

# The evolution of floodplain risk management and real-time flood management planning in New South Wales

*Chas Keys reflects on floodplain risk management endeavours and planning for flood response over the years*

## Introduction

Queensland and New South Wales account for the great bulk of the flood problem in Australia. In round terms each of the two states bears 40 per cent of the total economic cost which floods generate nationally and the great bulk of the deaths which they cause. Estimates of the average annual dollar costs of flooding in NSW range (in 1998 dollar terms) from \$128 million for all floods costing at least \$10 million between 1967 and 1999 – not a period associated with particularly frequent or severe flooding (Bureau of Transport Economics, 2001:35) – to \$148 million (Agriculture and Resource Management Council of Australia and New Zealand, 2000:2). Genuinely severe floods, such as the 1955 flood in the Hunter Valley which cost roughly \$700 million in today's dollar terms, may by themselves greatly exceed the state-wide average. As far as deaths are concerned, floods in NSW have killed hundreds of people and perhaps as many as 1,000 since the beginning of European settlement.

In the history of NSW, there have been six separate flood events which have killed at least 20 people (Coates, 1996:51).

In NSW there have been formal attempts to manage the problems wrought by flooding almost since the earliest days of the colony. The effort intensified after the great floods of the mid-1950s, and especially over the last three decades considerable sums have been expended on floodplain management initiatives around the State. Increased attention has also gone into planning to improve the quality of real-time responses to floods since the early 1990s.

## Influencing and protecting development: floodplain risk management initiatives

Governor Lachlan Macquarie began the floodplain management effort during the second decade of the nineteenth century, providing allotments on high ground for the dwellings of settlers farming the lower floodplains of the Nepean and Hawkesbury rivers. He set up the 'Macquarie towns' which were intended to be (but as the 1867 flood proved were not) above the levels which floods could reach. Later in the century a number

of towns in other river valleys were relocated from severely flood liable sites to locations on higher ground. Bega, Gundagai, Moama and Nowra were among them. Other towns, bruised by the experience of repeated flooding, began to eschew the lowest-lying land near major watercourses. Farmers constructed levees to keep floods out of croplands and some towns, especially in the western parts of NSW, formed the habit of pushing up earth levees when floods were approaching.

But it took the events of 1954–56, when almost all the State's major rivers saw genuinely serious floods, to initiate a trend towards comprehensive, co-ordinated floodplain management initiatives in NSW. Before long a number of special-purpose flood mitigation authorities had been established in the valleys which were especially badly affected. These councils (and where they did not exist the territorial councils of local government) moved to contain the effects of flooding, principally by building levees to protect the flood prone parts of urban centres. In several cases, ring levees were built to give protection to whole towns. Dams constructed to provide irrigation and town water supplies were planned with flood storage 'airspace', contributing to the mitigation effort, and drainage works were undertaken to allow the speedy removal of floodwaters from farms on floodplains.

This was the era of structural works aimed at controlling flooding. Helped by grants from the higher levels of government, considerable sums were spent by councils to build them. By contrast little was done to use planning instruments to restrict development on floodplains. Powers existed, but even when they were used, the monitoring and enforcement were weak (May et al, 1996:72). Nor were there concerted efforts to modify existing developments to ensure their greater resilience when flooding occurred.

Severe and repeated flooding across much of NSW in the early and mid-1970s generated the impetus for the creation of a stronger regulatory system by which the State Government sought to remove existing development from flood liable areas or to make it more compatible with the flood risk, and to prevent future development from being undertaken there. The instruments adopted to ensure local councils' compliance with the new policy were highly stringent, prescriptive and coercive (Smith, 1998:236), and there was considerable resistance. There was also a public outcry against the maps which the State Government had produced to show in statistical (annual exceedence probability) terms the level of flood risk in various flood liable areas. People felt they would have the effect of devaluing their properties. Eventually, the maps were withdrawn.

The pressures mounted against the policy by councils and the public forced a radical modification of it in 1984. A more flexible, more co-operative approach emerged in which development outcomes on floodplains were negotiated according to their merits rather than on the basis of strictly statistical measures of flood frequency which substantially ignored the realities of flood impacts. These varied greatly in different areas for land with similar levels of risk in terms of frequency of inundation. The State

Government incorporated its new flood policy in a guiding manual for councils (NSW Government, 1986) and provided substantial funding so that flood problems could be carefully studied before land use decisions were made or mitigation measures adopted. The previous emphasis on levees was reduced, too, by the encouragement given to the voluntary purchase of flood prone properties and the raising of houses on floodplains. Floodplain management was becoming more flexible in approach and more varied in method.

The manual has been re-issued twice (NSW Government, 2001, 2005) with considerable modification of detail and with further comprehensiveness of approach being introduced. Emergency management measures relating to preparations for flooding are increasingly to the fore, and councils have been required to take note not only of adopted 'design' floods (typically the 1 per cent annual exceedence probability event) but of rarer and more devastating floods up to the level of the Probable Maximum Flood (PMF).

Despite the many controversies which have accompanied the evolution of floodplain management policy in NSW, including those of the mid-1980s, it has been a signal success in the management of the effects of flooding. One independent expert observer has argued that floodplain management policy in NSW is "close to international best practice in the field" (Smith, 1999:1), the State having approached the problem with "a degree of consistency and vigour unmatched by the other states of Australia" (Smith, 1998:235). The outcome has been a considerable slowing of the increase in the exposure of public and private assets, a reduction in flood relief payments and a considerable mitigation of the disruption and nuisance which flooding causes. NSW is, to a significant extent, a case in which the oft-stated

"manageability" of flooding has been achieved as a result of the promotion and funding of a wide range of increasingly well-tryed methods which can exploit this very characteristic of the flood hazard.

## Preparing for the real-time management of floods

Floodplain management initiatives are undertaken outside flood time in anticipation of flooding occurring in the future. When floods actually occur there is a need to manage their effects in real time. Communities did this from the start in NSW. Private and police boats were used to rescue people in danger and to resupply those who were cut off by floodwaters, the local efforts sometimes reaching quite high levels of co-ordination and sophistication. Between 1869 and 1900 a number of towns on the eastward-flowing rivers between the Hawkesbury River and the Queensland border set up volunteer 'water brigades' for the purpose of saving life and property during times of flood (Lewis-Hughes, 1998). At least 20 brigades had been formed by the end of the nineteenth century and, while most had gone out of existence by the 1950s, their crews of young men in rowboats had saved many lives when people were trapped in rising floodwaters, unable to escape by their own efforts.

The great floods of the mid-1950s resulted in a special purpose, volunteer-based flood management agency, the State Emergency Services (SES), being established to lead communities through future episodes of flooding. The SES has been involved in flood response activities ever since, beginning with organising the raising of existing levees to protect property when floods were approaching and delivering blankets to evacuation centres when people had been forced to leave their homes. But the SES was quickly involved in preparing for flood responses as well. This it did by working to

improve the quality, safety and numbers of floodboats which were used for rescue and resupply purposes when floods were occurring, and by augmenting or establishing basic flood warning systems in river valleys throughout the State. This latter task involved recruiting volunteer gauge readers and developing arrangements for the collection and interpretation of flood data from the field and the broadcasting of information and advice over radio stations.

Later, the SES began to develop simple plans to guide local flood response activities and to experiment between events to find the best ways of dropping supplies to people who were cut off by floodwaters. During the 1970s, in particular, the SES became highly practised in setting up tent cities for evacuees and in managing evacuation operations generally. In flood times, the SES came to be the central co-ordinating agency for the many types of response activity that had to be undertaken.

But in 1989, a report on the activities of the SES was severely critical of its efforts in the planning field. The suggestion that the management had not been sufficiently forceful in promoting flood planning brought a new approach. Increased emphasis was placed on the development and utilisation of 'flood intelligence' (basically, information on the consequences of flooding in defined areas at specified gauge heights), and significant resources were devoted to the development of flood plans at the local council level. These plans created 'records of intended proceedings' for flood operations, and as the bank of flood intelligence grew it became more and more possible for SES controllers to visualise the kinds of decisions and actions which would be needed for floods of different levels of severity within their areas of responsibility. By the mid-1990s all council areas with a significant riverine flood problem (more than

130 out of the then 170 local government areas in the State) had a flood plan which noted what would be done to address the warning, information-providing, resupply, property-protecting, evacuation and other tasks which usually need to be carried out when floods occur.

As far as possible, within the limits of the available intelligence, all levels of flood severity were recognised in this planning, including flooding caused or made worse by dam failure. Several dams in NSW were known to be at risk of failure in extreme rainfall events or because of structural deficiencies, and planning to warn and evacuate people below them became an important component of the SES's flood planning generally. In like vein, the SES developed arrangements to guide responses to tsunami.

When each council area had a flood plan, attention shifted to deepening their contents and ensuring that SES personnel understood how to use their provisions. The latter objective was sought in part by introducing a regime of periodic testing of plans and personnel, tabletop exercises being used to identify the sorts of decisions which would be required given particular forecasts of flood severity (for example, in predictions provided by the Australian Bureau of Meteorology). At the same time the planning for key tasks, notably warning and evacuation, became more detailed and the plans spelled out how these tasks would be carried out under specified conditions (for example, in relation to severity).

Doorknocking operations, needed when many people have to evacuate, are being planned in considerable 'how-to' detail and the arrangements tested in field exercises. SES division (regional) controllers have recently been required to prepare indicative warning messages outside flood time to guide what will be sent to radio stations for broadcast during floods. Preparing these messages in quiet time ensures that the flood intelligence can be appropriately

incorporated and the relevant notes of persuasion to action (whether to protect assets or to evacuate) are included. Experience had shown that it was extremely difficult to get these issues properly covered when warning messages were put together wholly during the busy time when floods were approaching. Too often, what went to air did not adequately explain the problem to people in the path of coming floods or motivate the responses required to promote property protection or evacuation to safety. Many warning messages, in fact, were simply not understood by their intended audiences.

More depth was also sought in the planning of evacuation operations. This was stimulated by the recognition that NSW has several areas in which there will, in severe floods, be large numbers of people needing to evacuate to safety in short periods of time before evacuation routes are lost to rising floodwaters. The Windsor area, on the Hawkesbury River, and the Lismore area, on the Richmond, are two such cases. The recognition that many lives will occasionally be at risk in such situations (which include instances of densely-populated 'flood islands' which will be fully submerged in floods well below PMF proportions) has stimulated an approach in which evacuations are carefully planned against time horizons. The intention here is to ensure operations can be 'paced' to get everybody to safety in the time available as determined by the flood forecasts on the day. This work is an example of the concern the SES has about the dangers that will be created by very severe floods worse than have been seen in the State's flood prone communities to date (see Opper, 2004, for a full description of the timeline approach).

One further example of the SES's flood management work should be mentioned. This is the effort, especially over the past five years, to educate the members of flood prone communities about the



Source: Department of Lands Panorama Avenue Bathurst 2795  
www.lands.nsw.gov.au

*The Kelso floodplain on the eastern side of the Macquarie River at the peak of the flood of August, 1986, the year before the voluntary acquisition scheme was introduced. Note particularly the density of dwellings in Hereford St, left of the centre of the photo and running away from the river.*

flood threat they face and what they can do as individuals to manage its potential effects on their own properties and families. Commemorations of past floods have been useful vehicles for the dissemination of 'floodsafe' action guides with contents tailored to local environments (Keys et al, 2003a). Breakfasts have also been held at which business operators in flood liable central business districts have been given flood planning toolkits to help them understand how they can better cope with floods in the future (Gissing et al, 2005).

### Appraisal

What stands out in the history of floodplain risk management and planning for real-time flood management in NSW is the increasing comprehensiveness of the efforts being made, especially over the past 15–20 years. A wide range of flood mitigation measures, structural and non-structural, has been employed by councils to

tame the costs of flooding. It is difficult to be precise in economic terms about the impact of these measures, but it can be said that dozens of communities now have levee protection, and many have conducted programmes to remove dwellings and other buildings from flood liable areas or raise them higher above the ground. New development has also been discouraged from floodplains. The impacts of these measures have been widespread, significant and positive.

The SES's preparations for the real-time flood management task have similarly become more comprehensive. The planning is deeper and more detailed than previously. Flood intelligence is developing steadily (and with it, local volunteer comprehension of the problems to be dealt with is growing), and members of floodplain communities are being engaged in educational activities designed to help them better

manage the flood hazard in their own areas.

Floodplain risk management and planning for real-time flood responses are also being better integrated. Consultant studies of flood problems, once designed solely to inform councils' decisions on floodplain management strategies, are providing increasingly detailed and useful flood intelligence on which the SES can conduct its planning. In return the SES plays an increasing role in advising councils about emergency management considerations relating to potential developments on flood prone land (Keys et al, 2003b). This is in line with the State's flood policy which has sought, over time, to incorporate more formally the emergency management dimension of the flood problem.

Despite these significant positives, there are several barriers and challenges to be dealt with. Some relate to the relative infrequency of



flooding at the local level. Parts of NSW have had no floods for more than a decade, and no severe ones for much longer. The State has had three severe droughts during the past quarter century and, the floods of Nyngan (1990), Coffs Harbour (1996) and Wollongong (1998) notwithstanding, very few flood events that could be said to be genuinely severe. In these circumstances it is difficult for SES volunteers, most of whom have a bent towards response activities rather than planning, to develop and maintain a focus on preparing for floods. There is a risk when floods are few and far between that attention will drift to the organisation's many other roles.

The attention of councils may drift too, compounding the oft-existing tendency to believe that floods are less of a threat than the State's flood policy shows them to be, and leading to reduced vigilance about development on floodplains. Fortunately, many councils have

shown great tenacity in tackling their flood problems. One such council is Bathurst, in the NSW central west, where the 100 dwellings on the Kelso floodplain at the time of the 1986 flood have been reduced to 25 since a voluntary acquisition scheme was initiated in 1987. No doubt the occurrence at Bathurst of three floods of about 2 to 3 per cent annual exceedence probability in a short period (1986, 1990 and 1998) has helped to maintain the focus.

Similar cases of maintaining the commitment to the reduction of the impacts of flooding can be cited in other parts of the State. This has not been easy given the continued threat to the federal funding of floodplain risk management initiatives in recent times and the sense that the State government's flood management group (which has been crucial in guiding councils' efforts) has been reduced in size and to a degree marginalised

in numerous departmental restructurings since the mid-1990s.

Other challenges relate to difficulties in the relationship between councils and the SES. Some councils have been critical of SES flood warning initiatives, fearing negative short-term commercial effects and the 'advertising' of flood problems to the wider world. Some councils have also tended to use marginal planning practices in their own floodplain management dealings. One of these is the practice of requiring evacuation plans, in the case of development applications relating to flood prone land, to be prepared on behalf of development proponents before consent will be forthcoming. The SES has argued with councils and in the Land and Environment Court against this approach given that such plans are likely to be written only for the purpose of gaining consent, cannot be kept current and fit for the purpose of preparedness for evacuation, and cannot be policed



Source: Department of Lands Panorama Avenue Bathurst 2795  
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*The same scene at the peak of the flood of August, 1998. There has been a marked thinning out of houses in Hereford St and to a lesser extent in other streets to the right (south) which became part of the scheme later than was the case with Hereford St. The 1998 flood created an acceleration in the rate of take-up of council offers to purchase properties.*

effectively over the longer term when properties change hands (see Keys et al, 2003b). The SES encourages private flood plans (indeed it has templates for their preparation) but it opposes their linkage to a consent context in which they are likely to be used to 'paper over' the safety issues relating to development sites rather than to address the problems.

These difficulties notwithstanding, floodplain risk management endeavours and planning for flood response have made considerable progress in NSW in recent times. The State's flood prone communities are undoubtedly in better stead to cope with flooding now than they used to be even though the challenges of ensuring they are made safer and less prone to economic loss remain. Making communities ready for the flooding they will inevitably face is a never-ending task. It is a task that cannot be met without both sound floodplain risk management practices and effective preparation for responses to floods.

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## Other AJEM articles by Chas Keys

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