PART NINE

POLICIES AND PROGRAMS FOR FLOOD HAZARD MITIGATION

OPERATION OF NEW SOUTH WALES FLOOD POLICY

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Introduction

Australia is the driest continent. McMahon (1982) presented a comparison of world and Australian hydrology showing that in general Australia's streams are considerably more variable than other rivers. For example, relative to mean annual runoff, mean peak annual floods are about an order of magnitude larger in Australian rivers than elsewhere. It is this large variation in flow that leads to significant flood problems in Australia. This paper outlines the system of floodplain management in New South Wales, the most populous state in Australia.

Early History and Settlement Trends

European settlement in Australia commenced in Sydney, the capital of New South Wales, in 1788. From that time towns were established on the fertile floodplains of the state's rivers. Awareness of the flood hazard by the early settlers was generally outweighed by the more pressing demands for survival, and development of the floodplains proceeded. Flood events, even those of great severity, had little discernible impact on the patterns of urban development. This is a trend familiar to floodplain managers the world over.

Institutional Aspects

Political Framework

Australia has a three-tier government. It has a federal government covering national issues. At the second level is a set of six state and two territory governments. The third level is local government. In New South Wales there are 177 local government authorities with populations from less than 2,000 to more than 200,000.

Distribution of Responsibility

All three levels of government share responsibility for flood-related issues in New South Wales. The primary responsibility rests with local government, which develops land use planning (i.e. zoning) instruments, called local environmental plans (LEPs), and determines applications for development consent under those plans. The state role is to set policy and provide technical and financial assistance to local government. It also provides the framework for emergency management, response, and recovery. The federal role is primarily to provide financial assistance, both in implementing floodplain management measures and in providing emergency relief during and after natural disasters.

Evolution of Floodplain Management

Floodplain development in New South Wales proceeded with some awareness of flood hazard, but with limited reaction to its impact, from the eighteenth century until well into the twentieth. The 1940s and early 1950s saw a series of major floods in New South Wales that caused considerable urban and agricultural losses. The most severe event, the 1955 flood on the Hunter River, inundated 5,000 homes, destroyed 160 houses, killed 14 people and caused enormous urban and agricultural losses. In today's terms, those losses would be valued at about $600 million (Australian dollars).

Engineering Management

In the wake of this event, the state government established a statewide program for subsidizing local government in the construction of engineering flood mitigation works. The program was aimed at containing urban and agricultural losses by reducing the frequency of inundation and by providing good post flood drainage, rather than by necessarily excluding floodwater.

Planning Management

At the commencement of this mitigation works program the state government introduced the Hunter Valley Flood Mitigation Act (1956). That Act provided legislative backing for the construction of works and established a system for controlling development on the floodplains of the Hunter River. For 30 years the Act served successfully to prevent development in the most hazardous areas and to prevent development that would, because of its adverse impact on flood behavior, increase the flood hazard for others. However, the control systems in the Act were not extended to other valleys in the state, as might have been envisaged at the time of its implementation. As a result, outside the Hunter floodplain, development of flood-liable land continued unabated. In the mid 1970s a review of floodplain management was initiated in the wake of

another series of significant floods. The review highlighted that, due to increased development on the floodplains, flood losses had been growing throughout the life of the flood mitigation works program. A simple planning policy was then introduced to encourage local government to restrict development on flood-prone land. It can be briefly summarized as follows:

- No development on land inundated by 5% floods, which were designated as floodway;
- No development on land inundated by 1% floods where flood-free sites existed; and
- Removal of existing development from the most hazardous floodways.

This approach between 1977 and 1984 was combined with engineering flood mitigation works. Effective implementation of the policy required mapping of flood-liable lands. The mapping was done by state government agencies, whereas floodplain management was the responsibility of local government. Consequently, maps were at times published by an agency without a council being in a position to indicate how the problem would be managed.

By 1982, considerable opposition to the policy had mobilized, the main catalyst being the identification through floodplain mapping of thousands of flood-prone properties in the western suburbs of Sydney. Many of these areas had been developed in ignorance of the existence or the size of the potential flood hazard. Where mapping identified flood-liable areas, the policy severely restricted use of the land. Consequently, there was dismay, disbelief, and angry reaction at the news.

The resulting pressure from land owners and local government forced a thorough review of the policy and ultimately adoption of a new policy in 1984. As the primary focus of objection was on floodplain mapping, this was halted and the associated simple statewide planning rules were put aside. Also, the 1% flood was abandoned as the statewide standard for defining flood-liable land, in favor of a flood standard to be determined by each council.

Merit Management

Like its predecessors, the new floodplain management policy built on past initiatives. It retained the primary objective of flood loss reduction, but determined that this should be achieved via consideration of the merits of the local situation, rather than through application of standardized planning restrictions. This philosophical change from a "prescriptive" to a "merits" approach resulted in a more balanced and flexible attitude to floodplain management.

The New South Wales government *Floodplain Development Manual* (1986) was set up to outline a process. Although it had to fit into the legal framework of the development approval process it was not written as a prescriptive, clear-cut set of roles. The "non-cookbook" approach is perhaps the strongest feature of the manual.

Integrated Floodplain Management System

The current system of floodplain management described in the manual is based on merit and implemented by a classic carrot and stick mechanism. The stick is "duty of care," a long-standing legal concept enshrined in English law and tested in the courts. In lay terms, it pressures a local authority to make a responsible development decision in recognition of any potential hazard of which the authority should reasonably be aware. If a responsible decision is not taken, an owner or developer suffering due to a hazard, such as a flood or erosion, may succeed in a suit for damages on grounds of negligence.

The carrot involves a legislative amendment to the Local Government Act, giving indemnity to authorities from claims for damages from flooding to development they approved, unless it can be proved they did not act in accordance with the principles contained in the manual.

The Floodplain Management System

The floodplain management system is a systematic process by which a floodplain management plan can be developed, tailored to the needs of a community and have regard to both the environment and the local flooding characteristics.

The system, now sitting between duty of care and indemnity, is simple in principle but complex in practice. It involves the weighing of dissimilar considerations to achieve an acceptable compromise or balanced decision. The factors to be weighed are social, economic, ecological, and hydraulic facts. The manner and order in which they are addressed is shown in Figure 1.

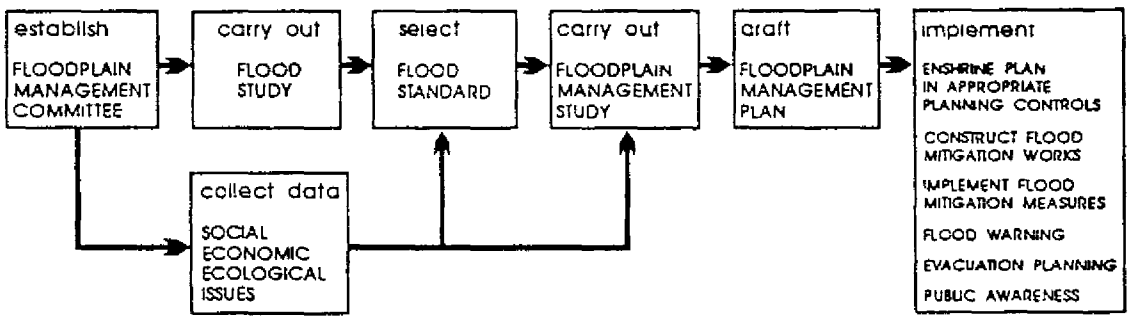

Figure 1. Operation of floodplain management system.

The system can only be effectively implemented at the local government level where the significance of area-specific social, flood, and economic facts can be judged. This presents a problem for local councils which may not have the specialized technical facts and economic capacity. However, this is addressed by the state providing professional and financial support throughout the process and with the federal government also assisting financially, within certain limitations and budgetary constraints. In New South Wales the Environmental Planning and Assessment Act (1979) provides the framework for regulating development and protecting the environment. It requires that in determining development applications, councils consider the impact of the development on the environment, the social and economic effects of the development and ". . . whether the land to which that development application relates is unsuitable for that development by reason of its being, or likely to be, subject to flooding, tidal inundation, subsidence, landslip, or bush fire or to any other risk . . ."

The floodplain management system dovetails neatly with the planning and environmental law of the state.

The Committee

The floodplain management committee is formed by the local council. Its role is to assist the council in the decisionmaking involved in preparing and implementing a management plan. It also provides an opportunity to introduce affected local community representatives into the process of floodplain management at the very start of the process.

The Flood Study

The flood study defines the nature and extent of flood behavior in a particular area. The flood behavior is summarized, in diagrammatic form, showing flood surface contours and velocities. Such diagrams are produced for a range of floods and effectively replace floodplain mapping with a far more detailed picture of the potential flood hazard.

The study report is generally based on a mathematical model that can be used during the management study to define the impact of proposed development or mitigation strategies on the flood situation.

The Flood Standard

The flood standard defines the area of land subject to flood-related planning and development controls. Its selection involves balancing social, economic, and ecological considerations against the consequences of flooding, with a view to reducing the potential for property damage and the risk to life and limb. Councils are encouraged to think hard about adopting a standard other than the 1% flood.

The Management Study

The floodplain management study identifies appropriate management measures and assesses their effectiveness in mitigating the effects of flooding on existing and potential development. It can involve a suite of studies primarily concerned with evaluating impacts:

- the impact of flooding on development;
- the impact of mitigation on flooding;
- the impact of development on flooding; and
- the ecological impacts of mitigation, etc.

As well as evaluating impacts, the management study is the place where economic, social, engineering, and ecological facts are brought together and weighed by the local authority in order to achieve a balanced decision. The flood study would usually include a physical or mathematical model. Use of the model during the management study allows the hydraulic impacts of different management options to be gauged. This includes the impact of large-scale development on flood behavior and losses. A holistic evaluation of the fixture situation removes the problem of the cumulative impact of multiple actions, each of which individually has little impact. From such results, economic, social, and ecological impacts of flooding and floodplain management proposals can be generated.

The Management Plan

A management plan involves the formal adoption by a council of a defined floodplain management strategy. Its development is essentially a balancing act. The plan is the means by which flood-liable land is managed, developed, and controlled in both the long and short term. It provides a common rationale for both site-specific and general decisions, and a sound basis for decision making in respect of mitigation works and management measures.

Implementation

The current New South Wales policy was announced in December 1984. A draft *Floodplain Development Manual* was released for public comment late in 1985 and indemnity legislation was enacted in 1986. The present manual was gazetted in February 1987. Since that time it has been actively embraced by most councils.

Future Implications

The floodplain management system described in this paper is appropriate to today's social attitudes in New South Wales and sets optimum solutions as a goal. The *Floodplain Development Manual* renders achievement of that goal a practical reality. There were initial reservations that the manual and its management process, with its emphasis on site-specific management plans rather than a statewide standard cookbook for planning control, would not work. In practice, however, the process has worked well.

A recent review of the operation of the manual has been carried out. The greatest fault found was confusion between the concept of the local management plan based on merits, and the use of the guidelines for individual development applications, again on merits. Individual developers often argue that assessment on an area-wide cumulative approach contradicts the merits approach. This argument is fallacious and, if accepted, merely perpetuates the problem of the cumulative impact of ad hoc decision making. As the interim situation no longer applies, sections relating to the dealings with individual proposals on an ad hoc basis, are being removed from the manual. The manual is currently being redrafted to fine-tune areas identified in the review as requiring adjustment. However, the overall approach will remain the basis of floodplain management in New South Wales for many years to come and will carry us into the third century of European settlement.

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INTEGRATING HAZARD MITIGATION, RESOURCE PROTECTION, AND WATERSHED PLANNING TO FACILITATE A UNIFIED NATIONAL PROGRAM FOR FLOODPLAIN MANAGEMENT

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Introduction

The Great Flood of 1993 focused the attention of the nation on the economic, human, and environmental costs associated with decades of unwise land-use decisions, attempts to control the natural phenomena of flooding, and the loss and degradation of floodplain functions throughout the watersheds of the Mississippi and Missouri rivers. In part, this human disaster can also be attributed to the decision-making process at all levels of government being hindered by inconsistent statutory mandates and fragmented planning and jurisdictional responsibilities across numerous government agencies. In recent years, there has been increasing interest in formulating a more comprehensive, ecosystem approach to protecting and managing human and natural systems to ensure long-term economic and ecological health. A unified national program for floodplain management provides a framework for such an approach.

Effective implementation of a unified national program will mitigate the tragic loss of life and property, and the disruption of families and communities, caused by floods. In addition, it will provide benefits relative to protecting and restoring the viability of riparian ecosystems and contributing to sustainable development of riverine communities. This paper focuses on the strategies and goals presented in the 1994 document, *A Unified National Program for Floodplain Management*, which provides a conceptual framework for achieving the dual purposes of floodplain management: reducing the loss of life and property and preserving and restoring the natural resources and functions of floodplains.

A Unified National Program for Floodplain Management

Maintaining the flood-carrying capacity of rivers and streams, preserving and restoring wetlands and other critical riparian habitats, ensuring continued viability of prime agricultural soils, and protecting the health, welfare,

and safety of the public should be viewed as being mutually compatible and consistent with sustainable development. Furthermore, there are a number of intangible benefits relative to quality of life issues such as the basic human need to experience and enjoy natural environments near water (see Wilson, n.d., for example). A unified national program seeks to achieve these goals through wise use of floodplain lands and waters.

The Federal Interagency Floodplain Management Task Force, established in 1975, is charged with carrying out the responsibility of the President to prepare for the Congress proposals necessary for a Unified National Program for Floodplain Management. The 1994 Unified National Program document differs from previous versions in two important ways. First, it includes a new floodplain management strategy—preserving and restoring the natural resources and functions of floodplains. This strategy is presented as being not just an end in itself, but an effective means to reduce human losses as well. Second, in addition to promoting better interagency and intergovernmental coordination, it recognizes the need to establish long-term national goals to be achieved over the next 30 years. Each agency can therefore carry out its mission as directed by Congress, but also further floodplain management goals by augmenting their existing policies and programs.

One of the goals developed by the Task Force is "to reduce by at least half the risks to life and property and the degradation of the natural resources of the Nation's floodplains" by the year 2020. Reducing these risks should be viewed as being concurrently achievable through the strategy of preserving and restoring the natural resources and functions of floodplains and by a coordinated, integrated approach to resource protection and hazard mitigation. An important means to achieve this goal includes conducting an inventory of the structures and resources in those areas most at risk. Technical assistance in this regard could be provided by geographic information systems, floodplain and wetland maps, and data from NASA's Mission to Planet Earth, to name a few.

An Integrated Watershed Approach

As early as the 16th century B.C., the Chinese Emperor Yu recognized that to protect rivers it was necessary to protect the mountains. In the 16th century A.D., Leonardo da Vinci concluded that flooding in Florence was due primarily to upstream deforestation in the Arno River Valley. However, in America, starting in the early 19th century and continuing until recently, federal government policies emphasized a structural approach in trying to control floods and maintain navigation. In addition, because wetlands were deemed to be desolate wastelands and generators of disease, federal policies encouraged and supported the conversion of millions of acres, mostly to create highly productive

agricultural lands. As we have come to learn all too well, the adverse environmental and economic impacts of these policies have been significant.

In recent years management goals for our rivers have broadened to include improving water quality, protecting wildlife habitats, encouraging waterfront revitalization, enhancing recreational opportunities, and balancing public and private property rights. However, these efforts have often been single purpose and generally local in nature. In progressing toward sustainable use of our riverine resources it is important to identify how best to integrate various programs so that they are not implemented independently of, or in opposition to, each other, but rather in ways that are both compatible and complementary and that protect natural resources while meeting the needs of local communities. Preserving our national parks must continue, but our vision for the future must include a greater emphasis on protecting and restoring the land and water resources where we live, work, play, and spend most of our time.

The administration has recently expressed the need for an ecosystem and watershed management approach as a means to ensure sustainable

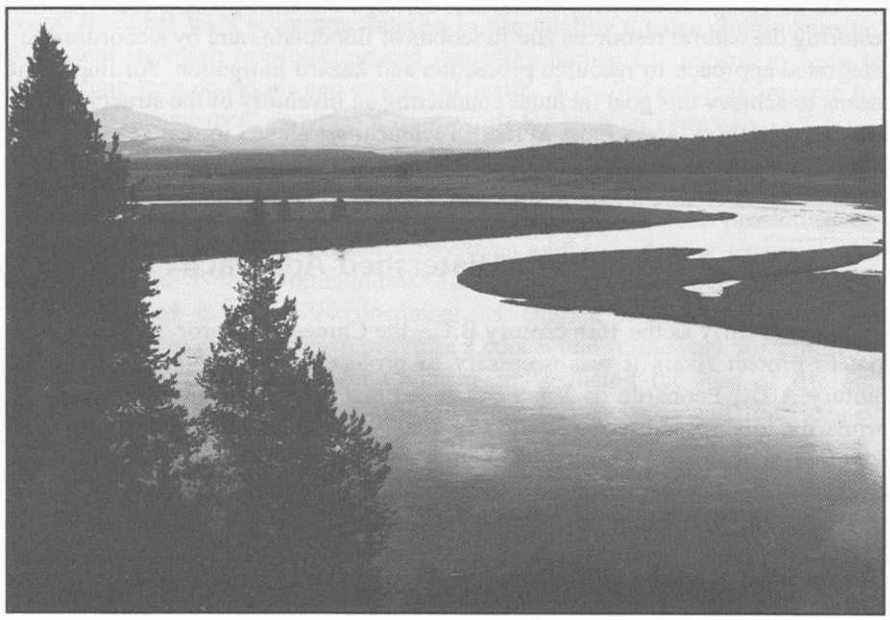

Figure 1. The Yellowstone River.

development and environmental quality for present and future generations. A recent report by the National Performance Review, *Reinventing Environmental Management,* underscores this by stating, "It is self-evident that the federal government should do its utmost to ensure the sustainability of our human communities and the ecological systems upon which we depend." To facilitate this approach it would be appropriate to consider integrating, both procedurally and substantively, the elements of those programs that, taken together, could mitigate flood frequencies and provide a multiplicity of human and environmental benefits. These might include, for example, the flood hazard mitigation provisions of the National Flood Insurance Program, wetlands and watershed protection programs of the Environmental Protection Agency, ecosystem management by the Fish and Wildlife Service, the restoration of degraded rivers and streams by the Army Corps of Engineers, river protection planning by the National Park Service, and best management practices for forests and farmlands by the Forest Service and Soil Conservation Service. In addition, because sound policy must be based on good science, a hydrologic determination of the nexus between effective watershed management at the regional level and a reduction in flooding potential at the community level could provide the necessary technical data to preserve and restore natural resources throughout the watershed.

The Corps of Engineers, for one, has modified its mission to become more sensitive to environmental quality issues. Lieutenant General Williams, Chief of Engineers, succinctly articulated this when he stated, "Our objective must be sustainable development . . . No public works project should be constructed that causes irreparable environmental degradation, for over the long run such a project can neither improve nor even maintain quality of life" (Williams, n.d.).

Conclusion

The challenge now is for all levels of government and the private sector to focus attention on the need for an integrated, sustainable approach to managing the human activities and natural resources within floodplains. This new way of thinking and achieving the proposed national goals will bring us closer as a nation to successful implementation of a Unified National Program for Floodplain Management.

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