# Improving Flood Warning – Which Way Forward?

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## Summary

This paper presents and discusses the outcomes of a workshop on flood warning held in November 2002 with the aim of further improving the quality of flood warnings in Australia. The outcomes included suggestions for improvements in policy and practice and recommended a need for more attention and research in the area of community engagement in flood warning system design and operation. A need for stronger national leadership and coordination was also identified and the formation of a national flood warning committee to achieve this is recommended.

## Introduction

Flood warning in Australia is a shared task among agencies at all levels of government. While the Bureau of Meteorology plays the lead role at the national level, agencies at the state and local levels also play essential roles with details and arrangements varying by state/territory. The development of flood warning services to their present level has been a process of continuous improvement over the years. The purpose of this paper is to further that process by presenting the outcomes of a national workshop in November 2002 which examined issues limiting the effectiveness of the current service and debated means of overcoming problems. The paper will first briefly trace the historical development of flood warning services in Australia to date and then use the outcomes of the national workshop to discuss some ways forward toward further improvement.

## Brief Historical Perspective

Although flood forecasting and warning systems existed in various forms prior to 1955, it was the devastating floods in New South Wales in that year that led to the Commonwealth Government Cabinet Decision to establish the hydrometeorological service in the Bureau of Meteorology which, among other things, included the provision of systematic flood forecasts. This service was concentrated mainly in the eastern states and specialised forecasting systems were gradually implemented in the major flood-prone river basins. The focus was on flood prediction and good progress was achieved with more and more river reaches being served and increasing forecast accuracy being achieved. Despite this progress and the ability to accurately predict flood levels well ahead of their occurrence, the effectiveness with which this information was used to reduce the damaging impacts of flooding did not advance at the same rate. An example of this comes from the disastrous Brisbane flooding in January 1974 when, despite an accurate forecast by the Bureau of Meteorology of the peak river height 21 hours in advance, “problems of dissemination and interpretation of the warnings, coupled with some reluctance by the community to accept the gravity of the situation, meant that the full value of the flood warning system was not achieved” (Bureau of Meteorology (1)).

Institutional uncertainty introduced following the 1976 Committee of Inquiry into the Bureau of Meteorology, which recommended that responsibility for flood forecasting and warning should rest with the states, severely hampered progress toward improving flood warning effectiveness. This situation was resolved to a large extent when the Commonwealth proposed new arrangements for the provision of flood forecasting and warning services throughout Australia, involving a cooperative approach between all three levels of government. These arrangements included additional resources from the Commonwealth to

implement new and improved systems on a more expanded national basis and involved the establishment of state/territory-based Flood Warning Consultative Committees (FWCC) to advise on priorities and facilitate coordination among the different agencies involved. These committees were primarily concerned with implementing the technical components of systems but more recently have had their terms of reference broadened to include aspects such as the communication and dissemination of warnings.

Following widespread and severe flooding in eastern Australia during April 1990 a national workshop was held to examine the performance of the warning system during those events and to identify areas for improvement. Warning practices were generally considered inadequate in many areas and the meeting covered topics such as how to better integrate the various elements of warning systems, community perspective on warnings, user profiles and interpretation of predictions for end users, media issues, as well as a number of technical aspects. The workshop called for a national guide to best practice, which was duly produced (EMA (2)). The emphasis was on issues of flood detection and warning dissemination and response, which appeared to be the key failures of the floods in 1990, with less attention given to understanding community processes and needs.

In the ten years or so since that workshop, the coverage of technical systems has increased steadily and there have been improvements in warning dissemination and communication, particularly through the use of new technologies. These improvements, however, have not always been applied uniformly throughout the national system. The influence of the guide to best practice over this period is difficult to assess accurately. The evidence suggests that its advice has not been applied universally among the agencies involved in warning system design, although there are some good examples (Songberg et al (3)). The performance of warning systems in recent floods has been varied, but the absence of common assessment and performance review procedures makes conclusions about trends difficult. There does, however, seem to be a common view that official flood warnings at least are not having their intended impact on community behaviour (see for example Pfister (4)) despite recent improvements.

Hence, following a short scoping meeting in April 2002, a national workshop was convened in November 2002 with the working title *"Flood Warnings: often provided, sometimes received, but frequently not heard"* to review and discuss the factors which limited current performance and to suggest what future action is needed.

## The November 2002 Workshop

This workshop was convened by Emergency Management Australia (EMA) and was held for three days (6-8 November 2002) at Mt Macedon, Victoria. Participants came from the State/Territory Emergency Services, the Bureau of Meteorology, state water and flood management agencies, catchment management authorities, consultants, academic institutions and the Australian Government Solicitor's office. An international dimension was provided by a representative from the National Flood Warning Centre of England and Wales. A report of the workshop has been prepared (EMA (5)).

The workshop involved a mix of presentation and workshop sessions covering the status of flood warning, the effectiveness of current institutional arrangements in Australia for the different flood environments, legal issues, issues relating to community engagement, communication of uncertainty and problematic environments (for example, caravan parks). The final session of the workshop dealt with the identification of gaps and how these might be handled in the future. This was done through a "nominal group process" involving participants identifying and then voting on areas that needed most attention. This produced a fairly wide range of issues and suggested actions that have been distilled down to the following outcomes:

- The necessity for community engagement through increased education and awareness;
- The importance of recognising the target audience for flood warnings and the need to utilise this knowledge to improve the way that risk is communicated;
- The need for greater national consistency of practice, including standardising of terminology. This was closely linked with interest in an updated edition of the EMA flood warning guide;
- Investigation of the desirability of a national flood agency/a single national authority;
- The need for policy improvements in the area of flash flood warnings;
- The need for performance assessment that satisfies auditing agencies.

## Discussion of Outcomes

### Improved Community Engagement

What is meant here is the need to understand how communities work, their needs when threatened by a flood and how they are likely to communicate information and respond to the threat. Improvement in community education, engagement and awareness was identified as the single most important action that could be taken to improve flood warnings in Australia, although it was recognised that this was difficult to do well. This outcome is consistent with recommendations for improvements to warning systems made from other reviews (for example ISDR (6)), where the need for continuous dialogue between the users and the agencies designing and delivering warning systems and services in order to make collective decisions has been recognised.

Understanding communities is difficult but it is important to gain an in-depth picture of the community before attempting to disseminate information. Social mapping is a tool that can assist here. The value of a bottom-up approach to community warning system development involving community engagement has been discussed by Betts (7). Looking at other sectors, the work of the Country Fire Authority of Victoria with its “Community Fireguard” approach was an example of the benefits of empowering a community with knowledge and an adjustment in roles whereby the authoritarian/expert becomes the community facilitator. More research is needed in this area. The assembly of best practice guidelines (or expansion of the current EMA guidelines) with case studies of effective community engagement that promotes a warning model for communities that includes community ownership is one way ahead. Creating a national grouping of people involved in community flood education to share information, ideas and resources is another.

### Risk Communication

The best ways to communicate risk at the local level, based on a sound understanding of user needs, was identified as the most pressing research need in the flood warning field. Some technological solutions were supported, based mainly around the Internet and the use of GIS capabilities. While these technologies may be part of the solution, the need to research issues to facilitate a seamless chain for managing and communicating risks, including the management of uncertainty, was seen to be required. At the policy level, it was also considered important that local government be required to advise home owners and businesses of their exposure to flood risk and that flood prone land is openly identified. It was considered appropriate that a high profile legal opinion be sought to make it clear that organisations must pass on information on risk to the public.

### Institutions, Policy and National Consistency

A further action strongly supported at the workshop was the idea of improved national consistency and coordination, possibly through some form of national peak body. Those with

experience of their operation felt that the state/territory-based FWCC's had led to improvements in flood warning processes and outcomes, but that a single national agency or national authority would help. There was also support for some regional level FWCC structure to bring this form of coordination closer to the community user groups. This view was no doubt strongly influenced by the example of arrangements in the UK discussed at the workshop, where a single national agency (Environment Agency) is responsible for all aspects of flood warning with strong leadership provided through the National Flood Warning Centre.

Under the present institutional arrangements the Bureau of Meteorology is the national lead agency, with particular responsibility for the technical forecasting role and for issuing warnings to emergency management agencies and to the public through the mass media and the Internet. State and local agencies work in cooperation with the Bureau and play essential roles in supporting the technical forecasting infrastructure as well as with warning delivery and response. Flood warning services are provided within a wider flood management and mitigation infrastructure operated by state, local and regional catchment authorities. The Department of Transport and Regional Services provide funding support for a full range of flood mitigation measures, including flood warning. The picture is quite complex and to improve performance, particularly on a national scale, an integrated approach across agencies and through all levels of government is widely agreed to be required.

The establishment of some sort of national group on flood warning would help achieve this integrated approach. While this may not have the political strength to bring about the levels of integration being achieved in the UK for example, it would provide a forum within the present institutional arrangements to facilitate the exchange of ideas and practice across the states/territories, as well as to promote national consistency and best practice to achieve improvement throughout the system. More regionalised FWCC coordination arrangements that might be established and linked with this national group would provide the coordination mechanism to feed the benefits of improved national procedures through the State FWCC committees down to the regional (if not local) levels to help strengthen the linkages between the warning agencies and the community. Such regional committees are used for other Bureau warning services. The national group could provide more focussed guidance on research needs as well as promoting improved approaches to performance review and assessment of flood warning systems. It could also act to meet the need for improved inter-agency coordination identified at the workshop by promoting more regular state and national workshops, noting that the November workshop was the only such workshop in the past ten or more years.

There was a view at the workshop that more national consistency was needed; in particular some standardising or consistency of terminology. The warning task in all states is essentially the same and identifying and promoting the most effective warning terminology on a nationally consistent basis would ensure that all of the groups at risk had the benefit of best practice in this area. Furthermore, more nationally consistent terminology would ensure that the increasingly mobile population received consistent warning information. The Bureau of Meteorology is currently reviewing all of its warning products, including flood warning products, to achieve more national consistency; however this process would be assisted by the stronger national focus that would be provided by a national flood warning group. Consistent national approaches also produce efficiencies in being able to mount national level public education and awareness campaigns, rather than separate state or locally based approaches which is already producing inconsistencies in some areas (for example, colour coding of flood maps). A national approach would allow pooling of limited resources to achieve maximum impact and programs could be based on well researched communication and marketing strategies along the lines of those in the UK system. Actual practice still has to be delivered locally but a national approach will help generate and foster good practice.

### Flash Flood Warning Policy

The current flood warning policy treats warning for flash flooding (rain-to-flood times of 6 hours or less) in a different manner to other forms of flooding. Because of the limited lead time available, local involvement is more critical and so the current policy encourages the development of locally-based warning systems, facilitated by the Bureau but funded, implemented and operated at the local level (for example, by councils and State Emergency Service units). The Bureau also supports these systems through the provision of specialised severe weather warning services and products. There has been an uneven adoption of this policy and the institutional arrangements for flash flooding are not as formalised as for other forms of flooding. In some of the major urban areas (Brisbane and Melbourne) the drainage authority has taken on the task and there are good examples in smaller centres, but these are isolated. Consideration could be given to removing the policy discontinuity at the six hour barrier, but the technical challenge of effective flash flood warning nevertheless requires a different approach to the more standard flood warning system. The time constraints make local involvement critical and the technical difficulties generate more uncertainty in the forecasting and warning process that needs to be managed. The workshop felt a review was needed into the limitations and deficiencies of the current policy in each state with the aim of developing an improved approach.

### Performance Assessment

The workshop identified a need for improved approaches to flood warning system performance assessment. This includes post-event analysis to assess the effectiveness of warnings and response actions as well as the establishment of benchmark levels of performance to guide system design. Although different forms of assessment are carried out at present, there is no consistent approach that allows performance to be tracked, apart from the more technical aspects such as forecast accuracy. As pointed out by Handmer (8), any assessment needs to start with a clear indication of what constitutes success and this needs to be agreed among all stakeholders. An ongoing program of performance assessment will be useful to ensure continuous improvement and to assist in targeting resources to their most effective ends.

## Where to From Here?

The outcomes of the workshop and the above discussion provide some guidance as to the way ahead toward improved flood warnings in Australia. Some actions are relatively straightforward and could be implemented immediately; others require more consideration and, in some cases, further research.

The formation of a national committee or forum; perhaps a national FWCC, is a relatively simple action that could be achieved quite quickly. Terms of reference would need to be developed in association, and by agreement, with the agencies concerned, giving due consideration to linkages with other national disaster mitigation arrangements being developed following the COAG review. The initial task for this committee could be to look at the other actions identified above and prioritise and structure these into a strategic plan for moving the flood warning effort forward on a more nationally consistent basis.

The return from improved community engagement to increase the effective involvement of communities in the design and operation of warning systems and to improve the communication of risk at the local level would appear to be high. Yet it appears that we are not sure how to do this effectively and so research in this area should be given a priority. This would include identifying examples of where this might be done well now and communicating and promoting these more widely, possibly as part of any revision of the current EMA guide. Linked to this in some sense is the need to provide closer links between the official systems being built by agencies and these community processes. Regionally-

based committees, combined with a shift in focus of the present FWCC's to include more deliberation on the warning dissemination and communication aspects of systems, could help do this.

The various policy issues discussed above could also be taken up by the national committee initially and better formulated into proposals that would then be put to the relevant agencies and other bodies for consideration. This group could also identify additional research needs in areas such as improved performance assessment.

## Conclusion

The last ten years have seen significant improvement in many areas of flood warning in Australia. The technical system has grown with predictions becoming more accurate and timely along with improvements in the presentation and dissemination of warning information, largely through the application of new technologies. The FWCC's have also played an important role in other flood warning system improvements. This paper proposes a way forward involving a number of actions and areas for further research but based mainly on the establishment of stronger national coordination through the establishment of a national flood warning committee. This proposal requires further discussion with key agencies and stakeholders but is offered as a practical and effective approach to achieve further improvement to the national flood warning system.

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