



postnote

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MANAGING FLOODING

Up to 5 million people in the UK are at risk from river and coastal flooding. Annual average damage is estimated at around £800million¹. Recent severe flooding has led to suggestions that it is becoming more common and causing greater damage. While research continues on whether this trend is real, a number of possible causes are suggested: building on floodplains, alterations to river channels, changes in rainfall patterns and changes in agricultural and land management practice. Climate change is also predicted to increase flooding risk. This briefing outlines the policy and practice of managing river flooding, and examines how the response might be improved.

Background

River flooding is essentially a natural process that helps shape the landscape. It occurs when excessive rainfall (or melting snow) overwhelms the ability of the land to drain the water effectively. This is aggravated when the ground is already saturated and when river channels become blocked by debris. Flooding may also be exacerbated by changes in land use such as building on floodplains and changes in agricultural practices.

Throughout history, flooding has threatened human life and property. There have been many significant river floods in the UK. Some of the most devastating were in 1947, when nearly 300,000 hectares of land were covered by flood water, affecting most of southern, eastern and central England. In 1953, 300 lives were lost and an estimated £5 billion (at current prices) of damage was caused by coastal flooding. These events encouraged a substantial programme of building flood defences. The Easter 1998 and Autumn 2000 floods (see box) demonstrated that the risk remains significant.

A worsening problem?

In early 2001, The Commons Agriculture Select Committee noted² that the impacts of the 1998 and

Recent significant flooding in the UK

Easter 1998

The floods lasted 6 days and affected an area from Worcestershire to Cambridgeshire. More than 1,500 people were evacuated, five people died, (although there is a question over whether they died as a direct consequence of the floods), and insurance claims totalled £500-700million.

Autumn 2000³

Autumn 2000 was the wettest in the UK since records began (over 270 years ago) - much of the UK experienced prolonged and intense rainfall. For instance rainfall in October was four times the average for the month. In that period, more than 10,000 properties were flooded in England and Wales, and nearly 300,000 were at risk of flooding. Widespread disruption to road and rail services occurred. Weather-related Insurance claims totalled some £1billion.

Flooding in Shrewsbury, Autumn 2000



Source: Environment Agency

2000 floods were lessened by previous investment but pointed out that the potential impact of flooding on the nation's wealth and wellbeing is still significant, and potentially growing for a number of reasons:

- many flood defences will reach the end of their design life over the next decade
- the Government's estimates for new homes may increase pressure to develop on floodplains

- climate change is likely to affect rainfall patterns⁴, so potentially increasing the risk of inland flooding.

Policy framework

Government policy on flooding (see box below) is to reduce risks to people, property and the environment by:

- encouraging the use of adequate and cost-effective flood warning systems
- encouraging economically, technically and environmentally sound flood defence measures
- discouraging inappropriate development in areas at risk from flooding and coastal erosion.

Responsibilities for flooding policy

Flooding policy is fully devolved:

- England - The Department for Environment, Food and Rural Affairs (DEFRA)
- Scotland - the Department for Rural Affairs of the Scottish Executive
- Wales - The National Assembly for Wales
- Northern Ireland - the Department of the Environment.

On flooding, the UK Parliament has jurisdiction only in England - the focus of this briefing. DEFRA sets the criteria for investment priorities; pays capital grants to 'operating authorities', funds a research programme and ensures dissemination of best practice. In April 2000, DEFRA (then MAFF) set a series of 'High Level Targets' for the operating authorities against which it could monitor achievement of its aims and objectives for flood defence. The targets include (among others):

- providing policy statements setting out plans for delivering flood defence policy aims and objectives
- providing warnings and running emergency exercises
- developing a national database, through inspections of flood defences and flood risk assessments
- producing reports on development in flood risk areas.

Who implements policy?

This is the responsibility of 'operating authorities':

- The **Environment Agency** is the principal operating authority in England and Wales (the Rivers Agency in Northern Ireland and the Scottish Environment Protection Agency in Scotland). The Agency carries out general supervision over all matters relating to flood defence. It implements programmes of capital, maintenance and operational works; advises planning authorities on development and flood risk; reduces the risks of flooding from designated 'main rivers'; carries out flood forecasting and issues flood warnings.
- There are 235 **Internal Drainage Boards** (IDBs) in England and Wales with permissible powers to carry out flood defence works on watercourses which are not designated as 'main river' in their areas.
- **Local authorities** in England and Wales undertake flood defence works on watercourses not designated as 'main river' and outside IDB districts.
- In addition, many flood defences are privately owned and maintained for example, by the Highways Agency, Railtrack and other landowners.

Approaches to managing floods

Flood defences are built to protect people's lives and property and to sustain economic activity. Flood defences cannot provide absolute protection against all possible flooding but they can *reduce* the risk of flooding. Building defences to very high standards may be very expensive, may be highly intrusive in the human and

natural environment and may actually increase risks elsewhere or have disastrous results if any part of the system fails. Thus, there needs to be a careful balance between all costs and benefits. This is assisted by a range of indicative 'standards of protection' (see box below) that aim to ensure that risks are reduced to a level that is appropriate for the use of the land protected.

Standards of protection for flood defence

Severe floods occur less frequently than modest floods, leading to the idea of a flood having a 'return period', i.e. the number of years that might be expected *on average* between floods of a given size. For example, in some areas, the floods experienced in Autumn 2000 would have been expected only once in 200 years. This most definitely does not mean that such an event will occur on a regular cycle, once every 200 years, but that, averaged over a long time period, an occurrence of this scale is likely. Indeed, the risk is the same in any year.

It is not possible to protect against all floods and so measures are taken according to the expected frequency of specific floods. For river flooding, this 'standard of protection' is often set at the level of the '1 in 100 year return period' flood. This is also referred to as the '1 in 100 chance' flood, or the flood with a 1% probability of occurrence in an individual year.

There is a wide range of technologies that can be applied to flood defence; their actual use being a decision based on balancing economic, environmental and social factors (see the later discussion of appraisal). The most common approaches seek to protect the developed and natural environment by using constructed defences, e.g.:

- **raised river-banks and flood walls** - these exclude flood waters from the adjacent land and property but increase the height of flood waters above those protected areas.
- **canalisation** (or chanellisation) is the straightening, deepening and widening of natural river channels to increase flow capacity and to reduce flood levels but this may have adverse impacts on areas downstream and will significantly affect the river's natural features.
- **storage reservoirs** are used to regulate the flow of water in a main river channel by redirecting flood waters to a holding area and allowing the water to flow back into the main channel after the flood. Once the storage capacity has been exceeded additional flood flows may continue downstream undiminished.
- **sluices and barriers** are used to control and regulate the flow of water down the river channel. Tidal barrages in estuaries prevent surges moving upstream.

Less common (but increasingly sought), are approaches that seek to enhance the natural capacity of flood plain to store water, and to increase the amount of rainfall that can be absorbed into the soil higher up the catchment. Examples include maintaining meanders in river valleys, providing areas for floodwater storage (often also increasing nature conservation value), and ensuring sympathetic land management practices. These techniques are relatively novel, and there is less evidence of their cost-effectiveness than for the more traditional constructed defences.

Issues

Ensuring adequate funding

The Government's aim is to direct the funds available to areas of greatest priority. At present, annual investment in flood (and coastal defence) is around £400m per year. Of this, £240m is controlled by the Environment Agency (£150m for capital works and £90m for maintenance). Over the period 2000/01 to 2003/04, funding for capital works investment will have increased by 50%. However, it is widely recognised (e.g. by DEFRA¹, the National Audit Office (NAO)⁵, the Environment Agency⁶, and the Institution of Civil Engineers (ICE)⁷) that a substantially higher level of investment is required to avoid deterioration from current levels of protection.

Moreover, there are indications⁸ that climate change may have already increased winter rainfall over the UK, so potentially increasing flood risk. Estimates by DEFRA's consultants suggest that possible climate change would require investment to maintain current levels of protection to increase by £30-60m per year.

Ensuring value for money

Towards a more strategic approach

Over the past two decades, there has been a greater acknowledgement of the impact of flooding on people and property but also recognition that building flood defences can have adverse economic and environmental effects. For instance, DEFRA, the NAO, the Environment Agency and the ICE have all stated that the costs of some flood defences can be out of proportion to the risks faced, can harm the environment, can make flooding worse in other locations and affect the appearance of a local area.

Underpinning these changes in approach, the NAO, the ICE, the Environment Agency and DEFRA point to a need for a long-term policy on flood defences that considers entire river catchment areas. Such 'catchment flood management planning', (CFMP) is still in its infancy. Five pilot CFMPs are currently being developed by the Environment Agency⁹.

As an expression of these ideas, recent Government policy guidance¹⁰ seeks to influence developments in flood risk areas by stating:

- no development, including flood defence schemes, should lead to an increased risk of flooding elsewhere
- the susceptibility of land to flooding is an important planning consideration
- policies in development plans should outline the consideration that will be given to flood issues
- development planning should wherever possible avoid flood risk, and always seek to manage appropriately
- inappropriate development on undeveloped and undefended floodplains should be avoided
- developers should fund flood defences and warning measures in flood risk areas.

Project appraisal

Recent reviews have highlighted the need for individual flood defence schemes to be assessed in the wider context of the river catchment. The Government, the

Environment Agency, NAO and ICE recognise that these appraisals should take account of economic, environmental and social issues. Particular concerns are expressed by the ICE that the traditional appraisal of flood defence schemes has concentrated on mainly economic factors and so tends to overlook the consequences of flooding for affected people, especially in terms of the considerable distress and health damage that can result. For example, the ICE pointed out that houses often flood with sewage from drains and sewers overwhelmed by heavy rain. It suggests that this is more distressing than flooding from rivers and poses a considerable health risk. Such findings are supported by surveys by the Middlesex University Flood Hazard Research Centre (FHRC) of people's experiences from the 1998 floods.

The ICE therefore recommended that "*research be progressed to improve benefit-cost assessment, to enable monetary values to be attributed to the cost of health and social distress caused by flooding, or the benefit of its avoidance.*" DEFRA has commissioned a research consortium, including the FHRC, to develop a methodology by which such 'human cost' can be readily brought into the appraisal framework, and the results should be available in 2003.

In May 2001, DEFRA published the latest volumes of guidance on appraising flood and coastal defence projects (see box below). This provides advice on best practice for the appraisal of flood and coastal defence projects to ensure better use of public money and more transparent decision-making. Overall, the guidance points out that appraisals should take account of economic, environmental and technical issues underpinned with an adequate consideration of risk.

The appraisal of flood defence projects

Economic appraisal - The aim is to maximise overall protection through the national investment programme. Projects must demonstrate economic efficiency, so the standards of protection must be appropriate to the current land use. Projects are considered economically viable only if benefits exceed costs with the return on investment maximised where the highest ratio of benefits to costs can be demonstrated for each project by considering different options (including the 'do nothing' option), set against indicative standards.

Handling risk - Explicit account should be taken of uncertainties in the decision making process. Where risks are identified they can be avoided by alternative approaches or managed to reduce their consequences.

Environmental appraisal - The guidance sets out the scope of the environmental aspects of flood defence (e.g. biodiversity and landscape). It recognises the difficulties of placing reliable monetary values on environmental impacts while offering advice for appraising common situations.

Other issues are included in the guidance, such as strategic planning, climate change and sustainability. DEFRA is planning to issue further guidance on evaluating the performance of projects once implemented.

Increasing awareness and preparedness

Flood forecasting and warning

The box on page 1 summarises the consequences of the 1998 Easter floods. A review of these events led (among other things) to the establishment of the Environment Agency's National Flood Warning Centre to develop flood forecasting and warning systems.

Flood forecasting involves interpreting measured and forecast rainfall, and river and tidal levels, often using sophisticated mathematical models. This requires monitoring systems, which consist of a network of rain and river flow gauges and associated systems supervised by the Environment Agency. Daily rainfall forecasts provide information on the likely quantities, distribution and timing of rain for up to 5 days ahead. In particular, heavy rainfall warnings issued for periods up to 24 hours ahead are used to assist flood forecasters in deciding when to issue flood warnings.

Weather radar can be used to estimate actual rainfall and, by extrapolating rainfall patterns, to support short-term forecasting. Forecasting methods vary from simple extrapolation of upstream river levels to predict levels at given points downstream, through to sophisticated predictive catchment flow forecasting modelling systems. While such models are useful in supporting decisions to issue flood warnings, the ICE points out that these remain very uncertain. Although research is continuing to improve forecasts, decisions to issue flood warnings remain a matter of human judgement.

Emergency response

The NAO, Environment Agency and the ICE have stated that the wide range of organisations and responsibilities involved creates difficulties and confusion, possibly even increasing the risk of suffering flood damage for some people. One option put forward (e.g. by the NAO and ICE) is for the responsibilities to be firmly consolidated on a single executive agency with enhanced supervisory powers over the various operating authorities. The Government also plans to overhaul emergency planning legislation but the timetable is unclear at present.

Clean-up and recovery

As discussed above, flooding has a devastating effect on property and also causes great distress to the people affected. The Environment Agency has produced guidance on how to clean up, dry out, restore and repair a home after flooding, together with details of organisations that can offer information, support and practical help in the clean-up operation.

Clearly, however, the clean-up has to be paid for. This is the role of flood insurance. The Association of British Insurers has stated¹¹ that insurers wish to continue providing affordable cover against the risk of flood damage unless the risk has increased such that flooding has become inevitable. There are many issues related to the provision of flood insurance¹² but they cannot be covered in this short briefing.

Overview

The recent reviews of flood management indicate that many consider the current levels of funding to be inadequate to maintain current standards of defence in many areas and that this is likely to worsen given any climate change. The Government is expected to report on a review of the funding mechanisms for flood defence by the end of 2001 and to consult on a package of proposals. Nevertheless, whatever the level and mechanisms of funding, spending must be targeted appropriately. Investment decisions should therefore ensure value for money, taking best account of economic, social and environmental concerns and involving the public in planning and decision-making.

Also the assessment of flood risk needs to be improved, in particular, to ensure that flood forecasting can take account of land-use changes and climatic uncertainty. However, people at risk from flooding need to recognise that floods cannot be prevented, only managed. Awareness of flood risks therefore needs to be raised. At the same time, more effort should go into preparing for flooding and into helping recovery after a flood, including improving planning and co-ordination of emergency responses.

Further work

This briefing provides a concise overview of some of the main issues regarding how inland flooding is currently managed and how it might be improved. In January/February 2002, POST will conduct an internet-based discussion on this topic in conjunction with the Hansard Society. Parliamentarians and others are invited to participate. POST plans to consolidate its work in this area later in 2002 and to produce an update to this briefing. Further information is available (see below).

Endnotes

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- Commons Agriculture Select Committee, 2001. 3rd Report Session 2000-01, *Flood and Coastal Defence: Follow-up*. HC 172.
- POSTnote 151 Autumn 2000 floods and rains, December 2000.
- On coastal flooding, sea levels are expected to rise by up to 6 mm each year over the next 50 years in south-east England.
- National Audit Office (NAO) *Inland Flood Defence*, March 2001
- Environment Agency, *Lessons Learned*, March 2001
- Institution of Civil Engineers, *Learning to Live with Rivers*, November 2001
- Osborn, T.J., Hulme M., Jones, P.D. and Basnett, T.A. (2000). Observed trends in the daily intensity of United Kingdom precipitation, *International Journal of Climatology* **20**,347-364.
- The Irwell, Derwent, Medway, Severn and Parrett catchments
- DTLR, 2001. *Development and Flood Risk*. Planning Policy Guidance Note 25.
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- e.g. see Commons Hansard, 20 November 2001, 1WH-24WH

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