
How can we learn to live with rivers? The findings of the Institution of Civil Engineers Presidential Commission on flood-risk management

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In the wake of the floods of 1998 and 2000 the Government invited the Institution of Civil Engineers (ICE) to carry out a technical review of flood-risk management in England and Wales and to consider the most appropriate approaches to flood-risk management for the 21st century.

The findings of this Commission are published in the ICE report *Learning to live with rivers*. Further information on the Commission and its work is available at www.ice.org.uk/presidential.htm.

This paper provides an introduction to the need for such a review and the scope of the Commission's work. A summary of the findings of the Commission are presented along with key recommendations for improved flood-risk management in the future.

Keywords: floods; risk; management

1. Introduction

During the last decade, in particular in 1998 and 2000, parts of the UK were subjected to severe flooding. The costs of such flooding are immense, both in terms of human suffering and the economic losses associated with damage to infrastructure, loss of business and the cost of insurance claims.

It was in this climate of high public awareness of flood risk that the Government invited the Institution of Civil Engineers (ICE) to undertake a review of the technical aspects of flood-risk management in England and Wales and to consider the most appropriate approaches to flood-risk management in the 21st century. This review was undertaken by a team of expert commissioners under the leadership of a past president of the ICE, George Fleming.

The Presidential Commission consisted of Professor George Fleming, University of Strathclyde (Chairman); Mr Lindsay Frost, Lewes District Council; Dr Stephen Huntington, HR Wallingford Ltd; Professor Donald Knight, University of Birmingham; Mr Frank Law, formerly of the Centre of Ecology and Hydrology Wallingford; and Mr Charlie Rickard, Mott MacDonald.

One contribution of 18 to a Discussion Meeting 'Flood risk in a changing climate'.

2. Scope of the Commission

In particular, the Commission was asked to review the following subjects.

- (i) Current methods of estimating and reducing flood risk.
- (ii) Whether a more strategic catchment-wide-based approach to fluvial flood alleviation is appropriate.
- (iii) The impact of flood defence on the natural and built environment.
- (iv) Whether flood-risk management can make more use of natural processes.
- (v) Possible impacts of climate change.
- (vi) Experience in other countries.

A major part of the review was the gathering of evidence, both oral and written, from a range of interested parties, and this can be viewed at www.ice.org.uk/presidential.html, along with the minutes of all meetings.

3. Summary of findings

Current best practice for flood estimation in the UK is the *Flood estimation handbook* (FEH) (Institute of Hydrology 1999). This presents a statistical approach to flood estimation, using statistical analysis of flow records and rainfall-runoff methods based on the unit hydrograph. This is a steady-state method, recent data (from the last 10 years) are not included and changes in land use and climate are not considered. Computational power has improved dramatically over the years and a variety of numerical flood forecasting models have been developed, offering the opportunity to assess different scenarios. However, the computational approach has not been widely adopted in the UK, but with better computational power, increased data, a better understanding of the physical processes themselves, digital terrain models and increasingly accurate short-term rainfall forecasts it is becoming possible to predict flood events with increasing accuracy and in real time. This is seen as the way forward for flood forecasting and risk management.

Floods are a natural phenomena and cannot be prevented, only mitigated against. Nature disposes of the excess water generated from an extreme rainfall event onto the flood plain of the river. However, when humans start to develop the flood plain and introduce flood-protection methods to prevent inundation this emergency storage area is lost and the water conveyed downstream, often increasing flood risk for these communities. Similarly, changes in land use within a catchment can radically change the runoff pattern and the resulting flow regime. For these reasons it is vital that fluvial flood alleviation is considered on a catchment-wide basis. A review of best practice in flood-risk management in France, Italy, Japan, the US and the Netherlands further enforces the need for an integrated approach. Other countries have greater confidence in river-basin modelling than we have here in the UK and the technique is widely used for both flood-risk assessment and real-time flood forecasting.

Evidence presented to the Commission found that flood defences have a significant impact on both the natural and built environment, primarily by reducing flood risk.

In general, flood defences have been sympathetic to the built environment and are now an integral part of a sustainable built environment. However, defences have been less successful at reducing flood risk within the rural environment. It was also concluded that sustainable flood-risk management can only be achieved by working with the natural response of the river basin.

Evidence suggests that climate change is having, and will continue to have, a significant impact on the rainfall, evaporation and runoff within catchments. Best practice for flood estimation must be designed to include the effects of climate change if we are to produce accurate flood estimations.

Other key findings of the Commission include the following.

The human factor. The levels of distress, suffering and upheaval experienced by flood victims should not be underestimated and greater weighting should be given to the social/human factor when assessing flood risk.

Communication. It is important to communicate flood risk to the public. Public awareness and pressure on the public purse is high after major floods but as time moves on the risk of flooding is forgotten until the next time. This cycle of complacency must be broken and a sustained and long-term programme of flood-risk management be undertaken.

Skills shortage. There is a major skills shortage in the field of river engineering. Graduates are in short supply and the downward trend in applications to study engineering and mathematics is likely to continue. Ongoing training is vital and must be provided to Environment Agency, government, water-company and consultancy staff to ensure they have the necessary skills to manage flood risk in a successful and sustainable way. There is a particular need for training in the use of hydrodynamic models and the running of 'what if' flood scenarios.

Recommendations. Fluvial flood-risk management must be a holistic process. When considering where flood protection measures are required, the human dimension should be assessed in addition to technical and economic benefit–cost analysis. In order to successfully manage flood risk we need to fully understand the physical processes involved and how human activities such as agriculture and urban development can affect these. In order to do this a body of trained and motivated professionals is needed, equipped with the necessary tools and resources. Most importantly, in order to manage flood risk successfully the public must be engaged, as the understanding and cooperation of the communities affected is vital.

A selection of key specific recommendations are given below. The full list is published in the ICE report *Learning to live with rivers* (ICE 2001).

- (i) Human costs should be built into future benefit–cost assessments.
- (ii) Flood-risk maps should be updated to provide more detailed and accurate data to the public.
- (iii) It is vital to raise awareness and understanding of flood risk. Probabilities should be used to describe the likelihood of flooding and historic flood-level marks should be kept.

- (iv) Flood-risk assessments should accompany any planning applications for development within the flood plain.
- (v) Flood storage areas should be an identified land use and included in local plans.
- (vi) Flood emergency plans should be developed for all significant settlements at risk of flooding, to include flood preparedness and post-flood recovery plans.
- (vii) Flood-defence schemes should aim to provide protection against the 0.01 probability flood, even if a lower standard may yield a higher benefit–cost ratio.
- (viii) Further research is needed in the field of flood-risk management and should involve greater collaboration between the Environment Agency, the Department for Environment, Food & Rural Affairs (DEFRA), universities and research institutes.
- (ix) Publicly collected primary and processed data (topographical, meteorological, hydrological and hydraulic) should be made publicly available to ensure the data are fully used.
- (x) There is a lack of reliable flood event data and more emphasis should be given to collecting data during real flood events (at minimum burden to the Environment Agency and other services involved in emergency management).
- (xi) There is a strong case for significant increases in public spending on all aspects of flood-risk management, from maintenance of existing defences to new flood warning systems.
- (xii) Currently a range of bodies and organizations have responsibility for flood-risk management in England and Wales. Matters would be simplified if that responsibility was to be consolidated around one executive agency with enhanced supervisory powers over the various operating authorities.

References

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