



# Flood resilience and resistance for critical infrastructure

## Project Summary SC080045/S1

A new report looks at how critical services provided by energy, water, sewage and other plants in the UK are affected by and protected during floods.

This project on flood resilience and resistance in critical infrastructure was established by CIRIA, the construction industry research and information association. The project builds on previous work on flood resilience in properties and aims to address issues raised by recent severe flooding in the UK. The report provides an overview of how the risk posed to critical infrastructure by flooding is currently managed across the UK.

Critical infrastructure comprises the facilities, systems and networks necessary for the functioning of the country and of essential services upon which we depend. 'Flood resilience' involves designing or adapting an infrastructure asset such that, even if it comes into contact with floodwater during floods, no permanent damage is caused, structural integrity is maintained and, if operational disruption occurs, normal operation can resume rapidly after a flood has receded. 'Flood resistance' involves designing or adapting an asset such that floodwater is excluded during floods and normal operation can continue with no disruption to the essential services the asset provides. These two techniques play a central role in managing the flood risks associated with critical infrastructure.

The report outlines the key challenges currently facing the industry in this area. Case studies illustrate the lessons learnt by infrastructure owners and operators who have suffered flooding problems in the past.

Flood risk management for critical infrastructure across the UK is then considered with respect to:

- flood risk assessment
- resilience and resistance measures
- investment prioritisation.

The report's key conclusions and recommendations are summarised below.



*Temporary demountable flood barrier protecting the National Grid switching station in Walham, Gloucester, the day after the flood inundation in July 2007 (Courtesy of Geodesign Barriers Ltd).*

Most flood risk assessment to date by infrastructure operators has made use of national flood maps prepared by the Environment Agency, Scottish Environment Protection Agency and Northern Ireland Rivers Agency. These maps provide information on a limited number of annual probabilities of river and coastal flooding only, ignoring the presence of flood defences. These maps do not make allowances for climate change (except in Northern Ireland).

It is currently difficult for operators to assess the degree of exposure to surface, groundwater and infrastructure-failure flood hazards. The next generation of flood maps, and their associated hazard registers, need to address this issue, making better use of existing information and ensuring that new data is collated in a consistent format.

The main issue with resilience and resistance measures is the standard to be adopted. Sir Michael Pitt recommended that resistance to a 0.5 per cent (one in 200) annual probability flood would be a proportionate starting point for critical infrastructure. It is easier to protect existing infrastructure from flooding than it is to adapt and upgrade the infrastructure.

The 0.5 per cent (one in 200) annual probability standard will be particularly difficult to achieve for roads and some rail infrastructure. The report recommends developing guidance on resilience/resistance standards for different categories of critical infrastructure which recognises the variations in flood hazard exposure and resistance/resilience levels. The report proposes a risk-based framework for these standards.

Flood resilience measures should be adopted as part of an organisation's business continuity management, whole-life asset management plans and climate change adaptation strategies. Critical infrastructure owners need to develop long-term strategic investment that optimises investment decision-making. The economic regulators should aim to provide a framework within which this objective can be achieved.

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