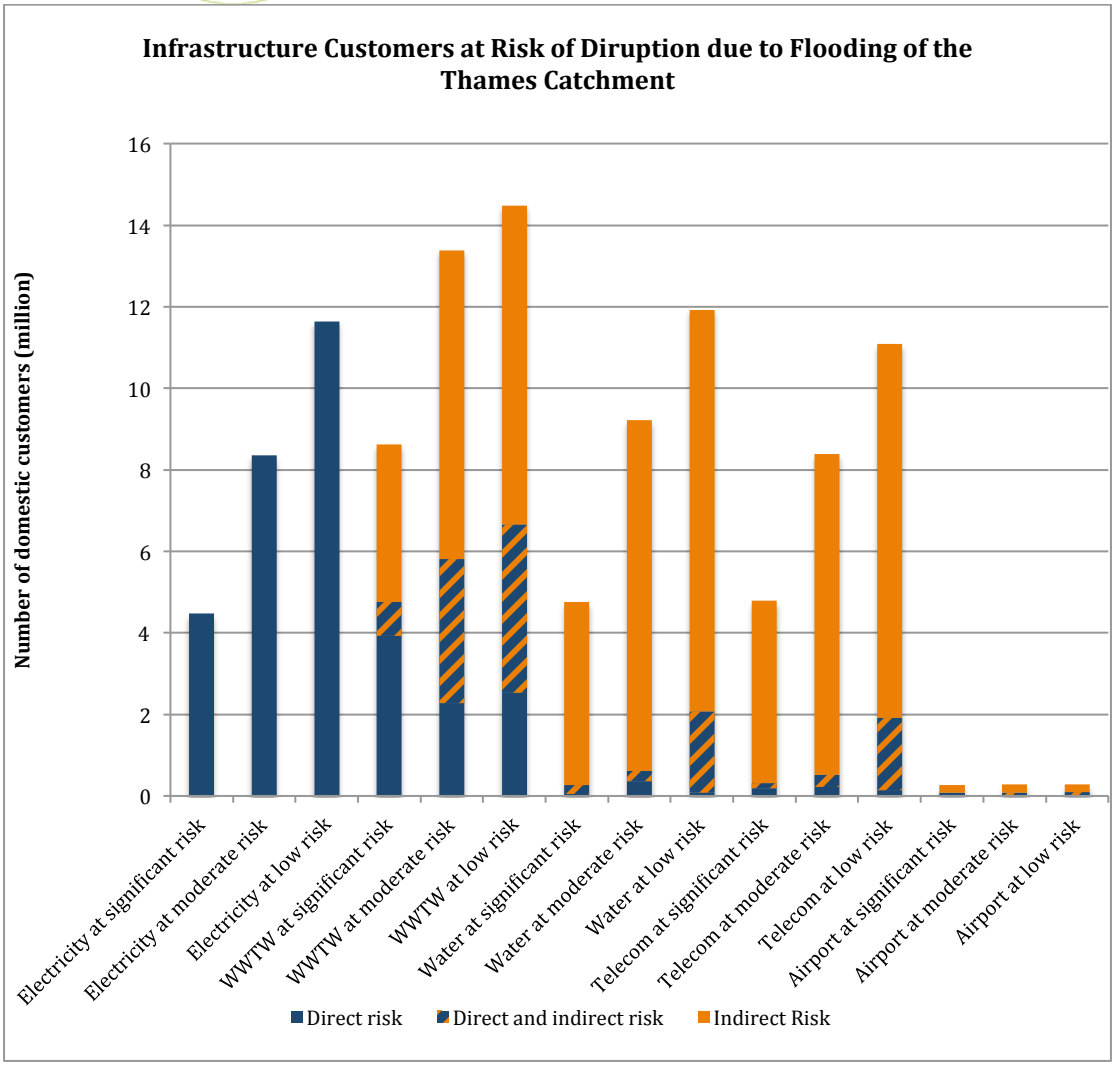
Characterising the Potential Impacts of Flooding on Thames Valley Infrastructure

Scott Thacker

During the winter of 2013-2014, Great Britain experienced a number of severe storms, resulting in widespread and persistent flooding. In addition to the flooding of around 6000 homes, the floods caused disruptions to critical infrastructures, which play a key role in supporting society and the economy. Transport infrastructure was badly affected. Notable impacts included the closure of the West Coast Mainline at Dawlish for several weeks and the failure of 3 electricity sub-stations at Gatwick airport that contributed towards the disruption of 13,000 airline customers.

In response to these events, the UK Infrastructure Transitions Research Consortium (ITRC) performed analysis that was presented as evidence to the Science Advisory Group in an Emergency (SAGE). The analysis utilised the ITRCs unique modelling capability that has been developed to enable the long term planning and adaptation of national infrastructure systems in the face of a changing climate. The ITRC National Infrastructure System Model (NISMOD) integrates network data from the energy, transportation, water, waste and digital communications sectors to provide a comprehensive model of the nations infrastructure. For the first time, this model represents the effect of interconnectivity and interdependence between infrastructure networks, which can result in failure at a particular location having disproportionate consequences. Recognizing the central role that electricity occupies in supporting the national infrastructure, we provide a detailed mapping of the dependencies that airports, telecom masts, water towers and water treatment assets place on supporting electricity assets. Infrastructure usage statistics and census population data have been used to understand where large numbers of people are dependent on critical infrastructure. We integrate infrastructure system data with Environment Agency (EA) national flood risk assessment (NaFRA) outline maps to explore the potential disruptions associated with flood related failure within the Thames catchment.

The ITRC analysis is presented for three flood likelihood risk categories: (i) low - the chance of flooding each year is 0.5 per cent (1 in 200) or less, (ii) moderate - the chance of flooding in any year is 1.3 per cent (1 in 75) or less but greater than 0.5 per cent (1 in 200), and (iii) significant - the chance of flooding in any year is greater than 1.3 per cent (1 in 75). For each flood likelihood scenario the consequential infrastructure impacts and the number of customers directly or indirectly effected has been calculated.



Results from the analysis are plotted above to show the magnitude of potential customer disruptions that could result from flooding within the catchment. Rather intuitively, wastewater treatment customers are at a high risk of disruption; this is due to their geographic location, which is typically proximate to a watercourse. Conversely, water tower and telecom mast customers have a relatively low direct risk of disruption due to their location at elevation, away from flood prone areas. The largest numbers of potential direct customer disruptions are to those that consume electricity. This is particularly important for the customers of the other infrastructure sectors who face a large indirect risk due to their dependency on the electricity sector. Airports have the lowest potential magnitude direct and indirect disruptions, though disruptions in this sector can come at a high social and economic cost.