FLOOD WARNING: AN AUSTRALIAN GUIDE

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In October 1991, some 50 people from the various states and territories gathered at Mt Macedon to consider the effectiveness of flood warnings in Australia. Their occupations and professional interests illustrated the wide-ranging nature of the flood warning task: amongst those present were meteorologists, hydrologists, water authority and council engineers, police, emergency managers, academics, local government councillors, journalists and specialists in public education. After a week of discussion, the workshop participants decided that a manual of 'best practice' should be produced to guide those with responsibilities in the flood warning field.

That manual has now been published by Emergency Management Australia and is being made available to the numerous stakeholders involved in flood warnings including State Emergency Service units, technical services departments of councils, water management authorities, the Bureau of Meteorology and others. Later in the year it is intended that a number of workshops will be conducted, in those states which require them, to familiarise flood managers with the contents of the manual. The document itself has been accepted by the individual Flood Warning Consultative Committees in the six states and by their equivalents in the Northern Territory and the Australian Capital Territory. Its drafting was a lengthy process involving input from numerous people from all around Australia, and the writing team gratefully acknowledges the help and guidance received.

The Content of the Manual

In describing a set of best practices to guide flood warning in Australia, the manual focuses on tasks rather than on the inter-organisational arrangements within which they must be carried out, since the latter vary considerably between the various states and territories. The tasks, however, are the same within each jurisdiction.

In terms of flood context the primary focus is riverine flooding, rather than localised 'flash' flooding from thunderstorms or surcharging drains, or flooding from oceans as a result of storm surge or tsunami conditions. Nevertheless many of the principles which the manual espouses are applicable to the development of warning systems and procedures for a wide range of hazards.

The manual is structured as follows. Each chapter begins with a number of questions and answers which summarise the chapter's content in a nutshell. The details are then spelled out, and each sub-section within a chapter is summarised in an italicised paragraph.

Chapter 1 identifies the **role of flood warning systems** in preparing for flooding, while Chapter 2 outlines the **components** of the 'total flood warning system' and describes how the system should be developed. The next two chapters describe the important elements of **flood prediction** and how the predictions need to be **interpreted** to ensure that the likely consequences are properly comprehended by the community and the appropriate responses taken. The focus then shifts to the

communication process, that is, how **warning messages** should be designed (Chapter 5) and how they can be **disseminated** effectively to those at risk (Chapter 6). Chapter 7 deals with the need for warning systems to be **reviewed** periodically to ensure their continued readiness and improved operational performance. The final chapter (Chapter 8) restates the basic questions which underpin the flood warning task, and an annex summarises current organisational responsibilities for flood warning and response in the individual states and territories.

The Process of Flood Warning

There have in Australia been many examples of good practice in flood warning, but equally there have been examples when such practice has been absent. In part, sub-optimality results from a tendency not to define the task **holistically**; that is, to deal with only **parts** of it or to carry out only **some** of the actions which are needed. The manual deals with this issue by focussing on a multi-faceted 'total flood warning system' and identifying appropriate strategies for implementing or developing its various parts.

The total flood warning system is defined as including:

> Flood prediction ('How high will the water go, and when will that height be reached?)
> Interpretation of flood predictions ('At the predicted height, where will the water go and who will be affected?')
> Message construction ('What do we need to know to give people an easily understood and persuasive warning?')
> Communication ('How do we get the warning message out?')
> Response ('Did the people understand the message and act to reduce the impact of the flood on them?')
> Review ('How do we improve our warning system by checking its performance after an event or upgrading it when there has been no flooding for some time?')

The first of these elements is normally the preserve of the Bureau of Meteorology, which produces a statement saying that a flood on River W at Location X will reach Y metres at Z time. This statement is usually called a Flood Warning, but in reality it is a flood prediction which forms only **part of** a warning. Value which can be added to such a prediction will greatly augment its usefulness to the community which is being warned.

The first element of added value is in the interpretation of the warning: that is, working out where the water will go at the predicted height and what its consequences will be. In essence, this means defining the horizontal spread of a flood at the forecast height. A vital tool here is the **flood intelligence card** which indicates what happens at a range of gauge heights in terms of roads being cut, farmlands, houses and business premises being inundated, levees being overtopped or other consequences.

At their best, such cards can provide a fairly complete and accurate picture of the impacts of floods of various levels of severity. This picture can be used so that people are advised before the arrival of a flood of its likely impact on them: armed with this advice, they will have the opportunity of following appropriate strategies to maintain their own safety and to minimise the property damage they will sustain.

In essence, the card allows flood managers to work out **in advance** what the consequences of a flood of any predicted severity will be. In many flood liable communities in Australia, however, the data for such cards is non-existent or sketchy, and flood managers have only very general notions of what the impact of a coming flood is likely to be. Where this is the case, the potential for the development of high-quality warnings is likely to be very limited.

A second element of added value relates to the construction of warning messages. In the past, too many warning messages have done no more than postbox the Bureau's predictions and a series of gauge heights. Such messages by themselves give only very basic pictures of what the coming flood will mean to people and provide no help by way of **advice** on coping with its effects. Some improvement can be achieved by appending a list of the **consequences** which have already ensued (for example, the roads which have been closed or the areas which have been inundated), but it is even better to go further and describe in simple words what is **likely** to happen as the flood rises towards the level predicted. Doing this is the basis for indicating what people should do to mitigate the probable effects of the flood - whether that means avoiding particular roads on their next journey to work, lifting pumps, stocking up on food, or preparing to evacuate. For different communities or parts of them, different messages may be needed.

The best warnings are of little use, though, if they are not heard and understood by those who need them - that is, by those who will be affected in one way or another by the coming flood waters. Frequently, messages are transmitted only via radio stations. Radio transmission is vital and must be used - but there are other relevant dissemination modes including telephones, doorknocks, loud hailers, warden systems, or, in some cases, newspapers. Which modes are used is a matter, usually, of both the flood (its severity and the time which is available before impact) and the nature of the community and the probable effects of the flood upon it. If evacuation is likely to be necessary, optimal warning practice implies that those who might have to move should be advised **personally** if at all possible - preferably by telephone or doorknock - and given information on what to do before they leave and where they should go to. As a general rule, and especially in severe floods, **several** modes should be used.

The final element of the total flood warning system relates to the need for a review of system performance after an event. Predictive models need to be re-examined, as do intelligence cards and message-construction and dissemination procedures. The questions that must be asked are about whether the information provided was accurate and whether everyone who needed it received it in a timely fashion, understood it and acted appropriately. Asking and answering these questions should help build in improvements for the 'next time' response. System review should also be undertaken as technology and environmental circumstances change.

Conclusion

In sum, the warning process needs to be forward-looking and armed with appropriate information about the likely consequences of a coming flood. Five basic questions define the task of the flood manager as far as warnings are concerned:

* How high will the flood reach, and when?

* Where will the water go at the predicted height?

* Who will be affected by the flooding?

* What do these people need in order to respond effectively?

* How can they best be given the appropriate information?

Who are the flood managers involved in the warning process? Simply, they are the people who are responsible for the design or operation of some aspect of the flood warning process. These are the people at whom the manual is targeted: they include professional hydrologists and emergency managers employed by various government agencies, local council personnel (especially those in departments of technical services and engineering), police, and volunteer members of emergency service organisations. Most are to be found working at the local level of the flood prone community.

All have vital roles to play in ensuring that people are kept safe and that economic and other forms of damage are minimised when flooding occurs. It is a large and complex task, but it is not impossible to carry it out effectively if the job is thought about beforehand and if those who are responsible for warnings understand the characteristics of their rivers and their communities.

Copies of ***Flood Warning: an Australian Guide*** *are available from the Australian Emergency Management Institute, Main Road, Mt Macedon, Victoria 3441, Australia.*

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