PLANNING FOR FLOODS IN NEW SOUTH WALES

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Six years ago, the State Emergency Service in NSW was subject to a process of review. Like most such exercises, the review found the organisation had some strengths and some weaknesses - but it was the weaknesses which drew most of the attention. In particular the evaluation was severely critical of the lack of planning that had been done to prepare the organisation and the community for floods. The SES had been responsible for the management of floods since its inception in 1955, but only a few flood plans had been prepared and no formal program to create a comprehensive body of plans was in evidence.

Since the review, and the organisational restructuring which it helped bring about, a major planning project has been under way in NSW and this project has now produced a flood plan for almost every council area in the state which can be said to have a riverine or lacustrine flood problem. Moreover, efforts are being made to ensure that these plans are kept alive and useful to emergency managers and that they are known about and understood in the communities in whose interests they have been prepared.

The Flood Potential in NSW

Like Queensland, and to a greater extent than the other states of Australia, NSW has a serious flooding problem. Floods are frequent events: even in the 1990s, when eastern Australia has been severely affected by drought, a flood warning has been current somewhere in the state for between a quarter and a third of the time. Large numbers of people live in flood-liable areas, and the value of the agricultural, industrial, commercial, residential and public assets which are at risk from flood waters is massive.

Every few years, huge areas of inland NSW become flood-bound as happened in 1955, 1956, 1971, 1974, 1976 and 1990, and periodically there is severe flooding along the more heavily populated coastal rivers which can threaten substantial urban and rural populations.

The state has a long history of disastrous flooding which, in the nineteenth century, caused the relocation of a number of burgeoning towns. In this century, substantial urban centres like Lismore, Grafton, Kempsey, Maitland, Moree and Forbes have been severely and repeatedly damaged by flooding, and Sydney and nearby areas have not escaped the ravages of flood waters. Periodically, mass evacuation has been necessary - the last occasion in April 1990 when virtually the whole of Nyngan (population 2500) had to be evacuated to Dubbo when the levees which had protected the town were overtopped.

All told, the average annual cost of flooding in NSW has been estimated at some $150,000,000 - about 40 per cent of the Australian total (Australian Water Resources Council, 1992). This same source places the number of urban properties in NSW which

are at risk of inundation in 1% AEP (Annual Exceedence Probability) flood events at 110,000, to which must be added an unknown but large number of rural properties which are similarly exposed. Literally dozens of towns and villages have flood liable territory, and many are built entirely on floodplains. The vast majority of the local council areas of the state, in fact, have some developed land which is prone to inundation, and large tracts experience frequent flooding.

The 1% flood event in an area does not, of course, define the limit of potential flood liability there. Floods more rare and more severe than the once-in-100-years event can and do occur. Windsor, on Sydney's north-western fringe, had a flood in 1867 of a magnitude which is likely to occur there on average only once in about 250 years, while Maitland (in the lower Hunter Valley) experienced a 200-year flood in 1955. Nyngan's flood of 1990 is reckoned to have been of a magnitude which would be experienced at the town, on average, only once every 250 years (Department of Water Resources, 1990). Similarly rare and severe floods will no doubt occur in these areas and others in the future.

Given the profoundly river-oriented nature of the NSW settlement pattern, generated as it was primarily in the nineteenth century, these floods are likely to be serious in the extreme. A once-in-200-years flood on the Clarence River, in the state's north-east, would overtop a number of town levees and flood the houses of nearly 20,000 people in Grafton and a number of smaller centres and rural areas nearby (Soros-Longworth and McKenzie, 1980). Such a flood would only be slightly larger, in peak discharge and in flood height, than the worst flood ever recorded on the Clarence River since European settlement. Few of the levees built to protect towns in NSW, incidentally, are designed to keep out floods as severe as the once-in-200-years events would generally be.

An indication as to just how severe flooding could be is given in Figure 1, which compares the hydrograph of the record 1955 flood at Maitland with that of an 'extreme flood' (an estimate of the Probable Maximum Flood) at the same location (Newcastle City Council and Port Stephens Council, 1994). Clearly, the record flood would be dwarfed in terms of magnitude and, no doubt, of severity. At Grafton, the peak discharge of the Probable Maximum Flood is estimated to be nearly three times that of the record flood of 1890, and a PMF would overtop Grafton's protective levees by a matter of some metres (Water Studies Pty, 1992, 8). PMFs are, of course, theoretical - but floods which are well short of the magnitude of such extreme events can happen and can be very severe indeed.

Beyond the potential impact of flooding which can be considered to be a normal, even if rare, part of nature, there is another flood threat in NSW. Some 26 storage dams, it has been ascertained, are 'deficient' in the sense that their failure is possible in a very large flood or because of structural weaknesses, and others are suspected of being deficient and accordingly are under investigation. Dam failure, by its very nature, would cause more severe flooding over considerable downstream stretches of river than nature could produce by itself. Most of the deficient dams are thought to be likely to fail only in extreme flood events - events of a magnitude that would be likely to occur at each dam

site only once in several hundred or thousands of years in most cases - but the potential impact in several instances is huge.

If Warragamba Dam, to the west of Sydney, were to fail, the number of dwellings in Penrith, Richmond, Windsor and nearby areas which would be at risk would be about 20,000. Failure of Burrendong Dam, on the Macquarie River, would do great damage to the centres of Wellington, Dubbo, Narromine and Warren besides inundating huge areas of rich farmland to unprecedented depths and for very long periods. Most of the deficient dams in the state are smaller than these two and failure would cause damage over much more localised areas and affecting much smaller populations: nevertheless, in most cases the impact of failure would be catastrophic in the areas affected.

Dam-failure flooding, then, and large-scale 'natural' flooding even well short of the severity which nature is believed to be capable of creating, would be disastrous in the areas they struck. Even the more routine and frequent floods can be costly and dangerous, and, indeed, it is these events which are responsible for most of the damage which flooding actually does.

Because of the severity of the state's flood problem, a great deal of community effort has been expended to mitigate the damage which flooding does. By the early 1990s, one estimate was that some $375,000,000 had been spent since about 1950 by public authorities in NSW (Clarke, 1991). The vast majority of this money was committed to engineering works such as levees, retention basins, mitigation dams and bypass channels, through increasing proportions of the total flood mitigation effort of recent times has gone to the so-called 'non-structural' approaches. These include discouraging development in flood liable areas, flood proofing dwellings by raising them above flood height, developing flood forecasting and warning systems, equipping emergency services for flood response work - and, of course, planning for the moment when flooding occurs.

Planning for Floods

From an emergency planning perspective, floods are among the more manageable of hazard agents. They happen fairly often and in some areas according to a regular seasonal rhythm (which creates familiarity with them and opportunities to gather data on their behaviour), they are predictable as to location (that is, they occur on and adjacent to rivers), there is usually some warning of their occurrence (which facilitates resource allocation and decision-making in the response phase) and it is usually possible to determine who will be affected and what the problems will be as far as warning, rescue, evacuation and resupply tasks are concerned. Certainly, floods are easier to plan in detail for than thunderstorms (which are capricious and for which there is usually little warning), exotic animal diseases or volcanic eruptions (which are rare in Australia to the point of being virtually unknown) or Lockerbie-type air crashes (which simply cannot be planned for in specific terms or in detail). In short, much can be known about flooding before it occurs, and there is an opportunity to work out in advance how it can best be managed in the interests of protecting property and maximising human safety.

Despite all this, and despite the severity of flood threat in Australia (particularly in the eastern states), detailed and systematic flood planning has been lacking in this country. In the main this has been a result of the response-oriented culture of the emergency management organisations which have been slow to embrace the full dimensions of the link between the preparedness and response foci. Yet it surely cannot be denied that efficient response will be to some extent a consequence of high-quality preparedness – not only in terms of having personnel trained for the necessary field tasks when floods strike but also in terms of ensuring that a managerial understanding of the consequences of flooding is established in the response agencies before floods actually occur.

In NSW, the State Emergency Service is the legislated 'combat agency' for floods. This has in recent years been interpreted as meaning that the SES must develop a high level of expertise in flood management which goes beyond tasks such as floodboat operation and the rescue and evacuation of people once floods have struck. In particular, the organisation has been encouraged to recognise that it must develop a broadly-based understanding of the flood hazard and prepare managerially for it. A central element of the now heightened emphasis on preparedness is the preparation and use of flood plans.

The Flood Planning Project in NSW

The SES embarked on a major flood planning project in 1990 with the aim of developing a flood plan for all council areas with a potential riverine or lacustrine flood problem. These plans cover all identifiable, credible flood threats both natural and, where applicable, those related to the potential failure of dams with known flood-handling or structural deficiencies. They cover all levels of flood severity, from mere freshes on rivers (necessitating no more than the issuing of pump warnings for farmers) to events which could necessitate mass evacuation possibly involving thousands of people. Each local government area (or in a few cases pairs or groups of them) has a single flood plan.

The plans are written to a standard structure from a generic model. The process starts, in each case, with an appraisal of the hazard - in which the SES has benefited from the numerous flood and flood management studies commissioned over the past 15 years by the former departments of Public Works and Water Resources. These studies have collected a vast amount of data on flood history and frequency and have made estimates of the discharges, velocities and flood levels which would apply for a range of design floods.

Another important element has been the appointment of an Intelligence Officer in the State Headquarters of the SES. It is the task of this officer to obtain and process information on flooding from these studies and from local council and SES records. Much of the information relates to the effects of flooding on communities at specific gauge heights: such data forms a vital basis for decision-making within the planning process and during floods themselves. The Intelligence Officer also ensures that as floods occur, information about them is systematically captured so that it can be used to update and further our understanding of flooding and build up our stock of height-consequence intelligence.

Further information may need to be gleaned from specialist sources. A case in point is demonstrated by the existence of the several dams in NSW which are deficient and liable to failure. Where this problem exists, dam owners have been required to provide information on the area at threat should failure occur and the amount of time which is likely to be available between the point at which the threat becomes a real possibility and the time by which an evacuation must be completed. This information demonstrates who is at risk (generally, many more people are at risk from dam-failure flooding than from 'normal' flooding in the same valley) and provides a basis for determining what sorts of warning procedures and evacuation arrangements will be necessary.

The actual writing of the plans began with the production of a generic model plan and the conducting of a number of planning clinics to assist SES volunteers in coming to grips with the planning task: in essence, this involved the development of the skills needed to produce flood plans. As drafts of these plans were written, State Headquarters staff reviewed them and offered comments. In many cases, particularly where the planning problems were complex and difficult to solve, staff provided direct assistance in defining the issues, seeking answers to questions about warning, evacuation and other elements of flood response and actually preparing the plans themselves. Nearly five years later, about 115 local flood plans have been produced and the first phase of the project is nearing.

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