supplies (both stored and piped) if water temperature exceeds this.
U	4°C to 60°C Bacterial growth on food encouraged between these temperature. Likelihood of food borne diseases increase by 4.5% for every 1oC increase in air temperature.