

Transport for London

Appendix

Table of Actions: Implemented Actions

Business Function	Extreme Weather or Climate Risk	Summary of Actions (as set out in first report)	Timescale over which actions were planned	Progress on Implementation of Actions	Assessment of extent to which actions have mitigated risk	Benefits/challenges experienced
TfL Road Network and Bus operations	Increase in rainfall especially during winter periods	Mitigation already under way - drainage plan, gully and pumping station renovation. Interdependency with Thames Water, maps of flooding hotspots on the TLRN and bus stations and garages at risk of flooding.	Ongoing	Pumping station work complete. Hotspots, drainage plan, gullies - A review of the highway drainage strategy was carried out. See report page 14.	This review identified critical locations where flooding would have the greatest impact on the road network. It identified a number of improvement actions, looking at CCTV monitoring, maintenance and supplementary cleansing, roles, training and relationships with other key organisations.	The review has informed the drainage plan, helping to prioritise and fund the upgrade measures.
Rail, Tube - Rail short circuiting preventing train operation, flooded under-track crossings, cable damage	Increase in rainfall especially during winter periods	Some assumption that these impacts will be short term disruption. Mitigation includes accurate weather forecasts, planning and response	Ongoing	London Underground carried out a Comprehensive Flood Risk Review covering all sources of flood risk to all of its assets. See report pages 12 and 25.	The review provides a technical report to the Business that makes a statement on the current tolerability of safety risk and the current business risk exposure. It makes recommendations on optimisation of risk exposure in the future, by providing advice on steps necessary to manage and mitigate future flood events. It provides a dedicated Flood Risk Management <i>Geographical Information System</i> (GIS) to facilitate flood risk management.	The review provides a quantified input to the business case for targeting specific mitigations.
Rail and underground tunnels	Tidal and fluvial (and drainage) flooding	High level of mitigation already exists. Network management, tunnel mitigation work, emergency preparedness, flood plans	Ongoing			

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Diverse range of TfL business areas, including London Underground, Rail, buses, trams	Extreme high temperature	Optimising service patterns to minimise trains halting in tunnels. Improving heat loss from trains, air conditioned trains on sub-surface lines, Victoria line tunnel ventilation. „Stay Cool“ communication campaign, specify white bus roofs, install upper deck cooling systems on all new buses, relocate street traffic control equipment	Ongoing work deals with excess heat from line upgrades. Further work needed in future decades to prepare for climate change.	Most of these actions are ongoing, our ‘business as usual’ approach to managing extreme weather. For tunnel and station ventilation, see report pages 12- 13. We have doubled Victoria Line ventilation shaft capacity. We have installed air cooling units at Green Park and Oxford Circus. We have introduced air cooled New Bus for London and trains on the sub surface lines.	The measures have mitigated current heat risk from more frequent train service and on new buses.	There are benefits to passenger comfort. There are challenges relating to increased energy use in fans and motors. We are looking at opportunities to extract waste heat from the Underground system.
Rail, Underground and Roads – Earthworks stability e.g. embankments and cuttings	High rainfall or drought affecting the degree of soil moisture in earthworks	LU Asset management plan, use plant species that can withstand expected adverse conditions, cyclic and reactive landscape maintenance regime in place.	Asset Management Plans and will be reviewed regularly	See report page 12. A full assessment of all earthworks assets that was carried out in 2011, so there is now an excellent understanding of the full earthworks asset catalogue and the condition of all existing slopes on the London Underground network.	As a results of the assessment, all earthworks with high risks received effective mitigation action.	LU engineers have considered not just the technical aspects of the work, but how it can be undertaken in a way that will enhance the environment and maximise sustainability, e.g. by ensuring the use of existing fill materials in earthwork remedial works’ design and construction, and with sensitivity to the surrounding environment.
TLRN, bus network, transport network platforms, rail and tram tracks, signals	Extreme ice and snow	Winter Maintenance Plans and a robust Winter Maintenance Programme. Road users informed of real time hazards via the London Streets Traffic Control Centre through Visible Message Signs and updates on TfL website which serves to modify road user behaviour through improved communications. Adopt components used in countries which already experience extreme temperatures. Increase	Ongoing (seasonal)	These plans are ongoing as part of seasonal preparedness and are performing well. See report page 8. London Overground has installed points and track heaters at depots as part of its process to extend the service from four to five car trains. See report page 10.	Our plans mean we have been assessed as achieving good resilience performance compared to other transport providers in London during periods of cold weather and ice.	The benefits include provision of continued services for our customers.

		network intelligence and extend hotspot database. Salt alternatives to be investigated. Collaboration with London boroughs to improve London wide resilience including compilation of resilience networks, mutual aid and consideration of pan London salt stocks				
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Table of Actions: New and Continuing Actions

Further or New Actions Planned	Risks Addressed by Actions	Timescale for New/Further Actions Planned
Addressing the risks identified in the London Underground Comprehensive Flood Risk Review	Natural and man made flood risks	Varies according to which mitigations are specified and delivered by different parts of the business during the next year.
TfL is doing a trial of material viability for different porous asphalts under London's road use conditions See report page 14	Pluvial flood risk	By end of 2016
London Underground has commissioned a design guide containing the latest understanding of clay cuttings and embankments. This will help to deliver a new understanding of analysis and failure methods to inform future upgrade works.	Flood and heat (freeze/thaw) risks	By end of 2015
Continuing to deliver the highways asset management plan	Flood risks	Ongoing
Continuing to deliver the Rail and Underground asset management plan	All climate risks	Ongoing
Continuing to specify new projects and services with regard to climate projections	All climate risks	Ongoing