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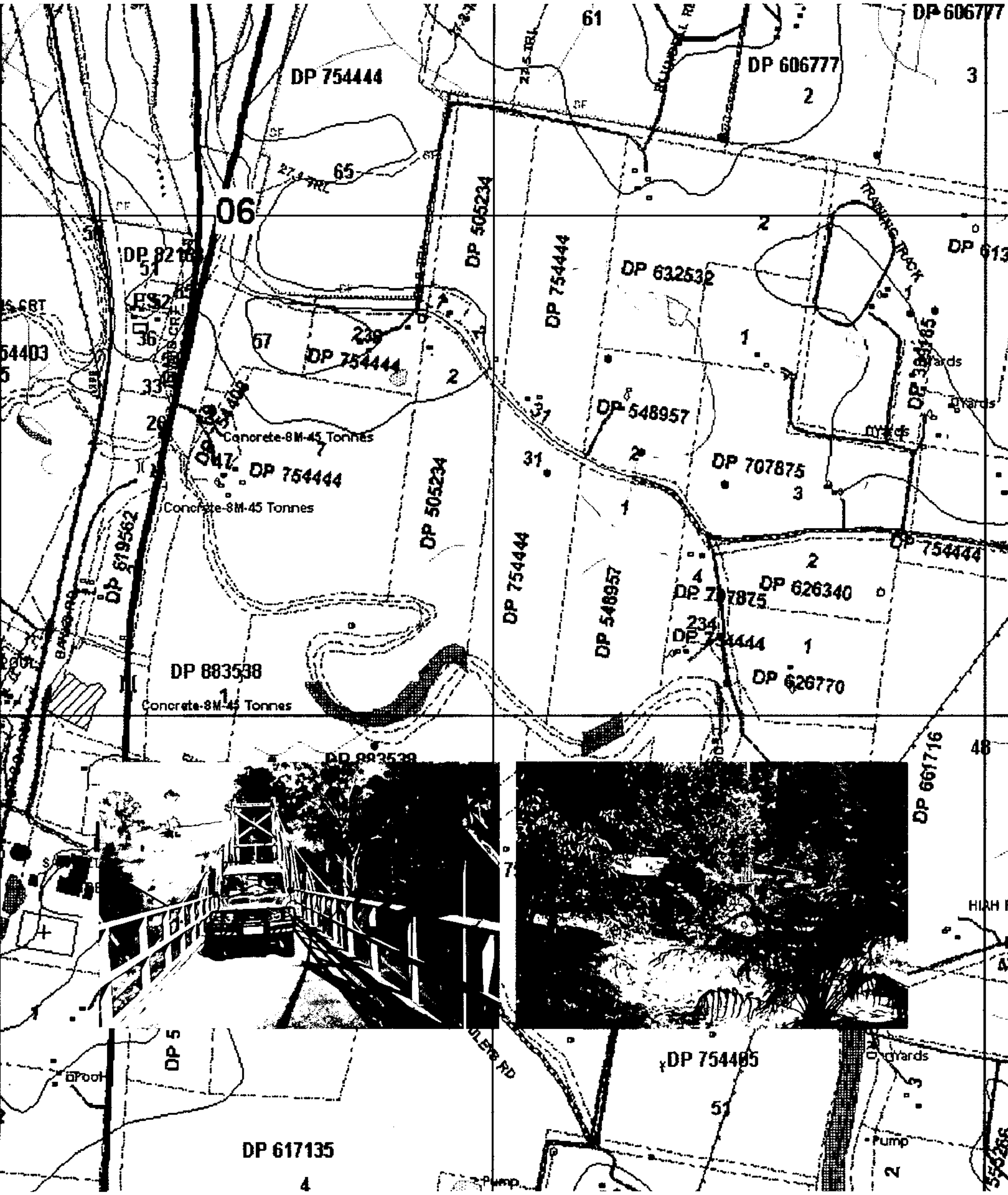

In this issue...

Cover: Spatial data collection at a local level (community mapping) can be used to fill the gap between available datasets and those required by emergency managers.

The Australian Journal of Emergency Management

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The journal endeavours to provide an information sharing forum for all those involved in emergency management. Contributions relating to Australian and international emergency activities, articles identifying and discussing issues, policies, planning or procedural concerns, research reports and any other information relevant to the emergency and disaster management community are welcome.

The aim of this publication is the exchange of information and views across the Australian emergency management community, therefore, the views expressed in this journal should not be taken to be the views of Emergency Management Australia.

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Articles for publication may be forwarded to:

Rob Fleming
Editor
Australian Emergency Management Institute
Main Road
Mt Macedon, Victoria 3441
Tel: 03 5421 5100; Fax: 03 5421 5272
Email: rfleming@ema.gov.au

Subscriptions

If you wish to be placed on our mailing list please contact Rob Fleming, Australian Emergency Management Institute, at the above address.

Journal design and production by
Dianne Treble
Publishing Innovations
RSD 813 Spring Hill, Victoria 3444
Tel: 03 5424 8339; Fax: 03 5424 8262
Email: publish@kyneton.net.au

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The Defence 2000 White Paper

Many readers of the Journal would be well aware of Emergency Management Australia's relationship with the Australian Defence Organisation.

On December 6th, 2000 the Government released the Defence 2000 White Paper. It has been described as the most far-reaching Defence Policy Statement released by any government in 25 years of long-term thinking on capability, organisation, funding and personnel.

It is a clear statement of the Government's requirements of the Defence Organisation.

- The decisions in this White Paper provide Defence with a plan—the Defence Capability Plan—for the development of Australia's armed forces over the next decade.
- The task for Defence is to implement this plan.

The White Paper process has been characterised by a lengthy and intensive series of National Security Committee of Cabinet meetings that started in late February 2000. This resulted in the most comprehensive process of ministerial-level decision-making about Australia's defence policy for many years.

There will be an immediate increase of $500 and $1,000 million over the next two years in order to provide substantial funding for a number of key initiatives.

The Government estimates that defence spending will need to grow by an average of about 3% per annum in real terms over the decade. It is committed to provide this funding and has directed Defence to plan within that budget.

The White Paper acknowledges the Australian Defence Force's commitment to emergency management as one of several peacetime national tasks. It mentions EMA providing training, national policy coordination and coordinated responses for civil emergencies and national disaster relief. Throughout the White Paper community consultative process, emergency management was raised on several occasions in discussions about non-military security issues.

Generally, I believe that the profile of emergency management has featured very prominently in the White Paper. The emergency management community needs to get across The White Paper's intentions and EMA has a pivotal role in the education of key partners and stakeholders in its implementation. We have a window of opportunity to advance the understanding of emergency management.

There is special emphasis in the White Paper on people issues, including the retention of key personnel, strong leadership and building enthusiasm. This is particularly relevant to emergency management, especially in attracting, training and retaining our people. EMA has this as a priority measure of performance in the context of White Paper implementation.

I would like to make thank those people who contributed to the White Paper development. Your efforts have been rewarded.

David Templeman
Director General
EMA

Corrections to previous issues

The Spring 1999 issue of the Journal included an article by Dr. Henry W Fischer III entitled 'Using cyberspace to enhance disaster mitigation, planning and response: Opportunities and Limitations'. This article was originally published under the title 'Enhancing disaster mitigation through the use of cyberspace: Suggestions and issues to consider' in the Journal of Contingencies and Crisis Management, Vol. 7 (1999) Issue 1, © Blackwell Publishers. All inquiries relating to the re-use of this article should be directed to Blackwell Publishers.

The Spring 2000 issue of the Journal included an article by Tricia Wachtendorf titled 'When Disaster Defy Borders: what we can learn from the Red River Flood about Transnational Disasters' which was published without acknowledgment of the sources of the photographs and maps. A number of images also had incorrect captions. The correct version of this article can be located on the EMA web site at www.ema.gov.au.

Cost-effective spillway design/review for small dams in Victoria: avoiding dam failure emergencies

by Dr John D. Pisaniello, BE (Hons 1), PhD, Research Fellow; A/Prof Jennifer M. Mckay, BA (Hons), LLB, PhD, GDLP, Associate Professor in Business Law, University of South Australia, School of International Business, Water Policy and Law Group; Mr Siraj Perera, M.Sc. MIEAust, MICE, Water Assets Engineer, Dept. Natural Resources and Environment, Victoria.

Introduction

Australia has a large number of relatively small, privately owned dams (farm dams in particular): those which have failed number in the thousands (ANCOLD 1992). A large proportion of these dams are located in Victoria which has an estimated 170,000 farm dams, 800 of which are large enough to cause serious consequences downstream if they failed (ANCOLD 1992; Murley 1987). The growth of farm dams in Victoria (and Australia) is also increasing at a rapid rate. For example, in the Victorian Lal Lal Reservoir catchment alone (234 km^2), farm dams increased in number from 182 in 1970 to 534 in 1985, representing an increase of about 200% (GHD 1987). When these dams were constructed, the majority more than 20 years ago, their designs were based on rainfall frequencies and intensities, design methods and criteria and standards of risk available at that time. However, these aspects have changed over time, together with population distributions and the condition of the dams, raising serious doubts about dam adequacy.

In modern times, the major concern with dam safety world-wide is the provision of adequate spillway flood capability. This is mainly because significant advances made in the fields of meteorology and flood hydrology have updated both maximum probable rainfalls and design flood standards above those on which most existing dams were based. As a result of these revisions, many dams have insufficient spillway capacities.

In addition to this concern is the fact that most private owners hire contractors to construct their dams. These contractors are, typically, not properly trained or skilled in the design and construction of dams. Thus, many private dams are not built to an adequate standard. For example, the layers of soil that constitute the dams are not properly compacted and the structures are not provided with adequate outlet works. This is evidenced by a recent case study investigating private dam safety management practices in South Australia (Pisaniello 1997, see also Pisaniello and McKay 1998). The study identified many unsafe, hazardous private reservoirs and found that most owners are not taking the necessary action in terms of analysis and upgrading of their structures.

Consequently, the recognition of risks associated with the dams has increased greatly. A need has therefore developed for private dams and risk to co-exist and for owners to appropriately manage their dams in line with current standards in order to reduce the risks involved, reflect community standards and provide increased dam safety assurance to downstream communities.

In particular, owners should review the spillway flood capabilities of their dams, and upgrade if necessary, in order to avoid liability for possible failure consequences (McKay and Pisaniello 1995). Unfortunately, the engineering processes involved are highly rigorous and time-consuming in practice and therefore generate high consulting fees which in many cases are not affordable by private owners. For this reason, owners tend to overlook the need for reviewing their dams and instead develop a sense of complacency, believing that as the dams have not failed up to now, then they will never fail. In essence, owners lack an appreciation of the risk of failure to society and the costs. The result is that dams are deprived of necessary upgrading and downstream communities are placed at risk. Pisaniello & McKay (1998) demonstrate the potential seriousness of this problem.

A clear need has developed for a mechanism that:

- raises public awareness of this problem and improves the transparency of the risks
- promotes consistency and uniform standards
- simplifies the engineering desig/review processes involved while keeping in line with state-of-the-art practice
- minimises review/design costs to private owners and in turn encourages better dam safety management

The Department of Environment and Natural Resources, Victoria, recognising this need commissioned the University of South Australia to undertake a study based on Pisaniello (1997 PhD thesis, see also Pisaniello et al 1999), in order to establish such a mechanism for Victoria. This paper summarises the preliminary procedures involved in the study, presents the resulting cost-effective flood capability design/review procedure, and provides worked examples of how to apply the procedure.

The development process

The Pisaniello (1997) procedure primarily involves the development of regionalised flood capability prediction relationships for dams on small rural catchments based on the Reservoir Catchment Ratio (RCR):

$$RCR = \frac{SC}{PI_{PMF}} \cdot \sqrt{\frac{\sqrt{RA} \cdot SH}{1000 \cdot CA}} \cdot \frac{\log\left\{\frac{PI_{PMF}}{PI_{100}}\right\}}{\log\left\{\frac{PI_{100}}{PI_{50}}\right\}}$$

(Equation 1)

where:

SC = spillway overflow capacity (m^3/s)
PI_{PMF} = peak inflow for the PMP design flood event (m^3/s)
RA = reservoir area at Full Supply Level (km^2)
SH = maximum height of spillway overflow (m)
CA = catchment area (km^2)
PI_{100} = peak inflow for the 100 year ARI event (m^3/s)
PI_{50} = peak inflow for the 50 year ARI event (m^3/s)

For regions where no variation is observed in the Annual Exceedance Probability (AEP) of the Probable Maximum Precipitation (PMP), the RCR can take on the compact form:

$$RCR = \frac{SC}{PI_{PMF}} \cdot \sqrt{\frac{\sqrt{RA} \cdot SH}{1000 \cdot CA}}$$

(Equation 2)

Developing the RCR, based on the Pisaniello (1997) procedure, necessitates the collection and derivation of appropriate 'calibrated' catchment and reservoir data in the study region, and the formulation of a range of hypothetical dams (approximately 20) on each catchment representing all possible scenarios up to the PMP design flood event.

An initial search for appropriate 'calibrated' data for rural catchments up to 100km^2 proved unsuccessful. SMEC Victoria was then commissioned by the University to undertake a more detailed search: this revealed an absence of such data in the State. It was therefore necessary to generate the required calibrated data, but unfortunately, only three small gauged catchments with reasonable historical data were available for this purpose. Fortunately, these are reasonably well spread throughout the State and for the purposes of this study, can be considered to represent the three main regions of the State relative to the Great Dividing Range (GDR):

1. **Barringo Ck.** GS 230209
   (Area = 5.1 km^2, 20 yrs record):
   Central GDR (ie. mountainous region)
2. **Shepherds Ck.** GS 415244
   (Area = 6.4 km^2, 20 yrs record):
   Inland side of GDR
3. **LittleAire Ck.** GS 235204
   (Area = 11.2 km^2, 40 yrs record):
   Coastal side of GDR

It should be noted that the coastal region warrants further subdivision into East and West regions in order to include cases which represent the Gippsland zone: this will be undertaken in future studies in order to increase confidence in the developed prediction relationships applying to the whole of Victoria.

The RORB program (Laurenson and Mein 1990) was used for modelling; catchment and sub-area delineations were made using 1:25,000 scale topographic maps. All catchment calibration, reservoir flood capability and PMF studies were undertaken in accordance with Australian Rainfall and Runoff (AR&R) (IEAust 1987 and new edition) and Bulletin 53 (BoM 1994).

The calibration flood studies basically involved:

- collation of recorded streamflow, daily rainfall and pluviograph data
- RORB catchment modelling
- trial-and-error 'fitting' of modelled hydrographs with recorded hydrographs

SMEC Victoria was commissioned by the University of SA to perform the calibration study for the Barringo Creek catchment in order to provide a basis for independent comparison and check.

In order to create the flood capability prediction relationships, it was necessary to produce a wide range of flood capability outcomes relating to embankment dams placed at the outlets of the regional calibrated catchments. The aim of the process is to represent the hydraulic response of any size of reservoir and spillway(s) relative to the hydrological flood response of the selected 'catchment type' (Pisaniello 1997). In brief, this was achieved for Victoria by performing the following:

- Creating a number of hypothetical dam cases, 57 in total, at the outlets of the selected catchments, comprising of varying size reservoirs and spillways which will produce a wide range of flood capability outcomes up to the PMF. The spillways must be free flowing and weir-type in nature. A good variety of cases was obtained by either:
  - widening the spillway
  - raising the top of the crest which increases spillway height
  - deepening the spillway which increases spillway height and decreases reservoir surface area and storage capacity
  - raising the entire embankment and spillway which increases reservoir surface area and storage capacity.
- Including each of the hypothetical dams as 'special storages' in the already created RORB models of their respective catchments.
- Determining design rainfall information and design losses for the selected catchments for events between the 20 year ARI and the PMF using the procedures described in AR&R (1987 and new edition) and Hill et al (1996).
- Using the RORB program to route flood hydrographs through each of the hypothetical storages, assuming the most conservative 100% full 'start' storage level case, to determine peak inflow, peak outflow and water elevation for all events up to the PMF.
- Producing a design peak flow prediction equation for the PMF event, ie. scatter plot of catchment area (km^2) versus peak flow (m^3/s) in the logarithmic domain. This equation when substituted into the RCR establishes a Regionalised Reservoir Catchment Ratio (RRCR).
- Using the determined peak inflows and elevations to establish peak inflow-frequency and elevation-frequency relationships for each dam. With these relationships the Imminent Failure Flood (IFF) capability of each dam is determined as 1/AEP (years). The IFF is taken as the smallest flood which peaks at the lowest point of the non-overflow crest (ANCOLD 1986): this is in line with the ANCOLD (2000) definition of Dam Crest Flood (DCF) for embankment dams. It should be noted that ANCOLD (2000) defines IFF as 'the flood event that could be reasonably expected to cause failure of the dam', and hence, for the purposes of this paper IFF is 'reasonably' assumed to coincide with DCF.
- These flood capability outcomes are used to create scatter plots of RRCR versus IFF. Lines of best fit are then drawn through the scatter plots and the associated regression equations are determined, thus producing the required reservoir flood capability prediction relationships.

The flood capability relationships developed using the above procedure form the main part of the overall design/review mechanism presented later.

Study results

Calibration flood studies

As described, the calibration process involved generating the RORB parameters k_c and m by trial-and-error 'fitting' of modelled hydrographs (using catchment losses as determined from Hill et al 1996) with recorded hydrographs for the two largest historical events for each catchment. The calibration results are presented in *Table 1*. It is important to note that 'good quality' historical data were available for the Little Aire catchment only (i.e. around 40 years of record). The data for the two other stations, although workable, were rather poor (i.e. around 20 years of record): this deems the results for these catchments somewhat unreliable for use with less frequent events (i.e. 100 yrs to PMF) which is unfortunate as such events form the basis of this project. Nevertheless, and despite this, these results are based on the best available data and therefore their use would

GS 230209 Barringo Creek (A = 5.1 km²)*					
Storm event	Peakflow	Calibrated parameters		AR&R (1987)	Andrews curves
	(m³/s)	k_c	m	k_c (m=0.8)	k_c (m=0.8)
May 1974	1.76	13	0.8	5.3	3.6
July 1990	0.88	7	0.8		
GS 415244 Shepherds Creek (A = 6.4 km²)					
Storm event	Peakflow	Calibrated parameters		AR&R (1987)	Andrews curves
	(m³/s)	k_c	m	k_c (m=0.8)	k_c (m=0.8)
Sep 1984	5.13	11.2	0.8	1.6	1.4
Jan 1987	2.91	13.0	0.8		
GS 235204 Little Aire Creek (A = 11.2 km²)					
Storm event	Peakflow	Calibrated parameters		AR&R (1987)	Andrews curves
	(m³/s)	k_c	m	k_c (m=0.8)	k_c (m=0.8)
Jun 1978	24.5	7.0	0.7	7.6	9.8
Oct 1976	19.2	7.5	0.8		

*The Calibration flood study for this catchment was undertaken by SMEC Victoria

Table 1: Comparison of RORB Parameters as Determined from Various Means

represent current acceptable practice.

In an attempt to substantiate the calibrated results, parameters were also determined using:

- regionalised prediction equations presented in AR&R (IEAust 1987), and
- Andrew's Fourier Plots (Dyer et al 1994). The results are also presented in *Table 1*, where they are compared to the calibrated results.

Table 1 demonstrates that, in general, there exists significant variation between the AR&R (IEAust 1987) and/or Andrews Curves results and the Calibrated results; Little Aire Creek being somewhat of an exception. The calibrated k_c values for both Barringo Ck. And Shepherds Ck. appeared abnormally high, which has the tendency to underestimate design floods, that is: they represent a non-conservative approach. At the same time, the lower values determined using Andrew's Curves would tend to overestimate design floods which represents a conservative approach. The erratic nature of these results was seen to have the potential to impact adversely on the final design/review curves. Therefore, following consultation with DNRE, it was decided to provide a sensitivity analysis and develop the design/review relationships at 'both ends of the spectrum', i.e. for both (1) a non-conservative approach (using the calibrated k_c values), and (2) a conservative approach (using the k_c values determined from Andrew's curves for the two smaller gauged catchments), as described below.

Developing the flood capability prediction relationships

Non-conservative relationships

A total of 57 hypothetical dam cases were created on the catchments, based on the Pisaniello (1997) procedure, so as to represent all the possible combinations of reservoir size and spillway capacity to pass the entire range of design floods up to the PMF. Flood capability studies were undertaken for each case in line with AR&R (IEAust 1987), and also keeping in mind the new edition of AR&R (1998), Book VI. All cases resulted in an AEP of PMF of 1 in 10^6 using the AR&R (1987) procedure (compared with 1 in 10^7 for all cases using the procedure of the new edition of AR&R): this therefore led to the Reservoir Catchment Ratio taking on the compact form, ie. *Equation 2*. Given the previous uncertainties surrounding Book VI of the new edition of AR&R, it was decided to adopt the more conservative AEP of PMF (1 in 10^6) for all works described here, while, if necessary, the less conservative case (1 in 10^7) would be considered in future works.

The magnitude of the Imminent Failure Flood (IFF) capability 1/AEP (years) was found to be a power function of the Reservoir Catchment Ratio for a single line of best fit over the entire range of AEPs. The sample data and line of best fit are presented in *Figures 1 and 2* respectively.

The coefficient of determination (R^2) for the relationship presented in *Figure 2* suggests a high level of predictive accuracy. However, to apply the above relationship also required the ability to accurately predict the peak PMF inflow associated with a dam for input to the RCR in order to establish the Regionalised Reservoir Catchment Ratio (RRCR). Therefore, the peak PMF inflows determined for the calibrated catchments were plotted against their areas and fitted with lines of best fit in the logarithmic domain. The peak PMF inflow (PI_{PMF}, m^3/s) was found to be a function of catchment area (CA, km^2) for the line of best fit as follows:

$$PI_{PMF} = 1.1723.CA^{2.5033} \quad (R^2 = 0.9734)$$

(Equation 3)

The above equation was substituted into the RCR (*Equation 2*) to produce the Regionalised Reservoir Catchment Ratio (RRCR) applicable to the sample region as follows:

$$RRCR = \frac{SC}{1.1723 \cdot CA^{2.5033}} \cdot \sqrt{\frac{\sqrt{RA} \cdot SH}{1000 \cdot CA}}$$

(Equation 4)

A new flood capability prediction relationship was constructed using the same sample outcomes but based on the above RRCR. The resulting scatter plot and line of best fit are presented in *Figure 3*.

Figure 3 demonstrates increased scatter and, hence, some loss of accuracy in moving from the RCR to the RRCR; this is a direct result of using the derived PMF prediction equation. Nevertheless, the level of accuracy displayed is still considered acceptable for predicting the flood capability of reservoirs on small catchments in the region.

Conservative Relationships

As indicated, the sensitivity analysis involved reconstructing the IFF prediction curves (i.e. *Figures 1, 2 and 3*) based on the lower k_c values determined using Andrew's Curves for the two smaller gauged catchments (see *Table 1*). A total of 19 additional points covering a range of AEPs from the 20 year ARI to the PMF were derived for this purpose: these are illustrated for the RCR in *Figure 4*.

Figure 4 demonstrates minimal overall scatter despite the large range of k_c values which the entire data set represents (ie. 1.4 to 13): this is a positive result as it suggests that the RCR absorbs much of

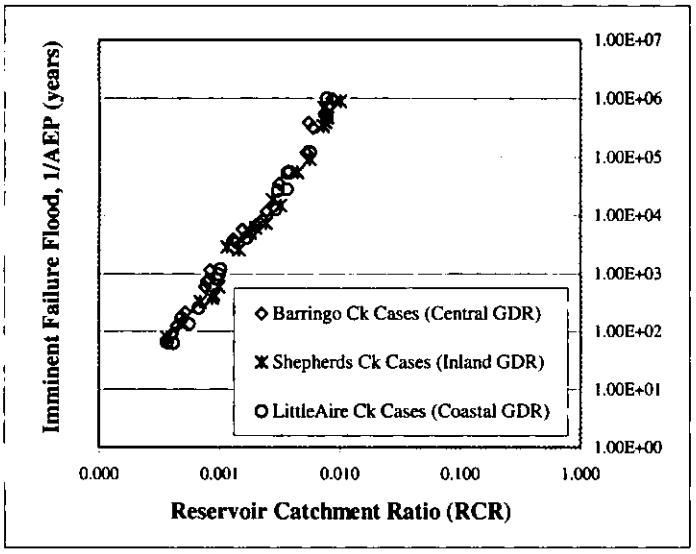


Figure 1: sample data according to each of the 'calibrated' regions

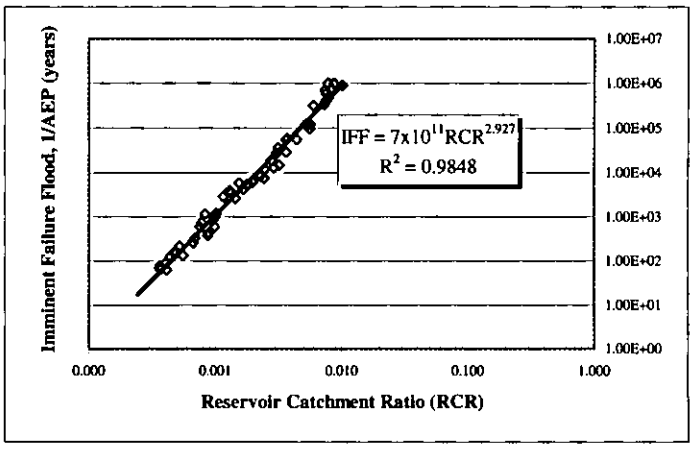


Figure 2: relationship between RCR and IFF capability for entire sample space

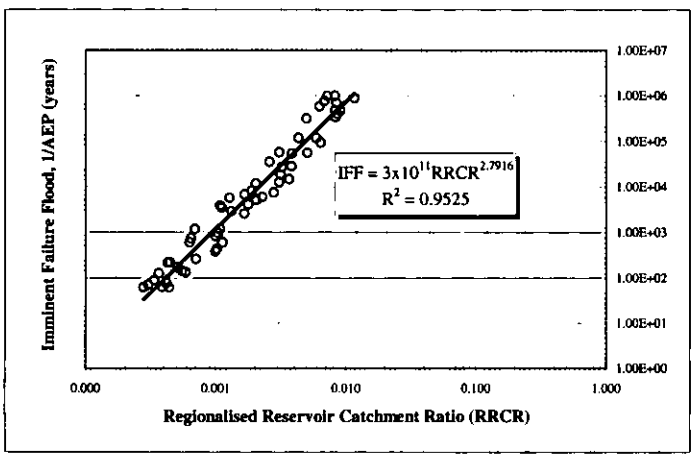


Figure 3: sample data and line of best fit for IFF prediction based on the RRCR

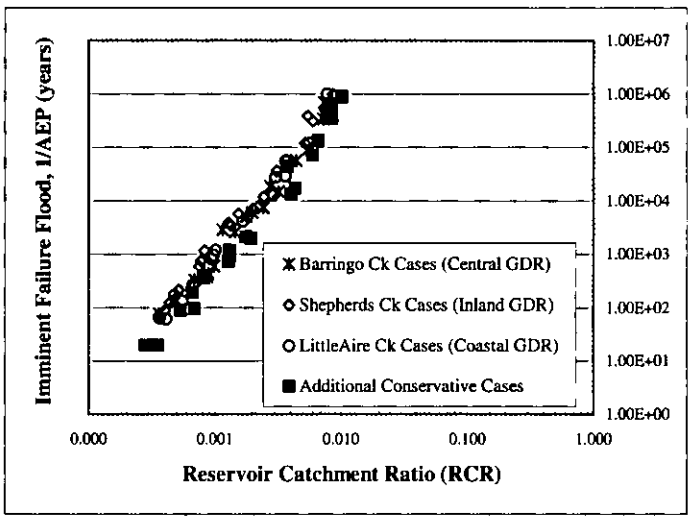


Figure 4: additional RCR sample data derived for the sensitivity analysis

the k_c influence in IFF prediction.

As before, applying the above relationship required the ability to predict the peak PMF inflow associated with a dam for input to the RCR in order to establish the RRCR. The PMF predictor derived for this purpose using the conservative k_c values is:

$$PI_{PMF} = 78.411.CA^{0.8123} \qquad (R^2 = 0.74)$$

(Equation 5)

Equation 5 was substituted into the RCR to produce a 'conservative' RRCR applicable to the sample region as follows:

$$RRCR = \frac{SC}{78.411 \cdot CA^{0.8123}} \cdot \sqrt{\frac{\sqrt{RA} \cdot SH}{1000 \cdot CA}}$$

(Equation 6)

A new flood capability prediction relationship was constructed using the same sample outcomes but based on the above RRCR. The resulting scatter plot and line of best fit are presented in *Figures 5 and 6* respectively, together with the non-conservative cases for comparison.

As before, *Figures 5 and 6* demonstrate increased scatter and, hence, some loss of accuracy in moving from the RCR to the RRCR. Despite this, however, the R^2 value displayed in *Figure 6* for the conservative curve still suggests a high level of predictive accuracy: this is a positive result. Figure 6 also demonstrates minimal separation between the conservative and non-conservative curves, with the curves actually converging towards the PMF. This is very encouraging considering the wide range of k_c values that the curves represent: similar to the RCR, the RRCR also absorbs much of the impact of k_c variance.

Application of the developed flood capability design/review

Procedure

The relationships presented in the above Section (ie. *Figures 3 and 6*) provide a procedure for engineers and dam owners to readily and effectively review and/or design the spillway flood capability of reservoirs on small catchments (area up to, say, 12 km²) in Victoria. ANCOLD (1986) criteria on design floods for dams, which for the most-part coincide with ANCOLD (2000) 'fallback' acceptable flood capacity criteria, can be incorporated into both *Figures 3 and 6* to create *Figure 7*: the principal design/review tool.

The procedure can be used in either review or design mode. However, the following three main conditions are associated with the mechanism:

- the catchment must be free of any significant flow attenuating storages upstream of the principal reservoir as these contribute to non-systematic, case-specific type flood response
- the spillway(s) must be free flowing and weir-type in nature
- the IFF must be taken as the smallest flood which peaks at the lowest point of the non-overflow crest. Providing this conservative condition is acceptable, the mechanism can be applied to any dam-type structure. ANCOLD (1986 and 2000) suggest that this

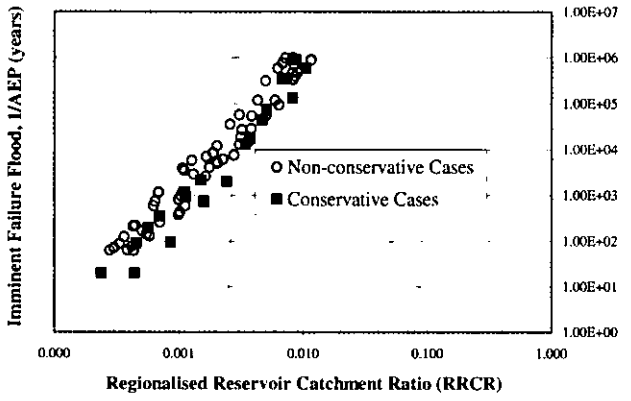


Figure 5: additional RRCR sample data derived for the aensitivity analysis

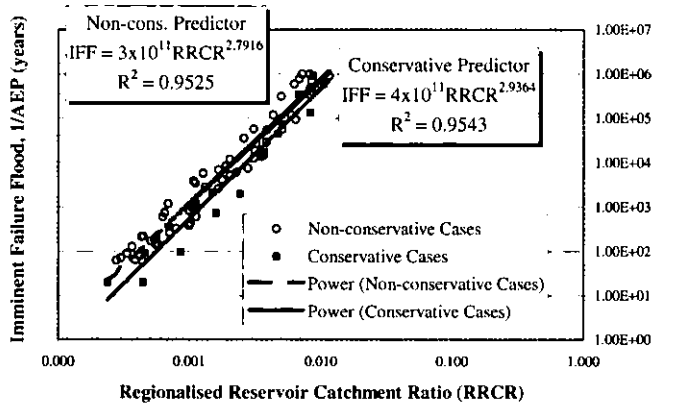


Figure 6: additional sample data and line of best fit for IFF prediction based on the conservative RRCR and comparison with non-conservative curve

condition is appropriate for embankment type dams

When using the procedure in review mode, the simple parameters required in the associated dimensionless ratio must be first determined for an existing reservoir. These parameters are then put into the prediction relationship to read off the corresponding flood capability, which is automatically checked against the displayed ANCOLD criteria. When used in design mode, the same basic parameters are related to a proposed reservoir, or upgrade of an existing reservoir. The parameters must be varied iteratively in the associated dimensionless ratio until the ANCOLD safety criteria together with the owner's storage needs are satisfied. Any proven method for estimating the storage capacity of a reservoir can be a useful tool in the iteration process, but is not a critical one as it does not affect the predicted flood capability used for design (this is illustrated in Appendix A). Pisaniello (1997) developed a model for this purpose based on two equations:

$$V = 0.415\,A.H$$

(Equation 7)

$$V(h) = \tfrac{1}{2}\left[\frac{A.h^2}{2H} + \frac{A.h^3}{3H^2}\right]$$

(Equation 8)

where:

V = total storage volume
A = top surface area
H = maximum height of storage
h = any height less than the maximum height (H)
V(h) = storage volume at height (h)

This model was verified by Pisaniello (1997) against real storage-height relationships, but unfortunately, these were of South Australian farm dams only. In order for the model to be used with confidence here, it should be verified against a Victorian data set. Nevertheless, and despite this, the model can still be used as a 'rough' predictor of storage capacity for farm dams in the State.

As to which relationship should be adopted in any particular case, this depends on the level of risk that an owner is prepared to take and/or the judgement and discretion of the design engineer. As a general rule, it is recommended that for design, the limiting ANCOLD criteria should always be satisfied with the conservative curve. However, when reviewing existing dams, particularly Low and Significant hazard ones, if the limiting ANCOLD criterion is not satisfied by a small margin via the conservative approach, but is satisfied with the non-conservative approach, then the overall flood capability can be based on the latter (at least until the former is refined in future works as described below). Both review and design worked examples are presented in *Appendix A*.

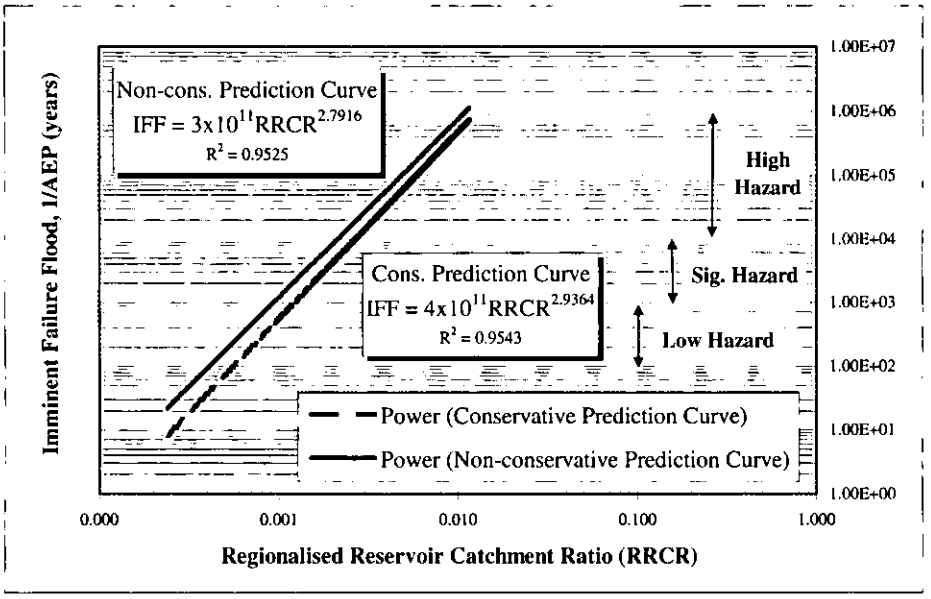
Overview, discussion and future research

At this stage the credibility of the relationships presented in *Figure 7* may be questionable due to the lack of representation of varying calibrated catchment sizes and subsequent uncertainty surrounding the RORB k_c parameters. Nevertheless, they do demonstrate worthiness of further works to increase credibility and genuine potential to provide a beneficial design/review tool to farm dam owners.

In essence, there exists an underlying need to better establish appropriate k_c values for small rural catchments in Victoria. Given the lack of small gauged catchments in Victoria, the Dyer et al (1994) procedure would be ideal for readily determining k_c values on small ungauged catchments in the State: this being the sort of catchments on which small farm dams are commonly located. However, in its calibration study of Barringo Creek, SMEC noted that the catchment did not identify particularly well with any of the groups of Andrew Curves and that this is not unusual in their experience. In contrast, when applied to the Shepherds Ck. and Little Aire catchments, this procedure provided for remarkable coincidence with the Type 2 Andrew Curve, thus providing some support for its use on other catchment cases for further refining the flood capability design/review curves. It is reasonable to adopt either the Dyer et al procedure or the AR&R (IEAust 1987) prediction equations in place of the abnormally high calibrated values as these were derived from very limited historical data (i.e. 20 years) which can not be related with confidence to extreme events. This notion is also supported by the analysis of the Little Aire catchment which contained much better historical data (i.e. 40 years) and in turn provided 'more expected' outcomes which better coincided with both the Dyer et al and AR&R values.

As such, future works will be undertaken so as to refine the conservative design/review relationship by:

- Establishing a 'well spread' range of additional catchments, say 4 to 6, of varying morphometry (particularly of the smaller scale size and including at least one in the Gippsland region)—determining k_c using either the Dyer et al (1994) procedure and/or AR&R (IEAust 1987) prediction equations—



For Non-Conservative approach:

$$RRCR = \frac{SC}{1.1723 \cdot CA^{2.5033}} \cdot \sqrt{\frac{\sqrt{RA} \cdot SH}{1000 \cdot CA}}$$

For Conservative approach:

$$RRCR = \frac{SC}{78.411 \cdot CA^{0.8123}} \cdot \sqrt{\frac{\sqrt{RA} \cdot SH}{1000 \cdot CA}}$$

where: SC = spillway overflow capacity (m^3/s)
RA = reservoir area at Full Supply Level (km^2)
SH = maximum height of spillway overflow (m)
CA = catchment area (km^2)

Figure 7: reservoir flood capability design/review relationship incorporating ANCOLD (1986) criteria

and including these in the refinement process so as to increase credibility and confidence in the developed relationships applying to the whole of Victoria.

- Given the final publication of Book VI of the new edition of AR&R (1998)—fully developing the alternative, less conservative relationship based on 1 in 10^7 AEP of PMF as determined using Book VI: this will merely produce a similar relationship to that presented here but with different slope.

The above works are currently being undertaken and will be reported in a future article.

Conclusion

There is a clear need to encourage private owners to review the spillway flood capabilities of their dams in line with current acceptable practice and to take appropriate remedial action where necessary. The regionalised procedure developed here can be used to provide such encouragement. The procedure is applicable to dams on small catchments up to 12 km^2 in size: this will cater for most private dam cases in the State.

The main benefit of the procedure is its simplicity which dramatically reduces the effort and resources required for conducting a 'state of the art' reservoir flood capability study. The procedure provides a basis for quick yet accurate review and/or design of private dam spillways against any design flood standards, and is in line with modern acceptable practice which is of critical importance in a court of law.

However, at present the relationships upon which the procedure is based may be seen to lack credibility primarily because of the lack of representation of varying catchment sizes throughout the State. This is due to the absence of appropriate small gauged catchments throughout the State and the uncertainty associated with the calibration results: this will be rectified in future works. At the same time, the sensitivity analysis has done well to demonstrate:

- the narrow bound within which more refined relationships will lie, therefore making the relationships presented here 'useable' in their current form
- the worthiness of further works to increase credibility
- genuine potential to provide both a reliable and beneficial design/review tool to farm dam owners, which will undoubtedly encourage better private dam design and safety management in Victoria.

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The authors wish to acknowledge the valuable contributions made by the following people and organisations:

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Author's contact details

Dr. John D. Pisaniello, BE (Hons 1), PhD, Research Fellow, University of South Australia, School of International Business, Water Policy and Law Group, Way Lee Building, City West Campus, North Terrace, Adelaide SA 5000
Phone: 08 8302 0031
Mobile: 0418 825 732
Fax: 08 8302 0512
Email: John.Pisaniello@unisa.edu.au

A/Prof. Jennifer Mckay, BA (Hons), LLB, PhD, GDLP, Director Water Policy and Law Group, University of South Australia, School of International Business, Faculty of Business and Management, Barrister and Solicitor, Way Lee Building, City West Campus, North Terrace, Adelaide SA 5000
Phone: 08 8302 0887
Fax: 08 8302 0512
Email: Jennifer.McKay@unisa.edu.au

Mr Siraj Perera, M.Sc. MIEAust, MICE, Water Assets Engineer, Natural Resources and Environment, Victoria. PO Box 500, East Melbourne VIC 3002.
Phone: 03 9412 4062
Fax: 03 9412 4360
Email: Siraj.Perera@nre.vic.gov.au

Conference Announcement

Twelfth world congress on Disaster and Emergency medicine

The twelfth world congress on Disaster and Emergency medicine welcomes you in an exceptional congress setting, where for three days, we will share our experience, present our research and discover the work of other international teams regarding emergency, catastrophe and humanitarian medicine.

It is to be held in Lyon from the ninth to the twelfth of May, 2001. The congress will deal with the practical aspects of catastrophe situations such as setting up a triage center, handling radio communications, studying identification procedures.

Two specialized trilingual one-day symposiums will also be held: the first is for emergency nursing staff; the second for paramedics, emergency medical teams and ambulance staff. Their aim will be to compare and share practical experience, guidelines and projects on an international level.

There will also be a discussion on how to evaluate medical practice. The organisers encourage you to bring to the debate methods and results and finally, the congress aims to highlight new pedagogical tools.

For further information

WDCEM 2001
1 rue de la Banniere
69003 Lyon France
Fax: 33 (0) 4 72 60 92 89
Email: wcdem2001@aol.com
www.wcdem2001.org, or http://pdm.medicine.wisc.edu/pdmcalendar.html.)

Appendix A : worked examples demonstrating the application of the developed flood capability design/review procedure

Review Mode Worked Example

Case Description: Farmer Jones owns an embankment dam at Mount Macedon in Victoria with a catchment area of 8 km^2 (as measured from 1:25,000 scale topographic map) and a well populated valley downstream in what would be a dam-break inundation area. The reservoir has a maximum still-water depth of approx. 10m and a surface area at Full Supply Level (FSL) of 0.048 km^2 (as measured from 1:10,000 scale aerial photo). The dam has a free flowing, broad crested weir-type spillway which is 10m wide and 2m high (max.) to the lowest point on the non-overflow crest. Mr Jones would like to know if the flood capability of his dam is of adequate standard in relation to ANCOLD(1986) guidelines?

Case Solution: In accordance with ANCOLD guidelines, the dam warrants a 'High' hazard rating given the populated valley downstream. It must therefore have an IFF capability of at least 1 in 10,000 AEP (see *Figure 7*) in order to be of adequate 'ANCOLD' standard. This can be checked as follows:

1. First check via Non-conservative curve (*Figure 7*):
   - Determine Non-cons. RRCR:
     - RA = 0.048 km^2, CA = 8 km^2, SH = 2m,
     - need to determine spillway capacity (SC) which for a rectangular weir with flow width, SW (m), and weir coefficient, C_w, is given by $\mathbf{SC = C_w.SW.SH^{1.5}}$, where C_w = 1.69 for free flowing, broad crested weir-type spillway (IEAust, 1987; Pisaniello, 1997). Hence, with SW = 10m, SC = 1.69x10x2$^{1.5}$ = 47.8 m^3/s.
     - Substituting into Non-cons. RRCR;

$$RRCR = \frac{47.8}{1.1723 \cdot 8^{2.5033}} \cdot \sqrt{\frac{\sqrt{0.048} \cdot 2}{1000 \cdot 8}}$$

$$= 0.00166$$

   - Using the non-conservative prediction equation in Figure 7;

$$\mathbf{IFF} = 3x10^{11}x0.00166^{2.7916}$$
$$= \mathbf{5200\ years}\ (1/AEP)$$

2. As the non-conservative approach does not meet the standard of 1 in 10,000 AEP, then there is no point in checking for the conservative approach, as the flood capability will only be worse.

3. Overall Assessment: As 5200 < 10,000, the dam is in need of remedial action!

Design Mode Worked Example

Case Description: Mr Jones, the owner of the dam in the above case, would like to know the amount by which he must increase the size of his spillway in order to make the dam of adequate flood capability standard? However, he must be left with a full storage capacity of at least 190 ML in order to meet his annual farming needs, and he would also like to avoid the option of raising the entire non-overflow crest.

Case Solution: A new spillway can be designed as follows:

1. In the review of this dam, 1 in 10,000 AEP for the Recommended Design Flood (RDF) was used as the minimum standard and was compared to the non-cons. predicted flood capability. For design, as lives are at risk downstream, best to adopt the conservative approach:
   - Thus, can determine the 'required' cons. RRCR to meet this standard by using the appropriate equation in *Figure 7* in reverse;

$$\text{for} \quad 10{,}000 = 4x10^{11}RRCR^{2.9364},$$
$$RRCR = 0.00259$$

2. Can now design the new spillway for RRCR = 0.00259 by using the cons. RRCR equation in reverse:
   - As the height of the spillway (SH) cannot be increased by raising the embankment, extra spillway capacity can only be obtained by widening the spillway (either the existing one or a new secondary one) and/or deepening its base. However, the amount by which the bottom of the spillway can be deepened is restricted by the farmer's storage capacity requirement. Therefore, need to determine the maximum depth that the spillway can be dug out without loosing excessive storage capacity. Equation 8 can be used for this purpose by 'trial and error' as follows:
     - Try increasing spillway depth by 0.2m, ie: SH = 2.2m. Therefore, the maximum reservoir depth reduces from 10m to 9.8m.
     - Substituting necessary parameters into *Equation 8*, the new storage capacity of the reservoir (RC) would become;

$$RC = \tfrac{1}{2}\left[\frac{0.048\times10^6\times9.8^2}{2\times10} + \frac{0.048\times10^6\times9.8^3}{3\times10^2}\right]$$

$$= 190.5\ \text{ML}$$

     - As 190.5 > 190, increasing the depth of the spillway by 0.2m is just acceptable. Therefore, can work with SH = 2.2m new maximum spillway depth.
   - Also require a new reservoir area at FSL (RA). This can be determined using *Equation 7* in reverse with a new maximum reservoir depth of 9.8m;

$$\text{for} \quad 190.5x10^3 = 0.415x(RA)x9.8$$
$$RA = 0.0468\ \text{km}^2$$

   - Therefore, substituting all necessary parameters into the cons. RRCR equation and applying it in reverse;

$$\text{for} \quad 0.00259 = \frac{SC}{78.411 \cdot 8^{0.8123}} \cdot \sqrt{\frac{\sqrt{0.0468} \cdot 2.2}{1000 \cdot 8}}$$

$$SC = 142.6\ \text{m}^3/\text{s}$$

   - The spillway width (SW) required to provide this spillway capacity for a 2.2m maximum depth is determined using the broad-crested rectangular weir equation (presented above under Review Mode Worked Example) in reverse;

$$\text{for} \quad 142.6 = 1.69xSWx2.2^{1.5}$$
$$SW = 25.9\text{m}$$

   - Therefore, as the spillway width is already 10m, it must increased by 15.9m, for a 0.2m increase in depth.

3. Overall Assessment: The size of the spillway must be increased from 2m deep x 10m wide to **2.2m deep x 25.9m wide** in order to satisfy the ANCOLD (1986) flood capability standard.

Note: If the use of Equations 7 and 8 is to be avoided, then alternatively the dam owner can maintain the original storage capacity of the reservoir, and an increase in spillway width can be determined for the original 2m high spillway.

Tasman Bridge disaster: 25th anniversary memorial service

by Rod McGee, Manager Asset Strategies, Department of Infrastructure, Energy and Resources, Tasmania and Lynn Young, State Recovery Coordinator, Department of Health and Human Services, Tasmania

Introduction

The collision of the vessel *ss Lake Illawarra* with Tasman Bridge on 5 January 1975 had a major impact on the lives of the people of southern Tasmania. The event had a number of unique characteristics and occurred at a time when the effects of disasters on communities were less well understood. Assistance to the community in this regard was thus limited.

An approach to the Tasmanian State Government by a local Lions Club led to a memorial service to mark the 25th anniversary of the disaster. This paper provides some background to the building of the Tasman Bridge and the disaster, discusses its effects on the community and describes the memorial service. It shows that effects of disasters can remain after extended periods and a memorial service after 25 years can assist members of the community.

History of Tasman Bridge

Hobart is divided by the Derwent River. Non-indigenous settlement of Hobart occurred in 1804, initially on the eastern shore but transferring shortly afterwards to Sullivans Cove on the other side of the river due mainly to a lack of fresh water. As early as 1816, a ferry took passengers across the river north of Hobart at Austins Ferry. A bridge at Bridgewater, some 20km north of Hobart, was opened on 30 April 1849. Ferry services across the Derwent close to Hobart commenced in the 1850's.

While a bridge of boats was proposed for a crossing close to Hobart in 1832, the first investigation of possible bridge crossings was not commissioned until 1913. Costs of all the options were however high and it was recommended that a ferry would meet traffic requirements for many years.

In 1936, a proposal for a floating arch bridge was submitted to the Premier by the Director of Public Works for consideration. The floating arch was proposed to eliminate deep and expensive foundations. The proposal was accepted and construction of the bridge commenced in 1938. It was opened to traffic on 22 December 1943. A lift span was provided to allow vessels to travel upstream. Population growth on the eastern shore had been slow to that time, but accelerated after the opening of the bridge generating increasing traffic demand. *Figure 1* shows population on the eastern shore and cross river vehicular traffic and highlights the rapid growth in both after the opening of the bridge.

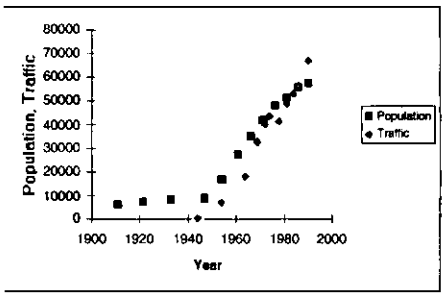

Figure 1 – Eastern shore population and cross river traffic

The bridge however suffered storm and corrosion damage and increasing traffic congestion, especially during the operation of the lift span. As a result, consultants were commissioned in 1956 to investigate options for a bridge to replace the floating arch. A number of bridge and tunnel options were considered during the preliminary design stage and review by the Parliamentary Standing Committee on Public Works. Navigation issues, including the possibility of ship collision, were assessed comprehensively. While a suspension bridge was considered the best option, its high cost and the inability of the State to finance it meant that a viaduct structure was adopted.

Construction of Tasman Bridge commenced in May 1960. The bridge was opened to 2 lanes of traffic on 18 August 1964, with all 4 lanes becoming operational on 23 December 1964. The bridge was officially opened by HRH The Duke of Gloucester on 29 March 1965.

Tasman Bridge Disaster

At 9.27pm on Sunday 5 January 1975, the bulk ore carrier *ss Lake Illawarra* struck

Figure 2 –Tasman Bridge during construction and floating arch bridge

Tasman Bridge resulting in the collapse of 3 spans, the sinking of the vessel and the loss of 12 lives. Seven of those were crewmen, the other five people were travelling in four cars.

A large number of organisations and members of the public were involved in the response to the event. Organisations included Tasmania Police, Tasmanian Ambulance Service, Hobart Fire Brigade, Royal Hobart Hospital, Civil Defence, Hobart Tug Company, Marine Board of Hobart, Public Works Department, Transport Commission, Hydro-Electric Commission, Postmaster-General's Department, Hobart Regional Water Board, Salvation Army and the Defence Forces.

The *Mercury* newspaper on the following morning said that: 'Few could comprehend the meaning of the disaster, the lives lost, the destruction of both the *Lake Illawarra* and the bridge itself and the huge traffic problems which will face Hobart for months, perhaps years to come'.

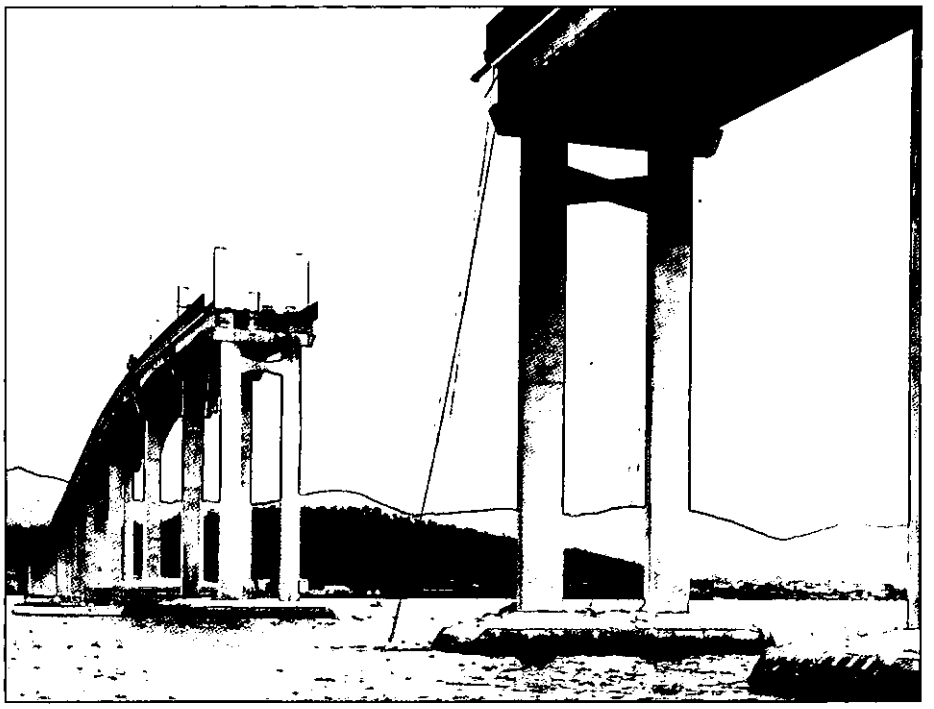

Figure 3 – Tasman Bridge, 6 January 1975

For people travelling from the eastern shore, the immediate effect was that what had been a 10 to 15 minute trip became a 2 hour journey in each direction. The nearest alternative road connection was via Bridgewater over mainly unsealed roads for a distance of approximately 50 kilometres. Ferries that had been carrying tourists on the Derwent started commuter operations on the following morning. The ferry fleet was expanded rapidly and shore facilities upgraded and built to cater for people wishing to cross the river.

Prior to the disaster, the eastern shore was almost exclusively a dormitory suburb with a large labour force that had to cross the water every day to workplaces on the western shore. The major tertiary institutions, private schools and hospitals were also on the western shore. There had been no decentralisation of government administration and there was a lack of eastern shore offices of insurance companies, banks, solicitors, doctors, dentists and many other businesses. Cultural activities were largely based on the western shore; these included the theatre, halls, the museum and art gallery, cinemas, restaurants, meeting places, lecture theatres and the botanical gardens.

There was a diverse range of effects on the community from the disaster. These included psychological effects arising from anger, uncertainty, inconvenience and dissatisfaction. Fatigue and reduced family contact were a consequence of the additional travel demands. Alcohol sales on the ferries were substantial, placing additional demands on relationships. Social contact was reduced. Many with part-time jobs, particularly women, gave up work because of the cost and time involved in travelling. Overtime was also in many cases curtailed. Phobias associated with water, ships and crowds became apparent in some. The difficulties were exacerbated by the lack of hospital services and specialists on the eastern shore. Pregnant women in particular felt very insecure. A number of businesses closed. Much of the frustration and anger was directed towards the transport services.

The Tasman Bridge disaster was in many respects unique. Because it occurred on a Sunday evening shortly after Christmas, there was relatively little traffic on the bridge. If the event had occurred during a weekday after schools had resumed and businesses had returned to work, the death toll could have been far higher. Except for those who lost their lives or were on the ship, no personal possessions were destroyed and there was nothing that the community could do to help clearing debris or provide support for rescue operations, clothing, shelter, aid or restoration of the damage as it had done after the 1960 floods or the 1967 bushfires in southern Tasmania. Visible progress on restoration of the bridge was slow because of the need for extensive underwater surveys of debris and the time required for design of the rebuilding. The role of Salvation Army and Red Cross, although geared to disasters, was limited to support for the search and rescue teams. The effect on the hospitals and police was small. The ferry queues did however provide some assistance by providing a forum where people had much in common and could vent their frustration.

A Tasman Bridge Restoration Commission was establish to oversee the rebuilding of the Tasman Bridge, which was widened to 5 traffic lanes and reopened in October 1977.

The eastern shore police presence and medical services were upgraded. Branch offices of several government agencies were also established. The increased Government presence on the eastern shore remains.

Flextime was introduced to reduce peak transport demands, and this also remains.

The disaster stimulated development in Kingborough, a municipality south of Hobart on the western shore, because of the reduced travel times for western shore workers compared to the eastern shore.

The eastern shore became a more self-contained community, with a higher level of employment and improved services and amenities, than it had been prior to the disaster. The previous imbalance between facilities and employment opportunities between the two shores was to a high degree redressed as a result of the disaster. Many roads were upgraded and the Bowen Bridge subsequently built to provide an alternative crossing.

Bob Clifford was successfully operating the Sullivans Cove Ferry Company as a ferry and charter operator and a boat

builder prior to 1975. The disaster was the catalyst which totally changed the focus of the company and was a significant influence on its growth. As Incat, the company is now an established exporter of high speed catamarans and a major Tasmanian employer.

Memorial Service

The Clarence Lions Club, from Hobart's eastern shore, proposed to the Minister for Infrastructure, Energy and Resources in January 1999 that a memorial to the Tasman Bridge disaster be erected. As a result of the proposal, a meeting of representatives of organisations and individuals that may have had an interest in the proposal was convened. The meeting resolved that a service, which included the unveiling of a memorial, would be appropriate and a planning committee was established comprising representatives of:

- Department of Infrastructure, Energy and Resources as owner of the bridge (chair)
- Department of Health and Human Services because of their roles in community health and recovery
- Clarence and Hobart City Councils representing the people of greater Hobart
- Tasmania Police, Tasmanian Ambulance Service, Tasmania Fire Service and State Emergency Service because of their roles in emergency management
- Department of Premier and Cabinet for matters of protocol
- Hobart Ports Corporation as managers of river usage
- Clarence Lions Club to represent community groups
- Tasmanian Council of Churches for their role in the spiritual aspects of a service
- Hon Bruce Goodluck MHR who was Warden of Clarence municipality at the time of the disaster and as a community representative.

It was recognised that music would be an important and integral part of a commemorative service and a sub-committee was established to develop that part of the program. The sub-committee comprised representatives of the pipe bands, concert bands and choirs invited to participate. The music program comprised recognisable tunes that were consistent with the nature of the commemoration. It also included the playing of a popular tune, 'The Ferry Boat Shuffle', which was written shortly after the disaster and described the carrying of commuters across the Derwent River and, with 'Highland Cathedral', provided a transition from the one hour music program for people arriving for the service itself.

The site selected for the service was beneath the eastern approaches to the bridge because of its proximity to the site of the impact, and its ability to accommodate the number of people likely to attend a service, albeit with some tidying of the area. It was also close to the location selected for the memorial plaque, being a large bridge pylon adjacent to the water's edge.

The Governor and Premier of Tasmania were invited to participate in the service and readily accepted.

The planning committee identified the desirability of placing a plaque near to the site of the collision, both for commemoration and for interpretation by visitors to the area. Careful consideration was given to the wording on the plaque to recognise the passage of time since the disaster and the likely inability to contact many of the families of the deceased to discuss the proposal. Significant input was provided by attendees at a disaster recovery course at the Australian Emergency Management Institute. A symbol was developed to illustrate the bridge with the collapsed spans. The layout of the plaque is shown in *Figure 4*. A commemorative brochure outlining the history of the bridge, the disaster and its effects on the Hobart community was prepared for and distributed at the service.

Awareness of the service was raised through a series of press releases over a period of about six months prior to the service and display advertisements during the preceding three weeks. The service was strongly supported by both print and electronic media. The chair of the planning committee gave a series of interviews in the preceding week. The media also gave prominence to its extensive coverage of the service.

The service was developed to have a number of symbolic aspects, including:

- being held beneath the eastern approaches to the bridge where many of the people involved in the early response were located
- choirs and bands comprised youths and adults from both sides of the Derwent River, representing the nature of the Hobart community
- prayers were said by leaders of the Anglican, Roman Catholic, Uniting, Salvation Army, Jewish and Islamic religions representing the spiritual diversity of the community
- extinguishing the lights on the eastern half of the bridge, to a lone piper playing a lament at the time of impact, recreated its appearance after the collision
- a single wreath was laid by a serving police officer from the police vessel Vigilant during a period of silence to represent those who had assisted in the response to the disaster, especially from the emergency services; both the officer and the boat were involved in the actual response.

Estimated attendance at the service exceeded 1000 and included families of some of those who died or were most affected by the disaster, senior representatives of government and organisations that had been involved in response

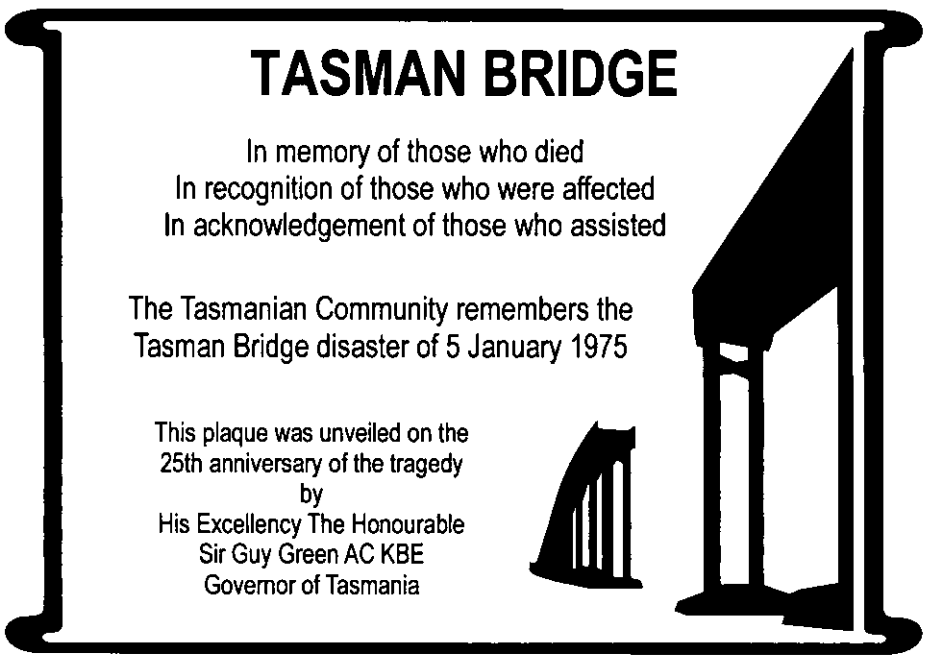

Figure 4 – Commemorative plaque

and recovery and members of the public.

In his address the Premier said that the disaster was clearly remembered by many Tasmanians. He noted that some were still struggling with the memories of its effects, and commended the resilience of the community in coping with the disaster. The Governor described the pain and loss of loved ones and the social and economic disruption. He paid tribute to the efforts of emergency services personnel in responding to the disaster and the way in which the State managed to the challenges created by the collision. He said that the eastern shore had emerged more self-sufficient in the wake of the tragedy and that Tasmanians were now stronger, more self-reliant and mature.

Community recovery aspects

The collision occurred at a time when the psychological effects of disasters on communities were less well understood. A service, prepared and led by members of the Tasmanian Council of Churches, to commemorate the tragedy of the bridge disaster, to celebrate the rebuilding of the spans and to rejoice in the possibilities which the reopening offered to greater Hobart was held on the occasion of the reopening on Saturday 8 October 1977. The reopening itself was however low key and other assistance to the community was limited. As noted previously, opportunities for the community to be involved in the response to the disaster and the physical restoration of infrastructure were minimal because of the nature of the event. It is likely that this lack of contribution contributed to the enduring nature of the effects of the disaster on a number of individuals.

Knowledge and practice regarding community recovery has developed significantly over the past 25 years since the Tasman Bridge tragedy. Eyre (1999) describes the psychological and social importance of post-disaster rituals associated with anniversaries of disasters, both in the short and long term, and the need to take account of the range of social, religious and political issues involved in planning for such commemorations.

It is of value for recovery agencies to examine the efforts made at the time of the commemorative service. The planning committee included a number of members with backgrounds in emergency management and community recovery and was able to draw on their training, expertise and involvement in the recovery aspects of the Port Arthur tragedy in the planning of the service.

A set of principles relating to community and personal support services has been endorsed by the Standing Committee of Community Services and Income Security Administrators (SCCSISA) and commended by the National Emergency Management Committee. The principles advise that:

Community and personal support services are most effective when they:

- are provided in a coordinated, timely and culturally appropriate manner
- are available for all people affected by the disaster including individuals, families, communities, groups/organisations, and emergency service, recovery workers and volunteers
- include the affected community in their development and management
- facilitate sharing of information between agencies as an integral part of the service delivery
- recognise that people will require accurate and current information about the situation and the services available
- are integrated with all other recovery services, particularly with regard to financial assistance
- provide assistance and resources to create, enhance and support community infrastructures
- recognise that cultural and spiritual

Pipe Bands	Cullen Bay, Mairi's Wedding, Rowan Tree, Steam Boat Song, Cock of the North, Bonnie Dundee, Green Hills of Tyrol, When the Battle's O'er, Sweet Maid of Glendaruel, 1976 Police Tattoo
Pipe and Concert Bands	Scotland the Brave, Skye Boat Song
Concert Bands and Choirs	Maritime Medley, Strike Up the Band, Anchors Aweigh, Andrew Lloyd Webber: A Concert Celebration, Songs that Made Australia, El Shadaih, I am Australian
Recording	Ferry Boat Shuffle
Pipe and Concert Bands	Highland Cathedral
Concert Bands and Choirs	Crimond
Premier of Tasmania	Address
Church leaders	Prayers
Concert Bands and Choirs	Abide with Me
Lone piper, lights extinguished on eastern half of bridge	Sleep Dearie Sleep
Police Vessel Vigilant	Silence, wreath laying
Governor of Tasmania	Address, unveiling of plaque
Concert and Pipe Bands, Choirs	Amazing Grace
Pipe Bands	Auld Lang Syne, Will Ye Nae Come Back Again, We're No Awa' Tae Bide Awa'

Table 1 – Memorial Service Program

Figure 5 – Estimated attendance at the service exceeded 1000 and included families of some of those who died or were most affected by the disaster

symbols and rituals provide an important dimension to the recovery process, and
- utilise personnel with appropriate capacities, personal skills and an awareness of the full range of services available.

The initial impetus from the local Lions Club, and their subsequent membership on the planning committee ensured solid and informed community representation. It facilitated the establishment of dialogue with representatives of the community which was further enhanced by representation from local government. The planning committee met on a regular basis over a period of approximately 12 months and a coordinated response, with a set of common and stated goals, was achieved.

That the committee had such broad representation from community and church groups, and all levels of government from the Premier's Department to Emergency Services highlighted the range of resources which are deployed, and thus need to be acknowledged, in the event of a disaster.

The fact that until 2000 no formal closure ceremony had taken place at the site marked the 25th anniversary as an appropriate time with a large proportion of the Hobart population remembering well the immediate and longer term impact of the tragedy. Representatives from a range of church groups and service organisations were involved in an attempt to deliver a culturally appropriate service.

Direct contact was made with as many of the families that may have been most affected by the disaster as could be located prior to the commencement of publicity so that they would be aware of the background to and nature of the service. With the passage of time and the spread of residential addresses for the ship's crew, this was however difficult. While the majority of those contacted were supportive of the commemoration, others indicated that events in their lives had enabled them to move on.

The inclusion of a contact telephone number in advertising for the service enabled a number of people to tell their story or of the involvement of others in response to the disaster; these stories had mostly been untold for 25 years. Awareness of the service was assisted by the support and interest of the media.

The service itself was described as emotional by the media, whose interviews included families of some of the deceased, one of the crewmen from the *Lake Illawarra*, and Frank and Sylvia Manley. Those interviewed described the beneficial nature of the commemoration, with one saying it was the service that we didn't have at the time. A number of those attending expressed similar sentiments privately to members of the planning committee with as much said as unsaid.

Frank and Sylvia Manley are two people who remembered the disaster vividly. Their vehicle was one of the two that were left with their front wheels over the edge of the gap. They still own the green GTS Monaro that featured in many reports of the event.

The Manleys participated in a number of interviews for media reports on the anniversary and the commemoration. *The Mercury* reported Mrs Manley as having said that "sometimes it's okay to talk about it, other days it's not' and that 'grief takes a lot to get over, you never get over it". *The Examiner* noted that Mrs Ingrid Harrison, who had been one of their reporters at the time, was still haunted by the night of the disaster each time she drives over the bridge.

A reunion for a substantial proportion of the crews of the ferries that maintained cross river links until the bridge was rebuilt was held on one of those ferries, the *Cartela*. It was one of a number of boats that moored near the bridge during the service. While unplanned, the sounding of its horn at the end of the silence and the rafting together of a number of the boats added further symbolism to the service.

The presence of the crews on one of the ferries used during the disaster in close proximity to the service was an appropriate commemoration for those people because of their particular role.

Spiritual symbols and rituals are an important dimension to the recovery process. The presence of survivors, relatives of those who lost their lives in the tragedy, dignitaries, the evocative playing of the lone piper, the extinguishing of lights on the bridge and the laying of the single wreath provided an air of solemnity appropriate to the occasion. Whilst the growth of the Eastern Shore as a direct result of the tragedy provided a positive side to the event, it appeared that, in a general community sense, there had been limited opportunities for the mourning of those who had passed away and were otherwise affected. The goal of the commemorative service was to pay those long overdue respects.

The attendance at the service, the telling of stories, the emotion of the service and the expressing of sentiments highlighted the enduring nature of the effects of disasters on communities and the beneficial effects of commemorations at appropriate times.

More recent disasters have provided opportunities closer to the event; the Tasman Bridge 25th anniversary memorial service nevertheless demonstrated that there are benefits in providing some form of commemoration after a significant passage of time where these opportunities have not arisen earlier. It is considered that the service met those needs of the Hobart community and further services are not envisaged.

Summary

The Tasman Bridge disaster on 5 January 1975 had a significant effect on the people of Hobart. While it resulted in major enhancements to physical infrastructure, it occurred at a time when the psychological effects of disasters on communities were less well understood and assistance to the community in this aspect of recovery was limited.

A proposal by a local service club to erect a memorial to the disaster was developed by a planning committee with broad community representation and expertise into a service to commemorate the 25th anniversary of the disaster. The staging of the service highlighted the enduring effects of disasters on communities and the benefits of such commemorations after extended periods where earlier opportunities have not been provided.

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Understanding employee responses to disaster

by Thomas E. Drabek, Department of Sociology, University of Denver, Denver, Colorado

Introduction

During recent years, disaster preparedness and planning within private businesses has moved from being a topic that was met with smiles and little else, to a recognised managerial responsibility. For example, 'In 1989 researchers showed that less than half of the Fortune 1000 corporations surveyed had a crisis management team or had any type of crisis management plan in place to deal with a major crisis or catastrophe' (More 1998, p. 224). By contrast, more recent surveys reveal a somewhat improved picture. 'According to a recent *Contingency Planning & Management*/Ernst & Young LLP study, 95 % of companies surveyed are either developing or have some type of BCP [Business Continuity Planning] in place' (Keating 1997, p. 1). But even this survey revealed gaps and voids that suggest vulnerability to disaster. For among the companies included in the 95 percent are those who are 'developing plans' (24%) and those who have completed plans only for certain departments or divisions (32%). In short, these survey data actually documented that only 38 percent of the companies surveyed claimed to have completed the planning process although most were evidencing some progress and commitment. A 1999 follow-up validated these results and the implicit vulnerability. 'While still encouraging, the results have fallen about two percent from 1998' (1999 results based on a four page questionnaire; 10,000 mailed, 531 returned, i.e. 5%) (Van Gilson 1999, pp. 12 and 16).

But what about behavior? When impacted by actual disasters, what do employees experience? Although a great deal has been learnt over the years about human responses to disaster (Fritz 1961, Barton 1969, Dynes 1970, Drabek 1986), employee responses have not received much attention. There have been a few studies of employee responses to single events like the accident at Three Mile Island (Chisholm et al. 1983), the bombing of the World Trade Center in 1993 (Wenger et al. 1994) and Hurricane Andrew (Sanchez et al. 1995). Others have reported a few observations regarding work place behavior that were reported during household evacuation interviews (Bourque et al. 1993; Goltz et al. 1992). But *no comparative studies of employee responses to disaster have been reported.* Following brief discussion of the theory and methods that guided and bounded my study and a summary of general responses, I will describe the results of five multivariate models that best predict variations in:

- work-family tensions
- desired change in evacuation pay policies
- perceived morale change
- dissatisfaction with management disaster response
- dissatisfaction with local government disaster response.

I will conclude with discussion of employee recommendations regarding desired changes in company disaster planning and response.

Theory and method

This study was guided by the *stress-strain theoretical perspective* which has been applied in numerous disaster studies for several decades (Haas and Drabek 1970; Drabek 1990, 1994, 1996, 1999a). It is a variant of the *emergent norm paradigm* (Turner 1964; Perry 1985) and draws heavily on *bounded rationality theory* (Burton et al. 1993). In essence, this perspective assumes that when people are confronted with danger they will form emergent perceptions of risk. Multiple layers of social constraint, including various forms of structured strain, i.e. inconsistency, ambiguity, and overload, pattern these emergent perceptions of risk. Hence, when disaster warnings are issued, all employees are free to select their behavioral actions. But their choices reflect the range of options they perceive to be available. These, in turn, are limited by varied forms of social constraint that are the outgrowth of their past life experiences (Drabek 1999b).

As in everyday life, during disaster employees are forced to choose between family and work. For some the decisions are easy—they may stay at work late to place sandbags, move furniture, or whatever. For others, a series of compromises are required to reduce the strain they confront because of family expectations and needs. Understanding the behavior evoked by disaster warnings, therefore, requires examination of a complex mix of social constraints that capture the juxtaposition of both work and family expectations.

Seven disaster events were compared through field work in 12 communities:

- Hurricane Felix (August 1995) (Carteret and Dare Counties, North Carolina)
- Hurricane Fran (September 1996) (Pender, New Hanover and Brunswick Counties, North Carolina and Horry County, South Carolina)
- flood (January 1997) (Washoe County, Nevada)
- flood (January 1997) (Stanislaus County, California)
- flood (January 1997) (Sutter and Yuba Counties, California)
- flood (July 1997) (Larimer County, Colorado)
- flood (July 1997) (Logan County, Colorado) for event descriptions and analytic characteristics, see Drabek 1999, pp. 28-54.

The research design was a comparative case study (Yin 1984) wherein field observations were augmented by systematic field and telephone interviews with 406 employees who worked for 118 different businesses. The firms were selected carefully to insure balancing across two analytic design variables, i.e. size and mission. Interviews averaged 45-50 minutes although many went well over an hour especially in the high impact areas. Following each interview, I requested that a short mail back questionnaire (30 items) be completed; two-thirds (66%) returned these. Also, 23 emergency managers were interviewed; they provided contact recommendations of impacted businesses and important contextual information regarding both the disaster event and the community response.

Employee responses

When warned about these disasters, threat

denial was the initial response regardless of the information source. All employees, however, tried to confirm the information through one of several coping actions. These reflected the constraint of social status. For example, CEO's and upper management contacted local authorities with some frequency whereas line personnel turned to relatives, friends, and media outlets. Extensive discussions with co-workers were reported by most employees. The content varied, but the most frequent topics discussed were:

- the potential severity of the threat
- where to go
- when to go
- the continued relative safety of both work and home locations.

During these discussions additional warning information was received, but often inconsistencies emerged. Decisions about work and family had to be made within a context of uncertainty and ambiguity.

As the warning period continued, over two-thirds said they stayed at work to help prepare the business for impact. Again, their actions clearly reflected the powerful constraint of social status. Those in managerial positions focused on providing necessary information to other employees, while those with other jobs boarded up, created back-up computer files, and assisted customers. These firms varied in their degree of *disaster-relevance*. Some like lumber yards and retail outlets that sold emergency supplies of various types were pressed to remain open as long as possible. This too was true of some shelter providers, e.g. hotels that provided rooms to media personnel who arrived on scene to report and record the upcoming destruction.

One-half indicated that their boss provided some form of evacuation related assistance during this time. The forms of assistance varied widely both in content and the perceptions of employees.

> 'Our manager offered a room at an inland hotel for me and my family if we decided to evacuate from our home.'
>
> 'We received pay advances; normally we get paid on Thursday and that was the day the hurricane was due. So management paid everyone early to help out with people leaving.'
>
> 'They indicated that if we had problems at home we could take time off to protect our homes. I had to get a pump to get the water out of my flooded basement.'

At times offers of help that might have been made in good faith were viewed with double or negative meanings by employees. On the surface, for example, these two statements might imply only a sense of gratitude.

> 'We could stay in their home—they offered. They knew we were not comfortable staying in our trailer.'
>
> 'He offered free rooms to anyone who needed a place to stay. I asked about our six dogs and he said we had pet rooms here so I could bring them here which I did.'

While guarded and tactful—and often couched in a context of appreciation—some employees added remarks that reflected hostility. Since they were at a manager's home, or more commonly at their work site such as a structurally sound hotel, they were available to work until just prior to impact. And afterwards, they remained on-site to assist in a rapid reopening. In the disaster aftermath they now had lingering doubts about their boss's motivations. Was it just circumstance that they, and sometimes family members, were a readily available workforce when other businesses had yet to get any employees back on-site?

Emergent perceptions of risk gradually intensified prior to impact, especially among employees who:

- resided in communities wherein the least amount of disaster planning had occurred
- received warning messages they interpreted as meaning that it was mandatory for them to leave their place of residence
- resided in a mobile home or apartment

So, with, or occasionally without their bosses approval, they left work. Nearly all went straight home although a few had arranged to meet family members in other locations such as a relative's home.

Those quickest to leave work, more often:

- confronted events with a lengthy duration of impact
- had bosses with high future risk perceptions
- were female

Those quickest to leave home, more frequently confronted events with a lengthy duration of impact that was either minimal or disastrous in its impact, e.g. hurricane threatened areas that were either missed at the last minute or impacted severely. Also, these employees more frequently received initial warnings three or four days prior to impact and formed very intense emergent perceptions of risk. Although additional variables demonstrated varied aspects of social constraint, these were the qualities that had the most influence (for elaboration, see Drabek 1999b, pp. 164–166).

Although most (96%) reported that neither they nor any family members were injured, over one-fourth (27%) said they had personal property losses of some type. In contrast, only one of the 118 firms, all of which were evacuated either before or after impact, escaped without damages.

Although a few (16%) refused to disclose even a 'ballpark figure,' most CEOs (43%) estimated losses that ranged between $10,000 and $99,999. Just over one-fourth (27%) suggested that their losses were not expected to exceed $10,000. The others (29%) suffered significant impacts including six that incurred losses in excess of three million dollars.

As would be expected, when some employees (15%) tried to report back to work, they were advised that temporary office locations had been established elsewhere. In some cases these were branch locations of a larger corporate structure to which employees were reassigned temporarily, but more commonly they were new locations that were leased while repairs were made. For about one-third (37%) of the employees, such arrangements were very temporary, i.e. two days or less. For others, such disruptions were much longer, e.g. 3–7 days (17%); 8–31 days (24%). Ten percent worked in temporary locations for over a month. A near equal number (12%) were still in such a place at the time of my interview, with expectations of remaining there for another couple of months. A few projected return times of another six months or more.

Although some employees emphasised that the temporary job relocation had negative impacts on their family, most (93%) took the inconveniences in stride. Those reporting difficulties usually noted longer driving times to get to the temporary location which in turn complicated day care arrangements, school transportation, and other child related issues. But those impacted negatively consistently expressed strong sentiments toward upper management whom they believed had little awareness or interest in the enhanced family stress they experienced.

Response variations

As is clear from this brief portrait of employee responses, there were important variations that clearly reflected selected aspects of a complex mix of social constraints. Multivariate analysis techniques were implemented to examine a large number of these. Five will be

addressed in this section of this article:

- work-family tensions
- desired change in evacuation pay policies
- perceived morale change
- dissatisfaction with management disaster response
- dissatisfaction with local government disaster response.

Work-family tensions

Acute priority conflicts between work and family during these evacuations were experienced by over one in five employees (21%). And three-fourths (75%) indicated that managers of private businesses should give more consideration to such tensions when they are preparing disaster plans. Undoubtedly, all employees experience some degree of tension at times between the demands of work and family. Although the rates are lower, these results are consistent with those documented among Three-Mile Island (TMI) employees by Chisholm et al. (1983, pp. 393, 402). When compared to their comparison group, i.e. persons employed at the Peach Bottom plant of the Philadelphia Electric Company, TMI employees '. . . experienced significantly higher overall tensions on their jobs during the incident than did PB employees'. Furthermore, '. . . interrole conflict contributed importantly to TMI employees' job tension. This is apparent from the impact of "need to be in two places at the same time," because the vast majority of TMI workers (approximately 90 percent non supervisors and 75 percent supervisory) indicated conflict between being at work and at home during the incident.'

I combined responses to three interview items pertaining to work-family tensions. This index was used to ascertain the social characteristics that were associated with those employees who experienced the highest levels of work-family tension during these evacuations. Among the thirty-four variables that were significantly related were such factors as racial minority status ($F = 3.92$; $p < .01$); children within the household ($F = 15.98$; $p < .01$); and prior evacuation of the business ($F = 17.05$; $p < .01$) (see Drabek 1999, pp. 168-171, for details regarding index construction and discussion of all variables).

Examination of several combinations of the thirty-four variables, however, led to the acceptance of a nine-variable multivariate model that accounted for about 16 percent of the variance within the index. As detailed in *Table 1*, the nine social factors that comprised this model were:

- community had a disaster sub-culture
- children living in household
- relatives were notified of business closure before employee left work
- disaster had extensive scope of impact
- employee was racial minority
- prior evacuation from work
- business had received disaster planning assistance from local emergency manager
- three or more people living in household
- business was 'disaster-relevant,' e.g. lumber yard that sold plywood and other emergency items during warning period.

Model that predicted work-family tensions*			
Social Factor	F	r	Beta
Community disaster subculture	12.07**	.237***	.146**
Children in household	7.07***	.214***	.134
Notified relatives of evacuation	26.41***	.255***	.131**
Scope of impact	6.89***	-.142***	-.122**
Racial or ethnic background	3.92***	.159***	.102**
Prior evacuation from work	17.62***	.208***	.104
Planning assistance by EM	7.33***	.136***	.081
Total number in household	4.89***	-.197***	.078
Disaster-relevant business	9.42***	.155***	.058

*Adjusted $R^2 = .164$; $F = 8.06$; $p < .001$; **$p < .05$; ***$p < .01$

Table 1: Model that predicted work-family tensions

Interrole conflict, like that which Chisholm et al. (1983) documented among TMI workers is reflected in several of these factors including number 2 (children living in household) and 8 (three or more people living in household). Disaster frequency and expectations of high risk were reflected in such factors as number 1 (community disaster sub-culture), number 6 (prior evacuation from work) and number 7 (business had received disaster planning assistance from local emergency manager). While other issues may be reflected, more intensified work-family tensions among minority employees is consistent with numerous risk perception studies such as those reviewed by Vaughan and Nordenstam (1991, p. 46). Clearly, '. . . ethnic minority status is associated with a greater likelihood of increased exposure to hazardous agents in a wide variety of occupational settings'. Furthermore, 'This differential exposure may account, in part, for differences in risk perception among members of ethnically diverse groups, because prior experience can influence the subsequent evaluation of risk'. Finally, employees of so-called 'disaster relevant firms' most frequently confronted bosses who truly believed that the broader community would best be served if the business remained in operation as long as possible despite increased amounts of threat information.

Evacuation pay policies

Two interview items were used to identify employees who believed that changes should be made in the compensation policy used during the evacuation. Salaried employees typically were paid despite these short-term business closures while those paid on an hourly basis were not. Various uses were made of sick leave and vacation time to reduce pay check impacts. Also, many employees expressed appreciation for being scheduled for additional work hours during the weeks that followed to offset pay reductions that had occurred because of these evacuations. Overall, however, 30 percent of the sample said they were not paid at all for the time they missed work because of these disasters. Reflecting acceptance of the legitimacy of a 'no work-no pay' policy stance, nearly three-fourths (74%) indicated that they did not see any need for change in the policy they encountered.

So as to identify the social factors that might differentiate among those with different views on this matter, 76 hypotheses were tested. These analyses indicated that 39 social factors covaried with the compensation policy index. For example, those employees who favored a policy change, usually meaning that full or partial compensation should be made to employees who can not report to work

because of a management evacuation decision, more frequently:

- were female
- had worked for the company fewer years
- were of minority ethnic or racial background
- were younger
- had job positions at or near the bottom of the organisational structure.

Other critical factors included certain business characteristics, e.g. routine core technology and high level of vertical differentiation; community features, e.g. small population size and wide circulation of a disaster preparedness brochure; and event qualities, e.g. lengthy forewarning and very limited escape routes.

A seven variable model was discovered that predicted about one-third of the variance in employee preferences regarding changes in company policies pertaining to disaster evacuation compensation (*Table 2*). Employees who most favored change in such policies were:

- those who had high expectation of a future event that would trigger another evacuation
- resided in communities that received a lengthy forewarning of the disaster event
- employed in businesses with highly routine technologies
- minimally involved in community service organisations
- personally warned initially three or four days prior to impact
- in lower level job positions
- living in a mobile home or apartment

Model that predicted change in evacuation pay policies*			
Social Factor	**F**	**r**	**Beta**
Employee future risk perception	4.87***	-.246***	.383**
Length of forewarning	12.89***	.256***	.312**
Core technology	9.76***	.214***	.308***
Number of service org. memberships	7.28***	.331***	.304***
Time of initial warning	5.40***	.212***	.257
Job position	9.80***	-.302***	-.163
Type of home residence	7.70***	-.247***	.050

*Adjusted R^2 = .344; F = 6.16; p < .001; ** p < .05; *** p < .01

Table 2: model that predicted change in evacuation pay policies

Perceived morale change

Responses to one interview item were, i.e. 'Do you believe that employee morale was adversely impacted because of the disaster evacuation policies and procedures used by this company during this event?' Since this was one of the last questions asked, it often was placed in context by prior remarks. The perception of each employee was coded as to whether or not they believed overall company morale had remained unchanged, improved, or deteriorated. Most (65%) employees indicated that the evacuation experience had little or no impact on morale, at least as they saw it. About one in five (21%), however, provided specific examples that they interpreted as improvement. Most common were themes of bonding; the disaster had brought them and most other employees closer together. But another segment—15 percent of the total—responded quite differently. For them the impact was negative, sometimes very negative. Indeed many expressed acute tones of bitterness about the way they had been treated. While many issues were involved two were mentioned quite frequently. First, 'They should have closed this place sooner; they kept us here until the last minute just to make another buck.' And second, 'They didn't show much compassion to those of us that had damages at home; we needed time off to get things back together but they just said "no! you're needed here"'

Many who expressed such displeasure also talked of seeking future employment elsewhere and gave various evidences of harboring serious grudges. 'They think this has all blown over, but there's a lot around here that are still pissed about how we got treated. They're going to regret it someday.'

What social factors differentiated these three categories of employee? Analysis revealed 33 different factors. Those who perceived a morale shift toward the negative reflected such individual characteristics as:

- shorter community residence
- having been divorced and/or currently living with a friend, but not married
- lower family income
- absence of pets at home.

They tended to work for companies that:

- had never provided any disaster preparedness training
- were more recently founded
- were smaller.

Despite these company qualities, many of these employees lived in communities that had experienced prior disasters and, in turn, evolved extensive disaster subcultures. And within the mix of seven events studied, these employees experienced those with minimal forewarning and minimal magnitude. But their escape routes were very limited.

Extensive trials yielded the seven variable predictive model presented in *Table 3*. It documented that those employees who perceived the most negative shift in morale had received warning messages indicating that the evacuation advisory issued by local government for the geographic area where they worked was mandatory, rather than voluntary (1). They also revealed high future risk perceptions (2), i.e. when asked how probable it was that another event would occur within the next decade, they specified probability levels ranging between 75 and 100 percent. Rarely, if ever, had they been afforded any disaster training while at work (3). The company wherein they were employed had a medium level of disaster loss, i.e. between $5,000 to $100,000 (4) and had done minimal or no disaster preparedness planning (5). The CEO of their firm had a medium level future risk perception, i.e. 50 percent probability level that another disaster would trigger a company evacuation within the next ten years (6). Finally, the firm had not received disaster planning assistance from any corporate office (7).

In short, employee morale deteriorated the greatest in those businesses that had done the least to prepare their employees at all structural levels to cope with the uncertainties and challenges these events presented.

Dissatisfaction with management

Each employee was coded into one of four categories regarding their degree of satisfaction with the way company executives had handled the evacuation, i.e. 'very satisfied' to 'very dissatisfied'. These codings were based on comments made and responses to about one-half of the interview items and their answer to the following question: 'How satisfied

Model that predicted perceived morale change*			
Social Factor	F	r	Beta
Warning message constraint - work	14.24***	-.335***	-.279***
Employee future risk perception	5.58***	-.249***	-.151
Disaster training	16.16***	-.226***	-.145**
Estimated company dollar loss	4.53***	.210***	.136**
Extent of company disaster planning	4.17***	-.220***	-.124
CEO's future risk perception	9.34***	-.208***	.108
Planning assistance by corporation	13.03***	-.205***	-.011

*Adjusted R^2 = .185; F = 8.16; p < .001; **p < .05; *** p < .01

Table 3: Model that Predicted Perceived Morale Change*

Model that Predicted Dissatisfaction with Management*			
Social Factor	F	r	Beta
Management offered help	13.85***	.251***	.252***
Type of pet	5.06***	.233***	.250***
Disaster-relevant firm	4.86**	-.136**	-.128***
Disaster training	3.83**	.121	.128
Children at home	5.06**	-.138**	-.098
Racial or ethnic background	4.13**	-.106	-.086

*Adjusted R^2 = .158; F = 6.34; p < .001; ** p < .05; ** p < .01

Table 4: model that predicted dissatisfaction with management

were you with the way they (the management) handled the warning situation?'. Among the 76 hypotheses tested, only seven were accepted. When these seven variables were used in regression analyses, one (number of persons in the household) did not increase the predictive power of the model. Consequently, I accepted the six variable model depicted in *Table 4*.

Which employees were the most dissatisfied with managerial responses? First, it was those who did not receive any offers of assistance from their bosses. As noted above, one-half of those interviewed provided specific examples of how their bosses and/or other company officials extended offers of varied forms of assistance during the evacuation. Over two-thirds (67%) had some type of pet that often figured into their evacuation decision.

This constraint is one that too many community disaster planners have ignored, but recent research has documented its importance to behavior responses and emergency management policy (Drabek 1996, pp. 68-71, 281-283; Heath et al. 1997). In this case, 'type of pet' refers to a threefold differentiation. That is, employees were asked whether or not they had any pets and then what type. Three code categories were used, i.e. dog, cat, other. Forth-three percent had a dog while about twenty percent were cat owners. The 'other' category included those with multiple pets of one type, or multiple pets of different types, or in a few cases some other type of animal such as a snake or bird. Over one-third of the sample (37%) were coded in this category. It was this group that most frequently voiced intense dissatisfaction with company management.

Many employees who voiced dissatisfaction worked for 'disaster-relevant firms'. These were companies with varied missions but the key criterion used in the coding was the CEO's stated viewpoint and description of their evacuation decision making. Lumber yards, for example, like some retail firms, were defined by some managers as being 'disaster-relevant' since many in the community needed their plywood, flashlights, generators, etc., to prepare their homes for the predicted event. Some hotel executives delayed closure or even remained open during the impact period because of perceived community needs. 'Those people caught on the highway need somewhere to go for shelter.' 'The media are here in full force and need some place to stay.' Some employees bought into these logics whereas others defined them as little more than 'a rationalisation to make a quick buck'. Also dissatisfied were those who had not received any on-job disaster training. Finally, if they had children at home or were of minority background they more frequently rated the performance of company management during the evacuation in negative terms.

These results are consistent with the interpretations of Sanchez and his associates (1995, p. 504) regarding '... the effects of corporate relief efforts on employees' organisational and health-related strain'. While they recognised the complexity of such assessments due to the multitude of agencies and informal groups who responded in Andrew's aftermath, their data supported a key conclusion.

> 'Relief efforts may thus control absenteeism and workers' compensation costs, which should rise when a disaster has affected most of a work force. In addition, according to our data, such basic help may also improve attitudes like organisational commitment in the months following a disaster' (Sanchez et al. 1995, p. 519).

Dissatisfaction with Local Government

A similar interview item and procedure to that used for assessing satisfaction with management provided a basis for coding employee perceptions of the local government response. The four categories, i.e. degree of dissatisfaction, were juxtaposed with 76 social factors. Significant patterning was discovered among 42 of these. Various combinations of these were examined through regression analysis until an eight variable predictive model was identified that accounted for about one-fourth of the variance in the government dissatisfaction measure (*Table 5*).

This model documented that a very different mix of constraints molded employee views about government performance that had been operative with their own company management. Three event characteristics—uncertainty of forewarning, accessibility of escape routes, and the length of forewarning—were crucial.

Thus, when employees felt that the warnings issued were highly uncertain and relatively short, they reported less satisfaction with government performance.

Model that predicted dissatisfaction with Local Government*			
Social Factor	F	r	Beta
Uncertainty of forewarning	25.87**	.315**	-.613**
Community disaster subculture	53.33**	.425**	.460**
Length of forewarning	55.03**	.419**	.411**
Accessibility of escape routes	27.42**	-.349**	-.220**
Degree of community disaster planning	14.10**	.249**	-.117
Community population size	13.06**	.293**	.101
Precision in warnings	18.49**	.280**	.058
Prior evacuation from work	27.21**	.254**	-.050

*Adjusted R^2 = .243; F = 16.74; $p < .001$; ** $p < .01$

Table 5: model that predicted dissatisfaction with Local Government*

Although they resided in areas where escape routes were readily available, in contrast to locations like the Outer Banks of the Carolinas where bridge and roadways severely constrain traffic flows, this condition did not blunt their negative assessments. But if the warnings received were defined as being imprecise, then their dissatisfaction was intensified. Typically, they lived in larger communities, that had few or no elements of disaster subculture, wherein only minimal amounts of disaster planning had occurred.

Finally, most of these employees had never experienced evacuation from their work place. Thus, the areas of constraint that shaped their perceptions of governmental performance contrasted sharply to those that molded their views of company management.

Employee recommendations

Two-thirds (66%) of those interviewed returned a short questionnaire. These were mailed to them immediately after each interview was completed. Certain of the questionnaire items afforded these employees an opportunity to share their views regarding numerous disaster evacuation policy options. Most relevant to the matters discussed in this article are the results based on the six questionnaire items listed at the bottom of *Table 6*.

Despite reluctances expressed during some executive interviews, most employees highly favored the distribution of a brochure that outlined disaster evacuation procedures. During employee interviews, many volunteered related concerns. For example, most had no idea of any company policy regarding disaster-induced evacuations including such matters as compensation or return procedures. These and related matters should be included in such a brochure. Almost all (91%) disagreed with a management inspired objection to such a policy. These employees did not believe that a brochure of this type would make them uncomfortable or fearful of their work place. Some managers had expressed such concerns in their interviews and in previous studies (Drabek 1996, pp. 281–282).

Would an annual disaster drill be helpful? Many (27%) indicated that it would not and a sizeable number (22%) were uncertain. The others (51%), however, responded differently. Apparently, they believed that a yearly exercise would enhance the effectiveness of responses to events like these (see *Table 6*, item 3). Furthermore, two-thirds (66%) indicated that local business associations such as chambers of commerce should demonstrate more interest in disaster evacuation planning.

Initiatives by such groups have been successful in some communities, especially when coordinated with activities sponsored by local emergency management offices and others involved in disaster responses. While more (28%) were uncertain for whatever reasons, over one-half (56%) of these employees indicated that local governments should provide more disaster evacuation training for private-sector business executives. Partnership arrangements for business and industry disaster seminars and hazard awareness workshops have been implemented successfully in some communities, but the overall picture is very spotty (Drabek 1994, pp. 207–218).

Most customers expect lodging establishments to be prepared for disaster. For example, a survey of over 500 tourists and business travelers documented this expectation. Indeed, 91 percent of them either agreed or strongly agreed with this identical questionnaire item (see footnote to *Table 6*) (Drabek 1996, p. 285). As might be expected, a survey of tourist business managers indicated less enthusiasm for this policy option (36% disagree; 14 neither agree nor disagree; 50% agree; n = 97 managers from nine communities in seven states; see Drabek 1994, p. 223). Thus, while they were less enthusiastic than customers, many of these employees favored this rather controversial measure that only a few communities have tried to implement.

Out of the 266 employees who returned their policy option questionnaire, over one-half (58%) took the time to write responses to the following open-ended question: 'When this evacuation occurred, the most helpful thing that the management of the firm where I work could have done was: _____'. Of these, one-third (33%) wrote comments limited to managerial praise, e.g. 'They did a good job'. Some of these hinted at employee priorities, but all were coded as 'nothing specified,' e.g. 'Just what they did; allowed all employees that wanted to, to go home'. Remarks written by the other 103 employees provide managers with a food for thought. Seven topics were identified (the percentage listed indicates the proportion of employees whose remarks reflected each theme):

- better communication – 34%
- close earlier – 26%
- provide employee assistance – 11%
- do more preparedness – 11%
- retain more staff to implement protective actions – 7%
- establish return procedures – 7%
- provide pay for employee time off during such evacuations – 5%

In summary, the multivariate models that were discovered clearly document the potential residual costs that disasters may impose on businesses. When preparedness activities have not been a company investment, managerial leadership may be curtailed. Employee expectations will not be met and tensions been work and family priorities may be exacerbated.

Consequently, perceptions of deteriorated morale may linger in the months following recovery. Such costs can be reduced or eliminated entirely if management makes a commitment to involving employees in a meaningful disaster preparedness program. When implemented such programs may permit an actual improvement in morale and organisation commitment despite the

Policy option**	strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
Company brochure	3 (7)	6 (16)	11 (28)	48 (126)	33 (87)
Brochure discomfort	47 (119)	44 (112)	6 (15)	2 (6)	1 (2)
Yearly disaster exercise	5 (14)	22 (57)	22 (56)	36 (42)	15 (38)
Business associations	1 (2)	6 (16)	27 (68)	48 (123)	18 (47)
Executive training	1 (3)	15 (37)	28 (68)	45 (110)	11 (28)
Mandate written plans	2 (9)	6 (24)	5 (21)	33 (135)	18 (72)

*The number in parenthesis is the actual number of employees who indicated the responses listed. Percentage is based on the total number who responded to each questionnaire item.

** Policy option items: 1. 'Business firms should provide all employees with a brochure that outlines their disaster evacuation procedures.' 2. 'If I ever received a hazard awareness brochure (e.g., hurricane information and response procedures) from my employer, I would not feel comfortable working there.' 3. 'The effectiveness of future evacuations could be enhanced if all business firms participated in a disaster exercise each year.' 4. 'Local business associations (e.g., chamber of commerce) should demonstrate more interest in disaster evacuation planning.' 5. 'Local governments should provide more disaster evacuation training for private-sector business executives.' 6. 'Local governments should require all firms providing lodging, including RV parks, campgrounds, etc. to have written disaster evacuation plans.'

Table 6: employee policy preferences

trauma and suffering that disasters inherently bring to communities and the social units that comprise them.

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Community mapping – an aid to emergency management

by Rick McRae, ACT Emergency Services Bureau and Alan Walker, North Coast Community Mapping, Wauchope NSW.

Introduction

This paper discusses an emerging area of data management within the overall emergency management framework. It is an area that has been slow in gaining the interest of policy makers, partly due to misunderstanding. However, current trends in spatial data management are driving us, perhaps inexorably, down the path to this very area. This is an attempt to clear that path. The fundamental point is that there is a very real gap between some of the datasets provided by statewide mapping and surveying agencies and those required by emergency managers. This is highlighted for our stock-in-trade, the topographic map. In this article we state that spatial data collection at the local level is an effective way of filling in the gap. The local community gets better protection, the emergency managers are better informed and state-level providers have access to accurate datasets that complement theirs. This is made possible by both new technology and new standards for spatial data management.

Why worry about spatial data? The traditional model of the response crew is that they have a lot of local knowledge—they know where they are going and they do the job. While this may be true in large part, there are a lot of new demands for spatial data that require development of spatial databases. Examples include:

- the provision of a fire shed in a small town once its population reaches a threshold value
- the preparation of district risk maps and plans
- interstate response of task forces
- reporting to government on levels of service delivery.

Clearly these are important things to emergency managers.

There are a number of problems with the spatial data with which we work. Rather than discussing technical issues, it is perhaps most useful to focus on the main means of access, during emergencies, to spatial data for most of Australia: the topographic map.

What's wrong with topographic maps?

Topographic maps are the fundamental source of spatial data for response crews operating outside metropolitan areas. They are on-hand at all times and all crews have training in their use. Senior officers often carry large numbers of maps. We use topographic maps all the time and find them an invaluable planning and operational support tool. They would appear to be an indispensable and welldesigned product.

On closer inspection, and from the perspective of the modern information age, topographic maps have some serious shortcomings. The primary issues include:

- they are chronically out-of-date and take too long to be revised
- they are not necessarily synchronised with any digital or other spatial datasets in use
- they do not show all of the data that emergency managers need
- they are not designed to meet the needs of emergency managers

The first two issues relate to *currency*, and the latter two to *relevance*.

Over three decades ago, Australia switched to the metric system of measurement. One of the biggest efforts involved in this switch was the production of new maps in metric units. A new definition of the earth's shape (ellipsoid) was produced, and from this the Australian Geodetic Datum 1966 (AGD66) was created, which gave a better result over which to drape a map grid.

The new metric grid, the Australian Map Grid 1966 (AMG66) was developed. This changed the core scale for topographic maps from 2 inches to the mile (1:31,680 scale) to 1:25,000 scale. This meant that each map in the country needed revision to the new metric scale—a heyday for map users.

Once the transition to metric had finished, the production of maps slowed down. At about this time, the impact of new computerised geographic information systems (GIS) was being felt. The mapping agencies saw the future importance of digital data and committed resources to the digitising of existing mapping data. We saw a switch from the employment of field surveyors (to record changes 'in the paddock') to employment of digitisers (to provide digital data from existing paper maps). The 'digital' changeover was a major undertaking involving heavy expenditure, in resources and in personnel, on the part of all mapping agencies. Very little map updating was undertaken during this process. Most topographic maps in southeast Australia are now in the 15 to 25 years age range. This disturbing fact should be of grave concern to emergency managers.

In the January 1994 Sydney bushfire crisis, the ACT Emergency Services Bureau, along with many other Australian fire services, sent task-forces interstate to help. When tasked these crews were handed photocopies of photocopies of 20-year-old maps, and told to work along fire trails that weren't even on the maps. This scene could be repeated next summer in most parts of Australia. It is a serious, but understated issue. Crews can normally do their job by relying on their pool of local knowledge. But when crews are operating outside their brigade areas, they don't have local knowledge to guide them. This is the very time when the local crews (whom they are assisting) can be guaranteed to be too busy to pass on their knowledge. This is thus a source of risk to out-of-area crews.

The pool of local knowledge, collectively across Australia, is an asset to the community of immense value, but shows up on no balance sheets. It needs to be recorded, and its full value needs to be accessed. Community Mapping is a way to start this.

The Australian mapping and surveying community decided that the geocentric definition of the earth's shape would be adopted across Australia (the Geocentric Datum of Australia 1994, GDA94). This is compatible with the Global Positioning System (GPS), unlike the geodetic definitions that had been used for map making previously in Australia. This makes life easier for surveyors, pilots, mariners and the military. Unfortunately

it makes any new maps prepared with the new map grid based on this (the Map Grid of Australia 1994, MGA94) incompatible with any previous maps. To put it another way, all of our maps became out-of-date at once, but unlike the similar event in 1966, the maps are not being revised in bulk. In December 1998, the Federal Government began work on spending $2,000,000 that it had set aside for revision of 1:100,000 scale maps in GDA94, and recognised that emergency managers had the most critical needs. However this is a very small proportion of the total effort needed.

So emergency managers are being diverted towards digital datasets to support their work. As a good example of this, during the 1999 Sydney hailstorm disaster, cadastral databases were brought on-line to assist with logging the tens of thousands of calls for assistance. A Joint Emergency Services Mapping Unit was created to service this capability (Anon 1999). This concept showed its benefits immediately and is being widely endorsed as a standard tool. However, the inner workings raise many fundamental issues. Principal among these is the need for current databases to be on-hand in preparedness for emergencies. While we are not custodians of the available data, we nevertheless need ready, confidential access. Also there is a difference in technology between office-based planners and vehicle-based response crews.

Another issue raised by joint mapping is that of reconciliation of the three key dataholdings of relevance to emergency management: the local knowledge mentioned earlier, the data held by local governments, and the data held by state mapping agencies. It is extremely difficult to ensure that these match, given their diverse histories and the differing updating efforts. Much of the data held by local governments has its origins back in the original development era. Surveyed boundaries from then do not necessarily match those surveyed to modern standards or even collected with GPS. The old data were not necessarily accurate. There is even a fundamental limit to this reconciliation, reflecting the scale dependence of data, its management and its applications. This is summarised in *Table 1*.

A number of major shifts in spatial data management in the public sector have coincided in recent years. Firstly, the state-level data agencies have needed to retreat to a well defined set of core datasets, driven by economic constraints. Secondly, the shift towards risk management (Standards Australia 1995) in emergency management has brought a growing recognition of the key role of spatial datasets. The holdings of the former do not match the needs of the latter. The third shift has been the ready availability of field GIS/GPS equipment that allows the collection of accurate and consistent data by unspecialised personnel. [This has been augmented by the recent improvement in precision with the removal of Selective Availability.] The fourth shift is an across-the-board recognition of the value of standards in spatial data. And, finally, all of these have reinforced a trend to devolve risk management down to the local level. (It is worth noting that a new shift, the recognition—in accrual accounting terms—of the value of spatial datasets, is yet to occur.)

Scale	Administrative unit	Data	Sources (examples)	Tasks
Coarse	State	State-wide holdings	Digitised map data	Policy
	Region	Planning data	Broad-area mapping programs	Strategic planning
	LGA	LG data	Surveyors, GPS	Hazard assessment
Fine	Locality	Local knowledge	Community mapping	Operational support

Table 1: scale dependence of data, its management and applications

So what information do emergency managers require? This is a very difficult question, and perhaps the best attempt at answering it is in Granger & Johnson (1994). They listed a number of 'essential elements of information': location, resources, personnel, weather, hazards, communications, transport, population, tenure, health, community, utilities, terrain, biota, rural use, urban use, and administration. For emergency managers to access all of these broad classes of information is a major task. Further, some of these have, traditionally, not been easy to access. It is only in recent years that a major focus on lifelines has yielded results. Building partnerships over a range of agencies is also yielding results. And traditional information sources, such as maps, are failing to match the ever-increasing demands for detailed information. Maybe part of the problem has been that emergency managers have not been 'in the loop' for designing information products.

Victoria's Country Fire Authority has for some years been producing and revising regional map books, which serve as 'street directories', but for rural areas. They facilitate both emergency contacts and risk management by providing A4-format, indexed access to information about residences. They are extremely popular, and have, to a limited extent, been emulated elsewhere. The key fact is that they give information that is not provided elsewhere. Privacy and other concerns dictate that this information cannot go on standard maps.

The authors have had direct experience with the issue of designing maps to meet the needs of emergency managers. In 1990 AUSLIG invited both authors to assist with the production of a 1:100,000 scale *Special Map* covering the entire ACT. This coincided with the need for a revision of the map. At the time AUSLIG was experimenting with the use of satellite image maps (SIMAP, a registered tradename) on the mainland (Wise 1992). They had been used successfully for some years in Antarctica, and were seen as being a faster way to produce maps 'back home'. They also had the ability to accurately depict vegetation types.

The map used a fully rectified LANDSAT image, with map grid, line work and text superimposed over the image. (The image was a hybrid of thematic mapper and panchromatic data, resampled to 25 m on the AMG.) The image took on the role of terrain shading and vegetation shading. Contours were not shown, as experimental maps with them included have shown that these made the end product too cluttered. The image had to be ghosted back to avoid it swamping all other information on the map—about 30% strength was found best.

The image was carefully selected:

- to be from a time-of-year when the local grasslands were quite different in their appearance in the image (thus giving maximum discrimination of vegetation types), and
- also to be from a time when the sun was high in the sky when the satellite

Question		Main response
How do you rate...	The way that landform is shown without contours?	Poor
	The colours shown in the satellite map?	Acceptable
	Your ability to make practical use of this map?	Acceptable
	The use of purple to show [operational] information?	Poor
	Your understanding of the image map?	Acceptable
How do you rate the new map, compared to the old map?		
	Clarity of the map?	Worse
	The way that vegetation is shown?	Better
	The overall use of colour?	Worse
	The way that land tenure is shown?	Better
	The fire tower compass roses?	Much worse
	The way the map grid is printed?	Better
	Placement of the labels for eastings and northings?	Better
	The way the legend is shown?	On a par

Table 2: views on the useability of the *ACT Bush Fire Council Edition* map and how it compared with the previous traditional edition.

passed over, avoiding large shadows (which show no information) in rugged terrain, such as the Brindabella Ranges west of Canberra.

A special print of the new map titled the *ACT Bush Fire Council Edition*, with a purple overprint of operational information (fire tower compass roses, key land uses etc) was produced. Purple was chosen as an opaque, high contrast colour largely absent from the base map. Grid labels were redesigned to aid the use of a folded map.

We issued the map to all our operational crews with a questionnaire designed to solicit their views on the useability of the map and how it compared with the previous traditional edition of the map. Responses were collated (*Table 2*) and showed some interesting trends.

Clearly there were some strong views expressed. We extracted from this some salient points:

- Use contours—terrain detail is important. These should be at 10 metre intervals, and tagged every 100 metres, to maximise map clarity.
- Land tenure is important.
- Fire tower compass roses are important, but must be clear.
- The design of a grid and its labeling (both in the margins and across the sheet) is important and must be optimised for ease of use. This also facilitates coordination of operational information when faxing and photocopying the map.

Other comments were invited on the questionnaire. One comment that was repeated many times was the difficulty of using the map at night in a four-wheel drive, under torchlight.

The request for contours was in conflict with the technical findings, and would be a major driving force in map design.

What can be done?

Some fundamental changes are needed to address the issues above.

- At all levels, emergency managers should be input to the design of spatial data products. At the end of the eighties, emergency managers were not 'on the mailing list' for mapping agencies. At the end of the nineties we were definitely on the list. The momentum driving this change is still there. If emergency managers, as a national community, pooled our resources we could gain considerable power to influence spatial data managers.
- Emergency managers need to review their needs for spatial data. In order to do this, we need to work around the philosophy of doing it alone that permeates our use of spatial data (McRae 1999). This requires the building of links between states, between the sub-cultures of emergency management (e.g. police, ambulance, and fire, SES) and with the private sector. The first step is to review what we have and what we need. Often the difference between these is outside of our financial capabilities. Cooperation is perhaps the best approach to take here.
- The value of local data must be recognised. It has been suggested that the best way to put a value on knowledge for accounting purposes is to look at its replacement cost. None of us has yet put on our balance sheets the value of the local knowledge of our response crews and planners.
- Priority areas need to be recognised—where the built environment is changing fastest, the data that describes it needs to be updated more often. Areas on the rural / urban interface are notorious for having out-of-date spatial information, especially maps. Yet it is these areas that need the most protection. A rapidly expanding suburban area may not be built to withstand wildfire, yet those houses stranded on the edge during summer may be at considerable risk. The same may be said about floods, with floodways that are unfinished.

Development of a standard approach

During discussions at the recent workshop on *Spatial Data in Emergency Management—Where are we now?*, (see McRae 2000) it emerged that there is a perceived and vital role for community-level mapping.

State or National mapping agencies need to develop and maintain key top-level datasets, addressing core mapping products. Extracts from community-level mapping products are able to assist with the development and maintanence of these datasets. This is an effective method of maintaining and keeping the data 'dynamic', without which the dataset is only a snapshot in time. The datasets need to be constructed in such a manner to ensure that State and National mapping agencies can draw down their data requirements at any time to meet their needs.

The use of the concepts in the Australian Spatial Data Infrastructure (ASDI, see ANZLIC 1997, and Granger 1998) will facilitate the interaction and coordination needed. ASDI allows agencies operating in an area (such as rural fire brigade, National Parks Service or State Forests, Council, or Department of Land & Water Conservation) to jointly ensure that as changes occur to local resources and property, the data describing them are kept up to date. A grader driver with State Forests may upgrade a road. GPS/GIS, computer-based systems make it possible to store these improvements in the database almost immediately.

Quality control of the data is an inbuilt resource: local knowledge will immediately alert those responsible at the local level to any inaccuracies. These can immediately be checked and rectified. Further quality control arises from the use, by Community mapping, of brigade areas as the building bricks for dynamic data sets of a district. Brigade members may be required to put their lives on the line during an incident and therefore have a very real reason to ensure local knowledge of their area is the best available. Give them a map of their area before fire season and they will ensure the information is up to date.

Mechanisms are being developed where the base for all mapping (either very accurate aerial photography or satellite imagery) is regularly updated over those areas where there is continous growth and change. This imagery allows rapid recognition of the location of changes. Cycles for this will vary depending on the amount of change and will vary from 3 to 5 years. All this results in considerable demonstrated cost savings to the community, both in data use, and in data collection by local volunteers in Fire Services and State Emergecy Services, and workers of the various land managers going about their daily business.

The local community now has the capability to produce their own maps during any emergency, such as a major bushfire, flood or hailstorm. It also has the tools to plan for very detailed risk management in future.

To coordinate all of the elements of this a comprehensive standard has been developed to cover data collection, data coding and depiction on maps. The standard, titled the National Emergency Operations Mapping Standard (or NEOMAP), has Emergency Management Australia as its national sponsor under the definitions of ASDI. The evolution of the standard is occurring through use in the field.

Most of this development is now focused on protocols and methods for keeping the data 'dynamic' and up to date, and on the standards for data coding. The latter work will ensure that the depiction of an object is the same in most commonly used desktop GISs and that they are capable of being rendered equally in colour or black and white (to enable faxing and photocopying during operations). While software such as MAPINFO (from MapInfo Corporation) and ARCVIEW (from ESRI) use different user interfaces and data formats, each should be able to produce maps that meet a common depiction

Figure 1: field crew with the North Coast Community mapping project

standard (see *Figure 2*).

A further element necessary to facilitate coordination is the use of a regional supervisor. A regional role is important, as not all agencies share jurisdictional boundaries, and the variable level of overlap that results forces a need for coordination of timetables, sharing of equipment and production of databases and maps.

Having developed the concept, it has been a long process liaising with mapping agencies to see where it can be linked into their mapping programs. It appears most likely that emergency services using a regional approach will be in a position to provide mapping agencies with a continuous supply of up to date accurate mapping data to enable them to produce publicly available maps. They will also probably become 'data warehouses' for other data users.

The current standards

During emergencies it is common practice to photocopy maps, as a tool to aid concise tasking. However, topographic maps do not photocopy well. The use of terrain shading and solid areas of colour to indicate vegetation cover causes large areas of the copies to appear as dark or black, and associated text is often illegible. The purpose of the value-added copy is to show strategic and tactical decisions. Dark 'blobs' hinder the depiction of these decisions.

After experimenting with a number of prototype designs, it became clear that

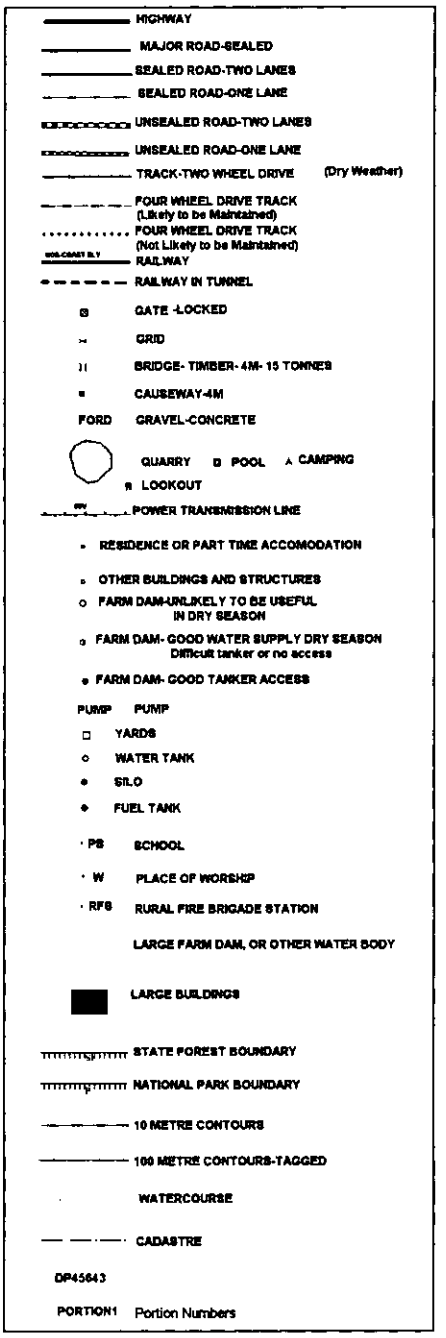

Figure 2: sample legend from a map generated from data coded to the Community Mapping standard. The standard covers the terms, symbols, symbol sizes and symbol colours.

the best way to show local knowledge on a map for emergency managers is shown in *Figures 3A & 3B*.

This design allows the user to select the most appropriate side to use at any time. The user can simply turn the map over along its short axis—very useful in the field on the bonnet of a vehicle.

While working with stakeholders on map design concepts some other matters have been raised. One of the difficulties in Community Mapping is that the people involved have limited training in spatial data management.

The area that requires the most careful control is ensuring data consistency. This necessitates software that provides a pull-

Figure 3a: Map side 1–Map to have full-strength image. The image was to be fully rectified and trimmed to map bounds. A full map grid was to be superimposed, as was a minimum of text to allow orientation. An appropriate legend, with interpretation notes, is included.

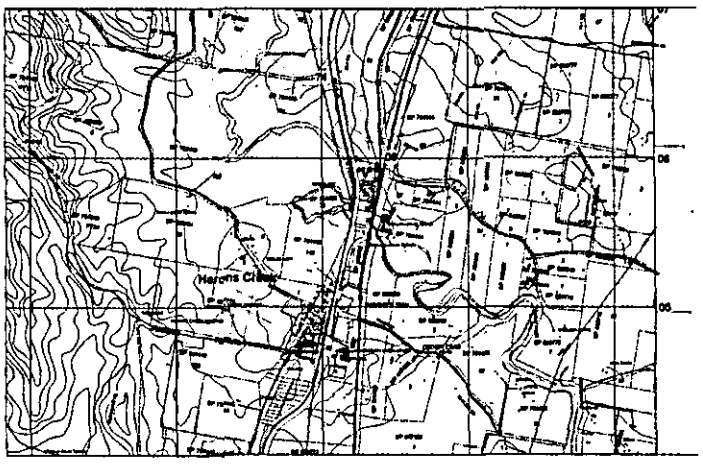

Figure 3b: Map side 2–This side of the map is lines, symbols and text only. No shading polygons are to be used except for large bodies of water. Contours are to be used. A full legend is included. (data sourced from field surveys and from project stakeholders.)

down list of phrases from which to chose for any attribution of mapped objects. In free-form text, a dam could be: 'dam', 'farm dam', 'large farm dam' or even 'fram dam' (i.e. a typographic error). A pull-down list could force a choice between 'farm dam–large' and 'farm dam–small'.

This then makes it easy to build the lists to use from standard data dictionaries. In turn this facilitates the building of a comprehensive database that describes the mapped object. In this we could include other features, such as (for dams) their permanency, ease of tanker access, presence of a pump or overhead filler, and usefulness in dry times. (*Figure 4.*)

This work has been progressing since early trials in the Yarrowlumla Shire area in 1994. Coding for building type allowed a direct match against the codings of the Australasian Fire Authorities Council's (AFAC) Australian Incident Reporting System (AIRS) codes.

It is also important to code against standards for mapping. The conclusion is to produce a super-coding that can be collapsed down to either mapping or AIRS codes (*Figure 5*).

Product development has been ongoing for community mapping data. Once the dataset is established, there are three main products that can emerge.

- A means for state or local government data agencies to reconcile their own holdings. The provision of current differential GPS standard data can allow an assessment of the accuracy of older data holdings.
- The production of large-scale maps. Maps at a scale of 1:25,000 or 1:50,000 can be produced with a GIS package and a suitable plotter. While considerable effort is required to build these at first, the effort afterwards is much less. Most of the initial effort is involved in the art of placing labels so that they are clear and do not obscure other information.
- Local area directories can be produced.

Figure 4: examples of the detail that can be coded in Community Mapping.

a. locked gates are a major issue for emergency access, and appropriate symbols should be used on maps.
b. bridges need to described: construction material, width, weight limit, river flood height at which the bridge becomes impassable. This is a wooden suspension bridge, 3.5 metres wide, 8 metres high, and, most importantly, with a load limit of 10 tonnes.
c. crossings–are they suitable for heavy vehicles such as a large fire tanker?
d&e. A rural dwelling can be coded for: address, ownership, and telephone number (for emergency contact); construction material; water supply; difficulty of access.
f. A rural shed (see Fig 5).

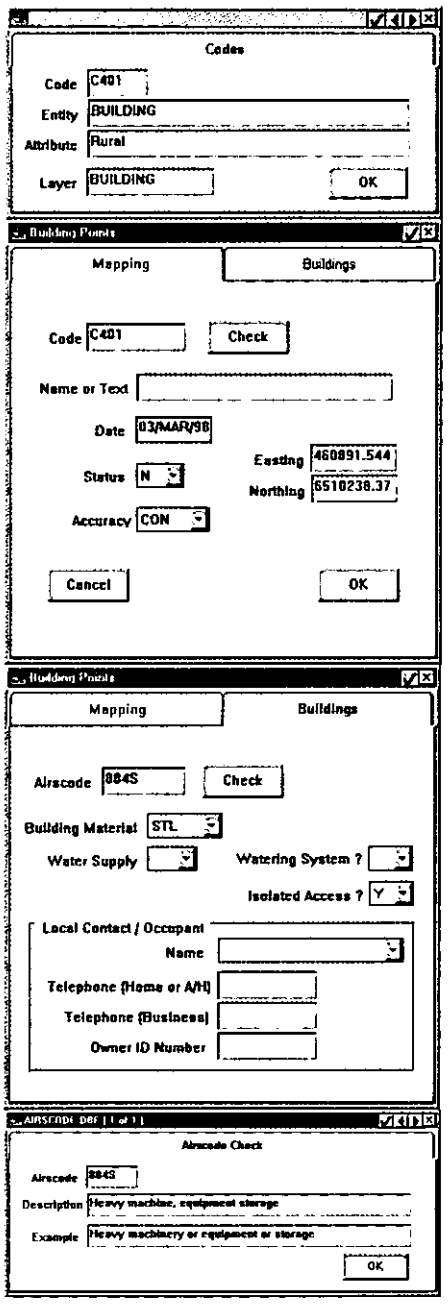

Figure 5: Data entry screens in the FieldNotes system for coding a building. The screens show attribution of the same structure for both mapping depiction and AIRS. (FieldNotes software is used for field data coding – produced by PenMetrics Inc and supplied by Rapid Map Australia.)

It is relatively easy in a GIS to produce a directory along the lines of those produced by Victoria's Country Fire Authority (for example CFA 1998). With a detailed database at hand, additional information can be added. Once the 'macros' are built, revision is easy.

Community Mapping can be defined as a combination of the following:

- local agencies take on custodianship of local datasets, relying on local knowledge of their staff and volunteers to update and verify the datasets
- these agencies provide their datasets to agencies at the local government and state government level to ensure compatibility with their datasets and maps
- adherence to nationally sponsored standards for data collection, data coding and depiction, and to the principles of ASDI
- an ability to locally produce spatial analyses and map products to meet local needs.

The future

Thus it seems that there is a future for the concept of Community Mapping. In this future, a broad-range of stakeholders gain considerable benefits. Local volunteers gain recognition of their local knowledge and also gain access to a range of map products that better suit their specialised needs. Local Government and local land managers gain access to these datasets and the maps, as well as an ability to reconcile their own spatial data holdings. State Governments gain an ability to ground truth their data holdings, and accelerated topographic map revision.

The application of the principles of ASDI causes many potential problems to evaporate. Application of data custodianship principles, recognition of national sponsors, and the use of metadata dictionaries will lead to considerable efficiencies.

They will also facilitate progressive adoption of 'hyperspace' as a way to manage Community Mapping. This will, in turn, give access to: value-added resellers, who can improve the usefulness of datasets without requiring the custodians to acquire expensive processing or storage infrastructure; remote data and mapping systems, that allow data transfer to mobile vehicles; and 'maps on demand', that allow better informed emergency management, and thus service to the community.

Finally, Community Mapping can forge better links between planning and response needs. A strong focus on the Australian Standard for Risk Management will facilitate this.

All of the factors listed above require an adherence to standards and thus a level of discipline to which many of us are not accustomed. This discipline will enhance the various levels of interaction within Australia's emergency management industries, and also the interactions with private sector providers.

Community Mapping continues to develop. If this is kept to a national standard and retains standards for depiction, Australia will be better prepared for most emergencies. Experience so far suggests that the concept readily sells itself to those who see it in action.

The project in Hastings shire has done a lot of the hard work in defining Community Mapping. It now needs to be taken up in other jurisdictions. Only then will the benefits of interoperability come to the fore.

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The data used in the figures were supplied by various stakeholders in North Coast Community Mapping, and are provided here as illustrations only.

Landslips – a moving story (a Municipality's perspective)

by Lex Ritchie & Glenn Hunt, Asset Management Department, Shire of Yarra Ranges, Victoria, Australia

Landslips occur in varying degrees, on a regular basis, throughout our municipality. Recently the Shire of Yarra Ranges initiated a shire-wide survey, by consultant geotechnical engineers, to assess the risk of landslip. During this process approximately 11% of the Shire's rateable properties were identified in the two highest risk categories.

Municipalities provide the link between response and recovery agencies and the local community. How well a community handles an emergency is directly related to the attitude, preparedness and involvement of the local government agencies.

This article provides one municipality's experiences of identifying a potential risk to its community and how they approached the situation.

The Municipality

The Shire of Yarra Ranges is located east of Melbourne. It has an area of approximately 2,400 km^2 and an enviable reputation for its natural beauty and numerous tourist attractions (i.e. the Dandenongs, Yarra Valley, Healesville Sanctuary, Puffing Billy). Approximately one third of the municipality is comprised of Crown Land. (i.e. State or National Parks).

The natural terrain, although picturesque, can carry an enormous risk to life, property and environment from events such as fire, flood and landslips.

The Shire was formed in 1994 during the State Government's review of municipal boundaries, 211 Victorian municipalities were reduced to 78 and the Shire of Yarra Ranges was created from a combination of four former municipalities. Consequently a need was established to consolidate the four previous Shire Planning Schemes into a relevant and consistent Planning Scheme for the newly formed municipality.

Various anomalies were highlighted during this process, one being the issue of geotechnical surveys having been conducted in two of the four pre-amalgamation municipalities. This subsequently obligated the Shire to initiate a comprehensive survey of all areas within its boundaries.

The survey

A geotechnical survey was undertaken during 1998/99 by consultant geotechnical engineers, Coffey Geosciences Pty Ltd. This assessed the risk of landslip potential across the entire municipality, excluding Crown Land. The survey allowed for the creation of an Erosion Management Overlay that could be incorporated within the new Planning Scheme and the Shire's Geographic Information System (GIS). This enabled measures to be taken so that the impact of development could be properly managed in relation to landslips.

The Erosion Management Overlay divides the municipality into six categories. These categories are shown in *Table 1*.

There are approximately 55,000 rateable properties within the Shire of Yarra Ranges.

The survey identified 434 properties in the High Risk category and 5,556 properties in the M2 Medium Risk category. This translates to approximately 11% of total properties.

Involving the community

Given the large percentage of properties affected within the municipality, it was imperative that extensive community consultation was undertaken. The deliberation process on what information to provide was extensive. The services of an external public relations consultant was obtained to provide a communications strategy on how to achieve a more informed community, without instilling panic amongst affected property owners.

The objectives of the strategy were to:

- ensure that the community understood that the Shire had introduced a Landslip Overlay to protect the safety of the community
- explain that the results of the landslip study required the Council to provide a consistent set of planning controls
- highlight to the community that the Council would continue with its maintenance of roads and Council drains and revegetation of public land to retard the risk of soil erosion, which can be a major factor in triggering a landslip
- educate the community about the practical steps that can be taken to minimise exposure to landslip on individual properties

Conveying the 'right' message to the community was important. A negative reaction from the public could have had an enormous impact on Council's resources and potentially damaged its credibility. The issues of how to 'break the news gently' to residents, while 'fully' informing them, was crucial and considerable resources were channelled into ensuring that this was achieved.

The methods utilised to inform the community, included:

- briefing Councillors and staff on the potential impacts of the landslip issue within the community and the availability of an Erosion Management Overlay within the Shire's Planning Scheme

Ex	Exempt	Flat land, unlikely to be any instability, no impacts
L	Low	Landslip unlikely even though the land is gently sloping
MO	Medium Risk	Construction requires compliance with guidelines
M1	Medium Risk	Construction requires compliance with guidelines
M2	Medium Risk	Slopes>20% require a mandatory planning permit and site specific geo-technical assessment
H	High Risk	At risk of landslip without any development. A planning permit can only be issued where a geo-technical investigation shows risk is acceptable. There may be circumstances where a planning permit cannot be issued.

Table 1 : The six Municipal categories defined in the Erosion Management Overlay

- development of an extensive information kit containing various **fact sheets** on landslips. These fact sheets included:
  - landslips in the Shire
  - summary of the landslip study
  - geology of the Shire of Yarra Ranges
  - Coffey Partners landslip study
  - qualified Geotechnical Engineers consultants list
  - landslip risk categories
  - development practices that should be avoided
  - information for land owners (specifically addressing each risk category)
- private consultations made available with appropriate Shire officers to discuss specific individual requirements
- extensive media campaign conducted
- provision of a 'hot line' to enable easy access for resident enquiries
- provision of information to other interested stakeholders, i.e. real estate agents, insurance companies, Government authorities, etc.

The response

The Shire was pleased with the community's positive response to the consultation process. Initially, Yarra Ranges Service Centres received an influx of general enquiries from property owners and requests to access the mapping information in their particular areas. Generally the information kits were well received and appreciated.

Unfortunately it is hard to guess whether this response was due to:

- the comprehensive community awareness program
- apathy on behalf of property owners who may not be affected until the category assessment affects the sale/development of their property
- the lack of understanding of landslips and their potential impacts on the community

In hindsight some form of feedback process could have been included with the information kits to establish a clear indication of the level of understanding among the community.

Landslips within the Shire

Landslips are a fact of life in the Shire of Yarra Ranges and have occurred for thousands of years.

The types of landslips that occur in the Shire include falling boulders, debris flows, slow long term earth movements, small landslips up to the size of a residential block and large landslips involving entire hillsides. Some landslips move relatively frequently whereas others have not moved for hundreds, perhaps thousands of years.

Landslips can result from both natural and artificial causes. Heavy rainfall has triggered many landslips in the Shire, such as those that occurred in 1863, 1891, 1928, 1934, 1958, 1992, 1994 and 1996.

Some artificial causes of landslip include:

- excessive or poorly engineered cutting and filling
- inadequate drainage of seepage and surface water
- removal of vegetation
- construction on an old landslip or debris flow
- poor irrigation practices
- poor storm water run-off design
- inadequate ground waste water disposal

Many landslips occur then re-occur in the same location, therefore sites where landslips have previously occurred have a higher risk of future landslip.

Case studies

Case study 1

***1891 Montrose landslip**–site of significant previous landslip*

A landslip occurred in 1891 on the north western slopes of Mt. Dandenong.

To give an indication of the severity of this landslip, the Thredbo Tragedy in July 1997 involved the displacement of 2,000 cubic metres of liquefied soil, whereas this event involved the movement of 30,000 cubic metres of earth and rock—damage was recorded over at least 1.4 kilometres and the flow was said to have reached speeds of up to 40 kilometres per hour.

The extract below has been taken from the Lilydale Express, published in August 1891.

'...Twenty minutes after the gigantic mountain landslip at South Mooroolbark everything seemed to rest in tranquility, excepting the thundering noise of the rushing waters as they fought their way with vengeance down the valley scooped out by the rocks and trees in their mad career. The rain was falling in torrents, but nevertheless a good number of willing hands had gathered in order to rescue those from further harm, who so narrowly escaped with their lives from being engulfed for ever in the maddening rush of debris which swept all before it...

'...The first sign of danger occurred about 10am, when the water rushed down past the house in torrents, filling the creek in a few minutes. Mr. Jeeves, the manager, and another man named Goodwin, then tried to flog the horses, across but failed. About 1.30pm things looked bad, and Goodwin started for Abbott's house with

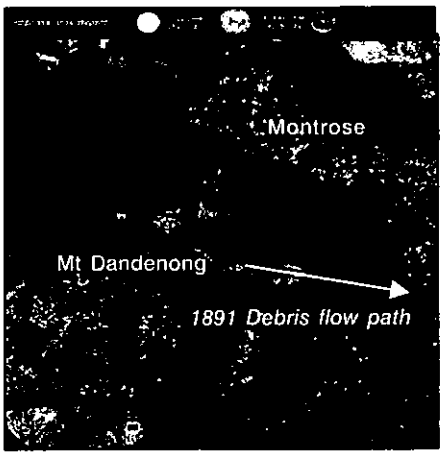

Figure 1: the Montrose landslip 1891 – 30,000 cubic metres of earth and rock moved down the slope at approximately 40km per hour.

his luggage, Mrs. Jeeves having gone a few minutes previously, with her child and the other two lads, Jeeves remaining to assist Mrs. Herschell across. Goodwin had just reached Abbott's fence when the mountain plunged down upon them with a noise like that of thunder. Goodwin received a severe shaking, but escaped serious injury. After recovering himself he said he ran down in the direction Mr. Jeeves and Mrs. Herschell had been carried. He then saw Mr. Sam Jeeves, who was covered with mud, crawl out of the debris. After searching and calling out, he saw something like an arm held up, of which he took hold. This proved to be Mrs. Herschell. After dragging the lady out of the mullock and stones, he filled his hat with water and poured it down her throat, she being nearly suffocated with mud...

'...Since then the rocks and earth have been falling in, thus, to a great extent, lessening the depth. No one as yet has given a decided opinion as to the cause of the collapse of such an immense body of earth, but as there is no solid rock foundation beneath the mountains, excepting large round to water washed boulders, which, perhaps are next to useless where the hill is so steep, all I can say for it is, as there were large openings or cracks to be seen some time back, no doubt the continual washing of the underground springs and numerous soakages, the moving of large round boulders and the continual swaying of timber by the storm had a great deal to do with it's failing after such a heavy rain. The cracks along the hill must have contained some hundreds of tons of water. The hill being so steep above the opening in the ground the water would come down with a terrible rush...

'...Mr Ellery says he and his wife were standing under the verandah when the fall of earth and water took place. He says

it bounded down the hill into the valley, then sprang up the hill on the opposite side like a thunder clap, whence it receded, and rushed straight onwards, sweeping everything like grass before it. He says he saw a large gum tree fully 10 feet through at the butt and 150 feet high, hurled 50 feet into the air, and large rocks, weighing many tons, were sent spinning into the air like footballs. When he saw Herchell's house swept down and broken into matchwood, his wife fainted at the sight, they not knowing where the inmates might be. Another eye witness stated he was shipwrecked three times, but was never so awe stricken in his life as when he saw the mountains coming down...

'...Many hundred of persons have visited the scene of the catastrophe within the last three weeks, coming from all quarters of the colony. All express the same opinion of the site, that is – 'It's something awful!' The mountain road has been completely blockaded from top to bottom, and will cost a good sum to repair it again. The exact area of the landslip is hard to define. From start to finish, it is about a mile in length. Giant trees and huge boulders have been swept from the main head, fully a mile down the valley...'

It is believed that the major contributing factor to the 1891 landslip was the heavy rainfall that continued unabated over a three day period from about midnight on Friday 10th July until Sunday 12th July 1891.

During the 1891 landslip relatively minor damage was recorded. The damage included the destruction of a house and some outbuildings in the path of the debris. Two horses were carried some 600 metres downslope and killed, two people were caught in the debris flow, narrowly escaping death, with one being buried in the debris.

In 1891 all drainage from the mountain was via natural streams and channels. Today on the steeper slopes this is still the case. On the lower slopes under road culverts have been installed and selected natural water courses have been piped. Based on available photographs and documented evidence uphill from the road (Old Coach Road) was well timbered, whereas downhill was mostly cleared and in pasture or crops. Photographs taken in 1904 suggest the timber density uphill from Old Coach Road was perhaps marginally less than exists at present.

Conditions existing in the area in 1891 were different to those in existence today. In 1891 there were only a few houses in the area and only one road which traversed the north west face of the Dandenongs.

Over the last 100 years the Montrose area has been extensively developed. Should a similar sized landslip occur today and the movement of debris follow a similar path, significant loss of life and serious injury could result. Destruction of buildings, even substantial solid brick houses, would be likely. The highest risk of damage or injury exists on the steep slopes below the area where the landslip might occur. The physical location of the Montrose landslip area is within the Dandenong Ranges National Park and subsequently no development exists on the site. The critical factor contributing to the damage potential is the resultant debris flow generated by the initial landslip, not the actual initial movement of land.

Case study 2

***Blackwood Avenue** – Active landslip*

In October 1992 an active landslip in Blackwood Avenue, Warburton moved significantly causing the evacuation of houses in the immediate area and the permanent closure of the road.

Historical information leads us to believe that this landslip has been in existence for, perhaps, thousands of years. It was almost certainly well established prior to European settlement in the Warburton area. The earliest recorded movement of the landslip occurred in the early 1950's, a newspaper article quotes a resident of Blackwood Avenue who was alerted to the movement when he *'...noticed his chooks which had been locked up the night before, wandering around his back yard...'* and upon investigation found the ground beneath the chook house *'...had dropped away during the night...'*.

Floods and record rainfalls were recorded in the Warburton area in 1952. The landslip has moved every decade since the 1950's and is expected to continue moving. It is believed that total movements in the order of 20 to 30 metres have occurred since the landslip formed (based on the present slope profile and the assumed pre-landslip profile).

The Blackwood Avenue landslip lies on the north bank of the Yarra River at Warburton. The toe of the landslip is at the edge of the river. Cumulative movements up to about 1.5 metres have been measured on the Blackwood Avenue landslip in the last seven years. Concern has been expressed that this landslip may fail catastrophically, blocking the river, and this could lead to flooding of the Warburton area.

The landslip covers approximately 6 hectares. It is irregular in shape and has a maximum length of about 320 metres and a maximum width of about 230 metres.

Currently there are no occupied buildings on the landslip. Four houses were on the site until the early 1990's. They have since been demolished or permanently vacated. Four houses lie in close proximity to the edges of the landslip.

Currently parts of the landslip are used for grazing, other parts are vacant and have vegetation varying from blackberries to eucalyptus regrowth.

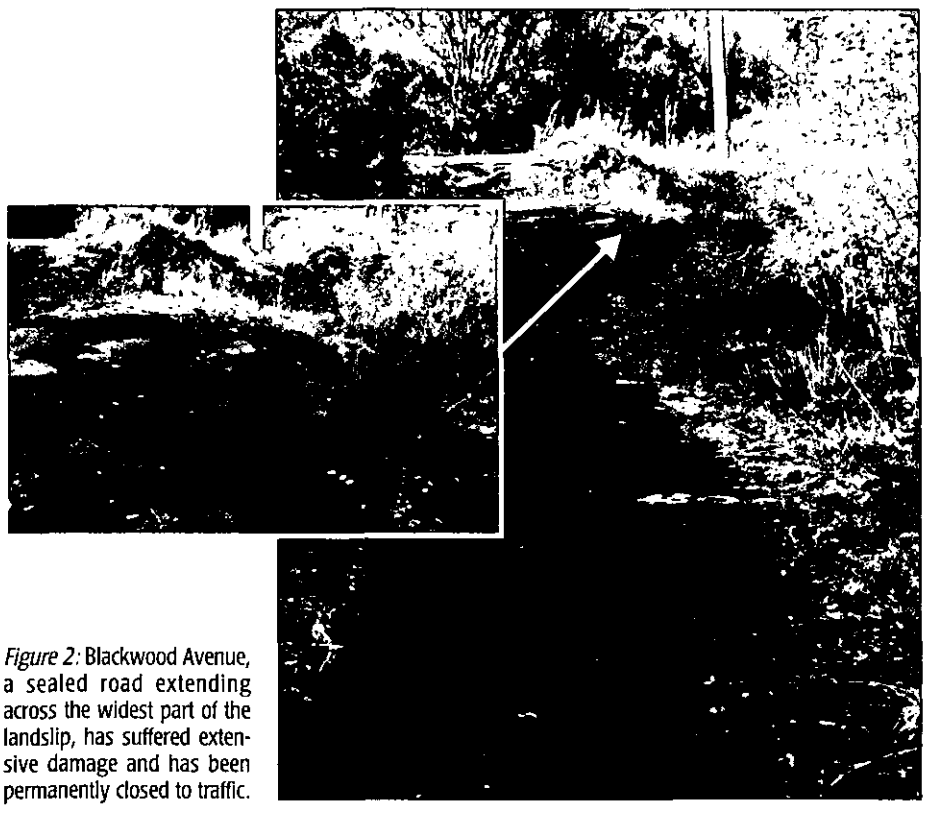

Figure 2: Blackwood Avenue, a sealed road extending across the widest part of the landslip, has suffered extensive damage and has been permanently closed to traffic.

No evidence has been found to suggest the landslip may have blocked the Yarra River in the geological past, let alone in more recent times. The available evidence indicates the landslip is 'slowly shuffling' along, most likely in response to heavy rainfall and that substantial movements causing the river to totally block are unlikely to occur. Irrespective, given the narrowness of the river, the uncertainties regarding the behaviour of any landslip and the events that could take place in a major storm/flood event, the consequences of the landslip blocking the river need to be considered.

In the very unlikely event of a total blockage of the river, the resulting landslip dam is likely to be made up of loose debris, which would erode quickly, particularly if over topped by the river. If the unexpected happens and the dam is not rapidly eroded, flooding will occur. This will, in turn, primarily affect infrastructure, such as the bridge spanning the Yarra River, which carries the main Highway through the township (*Figure 3*). This would result in the isolation of services such as the hospital and the volunteer fire brigade and cause flooding of a nearby caravan park. Should this occur, the consequences are considered to be manageable.

Where to now

The Victorian State Government's Emergency Management Act 1986, requires municipalities to prepare an Emergency Management Plan and to ensure the ongoing integrity of the plan, through regular auditing processes.

The basis of the Plan has been formulated by the Victorian State Emergency Service and is generic to all municipalities within the State. It must identify resources and specify details on how these resources are to be utilised during emergency prevention, response and recovery.

The Shire of Yarra Ranges has taken the initiative to incorporate into its Plan a series of sub-plans covering specific events, such as fire, flood and landslips. The aim is to have the Municipal Emergency Management Plan a 'working' document, as opposed to a 'shelf ornament'. Individual plans, directly relating to specific risks within the municipality, need to be developed using and expanding on existing documentation. These individual plans are a vital component of an all encompassing Plan, specifically designed to this unique environment.

The preparation of these Plans involves enormous amounts of time and effort. A high level of community consultation and successful links with external bodies, such as the specific controlling and support agencies, is vital in aiding us to prepare, respond, resource and recover from these events.

In order to accommodate the possibility of a landslip occurring within the municipality, we are currently in the final stages of developing a Generic Landslip Contingency Plan, as well as numerous Site Specific Plans. These are being formulated using the information obtained during the Landslip Survey conducted by Coffey Geosciences Pty Ltd.

While the initial emphasis of the Survey was community awareness and development controls, the Emergency Management focus was towards strategic landslip planning and site specific plans for known high risk or active landslips.

Contingency plans

Within Victoria the responsibility for managing a landslip emergency rests with the Victorian Police Force. Council's primary function is to facilitate the provision of resources as required. In the event of a landslip, the need for specialist equipment, resources and skills will occur. Therefore, our municipality needs to pre-empt this requirement by ensuring that we maintain a comprehensive list of resource providers.

In June 1999, the Shire of Yarra Ranges was requested to present a paper on Landslip Contingency Planning at a workshop conducted by the Australian Emergency Management Institute at Mt. Macedon in Victoria. This workshop was attended by Dr. Marion Leiba from the Australian Geological Survey Organisation and the Canterbury Regional Shire from New Zealand, along with representatives from numerous municipalities throughout Australia, including the City of Cairns, Queensland.

The proposed outcome of the workshop was to identify arrangements for:

- landslip mitigation
- landslip preparedness
- managing landslip response
- managing landslip recovery

This workshop confirmed that landslip contingency plans were basically non-existent and that the lack of specific guidelines meant that the municipality would be 'starting from scratch' when determining requirements for the development of this plan. The Shire of Yarra Ranges does not profess to be expert on landslips but relies upon the expertise and input of others to aid in the formulation of viable, comprehensive and practical plans.

We recognise that contingency plans should be clearly written, easily understood and flexible enough to enable implementation at any time. They should integrate various activities and plans and have the flexibility to cover a wide range of possible sources and levels of risk.

Some of the components of our Landslip Contingency Plans are:

- definitions
- history of landslips within the municipality
- risk analysis
- prevention/mitigation
- control agency and response
- scenarios

Figure 3: The Blackwood Avenue landslip lies on the north bank of the Yarra River at Warburton. The toe of the landslip is at the edge of the river. In the unlikely event of a total blockage of the river, infrastructure such as the bridge spanning the Yarra River could be affected.

- effects on the community (social and technical)
- resource listing
- local contact listings
- maps
- recovery aspects

Looking to the future

Given the significant number of high & medium risk landslip areas identified within the Geotechnical Survey, the ability to monitor regularly is not considered a viable option. The community awareness program and the production of the Shire of Yarra Ranges Planning Scheme, including the Erosion Management Overlay, provides the framework for the development of appropriate land management practices.

Due to the significant nature of the Montrose Landslip and the known quantity of the active landslip in Blackwood Avenue — Warburton, the Shire has undertaken steps to ensure regular monitoring occurs.

In the case of the Montrose landslip, formal survey monitoring comprising tape measurements and visual observation along several routes will be conducted. There is also the need for additional monitoring when triggered by extensive or prolonged rainfall.

The Blackwood Avenue landslip will have a completely different approach to monitoring. It is envisaged that following community consultation, adjoining property owners will play an important role in monitoring movement within the area. This is likely to take the form of a simple peg in the ground from which movement can be measured easily by an untrained observer. Formal survey monitoring will still occur, but on a more infrequent basis. Any movement detected and reported by property owners will be followed up by an immediate Geotechnical assessment.

Information sharing

It is imperative that information sharing occurs in relation to landslip activity within municipalities. Ensuring that the likes of the Australian Geological Survey Organisation (AGSO) and other relevant bodies, including the community, are informed of any activities is essential in historically documenting movements to enable a holistic picture of activity within any given area. This type of information is a vital component in the identification of areas of risk and their subsequent effective management.

During the heavy rainfalls experienced throughout the municipality in August 1996, numerous landslips occurred causing extensive damage to infrastructure and resulting in the construction of several gabion walls. There were four significant landslips recorded in various ares of the municipality, resulting in disaster funding claims in the order of $500,000. Although these incidents were all 'landslips' they were recorded as storm damage works and no information sharing occurred.

This task is very easily overlooked. Relatively minor landslips can occur on a frequent basis throughout the municipality and can be treated as routine storm damage or as a drainage system failure. Even when the word 'landslip' is associated with incidents, it is not necessarily a high priority to inform AGSO of the occurrence. Re-education of staff and the review of processes has been necessary to ensure that these types of events do not go un-recorded.

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Authors' contact details

Lex Ritchie is the Manager of Asset Management and the Municipal Emergency Resource Officer (MERO) for the Shire of Yarra Ranges. He has a degree in Civil Engineering, a Graduate Diploma in Municipal Engineering and a Company Directors Diploma.

As MERO for the Shire, Lex has worked closely with the Country Fire Authority, Victoria Police and the State Emergency Service over the past few years to enhance community safety throughout Victoria. He has actively supported and contributed to the continuous improvement of Municipal Emergency Management.

Glenn Hunt is an Emergency Management Officer, employed in the Asset Management Department of the Shire of Yarra Ranges. Glenn is currently undertaking the task of developing a generic emergency management plan in relation to landslips. He is also formulating more comprehensive Site Specific plans for known landslip areas throughout the Shire.

For further information contact:
Lex Ritchie or Glenn Hunt
Shire of Yarra Ranges Asset Management Dept.
P.O. Box 105, Lilydale, Victoria, 3140
Email: mail@yarraranges.vic.gov.au

Conference Announcement

Victorian Flood Management Conference Traralgon, October 2001

The next Victorian Flood Management Conference will be held in Traralgon in October 2001. It will be jointly hosted by the West Gippsland Catchment Management Authority and the Latrobe City Council.

From all accounts the inaugural Victorian Flood Management Conference held in Wangaratta in September 1999 was a significant step in raising awareness of flood management.

For the first time, local government planners, floodplain managers, emergency planners, consultants and people from other disciplines were able to come together to discuss developments in flood management. Presentations were made on a wide range of issues including the Victoria Flood Management Strategy, community involvement, the Victoria Planning Provisions, flood insurance, legal liability and flood mapping.

Since the last conference was held many of these issues have continued to evolve and new ones have emerged to command our attention

In a questionnaire taken at the end of the inaugural conference, many of the 140 delegates indicated that there was a strong need for further flood conferences to be held.

The second Victorian Flood Conference will be held in Traralgon from 9th to 11th October 2001. The Conference theme is *Planning for the Inevitable*, which should remind us that that we should never be complacent about the frequency of floods or their impact. This is well illustrated by the fact that the annual cost of damages from floods in Victoria is now estimated to be greater than $56m and is continuing to grow.

The Chairman of the conference organising committee is Wayne Gilmour, Floodplain Manager with the West Gippsland Catchment Management Authority.
For more information, contact Wayne on: 03 5175 7800 (phone)

A conference brochure and call for papers will be released in the near future

EMA UPDATE

Summer 2001

Produced by
Emergency Management Australia through the
Australian Emergency Management Institute
Main Road, Mount Macedon, Victoria 3441

Management of Civil Defence Operations course 2001

The Management of Civil Defence Operations Course gained formal status as an accredited course in August 2000. The course is usually conducted annually at AEMI usually in late November. However, the 2001 course has been scheduled for the last week of September.

The course is aimed primarily at the operational level of emergency management and examines issues relating to civil defence planning and operations to manage the effects of armed conflict in Australia. In addition to members of statutory emergency management/response agencies such as police, fire, ambulance, SES and welfare agencies, representatives from Defence, public health, the media, local government, public utilities, NGOs and commerce and industry are most welcome to apply.

For further information contact:
David Morton
Phone: 02 6266 5325
Email: dmorton@ema.defence.gov.au

Commonwealth Government reception plan

In October 2000, a two-day workshop was held at AEMI to review the Provisional Commonwealth Government Plan for the Reception of Persons Evacuated into Australia following an overseas event (COMRECEPLAN). Experiences gained through recent evacuations such as the Solomon Islands event had highlighted this requirement.

The workshop which was attended by around 30 persons representing States, Territories, Commonwealth agencies and non-Government organisations made a number of recommendations to refine the plan which will now be submitted to the national Emergency Management Committee for further consideration.

For further information contact:
Rod McKinnon
Phone: 02 6266 5328
Email: rmckinnon@ema.defence.gov.au

New Australian emergency manual—post- disaster assessment and survey

EMA will soon be publishing a new manual on Post Disaster Assessment and Survey as part of the Australian Emergency Manual (AEM) series. The new AEM will provide emergency managers with useful a planning guide for the conduct of initial survey and damage assessments following the impact of a disaster. The manual draws on material from Australia and overseas and will include a series of check-lists and proformas. The manual should be available by mid-2001.

For further information contact:
Don Patterson
Phone: 02 6266 5165; Email: dpatterson@ema.gov.au

International Search and Rescue Advisory Group

The Asia Pacific Chapter of the International Search and Rescue Advisory Group met in Seoul, Korea in November 2000. This was the first meeting of the group since 1993 and resulted from an exploratory meeting hosted by EMA in Canberra in March 2000.

The meeting was attended by representatives from 10 countries of the Asia Pacific Region and the UN Office for the Coordination of Humanitarian Affairs (OCHA). Attendees pledged to work together to improve urban search and rescue capabilities in the region. New Zealand will host the next meeting in late November 2001.

For further information contact:
Rod McKinnon
Phone: 02 6266 5328
Email: rmckinnon@ema.defence.gov.au

Review of disaster response plans

EMA is currently reviewing the Commonwealth Government Disaster Response Plan (COMDISPLAN) and the Australian Government Overseas Disaster Assistance Plan (AUSASSISTPLAN) as part of a three-year review cycle. The revised plans should be available in mid-2001

For further information contact:
Don Patterson
Phone: 02 6266 5165
Email: dpatterson@ema.gov.au

Indian Disaster Management Symposium

In November 2000, EMA coordinated Australian participation in a joint Australia India Council (AIC)/Confederation of Indian Industry (CII) sponsored Disaster Management Symposium in Delhi, India.

The Symposium covered a range of topics under the broad headings of prevention, preparedness, response and recovery with Indian and Australian speakers addressing each topic followed by open discussion. A number of small group workshops were conducted towards the end of the Symposium to address specialist subjects.

The nine person Australian team included representatives from James Cook University, Australian Maritime Safety Authority, Australian Geological Survey Organisation, Bureau of Meteorology, West Australian Fire and Emergency Services Authority, New South Wales Department of Land and Water Conservation, a Recovery Specialist and EMA.

For further information contact:
Rod McKinnon
Phone: 02 6266 5328
Email: rmckinnon@ema.defence.gov.au

Management of Chemical Biological Radiological Incendiary and Explosives (CBRIE) Emergencies/ Incidents course

The dates for the next CBRIE course to be conducted at AEMI have changed from 12–16 March to 25–29 June 2001. The CBRIE course is currently going through the accreditation process which should be completed by March 2001. Those who have attended one of the three previous CBRIE courses at AEMI will receive a new certificate through the mail in due course.

For further Information contact:
Don Patterson
Phone: 02 6266 5165
Email: dpatterson@ema.gov.au

Exercise SAGIP 2000

Exercise SAGIP is an annual multilateral forum that promotes the sharing of experiences in disaster response and humanitarian assistance and provides an understanding of the emergency management arrangements in place in countries from the Asia Pacific region. The exercise is an initiative of the Philippine Department of Defence with the word SAGIP meaning 'to save lives'.

Exercise SAGIP 2000 which was held in Manila during the period 23-27 October 2000 brought together 90 military and civilian persons from 17 Asia/Pacific countries.

Mr Trevor Haines from EMA participated in the exercise as a member of the four person Australian Defence Force led delegation and presented papers on Early Warning and the United Nations response framework for international Urban Search and Rescue Teams.

For further information contact:
Trevor Haines
Phone: 02 6266 5169
email: thaines@ema.gov.au

EMA Projects Program

EMA has made available project funding to support disaster prevention and management projects during 2001/02. Project proposals aimed at reducing disaster-related loss of life, property damage, and economic and social disruption in Australia are now encouraged from individuals, community groups, businesses, non-government organisations and agencies at all levels of government.

Details on the EMA Projects Program funding are available on the EMA web site at www.ema.gov.au. The closing date for proposals for Financial Year 2001/2002 project funding is 28 February 2001.

For further information contact:
Rob Cameron
Phone: 02 6266 5408
Email: projects@ema.gov.au

International Year of the Volunteer

It is estimated that there are over 500,000 volunteers registered with Australian emergency service organisations. Without them the emergency management sector could not function effectively. The year 2001 has been declared the International Year of the Volunteer (IYV) and provides a unique opportunity to recognise the outstanding contribution of those dedicated people who give so much to make communities safer.

EMA intends to undertake a significant leadership role in IYV to ensure the profile of volunteering gains wider community acceptance and understanding. States and Territories are planning activities to make the IYV a special year. A National Committee has also been established to coordinate national emergency volunteer IYV activities and met for the first time recently. At this meeting, ideas for national activities which could assist the recruitment, retention, training or recognition of volunteers were generated. EMA will submit a proposal to the Department of Family and Community Services to seek funding for activities identified by the national IYV Committee. EMA will also make a significant financial and in-kind contribution towards these activities.

For further information contact:
David Winterburn
Phone: 02 6266 5009
Email: dwinterburn@ema.gov.au

Australian Disaster Information Management workshop

The Australian Disaster Information Management workshop was held from 6–8 November 2000 with many representatives from a wide range of organisations. The workshop considered issues such as disaster information needs, benefits of a greater information capability and disaster information networking, some of the restraining forces, strategic objectives, possible actions, and resource implications.

For further information contact:
Jonathan Abrahams
Phone: 02 6266 5219
Email: jabrahams@ema.gov.au

National 2001 Safer Communities Awards

Following the success of the inaugural Safer Communities Awards in 2000, planning is now under way for the 2001 Awards. EMA is making arrangements to refine some elements of the Awards with a launch scheduled for late February at which time full details of the categories, nomination and judging criteria, and closing date for entries will be announced. It is expected that State and Territory judging will proceed in June or July followed by the national judging in August. While there were 75 entries for the 2000 Awards, EMA is looking forward to attracting a higher number of entries in 2001 from the emergency management, volunteer, local government and private enterprise sectors.

For further information contact:
Tom Parkes
Phone: 02 6248 9344
Email: awards@ema.gov.au

GDIN2001 Update

Preparation for the Global Disaster Information Network Conference (GDIN2001) is progressing well. This is a significant international event that EMA will be hosting on behalf of the Australian government. The Conference, which is to be held in Canberra from 21–23 March 2001, is open to all people with an interest in disaster

information management and is expected to attract up to 200 delegates from a range of areas within Australia and overseas. The Conference registration form and program can be found at the GDIN2001 website: *www.ema.gov.au/gdin/index.html*. An advertisement appears in this issue of AJEM.

For further information contact:
Greg McKenzie Smith
Phone: 02 6266 5317
Email: gdin@ema.gov.au

What's on at AEMI

AEMI Program of activities for March – June 2001

AEMI has reviewed the Program of Activities for the first half of 2001 and as a result there have been a number of changes to the program, including additions and substitution of activities. The accompanying table outlines the residential activities with the changes highlighted. Please note that only the National Studies Program (NSP) activities that have been programmed are included, no extensions appear on the table and that, in response to a number of requests from clients, we will conduct a number of Evacuation Management courses.

5–9 March 2001	Recovery Management
12–16 March 2001	Evacuation Management
19–21 Mar 2001	Emergency Management of Australia's Cultural and Linguistic Diversity (NSP)
26–30 Mar 2001	Exercise Management
27–28 Mar 2001	School Education Implementation Workshop
10–11 April 2001	Senior Executives Emergency Management Briefing
30 Apr–4 May 2001	Implementing ERM
6–18 May 2001	EMO Program Course 1
21–25 May 2001	Evacuation Management
21–25 May 2001	Exercise Management
28 May–1 June 2001	Implementing ERM
18–22 June 2001	Recovery Management
18–22 June 2001	Understanding ERM
25–29 June 2001	Consequence Management To CBRIE Emergencies Course

Reintroduction of Evacuation Management

The 3 ½ day accredited course in Evacuation Management has been included in the Program of Activities in March and May 2001. The aim of this course is to enable participants to contribute to the selection and implementation of evacuation as an intervention strategy. Upon completion of the course participants should be able to:

- Demonstrate the key issues in planning an evacuation strategy; and
- Explain the key issues in making a decision whether to evacuate.

The key topics in this course are related to the issues involved in the five phases of evacuation, that is:

Decision to evacuate; Warning; Withdrawal; Shelter; Return.

Emergency Management Officers' professional development program

The new program consists of three courses and is designed for newly appointed Emergency Management Officers (EMO's) with significant emergency/disaster management responsibilities. These may work in SES, emergency management organisations or have significant emergency management duties in other organisations.

The purpose of the program is to provide a comprehensive package to support the initial role and function of newly appointed EMO's and to provide the EMO's with sufficient skills and knowledge to enable them to facilitate and support emergency management within their communities. Upon completion of this program, participants should be able to:

- apply emergency management concepts, principles and arrangements
- apply emergency management tools and skills
- apply management principles, knowledge and skills in emergency management contexts
- display appropriate attitudes, values and behaviours

The program consists of three two-week courses: Course 1, Course 2 and Course 3. Course 2 comprises of an Understanding Emergency Risk Management (UERM) course and an Implementing Emergency Risk Management (Implementing ERM) course. It is expected that persons nominating for the program will make themselves available to attend all three courses in the program, as well as completing the associated assignment and project work. One program has commenced and the next EMO Program has been timetabled for:

Course 1: 6–18 May 2001; *Course 2*: 15–26 October 2001; *Course 3*: 18 February– 1 March 2002.

AEMI Program of Activities for the Financial Year 2001/2002

The Program of Activities and details about courses can be accessed via EMA website at *www.ema.gov.au*, or via The AEMI Handbook, which will be available from the beginning of April. The Handbook is obtainable from AEMI or the nominating authorities.

New Activities at AEMI

Next financial year (2000/2001) AEMI will be offering 2 new courses. They are:

- Response and Recovery Planning
- Emergency Management for Local Government

The accredited Emergency Coordination Centre Management will again be offered, as well as the following:

- Understanding ERM
- Implementing ERM
- Exercise Management
- Evacuation Management
- Recovery Management
- Management of Civil Defence Operations
- Consequence Management to CBIRE Emergencies
- Emergency Management Officers' Program

For more information on courses contact:
Judy Parker
Phone: 03 5421 5288, Fax: 03 5421 5272
email: jparker@ema.gov.au

National Studies program 2000/2001

The following are reports on the status of three activities that come under the National Studies Program banner.

Community Safety – Towards a safer community

AEMI is hosting a series of workshops on Community Safety. The aim of these is to develop a better understanding of the ways in which Emergency Management can contribute to Community Safety. Participants will include Emergency Managers, representatives from local government, and other policy areas including health, crime/injury prevention, community development and environmental health. Outputs from the workshop include a set of principles and strategies for integrating Emergency Management into local government practices. The first was held at AEMI on the 12& 13 of December. Two others will be held in March and May 2001.

For more information contact:

Mark Scillio, Senior Education Officer, AEMI
Phone: 03 5421 5292, Fax: 03 5421 5272
Email: mscillio@ema.gov.au

Emergency Management for Australia's Non-English Speaking Background community: residents and visitors

Emergency Management Australia in conjunction with the National Police Ethnic Advisory Bureau and Kangan Batman TAFE will be conducting a workshop titled *Emergency Management for Australia's Non-English Speaking Background Community: Residents and Visitors* from 19th March to 21st March 2001. The venue will be the Australian Emergency Management Institute Mt Macedon Victoria. The workshop will be structured around syndicate activity to develop best practice guidelines in this important area of emergency management.

For more information contact:

Louise Mitchell, Senior Education Officer, AEMI
Phone: 03 5421 5276, Fax: 03 5421 5272
email: lmitchell@ema.gov.au

Measuring the performance of disaster mitigation projects

Considerable resources are invested in risk reduction (disaster mitigation) measures by all levels of government. There are few Australian examples of the measurement of the effectiveness, efficiency or appropriateness of these measures. Without these, it is difficult to assess the merit of such measures.

The Commonwealth Department of Transport and Regional Services (DoTRS), Bureau of Transport Economics (BTE), and Emergency Management Australia (EMA) will be conducting a series of workshops to capture the available Australian information on the costs, benefits and performance of flood disaster mitigation projects.

The National Emergency Management Studies Program workshops will focus on structural and non-structural flood disaster mitigation projects and programs, with the expectation that the results will be applicable to other risks reduction projects and programs.

The expected outputs of the National Emergency Management Study Program workshops will be:

- A better shared understanding amongst Commonwealth and State/Territory government departments on the costs and effectiveness of flood disaster mitigation projects and programs; and,
- Information for the publication of a Working Paper by the BTE that examines the costs and effectiveness of flood disaster mitigation measures.

The expected outcome of the National Study Program workshops is a significant contribution to the capacity of Commonwealth and State/Territory government departments to assess the potential effectiveness of disaster mitigation projects and consequently more effective allocation of government expenditure.

All those wishing to participate in this vital work are urged to contact:

Peter Koob, Senior Education Officer, AEMI
Phone: 03 5421 5283, Fax: 03 5421 5272
email: pkoob@ema.gov.au

EMA publication news

School education resources

Swirling Winds, Dry Earth

A valuable resource developed, as part of the International Decade for Natural Disaster Reduction, for middle school when teaching about hazards, weather, or specifically on cyclones and droughts.

Designed with inquiry-based learning activities to help students develop skills and enhance their understanding of tropical cyclones and droughts. Each section looks at the natural and human causes of the phenomenon, its behaviour, and management options to maximise its benefits while reducing its negative impacts on people and the environment. Case studies throughout Australia are used to highlight different aspects.

60 pages with activities which require students to investigate the information and participate in the responses. A wide range of exercises supported by statistical data, photographs and blackline masters.

It is available through:
The Geography Teachers' Association of Victoria
PO Box 2066, Camberwell West, Victoria 3124, Australia.
Phone: 03 9824 8355.

Coming soon! The Hazards Happen CD-ROM teachers guide

The CD-ROM contains stories of Australian Natural Disasters, scientific explanations, hazard management games and quizzes, 100's of images and is easy to navigate around. The teachers guide contains lesson plans, teacher notes and student task sheet masters for Years 3–12. The lessons use a variety of approaches including poetry, drama, comprehension, collages, painting, oral reports and inquiry based activities to explore the hazard, cause, effects and how individuals can reduce their vulnerability. The lessons are designed for a range of learning areas across several levels of schooling.

The teachers guide will be available early 2001 and inquiries can be directed to: Russell Forster, School Education Officer on 03 54215242.

East Timor – emergency risk management

by Sgt Alf Turketo,
Australian Federal Police

Introduction

In February 2000, I attended a residential course called Understanding Emergency Risk Management at the Australian Emergency Management Institute at Mt Macedon Victoria. As a pre-course assignment, I clinically applied the Emergency Risk Management Planning Model to my 1999 peace-keeping deployment in East Timor. I was invited to expand upon this experience in an article and my subsequent delay in responding is due in part to my wish to confront and put to rest some raw and painful memories of this time.

I was a part of the unarmed fifty member strong first contingent of Australian Federal Police deployed to East Timor between July and September 1999, in support of the United Nations Mission to East Timor (UNAMET). The word 'assistance' was removed from the original mission title after an apparent objection from our Indonesian hosts; however, the letter 'A' remained embedded in the original United Nations mission acronym and foundation documents. Later as a member of the training team, I would jokingly explain to inductees that this 'A' was silent and referred to me (as in UN and "Alf's Mission to East Timor).

Before I continue further, it is necessary to detour for a short history lesson courtesy of the United Nations Department of Public Information (www.un.org/peace/etimor).

The United Nations General Assembly placed East Timor on the international agenda in 1960, when it added the territory to its list of Non-Self Governing territories. At that time, Portugal administered East Timor. Fourteen years later, in 1974, Portugal sought to establish a provisional government and a popular assembly that would determine the status of East Timor. Civil war broke out between those who favoured independence and those who advocated integration with Indonesia. Unable to control the situation, Portugal withdrew from the region. Indonesia then intervened militarily and later integrated East Timor as its twenty-seventh province. The United Nations never recognised this integration and both the Security Council and the General Assembly called for Indonesia's withdrawal.

Beginning in 1982, at the request of the General Assembly, successive Secretaries-General held regular talks with Indonesia and Portugal aimed at resolving the status of the territory. In June 1998, Indonesia proposed limited autonomy for East Timor with Indonesia. In light of this proposal the talks made rapid progress and resulted in a set of agreements between Indonesia and Portugal, signed in New York on 5 May 1999. The two governments entrusted the Secretary-General with organising and conducting a 'popular consultation' in order to ascertain whether the East Timorese people accepted or rejected a special autonomy for East Timor within the unitary Republic of Indonesia.

Against this back drop, in May 1999, the Australian Federal Police called for 'Expressions of Interest' from members willing to serve in a 'difficult environment' in a possible United Nations Mission to East Timor. A short time later, successful applicants were assembled in Canberra for comprehensive medical preparation and psychological testing during an intensive two-week pre-deployment course. Upon completion of this training phase, 1st Contingent members returned to their home states for a short leave break and to await the outcome of Security Council deliberations.

Phase 1–policy, procedures & terms of reference

On 11 June1999, the 4013th meeting of the Security Council adopted Resolution 1246 (1999) which established the United Nations Mission in East Timor (UNAMET) to '...organise and conduct a popular consultation, scheduled for 8 August 1999, on the basis of a direct, secret and universal ballot, in order to ascertain whether the East Timorese people accept the proposed constitutional framework providing for a special autonomy for East Timor within the unitary Republic of Indonesia or reject the proposed special autonomy for East Timor, leading to East Timor's separation from Indonesia'.

Resolution 1246 authorised the deployment within UNAMET of up to 280 unarmed civilian police officers to act as advisers to the Indonesia Police in the discharge of their duties and, at the time of the consultation, to supervise the escort of the ballot papers to and from the polling sites.

Resolution 1246 stressed that it was the responsibility of the Government of Indonesia to maintain peace and security in East Timor in order to ensure that the popular consultation was carried out in a fair and peaceful way. It was to be conducted in an atmosphere free of intimidation, violence or interference from any side and to ensure the safety and security of United Nations and other international staff and observers in East Timor. Resolution 1246 also authorised the deployment within UNAMET of 50 unarmed military liaison officers to maintain regular contact with the Indonesian Armed Forces in East Timor in support of this Security Agreement.

The UNAMET also incorporated about 425 United Nations Volunteers deployed in electoral, information and political components. The electoral component was responsible for all registration and voting activities at 200 registration/polling

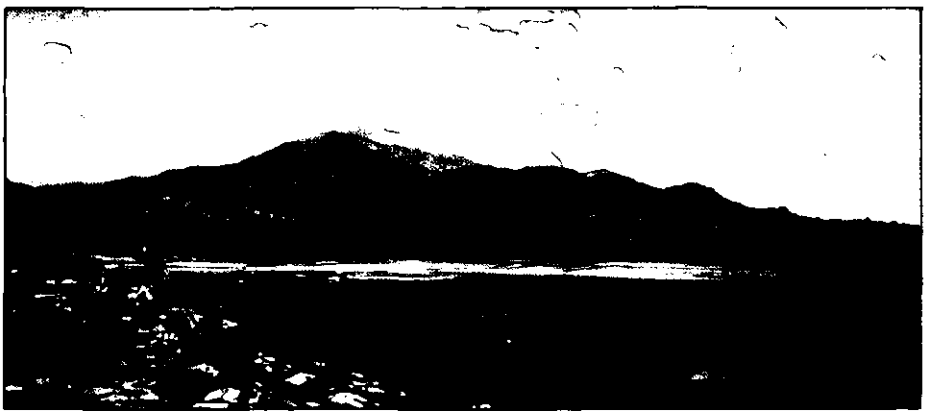

Figure 1: the main road through Manatuto heading west towards the capital of Dili.

sites distributed throughout the 12 regencies or districts in East Timor. The information component was responsible for explaining the popular consultation to the East Timorese people in an objective and impartial manner without prejudice to any position or outcome. Lastly, the political component was responsible for monitoring the fairness of the political environment for ensuring the freedom of all political and non-government organisations to carry out their activities.

Figure 2: river crossing on the 'main' road to Soibada, 64km south-west of Manatuto.

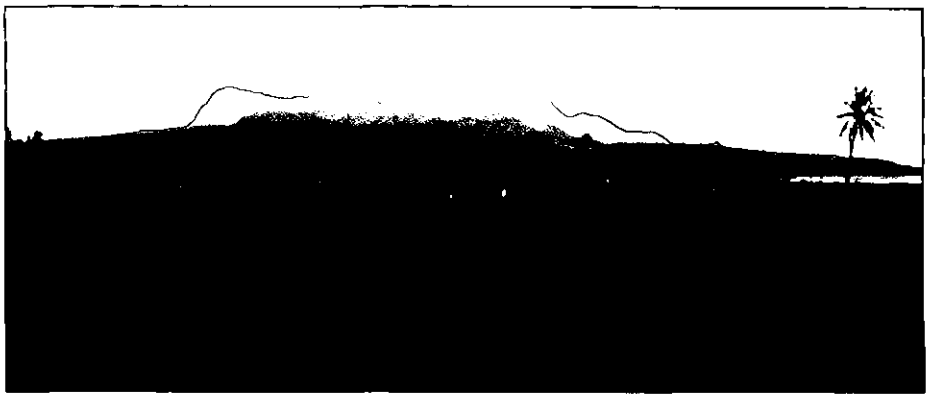

Figure 3: coastal bypass road around Manatuto, looking west to where the river Laclo meets the ocean.

Authority to plan

In June 1999, the leading elements of UNAMET were deployed to Dili, East Timor, as the main body assembled at the RAAF Base Darwin for documentation, induction and training. At this time, I was invited to join the United Nations Civilian Police Training Team who were tasked to induct and brief all civilian police being deployed into the mission area.

The UNCIVPOL training program involved briefings on the Mandate role and function of UNCIVPOL, the geography and climate of East Timor, the current political/social environment, personal health/physical security, fieldcraft and 4 wheel driving assessments. This was a very hectic period and the close support and assistance of the Australian Defence Force at this time was invaluable.

The build up, training and deployment of 261 civilian police (shortfall on 280) from 16 contributing countries was staged over 30 days to facilitate the controlled establishment and spread of UNCIVPOL throughout East Timor where local resources and facilities were limited or non-existent. On more than one occasion, I have had to explain to newly arrived civilian police that they were not going to Bali and not to expect hotels with air conditioning or western style restaurants. I suggested that they were going to 'Jenny Craig' Island where they may have to live in very basic conditions and forage for local food.

The UNCIVPOL Commissioner, Alan MILLS (formerly of the Australian Federal Police), decided that a UNCIVPOL member would be posted to each of the 200 registration/polling sites with two UN Electoral staff. A locally recruited driver and interpreter were added to this composite team which was then based within 1 hours drive of any given UN District HQ in each of the 12 regencies of East Timor.

Upon completion of this training role, I deployed to the mission area with my training partner Rick HARTEN of the Royal Canadian Mounted Police (the lone Mountie who had served with the UN in the snow of Bosnia but had never been to the tropics). We declined a job in HQ and opted to be posted out to the 'bush' in the district village of Manatuto on the northern coast of East Timor where the local governor was apparently being difficult and uncooperative with the United Nations.

Upon arrival in the village of Manatuto, I took up the role of operations officer within the 12 member (6 nation) UNCIVPOL team. I assisted the Team Commander in planning daily patrol activities (confidence building measures), examining security arrangements and compiling the daily situation reports to UNHQ. I took an active part in planning local operations and enhancing local security arrangements by building useful informal networks within the local community and with the Indonesian police.

Establish planning committee

All 12 members of the Manatuto UNCIVPOL were consulted in the preparation and planning of local operations and security arrangements. Regular meetings and discussions were held with community groups/leaders, local government officials, Indonesian police and military commanders to establish and maintain liaison points. These meetings validated future planning to achieve the goal of Mandate 1246.

Establish the context

The UNAMET Mandate required free and unimpeded movement within East Timor to facilitate the popular consultation as set out in the United Nations Security Council Resolution 1246, in order to ensure that the popular consultation was carried out in a fair and peaceful way and in an atmosphere free of intimidation, violence or interference.

Phase 2—profile the community

- about 30,000 East Timorese people in the District of Manatuto
- four United Nations Military Liaison Officers
- twelve United Nations Civilian Police Officers

Identify vulnerable elements and sources of risks

Reliable external agencies and United Nations security specialists in the Mission Area of East Timor provided accurate Emergency Risk Modelling based on intuitive understandings of behaviour and the changing built, physical and environmental elements. Risk evaluation criteria were developed with particular reference to legal obligations, political issues and geographical deployments (communications and transport barriers).

All Manatuto UNCIVPOL were vulnerable to the following priorities risks:

1. **Motor vehicle accidents** – patrolling on third grade rural road systems

Figure 4: typical highland village of Fatamacuerec, located about 30km south of Manatuto. Houses in the village are a combination of traditional and modern construction.

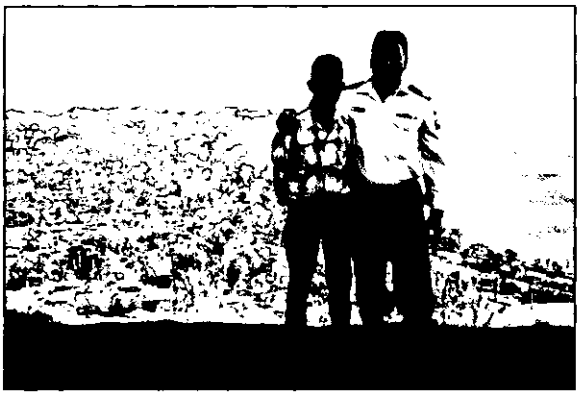

Figure 5: Sgt Alf Turketo and interpreter Joe Reiss on the hilltop shrine of St Antonio, overlooking the village of Manatuto.

particularly in the highlands, that are subject to degradation by monsoon weather (undercutting or slippage) and overuse from increased local traffic flow with the lifting of military restrictions on movement, combined with the influx of over 200 United Nations vehicles.

2. **Health risks** – insect borne diseases (malaria is endemic to the region), contamination of food and water, skin infections and environmental injury (such as heat exhaustion or heat stroke) combined with the absence of comprehensive medical support in the mission area.

3. **Civil unrest** – threats and acts of politically motivated violence intended to impede the UNAMET Mandate under Resolution 1246 or the disruption of the legitimate registration and polling process for the popular consultation.

Identify prevention, preparedness, response and recovery

Evaluate and select options, plan and implement treatments.

Pre-deployment training and briefings for UNICIVPOL were structured with the aim of minimising the exposure of this UN community to identified risk. This was achieved by involving UNCIVPOL members in all steps of a systematic process, that included Prevention, Preparedness, Response and Recovery options as follows:

1. **The risk of death or serious injury from motor vehicle accidents** was treated by requiring all UNCIVPOL members to pass a 4WD-competency assessment before being issued with a United Nations driving permit. In addition to the provision of a detailed country briefing and good quality patrol maps, there was a graduated deployment into the mission area (to develop local knowledge). Finally, local East Timorese were hired as drivers/guides and interpreters to further reduce this risk.

2. **The risk of death or serious injury from health risks** was treated by providing all UNCIVPOL members with a detailed health briefing and an introduction to fieldcraft. Members were provided with personal first aid kits, antimalaria medication, insect repellent, water purification tablets, dry rations, bedrolls, camp beds, mosquito nets and eating utensils. They were told to prepare for hardship.

3. **The risk of death or serious injury from civil unrest** was treated by providing all UNCIVPOL members with a detailed political briefing and ongoing updates as the mission gathered momentum. Each district in East Timor conducted a daily review that was forwarded to the UNHQ for immediate follow up by liaison officers if required. The Head of the UNAMET Mission, being the Special Representative of the Secretary General (SRSG) was required to provide progress reports to the Security Council every 14 days. A '5-Stage' Security Plan was developed and implemented with stage-1 being unrestricted daily operations and stage-5 being the evacuation of the mission.

Phase 3–decision

The local operations and security plan for Manatuto CIVPOL was subject to constant review and revision as UNAMET progressed towards the popular consultation with voter registration and education being completed, notwithstanding threats and isolated acts of intimidation from the local militia and rogue elements within the Indonesian security forces. Civil unrest became the first priority risk, the health risk was a close second (with over 70 cases of malaria) and motor vehicle accidents a distant third risk as the need for routine daily travel diminished. It should be pointed out that a substantial number of the Indonesian security forces and police personnel were locally recruited East Timorese who may have felt that their safety would be in jeopardy should the popular consultation reject the autonomy package being offered within the Republic of Indonesia.

Despite an extremely tight timetable, a high level of tension, East Timor's mountainous terrain, poor roads and difficult communications, UAMET registered 451,792 potential voters among a population of over 800,000 in East Timor and abroad.

On the voting day, 30 August 1999, some 98% of registered voters went to the polls to stand and queue in the blazing sun to cast their vote. I cannot accurately describe the looks of pure joy and elation on so many faces, both young and old, as the local East Timorese lodged their votes in the ballot boxes at the polling station where I stood guard on behalf of the United Nations.

At the end of the voting day, the ballot boxes were sealed and secured until they could be airlifted back to UNHQ for counting under international observation. With the completion of the ballot all UN Volunteers/electoral staff were withdrawn from Manatuto District and other districts, with the majority being withdraw from East Timor within 48 hours. All UNCIVPOL personnel concentrated in their District HQ's with restrictions on movement (Security status grade-3 'no move').

On the morning of Saturday 4 September 1999, the local Indonesian radio broadcast the results of the popular consultation ad announced that by the margin of 94,388 (21.5%) to 344,580 (78.5%) the people of East Timor had rejected the proposed autonomy.

Following the announcement of the result, pro-integration militias, at times with the support of elements of the Indonesian security forces, launched a

systematic campaign of violence, looting and wanton destruction throughout the entire territory. The Indonesian authorities did not respond effectively to the violence, despite clear security commitments made under Resolution 1246. Many East Timorese were killed and as many as 500,000 were displaced from their homes, about half leaving the territory, in some cases by force. The local family with whom my 'Mountie' partner and I boarded in Manatuto was removed and their house destroyed along with 85-90% of the village and local infrastructure.

After a very tense and hectic 72-hour period, all UNCIVPOL trapped on the eastern end of the territory were evacuated from Baucau by an RAAF C-130 transport and returned to the safety of Darwin. Unfortunately, I left many trusting East Timorese friends behind to an unknown fate. After debriefing, I realise that our risk management planning could not reasonably predict the extent and magnitude of the systematic violence that overtook UNAMET in the backlash to the rejection of Indonesia. I also understand that some East Timorese quietly accept the sacrifice of this generation to achieve independence.

In conclusion, I cannot condemn all of the Indonesian security forces for inaction. I did meet and work with Indonesian policemen of honour who endeavoured to discharge their duties during the popular consultation in a fair and impartial manner. However, they too were overwhelmed by the wave of violence that swept across the territory.

The views expressed by the writer are his and do not reflect the views of his organisation.

Conference Announcement

Global Disaster Information Network (GDIN) – 'Scoring Goals'

Canberra, Australia, March 21–23, 2001

EMA
Emergency Management Australia

Emergency Management Australia (EMA) is hosting the fourth annual conference of the Global Disaster Information Network—GDIN2001.

GDIN

Conference

Receiving the right information, in the right format, in time to make the right decision is of paramount importance for disaster managers. The focus of GDIN2001 therefore is to advance the understanding and collaboration between disaster managers and providers of information. It will bring together representatives from all areas of disaster information management, including:

- Government officials—National, Provincial, Local
- United Nations and regional organisations
- academics and researchers
- disaster managers
- non-Government and community organisations
- information managers
- industry—information technology, remote sensing, geographic information systems, software, hardware and equipment suppliers
- consultants
- journalists

Approach

- working group discussions
- plenary and parallel presentations
- forums
- poster sessions
- technical displays

Conference aims

- share information about achievements in disaster information management—'the goals that have been scored'
- progress the development of GDIN
- build closer relationships among users and providers of disaster management information
- identify further projects that will have a global impact in saving lives and property and in protecting the environment

Cost

- full registration fee: $550
- daily registration fee: $275
- cocktail party: $30 *(guest only)*
- conference barbecue: $35 *(guest only)*

Registration

Registration and Sponsorship brochures are available through EMA. Electronic copies including electronic registration is available through the EMA website or the GDIN International site

Conference details
Emergency Management Australia
PO Box 1020
Dickson ACT 2602 Australia
Phone: 61 2 6266 5219
Fax: 61 2 6266 5029
Email: gdin@ema.gov.au

Conference administration enquires
Australian Convention and Travel Services
GPO Box 2200
Canberra ACT 2601 Australia
Phone: 61 2 6257 3299
Fax: 61 2 6257 3256
Email: gdin@ausconvservices.com.au

www.gdin-international.org/ www.ema.gov.au/gdin

New guidelines aim to support older people in emergencies

by Lesley-Anne Knight, Emergencies Manager, HelpAge International.

Humanitarian disasters, whether caused by floods, conflict or earthquakes, put older people in special danger. They cannot always move as fast or as far as younger people and often lose out in competition for food, water and shelter. But their needs and views are given low priority compared with other vulnerable groups, according to research by HelpAge International. Humanitarian organisations frequently lack the expertise and capacity to address their particular needs. The result is often discrimination and unnecessary hardship.

There is a common misconception that in developing countries, relatively few people live to beyond 60 years of age. This is no longer true. The number of older people in developing countries will more than double over the next quarter century, reaching 850 million by 2025–12 per cent of the population[1]. By 2020, seven of the ten nations with the largest populations of older people will be developing countries: China with 231 million, India 145 million, Brazil 30 million, Indonesia 29 million, Pakistan 18 million, Mexico 15 million and Bangladesh 14 million.

These figures indicate how important consideration of older people's needs will become—in emergencies as well as in development work. Today, in major emergencies children are usually highlighted as the key victims, and saving their lives is the main priority. But older people have a right to care and protection along with other vulnerable groups when disaster strikes, HelpAge International argues.

1999 was the last year of the International Decade for Natural Disaster Reduction, and it was also the UN International Year of Older People. During 1999, HelpAge International was commissioned by the European Community Humanitarian Office (ECHO) and UNHCR to conduct a study of older people in major emergencies. The result was the publication in April 2000 of a set of guidelines that aim to assist humanitarian agencies working with older people in disasters and humanitarian crises. They suggest practical ways to meet older people's needs and to recognise their potential in emergency situations.

Research on older people in emergencies

The research that formed the basis for the guidelines documented HelpAge International's existing knowledge and experience from its involvement in emergency responses and explored the links between humanitarian organisations and older people in emergencies. Most importantly, it recorded the experience of older people in emergency situations, using participatory methods including group work, workshops, semi-structured interviews, story telling, case studies and ranking exercises. The researchers sought to cross-check points with key actors in civil society (officials, community and religious leaders, and other age groups including young people) and both international and local relief and development agencies.

The research examined relief work during crises and also during the subsequent phases of rehabilitation and recovery, with three main components:

- a review of HelpAge International's experience, using an internal workshop and literature review to formalise its institutional knowledge gathered over 15 years of working with and for older people in development projects and emergencies. The documentation covered 21 different emergency settings (initial assessments, rapid appraisal, project proposals, internal and external evaluations).
- four field studies of different types of emergencies covering both natural disasters and humanitarian crises as a result of conflict:
  - slow onset natural disasters (repeated flooding in Bangladesh)
  - sudden onset natural disasters (the 1998 Hurricane George in the Dominican Republic)
  - protracted conflict (in Bosnia during and after the war of 1992-6)
  - sudden onset political emergencies (the 1994 genocide in Rwanda)
- a questionnaire survey of humanitarian agencies to assess the level of understanding and experience within the

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Figure1: Blagoje Cirkovic, 83, rests on firewood provided by HelpAge International. He and his wife Roksanda, 86, (in background) are Serbians living in Gracanica, Kosovo.

Notes

1. For further details of population ageing see *The Ageing and Development Report: Poverty, Independence and the World's Older People*, HelpAge International and Earthscan, London, 1999. A summary of this report is available from HelpAge International.

© Lesley-Anne Knight/HelpAge International

Figure 2: Orissa, India, 1999.

humanitarian community of the situation and needs of older people. The replies (60 out of 180 circulated) were analyzed in a workshop.

Structural issues: poverty and invisibility

This research built up a fairly clear and consistent picture of the effects of emergencies on older people. Though not seen as definitive, the research and the guidelines based upon it are seen as contributions to an ongoing debate.

HelpAge International concludes that 'invisibility, exclusion and powerlessness are common themes emerging from older people's experiences of crises. It argues that this invisibility is part of a broader pattern of poverty and powerlessness. In a crisis, the chronic problems of poverty, exclusion and poor health become acute.

Among the key structural problems facing older people is poverty. Older people as a group are among the poorest in most societies. Their economic vulnerability makes coping with crises more difficult and recovery slower. Industrialisation, rural-urban migration and high labour mobility in many regions makes for unstable economic conditions, while better health care and longer lives mean the ratio of older people to those in middle age is increasing. The prospect is for an increasingly fragile economic and social situation for most older people worldwide.

Older women, the research suggests, experience emergencies differently to men. They tend to live longer than men, so usually form the majority of older survivors. The UN High Commission for Refugees estimates that on average 10 per cent of refugees in humanitarian crises are over 60 years old. In some cases, the proportion can rise as high as 30 per cent. The majority of these older refugees are women.

Older women as a group tend to be more vulnerable than men. A cyclone, a war or a flood is likely to undermine the networks that help them to survive, in addition to loss of homes or displacement. They depend on the informal economic sector for their livelihoods and rarely have any retirement benefits. Widows in particular may have to depend on relatives and neighbours to survive. Older women, and widows particularly, are excluded in many societies not just from wealth and resources but also from decision making.

An additional obstacle to addressing older people's needs in emergencies is their invisibility. The general public, governments and aid agencies in both the developed and developing world tend to ignore older people and rarely regard them as active members of society. They are at best seen as a burden or as passive recipients of care. They are rarely asked what their needs are.

The study of two natural disasters in Bangladesh, chosen as an example of prolonged or repeated natural disasters, illustrates these issues. In Bangladesh, large areas of land are close to sea level and prone to recurrent flooding of disaster proportions. Many coastal areas along the Bay of Bengal are affected by cyclones.

Older people from areas affected by flooding were interviewed in Munshiganj, in the flood plain of the Padma (or Ganges).They gave first hand accounts of floods that lasted for three months in 1998 and commented on their experience of earlier major floods. Older people on Moheshkhali Island were interviewed about the effects of the severe cyclone that struck in 1998 and gave accounts of earlier cyclones over the previous 50 years.

Referring to the Munshiganj floods, an aid worker with a local NGO noted: 'When we examined the mortality figures for four unions during last year's flood we found that out of 140 flood-related deaths, 77 were older people—over 50% of the total'.

After the floods, older people were often left behind, either to guard property or because they were not seen as a priority for communal shelter. In the cyclone shelters, older people could not compete with young people for refuge and there was insufficient room for all.

Loss of income, livelihood and ongoing poverty were the most difficult problems they faced. Their low social status and the absence of state benefits meant that older people were the last to receive help. The breakdown of family networks was a particular problem. Some felt that their abandonment was not intentional, but the result of the poverty of their sons, whose priority was their own families.

Many lost husbands, wives or family members and the trauma made it very difficult to find the motivation to rebuild their homes. Older widows found themselves dispossessed and forced to beg to survive. In a situation of food shortages, older people found it hard to compete for food and were often the last members of the family to be fed.

Aid agencies and older people in emergencies

The stated aim of most humanitarian organisations in emergencies is to provide emergency relief to whole communities, if possible targeting the most vulnerable. Most aid agencies recognise older people as a vulnerable group in emergencies but rarely assign them the priority given, for example, to children. Humanitarian organisations frequently lack the particular expertise and capacity to address older people's needs. This can result in discrimination and unnecessary hardship.

Immediate survival in an emergency often depends on rapid access to relief. Longer-term rehabilitation depends on the recovery of coping and support mechanisms. Many older people reported that they had problems in accessing relief aid and were often excluded from support

with economic and social recovery. Even when agencies carry out participatory assessments of need at community level to determine relief priorities, older people's vulnerability and their potential contribution to relief delivery and rehabilitation tend to be ignored.

A notable difference emerged between the perceptions of older people, as reflected in HelpAge International's experience, and those of respondents from aid agencies dealing with emergencies. In the ranking exercise shown in *Table 1* older people assessed their most important problem in emergencies as lack of income, followed by poor access to health services. Aid agencies thought food and nutrition and isolation were the most important with income not included in the top six problems they identified. This seems to reflect older people's concern with re-establishing their coping mechanisms compared with the relief agencies' more welfare oriented approach.

Problems identified by older people	Main activities of NGOs	NGO perception of older people's problems
Income	Health	Food and nutrition
Access to health services	Food and nutrition	Isolation / separation from family
Shelter	Water and sanitation	Access to health services
Access to age-sensitive health services	Basic need / non-food items	Age-related health services
Food and nutrition	Shelter	Psychosocial needs
Isolation / separation from family	Skills training	Destruction of social structures

Table 1: The six most common problems in emergencies identified by older people, compared with the six most common activities of the NGOs surveyed and the six most common problems that NGO staff thought older people would face in an emergency (HelpAge International 2000).

The guidelines

Invisibility, exclusion and powerlessness are common themes emerging from the experience of older people as expressed in the research. They consistently asked to be seen, heard and understood, to have equal access to essential support services and to have their potential and contributions recognised, valued and supported. The guidelines therefore promote consultation, inclusion and empowerment as the primary indicators for good practice.

Experience in the field indicates that these principles require changes in the way essential services are delivered and the way older people are viewed. This does not mean that special services should be established for older people. The emphasis is on integrating older people into mainstream services and ensuring equity of service provision across all sections of the community.

Older people identified the following as key issues and needs in an emergency:

- *basic needs:* shelter, fuel, clothing, bedding, household items
- *mobility:* incapacity, population movement and transport, disability
- *health:* access to services, appropriate food, water, sanitation, psychosocial needs
- *family and social:* separation, dependants, security, changes in social structures, loss of status
- *economic and legal:* income, land, information, documentation, skills training.

These are issues that any service provider must take into account when dealing with emergencies, if they are to challenge the discrimination currently experienced by older people. The guidelines can be adapted to meet needs in specific situations but the principles of consultation, inclusion and empowerment are intended to be evident in each case.

Basic needs and mobility

Older people identified several basic needs from their experience of emergencies. Where homes have been destroyed, they need building materials and labour to help rebuild shelters. In order to cook food, they need help collecting fuel and ways to share cooking arrrangements with neighbours or other individuals. Clothing, blankets, pots, pans and other kitchen and household equipment were among the basic items required, as well as a mattress or a raised sleeping area to avoid acute joint and muscle pain caused by sleeping on the ground. Solutions as simple as straw or grass inside flour sacks can dramatically increase an older person's capacity for self-care and survival.

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Figure 3: In an emergency, older people often find themselves with increased responsibilities for supporting their families, mobilising resources and caring for children, orphans and dependants. At the age of 58, Adera Karwirungu looked after 10 orphans in Rwanda in the aftermath of the conflict.

When planning their work, agencies need to be aware that many older people are not automatically given shelter by their adult children and must find shelter for themselves. Grouping older people together with people who they do not know (for example, to make up the numbers required to qualify for shelter or for allocation of supplies such as utensils, plastic sheeting and blankets) can lead to problems of exclusion and abuse as the larger group rejects or resents the presence of the older person. Communal shelters that do not offer some measure of gender separation may exclude women or other groups from using them. In some cases, such as cyclone shelters, this may represent a direct threat to personal survival.

Older people may have more difficulty in finding fuel and water than younger members of a community. This can affect their capacity to feed themselves, in turn

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Figure 4: Recent flooding in Mozambique and Zimbabwe left many older people without shelter.

reducing their capacity to collect fuel and water. Woodpiles and other fuel stocks can be provided for use only by vulnerable members of a community. Alternatively older people may be linked to supportive families where younger members help to collect fuel or water for the older person or the older person adds their ration to the family 'pot' and shares the cooked meal.

The research identified four main problems with mobility in emergencies:

- when housebound older people are left behind or are unable to gain access to essential services
- older people are sometimes unable to climb into trucks, or are slower than others and get left behind
- where there are no regular transport facilities, older people may not be able to reach essential services
- some older people are disabled by the loss of mobility aids, prostheses and spectacles in the emergency.

To address these difficulties, outreach elements can be built into service assessment, delivery and monitoring. In the Rwandan refugee camps in Tanzania, HelpAge International supported able older people to set up a home visiting system that aimed to identify housebound people, abandoned elders and those who lacked information about what help was available. Able elders and other community members made stretchers from locally available materials to transport those who could not walk to clinics.

'Fast track' queueing systems allow access for the most frail and vulnerable at service delivery points, especially where physical competition for relief supplies is high. Where trucks are used for transport, account needs to be taken of whether people with restricted mobility can climb into high-sided vehicles.

Healthcare and nutrition

Where the problems of isolation, lack of mobility and physical strength or trauma make it difficult for older people to access essential services, it is necessary to adapt these services to preserve equity of provision. Older people may find difficulties with access to health services because of mobility problems, the distance to centralised services, or the absence of community health systems and the loss of regular health facilities because of the emergency. Where older people are able to reach centralised relief and service delivery points, they may need protection or other support to access the service if they find themselves competing with people who are more able bodied. Establishing outreach services or prioritising the most vulnerable at clinics can address these difficulties. In emergencies there is often a lack of medication for chronic disorders, especially disorders that will become acute without regular treatment.

Simple age-related clinics to deal with issues such as joint pain and other ailments associated with ageing are especially relevant where displaced people are sleeping in the open or on hard, cold or damp surfaces. They also need to ensure that drugs are available to treat chronic disorders. These clinics may help to reduce pressure on limited resources by treating groups of older people together, and can limit 'revolving door' patterns of repeated patient visits to regular clinics.

Older people often encounter reluctance on the part of service providers to include them in supplementary feeding programs. Where they receive food, the food is frequently unsuitable for digestive systems and teeth compromised by the ageing process. Older people are also vulnerable to rapid debilitation caused by diarrhoea in the same way that children are, but their nutritional status is rarely monitored[1].

Psychosocial support

In the research surveys, older people identified the social and psychological traumas that accompany separation from, or loss of, family members, bereavement and loss of support. Older people are often left to care for younger children or other dependants in the absence of middle-generation adults. The destruction of social structures may cause loss of family and community support and loss of respect for older people as cultural and social values break down. In extreme cases this results in abandonment. Older people find they need protecton against theft, disposession, physical and sexual abuse.

Support can include extending family tracing services to isolated older people or, when no family members can be found, to develop 'foster' family links with supportive neighbours and families willing and able to support older people.

Those older people who have long term responsibility for children can be helped by providing support with school fees, materials or uniforms—preferably channelled through the carers—and linking older carers with other carers for mutual support and information.

The risk of sexual abuse can be reduced by creating awareness of the separate needs of older women and men and not mixing older women and men together to make up numbers for shelters without the informed permission of the older women, as experience has shown that this creates a high risk of abuse for the women.

The crisis in Kosovo is an example of how community breakdown can lead to violent and abusive behaviour towards all vulnerable groups, including older people. In late 1999, the Organisation for Security and Cooperation in Europe reported 'a deplorable pattern of violence and harassment' against older people. This occurred both during the Serb

Notes

1. For a discussion of nutritional monitoring of older people, see Suraya Ismail and Mary Manandhar, *Better Nutrition for Older People: Assessment and Action*, HelpAge International and the London School of Hygiene and Tropical Medicine, 1999.

onslaught on the Albanian majority and, after the refugees returned, against older Serbs remaining in Kosovo. These vulnerable older Serbs face recrimination attacks and harassment on the streets, at World Food Program distribution points and at medical centres. HelpAge International has set up a home visiting program, in coordination with other agencies, in Pristina to ensure that vulnerable older people from ethnic minorities receive warm clothing, meals and medical attention in their homes.

Rehabilitation

In the aftermath of humanitarian crises and natural disasters older people, as much as younger adults, need to rebuild their lives. But they suffer from a variety of economic disadvantages: inflation, loss of employment, lack of pensions, loss of markets and lack of access to credit schemes. Restoring income and the means of livelihood therefore play a critical role in the recovery and self-support of older people and their contribution to their families or other support networks, especially where there is no other form of income support. They need training in literacy, numeracy and new language skills in changed circumstances, as well as new practical and income-generating skills.

Rehabilitation programs often fail to take account of these needs, excluding older people from income generating projects and credit schemes. Yet the provision of tools, seeds and other material inputs and support for other forms of income generation is a means of supporting a whole family and the wider community, as well as older people themselves. Experience has shown that older people are among the most consistent and reliable in the management of savings and return of loans. Older people have also successfully undertaken literacy classes in refugee and resettlement programs.

Occupational activities can stimulate social contact, physical activity and a sense of self-worth, especially in refugee camps where opportunities for income generation are very limited or made redundant by the level of relief provision.

In Rwanda, aid agencies emphasised the importance of encouraging self-help rather than dependency, but older people themselves felt that the assistance given, while it was appreciated, was too short term, while their problems were long term ones. An older woman commented: 'Why don't the agencies support our projects? This would be much better than us waiting for them to bring things to us. We want to keep our projects growing—we can look after ourselves.'

Consultation and participation

The guidelines emphasise that older people should be consulted and involved in decision-making, both in making the initial assessments of need and in deciding how to allocate assistance. They recommend an 'outreach' approach to assessments—using staff, volunteers and other older people to locate vulnerable elders. In an emergency, older people often find themselves with increased responsibilities for supporting their families, mobilising resources and caring for children, orphans and other dependants. The guidelines argue that building on their contributions offers potential gains for both older people and service providers. Previous experiences of disaster or conflict, coping strategies, traditional skills and local environmental knowledge are important in mitigating the impact of emergencies.

This strategy is not confined to emergency responses. In protracted conflict situations such as that of southern Sudan, older people can become involved in managing their own lives. The HelpAge International Juba Emergency Programme, initiated in 1998, improved the quality of life and self reliance of older people by actively involving them in deciding priorities for aid. Juba's population of 160,000, including some 8,500 older people, has been heavily dependent on aid for the last 15 years. But the needs of older people were not specifically catered for.

Local committees of older people identified vulnerable elders by a set of criteria—including age, sources of income, living family members, health status—which they themselves had agreed.

The committees ensured that aid was delivered and monitored. They also organised practical activities, such as house building, sanitation and agricultural work. Members of the committees represented the needs of older people to NGOs, UN agencies and government officials. Training was a key part of the program, to increase older people's abilities to assess needs and to improve the awareness of older people's views and needs among NGO, government and UN staff.

Vulnerability checklists

HelpAge International has developed checklists to assess the needs of older people in emergencies. The first was developed for the HelpAge International refugee program in Tanzania. The checklist was designed for use in the large refugee camps found on the Tanzania/Rwanda border at that time. These key themes are common to most checklists:

- family circumstances
- social supports
- health
- mobility
- basic needs

Variations can be made according to the particular circumstances of any given emergency. Identifying the source or adequacy of income, for example, is an element not seen in this checklist but which would be important in most other settings.

What was evident from using the checklist was that a person could have problems in the areas of health, mobility and basic needs and still not be counted as vulnerable if they were well supported (social support). On the other hand a person might have fewer problems lower down the checklist but potentially be very vulnerable if they were isolated and unsupported. This checklist does not offer hard and fast answers to identifying vulnerability, but is a tool for highlighting the indicators of vulnerability.

During the Orissa cyclone relief program with HelpAge India, HelpAge International distributed questionnaires with a request to other aid agencies (international and local) to provide feedback on the situation of older people in the areas of cyclone relief. The importance of these forms and the information they provided was twofold:

- to raise awareness among agencies of older people's needs and whether older people's needs were even being considered
- to help ensure more accurate needs assessments for the provision of adequate relief assistance.

These forms are also being used in Kosovo and Mozambique and have enabled HelpAge International to identify and service the special needs of older people. They form the basis of referrals from other aid agencies to HelpAge International requesting assistance in developing aid programs to include older people.

Recent disaster responses—Orissa and Mozambique

In the period following the devastating November 1999 cyclone in Orissa, HelpAge International has been working to integrate its key principles for older people into the emergency response of local organisations with which HelpAge India works.

This cyclone was an example of a recurring type of natural disaster of which many older people have had experience. But one older villager commented that whereas in the past younger people in the village used to pay attention to older people's advice on what to do, they were less willing to do so now. This observation had also been made in the Bangladesh research.

In rural areas affected by the cyclone, there was a general lack of food and loss of utensils needed to cook rice and *dal*. Poor mobility limited many older people's access to food and water distribution points. In cyclone or hurricane disasters older people, like children, are severely affected by gastro-enteritis, diarrhoea and dehydration, as well as chronic respiratory problems aggravated by hours immersed in water and wearing damp clothes. Local NGOs, working with HelpAge India, are using mobile clinics to give frail older people easier access to health services and psychosocial support.

If older people are included in reconstruction they can play a key role in economic and social recovery after a disaster. In Orissa, HelpAge International plans to continue food provision, especially where older people are excluded from food for work programs.

Those who can, are rebuilding their homes, but community-based initiatives are needed for those older people who cannot do the work themselves and do not have family to help them. HelpAge India and local partners plan to implement small-scale income generation projects that will help to provide a self-sustaining livelihood for older villagers.

Severe floods in early 2000 devasted wide areas of southern Africa and especially Mozambique, affecting all population groups but in particular the vulnerable young, the frail and the elderly. The young and the old were most frequently separated from abler adults or abandoned in the immediate rush for survival. Some older people still do not know where their family members are.

The majority of older people found themselves in camps where their specific needs were not immediately recognised or taken into consideration. They were the last group to reach the established camps and were the last to know about the recession of waters and resettlement information.

Like many others older people spent many days in flood waters as they waited for rescue services, and those on safe land had no roof over their heads. The health of older people—without bedding, warm clothes or adequate food—deteriorates rapidly. Drinking dirty water, when there was no alternative source, aggravated what were already poor health conditions of the young and elderly. They were also more prone to skin diseases, malaria, diarrhoea, high blood pressure, and intestinal infections, in a situation where there were inadequate medical facilities. Some older people also reported that the food provided aggravated diarrhoea.

HelpAge International and HelpAge Mozambique are working in Gaza and Maputo provinces with local organisations for older people, to implement a relief and rehabilitation project. The initial goal is to relieve suffering and minimise the distress and psycho-social trauma of older people, their carers and wider family members and dependants.

The community-based nature of HelpAge Mozambique's local partner organisations, APOSEMO and VUKOXA which both work directly with older people, means that staff and facilities are already in place to purchase and distribute materials. From the onset of the disaster, field workers and volunteers began identifying the affected older people in both Maputo and Chokwe. Small contributions in cash and in kind were made towards the immediate needs of the most vulnerable infirm older people within their families and community.

In the medium- to long-term, HelpAge International and its partners seek to re-establish the coping mechanisms and self-reliance of older people. Older people in Mozambique must continue to work as it is their only means of livelihood. Few receive any kind of pension. They will need safe and fertile agricultural land to relocate and construct new homesteads.

Martha Mbiza is not sure of her age, but looks over 75 years old. She lives with her widowed daughter in law, Madelena, 56, and four children. The floods swept away their house and possessions, including Madelena's two goats. Madelena says she still has the strength for agricultural activities, helped by her mother in law and daughters, and will buy and sell items to boost her income. Martha says, 'the dead are in rest, but we continue to live to witness the worst torture of humankind.'

References

HelpAge International, *Older People in disasters and humanitarian crises: Guidelines for best practice*, London 2000, p. 18. Available free in English, French, Portuguese and Spanish from HelpAge International. The full document is available in English at www.helpage.org.

Further information

HelpAge International is a global network of not-for-profit organisations with a mission to work with and for disadvantaged older people world wide to achieve a lasting improvement in the quality of their lives. To deliver this vision, HelpAge International works through local partners providing fund and support to over 200 organisations in 70 countries. It has 63 member organisations. www.helpage.org

Lines that divide, ties that bind:
race, class, and gender in women's flood recovery in the US and UK[1]

by Elaine Enarson, Evergreen, Colorado USA and Maureen Fordham, Anglia Polytechnic University Geography Department, Cambridge, UK

Introduction

'I want you to listen to these women. I want you to hear their stories and how they struggled.' The speaker urged researchers and policy-makers to attend to the neglected experiences of Latinas like herself, a former migrant worker, in a major US flood. Why are these stories and struggles so important? Why are they so little heard?

This paper examines diversity in flood impact and recovery in major floods in the US (Red River Valley, Upper Midwest 1997) and UK (East and West Scotland 1993 and 1994), bringing a comparative perspective to two primary questions: First, how did the social relations of race/ethnicity, social class and gender increase the *structural vulnerability of women in* communities subject to flooding? Secondly, how did these patterns affect women's subsequent recovery from major flooding?[2]

Our investigations were intended both to offer a more nuanced perspective on 'diversity' in the development of disaster theory and research, and to influence organisational practices and cultures in emergency management. In the communities we studied, as in others (Wiest 1998; Finlay 1998, Fothergill 1999a), power structures based on race, gender and class exposed some residents more than others to the effects of disastrous flooding and complicated their emotional and material recovery. There was little evidence, however, that local emergency planners in these two settings had at hand an analysis either of women's structural vulnerability or of organisational barriers to recovery, to help guide the effective use and distribution of scarce resources. As our research is intended to help address this planning gap, we conclude with specific action recommendations for change.

Diversity in disaster sociology: feminist and social vulnerability theory

Notwithstanding the popular notion of disasters as social levellers impacting residents indiscriminately and the focus in dominant disaster theory on ostensibly universal patterns, the social impacts of extreme events are socially constructed within particular sociological contexts and experienced, at least in part, through gendered, racialised, and classed parameters. Deeply embedded patterns of gender, racial/ethnic, and class stratification and segregation shape the relative vulnerability of residents to extreme events like floods, their capacity to recover from flood effects, and their *power to engage in community reconstruction* (Blaikie et. al. 1994; Peacock, Morrow and Gladwin 1997; Enarson and Morrow 1998).

Specific social decisions, for example regarding urban development, zoning, social insurance, or construction codes, interact with physical hazards to shape the *relative vulnerability of residents to* extreme events. Community and household power structures place residents at risk, for example through racial bias in insurance payments or racial segregation fostered by real estate and lending institutions (e.g. 'redlining' neighborhoods), economic barriers to safe housing, poverty rates among the elderly, race- and gender-based job segregation and wage differentials, and exposure to personal violence (see Peacock, Morrow and Gladwin 1997; Enarson 1999; Childers 1999; Fordham and Ketteridge 1998; Fordham 1999; Enarson 1999a). Quite apart from the water, wind, or fire, social forces produce unsustainable environments and inegalitarian social relations setting the ground for 'disaster by design' (Mileti 1999) when natural hazards threaten human communities in the future.

Studying disasters 'through the eyes of women,' for example, clearly illustrates the inadequacy of theory which either universalises or compartmentalises or both (Enarson and Morrow 1998; Fordham 1998). Notwithstanding the self-evident diversity of the world's women, there are common patterns in the material conditions of women's everyday lives, including domestic and reproductive labor, caregiving and family support, and vulnerability to sexual and domestic violence. These commonalities afford women a unique angle of vision when natural and technological disasters impact human communities.

To study the social relations of gender in disaster is necessarily to study intersecting patterns of race/ethnicity, class, age, sexuality and other power relations in culture and society. There is a clear need to move beyond analysis limited to demographic variables or focusing on victimisation, i.e. examining race only as minority status, gender only in women's lives, and class only in the lives of the poor. We draw on feminist standpoint theory (Hartsock 1998; Smith 1987) and other writing by women of color (Hill Collins 1990; Narayan 1989) to analyse these intersecting patterns in women's flood experiences. In doing so, we reject the misconception (embedded as much in *popular culture as government research*) of a dichotomy between 'women' and 'minorities', including the false implication that 'all the women are white and all the blacks are men', to paraphrase the title of a popular women's studies text (Hull, Scott and Smith 1982).

Feminist standpoint theory, as developed by Nancy Hartsock (1983), Dorothy Smith (1987), Patricia Hill Collins (1990) and others, does not suggest a single, unitary female stance or exclusive truth claims, as the experiences of women across racial, ethnic, economic, sexual and cultural divides are manifestly diverse. But the knowledge earned by women, forged by oppression into a social group at once highly vulnerable to disaster and marginalised in emergency management, cannot be captured without attention to

Notes

1. We gratefully borrow our title from Johnnetta Cole's edited text *All American Women: Lines That Divide, Ties That Bind* (The Free Press, 1986).

2. In a forthcoming paper, we develop a comparative perspective on race, class, and gender in women's flood experiences in the US/UK and in developing societies.

gender relations in disaster theory and practice.

That we have not yet heard the voices of women disaster subjects, understood calamitous events and processes through their everyday experience, documented their disaster decisions and survival strategies, or addressed their interests and needs in disaster practice and policy reflects, not their irrelevance, but our failure to ask the right questions (Enarson 1998; Bolin, Jackson, and Crist 1998). Because the social location of the observer shapes knowledge claims (Stanley and Wise 1993), including the knowledge we have about disasters, the absence of these specifically female experiences in the sociology of disaster is a real loss.

Both vulnerability theory and feminist theory insist on a 'bottom up' or 'inside out' perspective on the social construction of disasters. As we argue in conclusion, disaster mitigation cannot remain the province of credentialed experts or community elites but must centrally engage the individuals, households, and communities most at risk (Maskrey 1989).

Overview

While stratification patterns impact all aspects of the disaster cycle, our focus in this paper is on emergency flood relief and long-term recovery. We also focus largely on women and issues women identify as significant in their relationships with male partners, fathers, sons, and brothers, and the male-dominated disaster planning and response organisations. We invite and anticipate the direct investigation of men's specifically gendered disaster experiences[3].

We begin by sketching a framework for women's structural flood vulnerability in the Grand Forks and Scottish study areas. Here, despite the geographical and cultural spread of our study locations, we identify common intersecting patterns based on race, class and gender which can, and should, be identified as an important part of social vulnerability analysis. Next, we use data from open-ended interviews and focus groups to suggest how the social relations of race/ethnicity, class and gender created significant organisational barriers to resources vitally needed by women and their families.

But these 'lines that divide' are more than simply the basis for increased disaster vulnerability. In the third section of the paper we argue that patterns of difference also make women especially important partners in community-based mitigation. We conclude with three major steps toward structural and cultural change in emergency management which, in our view, would help disaster planners and responders better identify and address diversity issues in emergency planning and response.

The flooded communities: event, method and sample

Two locations in Scotland form the basis for the UK research: the floods in Perth and Kinross in 1993 and in Strathclyde in 1994. A series of in-depth, qualitative interviews were carried out at various periods after the events (from 3 months to 4 years). The floods were region-wide events, which disrupted large parts of West (1993) and later East Scotland (1994). Most communities had experienced floods before but none remembered them to be of the same magnitude. Early emergency operations were compromised to some extent, in both events, because people were expecting the floods to follow the same path as before. When floods went beyond previous boundaries, or in unexpected directions, there were some delays in action. The damage was variable but many of the respondents had to be evacuated (or self-evacuated) from their homes and spent between a few days to nearly a year in temporary accommodation of various kinds[4].

In the twin river cities of East Grand Forks, Minnesota and Grand Forks, North Dakota, a series of severe winter blizzards set the stage for 'the flood of the century' in the Red River Valley. When local dikes were unexpectedly breached, emergency managers implemented the midnight mandatory evacuation of East Grand Forks (9000) and Grand Forks (50,000). Residents dispersed for periods of two to six weeks to relief centres, host families and extended kin around the nation as the isolated prairie cities assessed significant housing, industrial and agricultural damages and began vital repairs. In order to examine women's formal and informal disaster work, open-ended interviews were conducted at six, 12 and 18 months after the flood with 113 women in focus groups and personal interviews involving service providers, emergency responders, disaster outreach workers, single women, single mothers, rural women, crisis workers, women in service clubs, home health aides, senior women, family day care providers, housing specialists, professional and business women, neighborhood activists and others[5].

Structural vulnerability to flooding

How do taken-for-granted patterns of everyday life before major floods expose some, more than others, to chronic crisis and heighten their vulnerability to the social impacts of extreme events? It is beyond the scope of this paper to develop a complex analysis of local community power structures, nor do we want to suggest that this is necessary for effective emergency planning. But race/ethnicity, class and gender were, in the actual flood experiences of those we interviewed, inextricably interwoven into consciousness, living conditions and social relations impacting emergency preparedness, relief, recovery and mitigation. For the purposes of discussion, we take up race/ethnicity, class and gender sequentially in the following three sections, and focus more on the 'lines that divide' than the 'ties that bind' flood-impacted women. In the predominantly white Scottish communities studied, race/ethnicity issues did not emerge and were not directly focused on; thus, the first section below focuses more specifically on the Grand Forks study.

Racial/ethnic patterns along the rivers

As life is lived as a whole and social power constituted and experienced interactively,

Notes

3. Some recent work focuses on men and masculinity in disaster contexts but the literature is sparse. See Enarson and Scanlon [1999]; Alway,Belgrave, and Smith [1998]; and Roberts [1997].

4. In the earliest stages of research the respondents were predominantly white, working class women whose ages ranged from their late teens to some in their 70s and even 80s. They also ranged from single women in full time work, through married or separated women with young children and working part-time, to older women in full time employment or retired. Their jobs were mostly of relatively low status and low pay - cleaning, retail, clerical. In later research a number of middle class women were interviewed, again ranging in ages from their mid-twenties to beyond retirement. They were either married or widowed. Their occupations included those of human services (teacher, social worker) or small business owners. Additionally a number of interviews and informal meetings were carried out with professionals (emergency planners, social workers, police, etc.) connected with the events.

5. Respondents were predominantly Anglo (white, non-Hispanic), though a focus group was conducted with seven Latinas and four Native American women were interviewed. Eight women were over 70 but most were middle-aged, and either married or widowed. They were generally middle-class women employed in or retired from jobs in education, health, and human services (e.g. nurse, teacher, counselor, social worker). The group also included affluent women with secure careers as agency administrators, executives, or small-business owners, and marginally employed women in working-class occupations in the retail, clerical, and personal service sectors (e.g. teacher's aide, family day care, home health). The great majority reported moderate to severe damage to their homes and/or workplaces.

the race-specific aspects of living life as a woman cannot be isolated nor gender factored neatly from race. But the places in which disasters unfold have a racial history and structure important for planners to understand, as race in the US and elsewhere so powerfully limits people's access to key survival resources like economic security, safe housing and political voice[6].

The culture and society of this floodplain in the Upper Midwest were constructed first by indigenous cultures and then during white settlement by Northern Europeans interacting with native populations. More recently, demand for cheap agricultural labor in the rich fields of the floodplain drew Mexican and Mexican-American migrant workers to the region. Anglos continue to dominate both Native Americans and Hispanics politically, economically, culturally and demographically. On the North Dakota side of the Red River over 95% of Grand Forks residents are non-Hispanic white (Anglo). East Grand Forks, MN is also predominantly Anglo though Hispanic families reside there in larger numbers. Air Force Base personnel based just outside Grand Forks were visibly part of flood preparations and response[7] but these racially diverse military families were not so visibly part of the cultural community, nor was their flood work consistently acknowledged, for example in flood anniversary ceremonies.

Like Hispanic residents generally, the small minority group of Latinas residing in the Red River Valley are more likely than Anglos to live in poverty, to rent rather than own homes, to have limited formal education, and to work in low-waged occupations. Thirty-eight percent of Native American households in Grand Forks were headed by women, compared to 9% of Anglo and 22% of Hispanic households[8]. Among this group are many former migrant workers now settled in the region. As discussed below, deep-rooted social tensions between migrant and host residents clearly structured the interaction of Latinas with other victims and with relief workers, impeding their recovery in ways emergency planners cognisant of local racial power structures might have anticipated. We note below that Latina women were primary users of postdisaster relief systems and hence more exposed to racial bias than either Latino men or more affluent Anglo women.

A mechanism both of solidarity and division, race or ethnicity assume no single meaning in disaster contexts among either dominant or subordinate groups. As noted below, tribal membership was an important resource for Native American women seeking help for their families and cultural bonds among Spanish-speakers were strengthened by the flood and the shared experience of racial bias in the relief system. Ethnicity was also made meaningful in the dominant community through the celebration of Scandinavian culture, for example in the public discourse of media stories, local jokes, original songs, and local flood art. Residents and outsiders typically attributed the resilience of flood victims to the Scandinavian heritage of this stable Midwestern agricultural community, describing residents as 'very stalwart and noble and strong and tremendously courageous... and generous'[9]. This cultural heritage could be empowering for women:

> 'Well, I'm a pretty stubborn Norwegian! And one thing that my husband taught me is you tell it like it is—you know, if something bothers you or whatever ... And I don't take any guff from anybody. When I couldn't get my building permit because they said the Corps of Engineers had to come, and I had my contractor coming to put my window in, I wasn't going to cancel him because then I'd have to wait again. I just said, you know, in the building permit office, 'What are you going to do to me? My windows are going to go in.' ... My doors when they came in were wrong compared to what I ordered, and I went back to the person and he was hemming and hawing and I just said, 'Don't mess with me.' I took my finger and I said, 'You don't mess with me. Give me what I ordered.'

But ethnicity was not always interpreted positively by Anglo women; for example, one social worker attributed high rates of alcohol abuse and domestic violence after the flood to the reluctance of stoic Norwegians to speak publicly about 'family matters'.

Similarly, working-class cultural identity in the Scottish case studies played a part in both disadvantaging and empowering women in different situations. Working-class Scottish women empowered to take on the officials felt themselves regarded as nuisances when they demanded their rights. Their vociferous complaints meant they were sidelined during official visits in case they embarrassed local and visiting dignitaries:

> 'Any dignitary that came after the floods, it was highly chosen people they got to speak to. I mean they were no' coming to me or Janet or any ordinary people like us, because they were too bloody feared [afraid] to! I think they were scared to come to people like us. Can't blame them. To think of the amount of times I sounded off to people!'

Thus, in both communities, some stories were silenced in order to present a public face of satisfaction and consensus rooted in cultural homogeneity. Social relations grounded on race and ethnicity structure disaster vulnerability in any community and impact groups of people differently. Here, the compound effects of racial and gender dominance put women at special risk.

Rising above the water: economic patterns along the rivers

Structural economic barriers also differentially impact the recovery of flooded households. Women's economic status is a key factor universally in the ability of households to repair, rebuild, or relocate, to repair or replace cars, replace damaged clothes and household goods, to help family members recover financially, purchase physical and psychological health services, and in other ways begin again.

Social class mattered to women in Grand Forks and in the Scottish localities. Reflecting international gender patterns (e.g. the feminisation of poverty), women in these flooded regions were concentrated in female-dominated occupations in the service and retail trade sectors in female-dominated jobs less likely than others to provide security of tenure, flood services like on-site child care, uninterrupted pay-checks, and flexible working hours. Residents with insecure seasonal incomes or incomes contingent upon social relationships with men are inherently more vulnerable when the waters rise. In Grand Forks, more than 65% of all women (and 74 % of women with children younger than six) were employed at the

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6. Racial/ethnic patterns have not been fully explored in US disaster research, nor have gender and class differences within racial and ethic groups been examined. But see Perry and Mushkatel [1986], Bolin [1986], and Peacock, Gladwin, and Morrow [1997].

7. Military personnel provided critical help preparing homes and businesses against flooding and evacuating residents, operated a major emergency relief center serving all Grand Forks residents, and operated a comprehensive flood recovery program for impacted military families living off base. Military families also hosted evacuees for weeks in their homes on base and volunteered in response organisations like the Red Cross.

8. 1990 North Dakota Census, General Population Characteristics. Table 12.

9. Quoted in an oral history from the Flood Oral History Project, University of North Dakota, directed by Kim Porter and Eliot Glasshelm.

time of the flood[10] but few could support their families on their own wages. Lower-income households, including those headed by women, were rarely economically secure homeowners to whom many disaster relief programs are geared. Many of the Scottish women interviewed lived in social housing, which gave them no choice over location. Many would have moved away from the flood risk areas if they could have afforded to, as this woman reported: 'If we had the money, we should be safe because I still [don't] feel safe. No.'

Women supporting families on their own incomes were clearly more in need of help after the flood. In Grand Forks, savings accounts and credit cards helped some women evacuate their families to hotel rooms instead of to crowded emergency shelters. Affluent married women often described evacuating to the relative comfort of nearby lakeside cabins. In some cases, middle-class women and their husbands bought cheap flood-damaged rentals as investment properties. Professional women were also more able to take advantage of new social service flood recovery jobs. The availability of flood insurance freed some of the Scottish women from dependence on disaster rest centres or the poorest quality accommodation but the insurance money was limited and once spent they were again dependent on what the local authority could provide. However, they were perhaps better off than those in Grand Forks as there was a greater quantity (though never enough) of social housing generally available.

More than twice as many female household heads in Grand Forks are renters than are home owners. Single mothers in particular were highly represented in Fema[11] trailers, where managers estimated they comprised one-third of the total and were among the very last families to find other accommodation when Fema closed its trailer parks. Many older, large, affordable houses needed by single mothers with large families were located in the area most hard-hit by the flood. Asked where single mothers found housing 18 months after the flood, a member of the service agency coalition responding to 'unmet needs' on a case-by-case basis explained many were 'scattered out in the small rural areas—in Fema trailers but also scattered in other communities, just following low-income housing wherever they could'.

Women owning homes or land were clearly better able than renters or homeless women to recover from material flood losses. But our focus on the structural vulnerability to flood created by the divisions of social class should not be mistaken for a deterministic economic argument about vulnerability and power. Many affluent women in our studies drew on their husband's income, savings accounts, credit, second homes, professional credentials, and networks of social influence during this difficult period. But they were not immune to the emotional impacts of mandatory evacuation, housing damage, loss of personal memorabilia, the strains of rebuilding, or the loss of control. This member of the Grand Forks disaster outreach team recalled affluent residents she encountered during 18 months of outreach work:

> 'I wonder, too, if those that had more wealth maybe had more difficulty because they had more destroyed. Sometimes people with wealth or influence or power aren't used to dealing with hard stuff. And this was pretty hard. They were totally out of control. They had no management of what happened to them. For many of them, that was a new experience.'

'Talk about money—money doesn't do nothing for you,' a woman remarked as she read aloud from a letter written by a friend, an affluent widow evacuated out of town with her profoundly disabled grown son:

> 'We eventually ended up in [another state] in a Holiday Inn motel. While there I fell lifting [him] and injured my back. . . I was barely able to walk and was taking care of [him] even though my back was killing me... They fit me with a brace and as yet have no relief from the pain. And in the process of all this I began losing weight. I still weigh a husky 97 pounds. Needless to say, I look a mess and feel like one too. We are in an apartment but we both need more room and better traveling for [him]. Thick carpets are hard for him. What we are doing is marking time, day by day. We are lonely, lost, and I for one am too old to start over... Would you believe this place is so small we only have a card table and two chairs? I miss my kitchen, I miss my home and everything in it, I miss my friends. I miss my security. I miss my identity. Every single day. Nothing will ever be the same again. . . . I lost 50 years of love and history. There's not a thing to work or to fight for anymore. Forgive me, this is a very bad day. I hope things start looking better.'

> ...The gendered division of labor in the home left women disproportionately responsible for children, seniors and chronically ill or disabled relatives...

Similar stories could be added from the Scotland case studies. One of the most distressed interviewees was a woman from an economically secure background who was left by the flood without the will to pick up the pieces of her life. As with the case above, she also has a disabled child. The complexity of these women's lives suggest questions for future research into the way people who are already multiply impacted (e.g. through poverty, ill health, with carer responsibilities, etc.) do or do not cope with sudden disaster.

Women who did own or reside in single-family dwellings were not a homogeneous group. An Anglo wife and mother in a two-job working-class household described her 'depleted' checking account, high gasoline and food bills, and the painfully slow process of replacing household goods 'piece by piece by paycheck', notwithstanding receiving temporary housing assistance from Fema, private donations to flood victims (see below), voluntary labor from a visiting clean-up crew, $1,000 from their church, and canned goods from Salvation Army.

Class differences were vividly illustrated by the varying uses women made of flood recovery funds, including the controversial $2,000 'Angel' grants an anonymous donor made available to all Grand Forks residents on a first-come-first-serve basis. One woman used her Angel money to purchase a cheap used car to replace the one destroyed by the flood. A friend paid her ex-husband for his help mucking out the house to make it habitable for the children.

Notes

10. 1990 North Dakota Census of Population and Household: Summary Social, Economic, and Household Characteristics, Table 5.

11. The US Federal Emergency Management Agency.

The grant helped another woman rent an apartment for her family for three months rather than moving into a Fema trailer while the family searched for a new home to buy. An affluent woman in a two-career household applied for the grant but later passed it along to the family that had hosted them during their lengthy evacuation.

As in Grand Forks, flood recovery funds in Scotland became a focus for community divisions; what, in Perth, was originally termed a 'flood fund', and thus available to all impacted by the flood, was renamed (for the best of reasons) a 'hardship fund' to be targeted at those in greatest need. The latter were generally those without insurance and many of the insured felt aggrieved that they were now being disadvantaged for what they regarded as having acted responsibly:

> 'So you get people like us, pay your insurance, you skrimp and scrape to do it. . . And I know people who were not insured at all and they've got better houses now than they ever had before.'

However, some of those that did get help through the hardship fund found that rather than money they were given vouchers that they had to take to certain listed shops and were only allowed to replace particular selected items. They felt stigmatised when they went into the shops and could not hand over money like everyone else but were marked out instead as 'poor flood victims.'

As in the U.S., some middle class women found themselves in a liberal dilemma when offered flood recovery money: should they take it or not? For them, it represented the possibility of extra luxury items rather than the replacement of bare essentials and some struggled with a degree of guilt.

> 'We got money from the flood fund as well. . . I feel the money should have gone to people who needed it and, I'll be quite honest with you, we didn't particularly need it, so that might have been better managed.'

Structural factors increasing women's poverty and economic insecurity placed women at higher risk than men in these floods. Like race/ethnicity, class differences among women also positioned women differently to withstand the material losses of a flood and rebuild their homes and daily routines after these major community floods. The economic status of women was not, however, addressed as a public concern in the rebuilding process.

Gender patterns along the rivers

Gender relations in both public and private domains also increased women's structural vulnerability. Among other features of 'normal' pre-disaster life, the gendered division of labor in the home and violence against women put women and men differently at risk when massive flooding occurred.

The gendered division of labor in the home left women disproportionately responsible for children, seniors and chronically ill or disabled relatives. Accessing food, cleaning supplies, clothing and household equipment continued to be women's work under emergency conditions and later on. Some domestic tasks were also much more difficult. The employed woman quoted below strongly objected to the suggestion that women's work was less severely impacted by the flood than the work of men 'in the provider role'. She explained:

> 'I disagree. Personally speaking, when I couldn't fix a meal because I didn't have water, when I had my basement water in my kitchen—that's what I felt like I was responsible for, is washing their clothes. And I had to—it majorly disrupted my life, where my husband could go off and go to his job and bring a pay check home, and 'everything's just fine.' And I'm like, 'Everything's not!' I couldn't shop at the stores I wanted to shop at, I couldn't do anything. I thought the day-to-day living tore me apart big time.'

The floods sensitised some of the Scottish women to the limitations of their existing relationships and the gendered division of labor that had formerly gone unchallenged:

> 'I mean his whole total effort was shrugging his shoulders and sighing. I mean I was turning out my whole house, seeing to my kids, worrying myself sick. . . and I just felt he thought that where we were was very comfortable. . . 'I like it' and I says 'but you dinna understand.' He didna' understand how I was. And I just realised really what a hopeless sod he was. I mean probably if we hadna' been flooded out I'd have just sauntered along with him. His life didn't change. His Monday to Friday job was the same but from Friday to Sunday he was still assuming he was going out to the pub. I was left in the caravan and that's the bit I couldnae cope with. . . . I couldnae cope with my house and him and. . . a new baby and everything.'

Outreach workers, teachers, service providers and many mothers both in the US and UK commented that the work of mothering was also more complicated. Children unexpectedly became hostile or aggressive, developed psychosomatic illnesses, reverted to earlier developmental stages, became ill after exposure to mold and to hazardous substances used in rebuilding, and in other ways needed more time and attention.

As parents with primary responsibility for child care, women were especially vulnerable to disruptions in the formal and informal child care system. Costs are generally higher in centers than in private homes, so working-class women earning low wages relied more than others on informal home-based day care. Floodwaters damaged these home-based facilities substantially, delaying the return of many employed women to their jobs and putting many family day care providers out of business.

In addition, patterns of interpersonal violence exposed women disproportionately to harm in the wake of the flood. On the day the Red River crested, the local shelter housing homeless and battered women was already filled, so several clients of the local crisis center were housed instead in area hotels and motels. Crisis workers were out of touch with them during the emergency evacuation but learned later that some returned to unsafe relationships for lack of alternate housing. In any community, emergency managers can predict where resources will be most necessary by understanding patterns of power and privilege in their own community. Race, class, and gender inequalities—not simply proximity to hazard—set up some residents more than others to disaster long before floodwaters rise.

There is a second important dimension to 'diversity' issues in emergency management. Though flood recovery was generally interpreted as a race-, class- and gender-neutral process complicated only by bureaucracy, patterns of community and household power clearly impacted access to vitally needed services. These organisational barriers are outlined in the following section.

The flood recovery process: organisational and interpersonal barriers to services

Flood-impacted women across racial/ethnic and class lines drew heavily on

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Notes

12. Quoted in a newspaper account of 2,500 flooded Chippewa families who returned to the Turtle Mountain Reservation 150 miles outside Grand Forks [Long 1997].

immediate family and extended kin networks for lodging, money, emotional support and other key resources. Along the Red River Valley, a vibrant and resourceful family and kin network was an especially critical survival resource for women in subordinated racial communities.

Native American women turned for help to their extended families and, more broadly, to their tribal community. This parallel relief system based on tribal membership provided Native American women with critically needed material and emotional support. It also reduced their dependence on the racially-charged relief process in the Greater Grand Forks area. The tribal chairwoman explained it was the 'people's tradition to return to the land where they have their extended families... where they will be cared for[12]'. Another tribal official continued, 'It is our tradition that nobody would ever be without a home... that you would never refuse anyone anything[13]'.

Underpinning race and class differences was the gendered division of labor in flood recovery. Notwithstanding supportive family, extended kin and flood relief on Native reservations, impacted women in all our study areas had in common with disaster-hit women around the world the need to publicly seek assistance from public and private agencies. Asking for help was women's work, including standing in line to receive emergency goods, information, or guidance; doing the paperwork of recovery (e.g. completing forms, providing supporting documents, following-up with phone calls and letters); and contacting agencies for specific flood relief (e.g. counselling for disturbed children, health services for senior family members).

Class resentment in the politics of the flood recovery was complicated by gender and race/ethnicity, as we see below. Their visibility as service users exposed low-income women in particular to criticism. Social workers described women with severe economic problems as 'using the system', criticising them for accessing more than one service at more than one time in order to help solve problems after the flood. Like the men in their families, many resisted asking for emergency assistance from government and private relief agencies, reflecting the stigmatisation of social assistance and welfare. Yet women more often than men put aside these feelings and visited relief agencies repeatedly. Like so many other women with family responsibilities, this Native American mother of a young daughter had no choice:

> 'I had a hard time going to, like, Red Cross or anything like that. I had a very difficult time. And I don't know if it was a pride thing or what. My Dad would not go. [And your husband?] Oh, there's no way. No. And when we were [evacuated] out there, I had to go. I had nothing for my daughter.'

Women's interaction with institutional flood recovery systems not only illuminated gender patterns but also made race and class privilege starkly visible. In the next section we discuss a range of observed service barriers linked to the social relations of race/ethnicity, class, and gender.

'You don't belong here': racial/ethnic barriers to service

Hispanic migrant workers who returned to work the rich fields along the Red River after the spring flood suffered indirect but significant flood losses. Many migrant families skipped the 1997 summer season, but those who did come faced intense competition from flooded Anglo families also needing temporary housing, work clothes, and cheap household goods. Some established migrant families lost the trailers they left in the area from the previous season. Because these were not full-time residences they were classified as 'second homes' ineligible for compensation, although the trailers were significant primary residences during the field season for migrant workers otherwise forced to sleep in their trucks or camp in parks. After the spring flood, migrant families faced a more hostile environment than usual as flood relief was both covertly and overtly restricted to Anglos through coded references to 'Minnesota families' or 'residents'. As single mothers are overrepresented among migrant families, these racially-based patterns seriously disadvantaged many Hispanic women.

Ironically, some programs became more racially inclusive. An East Grand Forks agency serving migrant children integrated flood-impacted Anglo children into their summer programs, somewhat reducing the previous level of services to migrant children but providing vitally needed child care to flooded residents. A program director recalled bracing for community backlash when migrant and Anglo children were placed together in bilingual classrooms, but during a 'family fiesta night' for staff, parents, and children was pleased to see 'tables with migrant families sitting next to the local banker'.

Latinas in an East Grand Forks focus group discussion described many incidents of racial bias. One single mother, whose extended family lives in Texas, made a perilous 72-hour long-distance drive home after a distressing encounter with Red Cross volunteers unable or unwilling to assist her and her three children. Still seeing a counselor and taking antidepressant medication 18 months after the flood, she described her struggle to find housing when she returned to East Grand Forks:

> 'I had a hard time getting that apartment but I actually begged them—actually, I kneeled down and I said, "Please, me and my kids need a place." I had my furniture and clothing and everything in storage and I said "I have to go into storage to get clothing for me and my kids." I said, "I need a home." And he's over here... "Well, let me think about it for two weeks, because Mexicans used to live in my place and destroyed my apartments before the flood". That's what I was told by him. So that's where I thought racial had something to do with it... It really upset me when he did make a comment about Mexicans. I said, "Not all Mexicans are the same, that's where you are wrong".'

Race/ethnicity was also a factor in informal communication networks about the relief process. Language was a powerful barrier to Spanish-speaking women and men facing 'a wall of English', notwithstanding the availability of bilingual helpers in relief centres. At least some flood information materials were translated by the bilingual staff of service agencies working with Spanish-speaking families in the area. But this translation work took place after the flood under very difficult conditions and was not part of emergency planning to serve diverse populations. Latinas also reported exclusion from informal communication networks. For example, they recalled learning too late about the arrival of a semitruck loaded with donated vacuum cleaners, though many of their Anglo co-workers had already made arrangements for time off from work to meet the truck.

Formal service barriers (e.g. lack of assistance to migrant families not resident during the flood) were compounded by informal organisational practices. Both

Notes

13. Quoted in a newspaper account of 2,500 flooded Chippewa families who returned to the Turtle Mountain Reservation 150 miles outside Grand Forks [Long 1997].

economic need and their gendered role as help-seekers exposed Latina women in particular to racial bias and restricted access to vitally needed recovery assistance.

'Back to my abuser?' Lack of services for women in crisis

Flooding damaged or destroyed most downtown buildings in Grand Forks and East Grand Forks, including businesses and financial institutions but also community-based agencies serving residents struggling with flood damage and the chronic crises of homelessness, substance abuse, violence, mental illness, and unemployment. Although their work with these vulnerable populations was even more essential after the disaster, the flood's direct and indirect impact on facilities, staff, and resources made services less available.

Women were at greater risk of personal violence in the wake of the Red River floods[14]. Service statistics from the local crisis center indicated a 47% increase in crisis calls over the same quarter the previous year and a 65% increase in requests for protection orders. In some households, women were unwillingly drawn back into relationships with former partners who could help them clean their homes, make repairs, replace possessions, fix cars, or relocate. Crisis counselors heard later about the problems, which followed:

> 'It's not working out well, because there's a lot of promises that they don't keep. So they're trying to rely on 'em but yet they're not getting the support they need, and plus then the abuse continues. You don't necessarily have to be living with them to continue to be abused... [A] few have wanted to get divorced and then the divorce was delayed because of the flood, one for over a year. The courthouse was down for awhile, and all those issues of trying to get that back up and running.'

Battered and homeless women in the Red River Valley lost safe space to floodwater—and to community complacency about their vulnerability before, during, and after the flood. Community crisis agencies for women are not recognised by emergency managers as critical care facilities and the women they serve not seen as vulnerable in the way that nursing home residents or disabled residents are. Gaps in service were described by a staff member concerned for the life safety of women after the flood:

> 'We're very cramped here [in temporary facilities] and we don't have a place to hold our groups and we don't have any storage space and we don't have offices to do the private counselling we'd like to do... I think [the lack of a shelter] really compromises the security and the safety element for women. Abusers aren't stupid, by any means. They're going to figure it out. I mean, I don't think—Grand Forks isn't a large enough place where they might not think of some of the other places that we might be putting them... It's very easy to track somebody down, and that doesn't provide the kind of security and safety that we want to be able to provide for our clients. So, I mean we do the best we can, but I don't think—I don't feel very good about the options that we're offering right now, and I know that our clients don't. I assume that some people probably don't even utilize these options because that doesn't feel safe to them. So people aren't getting the help that they need.'

Coping with the emotional needs of male partners was a major challenge for many women in the recovery period.

In the Scottish case studies, issues of domestic violence did not emerge although their absence in interviews does not mean they did not exist at all. However one social worker involved throughout the 1993 floods near Perth, remarked that domestic violence had not been an issue and that on the contrary many of the women had been made stronger by the flood.

'Women were the strong ones': women helping men

Not all barriers to women's recovery emerged from organisational practices. Women's recovery was also complicated by the need to respond to men who struggled emotionally with the effects of the flood.

In many of our study locations, effective and wide-ranging door-to-door disaster outreach teams were in place for many months after the floods, offering a variety of resources targeting seniors, children, employers, and neighborhoods.

Many churches and social service agencies also offered flood-recovery programs like support groups or counselling. Yet there was no single pace of recovery. Many women interviewed a year and a half after water entered their homes described continuing physical symptoms of stress, needed help coping with children's self-destructive or aggressive behavioral changes and were still taking antidepressant medication.

Coping with the emotional needs of male partners was a major challenge for many women in the recovery period. This college-educated Native American woman described how her husband's emotional withdrawal from the family (and his physical absence two separate times) led to 'role reversal' after the Red River flood:

> 'He was not the strong one any more because he had such a difficult time, thinking, not only did he lose his home but his parents' home. And so I had to be the strong one. I still had to take care of my daughter. He did come up [where we evacuated] for a week. . .The first three or four months he was, he stayed away. He was real distant and kind of did his own thing. . . He said the most difficult thing for him was the fact that he is supposed to take care of his family and he had nowhere to bring that family.'

Interviewed a year and a half after the flood, and newly settled into a new job and new house, she felt ready for counselling but others were now reluctant to talk about personal issues raised by the flood, and free counselling was no longer available:

> 'It's now that I think that people need help, it's not right after the fact and it's not five months later, it's when they're settled...It's a year later, more than a year later, and I know I haven't dealt with it, but I'm conscious of that, and I know when I'm ready and my mind is ready I will deal with it. . . Men are supposed to be strong and tough and don't need

Notes

14. For a more extended discussion of violence against women in disasters, see Enarson [1999a] and Fothergill [1999].

anything. Women are supposed to be the ones who need help all the time. It's like—"excuse me?" It should have been there for him right after the flood, and then for me, now.'

In Scotland, the son of a single-parent family, who had taken on the role of 'man of the family', but who was absent during the floods was nevertheless affected by them:

'Now when it came to moving, to chucking everything out, coming back when the water went down and put it all out to get thrown away, which was pretty traumatic, he couldn't do that. He literally couldn't do that, he broke down. And a lot of it was that he couldn't stop blaming himself that he wasn't there to help us that night. And although he wasn't here the night of the floods, the floods have affected him.'

A social worker involved in the floods in Scotland told how 'the flood wiped the men, paralysed them' and the women became stronger through it. Men could not ask for counselling help for themselves but when their wives or partners received home visits from counsellors, the men would listen attentively in the background or slowly feel able to communicate their personal distress.

Gender identity, the gendered division of caregiving and the gender politics of disaster decision-making make emotional recovery difficult for both women and men.

The different emotional worlds of women and men may equip them differently for the hard work of disaster recovery and warrant more investigation, as do class and racial/ethic patterns of emotional recovery.

Lines that divide and ties that bind: solidarity and flood recovery

The strength of the 'therapeutic' united community was undermined by the very different experiences of women across class and racial/ethnic lines. We found that flooding reflected and exacerbated economic, racial/ethnic and gender inequalities.

In the Red River Valley, flooding increased the salience of ethnic identity, making racial bonds and divisions of long standing more visible. Ethnic solidarity seemed to increase among Euro-Americans, who experienced the flood as members of the dominant population; among Native Americans who turned to tribal authorities and systems for emergency relief and emotional support; and among the Hispanic community after their exclusion from the resources of mainstream relief agencies.

In Scotland, class divisions were exacerbated as spatially scattered middle class residents expressed their resentment of those in the spatially coherent social housing locations of North Muirton (Perth) and Ferguslie Park (Strathclyde) who appeared to command greater attention and services.

Women were not united across racial or class lines as a unitary or self-conscious social group. Many women did appear to become more conscious of gender divisions while negotiating with partners over household preparations and recovery work and observing the public flood recovery process. Most respondents agreed that women's specific interests and needs were neither identified nor explicitly considered. Women across races and classes, and in our different national locations, had sandbagged, walked the dikes/floodbanks and prepared families and workplaces for disaster, but were mostly (although not exclusively) absent from the table when planners developed reconstruction projects or local action groups formed to formulate action plans.

Our findings in these flooded communities suggest that addressing population diversity and community power structure is not an indulgence but a necessity in emergency management.

The solidarity of flood victims as a whole was undermined by an implicitly gendered, racialised, and classed vision of community recovery. In the long run, community divisions were not overcome but strengthened.

Responding to diversity in emergency management: strategies for change

Our findings in these flooded communities suggest that addressing population diversity and community power structure is not an indulgence but a necessity in emergency management. Building sustainable disaster-resilient physical environments for the future necessarily involves building more sustainable disaster-resilient social structures. The action steps identified below suggest a new model of emergency planning predicated as much on social as on physical vulnerability and a vision of residents as knowledgeable community planners and effective disaster responders as well as future victims.

Utilising social vulnerability analysis

Flood mitigation is not a technical accomplishment but a social process. Effective emergency preparedness and response must incorporate an analysis of how local racial, class, and gender inequalities are likely to impact residents through the disaster cycle. Differentials in housing, economic security, family status, health and other living conditions in diverse populations provide important clues about patterns of vulnerability and recovery.

Social vulnerability analysis is, or can be, an important planning tool for emergency managers. Concrete knowledge of local community power structures enables emergency planners to anticipate needs and target resources. Knowing the right questions to ask is the first step. What can be done now to ensure that mixed-sex teams are available to contact stressed families after the next flood? Where are the battered women's shelters and other group homes located and how prepared are they for a major community flood? Where are most women in the area employed and what proportion are single mothers? How can families living below the poverty level prepare their homes for flooding? How many families use which kinds of child care, and how well equipped are these facilities for a major flood? What are the major community language newspapers in the area and who in emergency management can communicate with their publishers and writers?

Few emergency management offices have the resources at hand to research historical and contemporary patterns in local community power structures. Relevant data are not always available (e.g. gender and race sensitive census data). Emergency management agencies should utilise the resources of universities and colleges and, in the process, forge new links with the disaster researchers of the future.

Concretely, we recommend that:

- baseline community vulnerability profiles be developed and updated

- community planning agencies be required to provide gender-, class- and race-sensitive social indicator data for the purposes of emergency planning
- data and reports from non-profit organisations serving vulnerable populations be utilised in emergency planning

Increasing organisational diversity

The concept of 'flood responders' is narrowly written to refer to those in formal occupational roles (e.g. police, firefighters, utility workers, social workers, elected officials, EMOs/Emergency Plan ners) acting in the public sector during and immediately after the event. This fails to capture the informal, private sector, voluntary, and on-going response roles of other women and men through the extended period of flood recovery.

A Latina social service administrator objected to the 'old military model' for just this reason: 'It doesn't address what happens right after, it doesn't address the healing part. Women tend to pick up the brunt of that.' She also protested that emergency managers fail to consult those most knowledgeable about vulnerable populations:

> 'Migrant women are an untapped resource. . . [V]ery few community planners would go to a [migrant woman] and say, "How do we plan for migrant families coming in? What do we need?" And I think here's where you have the... understanding, the knowledge of the community and the knowledge of the client.'

Because service barriers to women are most likely to be anticipated when organisations represent the full range of their own community, hiring for diversity is an important step forward. The employment, retention and promotion of larger numbers of women, and in higher status positions, in emergency management organisations is one change strategy, but it is essential to more fully engage non-specialists and to employ or otherwise involve women whose life experiences sensitise them to the privileges of race, class and gender. The burden of our argument is that those most needed at the table are women and men whose life experiences have made race, class and gender issues significant in their thinking about community development and emergency planning. We do not call for any litmus test of 'identity' or mechanistic model of affirmative action in emergency planning. We do argue that it is critical for local planning groups to include women whose life experience closely reflects the vulnerabilities and strengths of those most at risk in their own community should rivers flood or other extreme events occur.

Concretely, we recommend:

- self-assessments in disaster organisations to document existing race, class, and gender patterns of employment, training, and promotion.
- expanding community-based planning groups to include agencies representing the needs and interests of battered women, the homeless, immigrants and refugees, single mothers, low-income families and migrants, as well as the elderly and disabled
- increased consultation and interaction between emergency planners and local community groups serving vulnerable populations (e.g. inclusion in disaster plan exercises, shared mailing lists for newsletters and other emergency communications, revising emergency resource handbooks to include these groups)
- development of appropriate training materials on race, class and gender issues in disasters designed for in-house use by disaster organisations (e.g. anti-racist training for relief agency volunteers, in-house gender-equity programs)
- revising organisational mandates and relevant laws and regulations to include priority attention to all populations designated highly vulnerable at the local level
- direct assistance, as feasible, to assist crisis shelters and other community action groups to develop effective in-house disaster plans
- attention to details of program design which facilitate the participation of diverse groups of residents, e.g. child-care at relief centres and flood response events, mid-day rather than evening flood preparation and recovery meetings, long-term mental health services, appropriate venues, transportation assistance, and other changes.

Conclusion

Gender, race and class shape all people's lives, but women's experiences provide a particularly revealing lens on these intersecting patterns of power and privilege. Analysing women's disaster experiences is not a frivolous distraction from the hard work of identifying known risks and preparing communities for emergencies. It is an important part of the work ahead and can be advanced through new models of analysis and increased organisational diversity.

We have found as many similarities as differences in our geographically and culturally dispersed case studies. There is a need to increase the search for common patterns within and across national/cultural boundaries to develop our recommendations for organisational diversity and better meet the diverse needs of vulnerable communities. Our case studies have been from the developed north but there is a wealth of experience from the perspectives of the south (see for example the work of Duryog Nivaran and the papers in Twigg and Bhatt 1998 amongst many others), which would aid this analysis. We hope other researchers will further develop such international comparative work with the ultimate aim of building sustainable, participatory, disaster-resilient communities.

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Author's contact details

Elaine Enarson
33174 Bergen Mountain Road
Evergreen, Colorado 80439
Phone: 303/670-1834
Fax: 303/679-0938
Email: enarson@uswest.net

Dr Maureen Fordham
Geography Department
Anglia Polytechnic University
East Road, Cambridge, CB1 1PT UK
Email: m.h.fordham@anglia.ac.uk

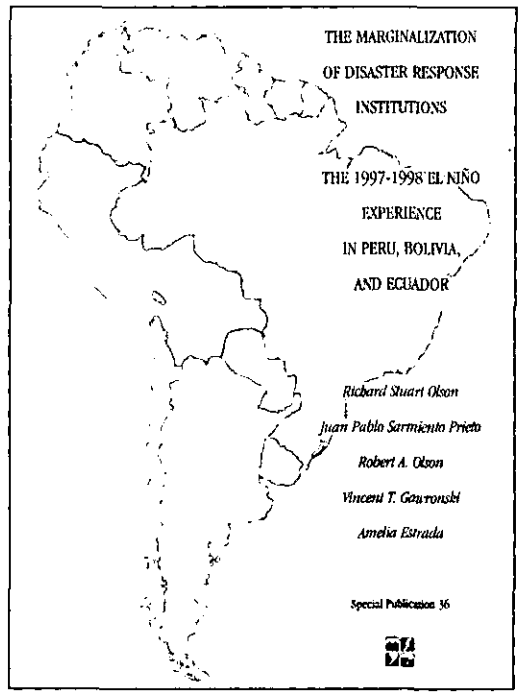
New Books

The Marginalization of Disaster Response Institutions

The 1997-1998 El Niño Experience In Peru, Bolivia and Ecuador

By Richard Stuart Olson, Juan Pablo Sarmiento Prieto, Robert A. Olson, Vincent T. Gawronski and Amelia Estrada

Natural Hazards Research and Applications Information Center, University of Colorado 2000, Special Publication 36, 43 pages, English (Spanish version available)



One of the latest in the invaluable series of Special Reports published by NHRAIC and made freely available in both hard copy and electronically for reproduction, this study sets out to answer a deceptively simple question—based on the experiences of Peru, Bolivia and Ecuador in dealing with the ENSO event of 1997–1998 (and to a lesser extent their experiences with a similar event in 1982–1983): Will the governments of those countries be institutionally better prepared to deal with the *next* major ENSO?

Two critical assumptions underlie the study, that institutional readiness to deal with disaster is a political and policy issue rather than primarily technical or administrative issues, and that disasters themselves are innately political events because of the enormous demands, multi-sectoral coordination requirements and decision-making stresses they impose on governments. The study recalls Quarantelli's 1987 analysis in which he noted that *accidents* and *emergencies* are typically dealt with by emergency services but *disasters* and *catastrophes* require higher-level coordination with all its political and policy implications, and suggests that in the case of all three countries the ENSO event of 1997-1998 broke through the emergency/disaster 'firebreak'.

The study's selected *unit of analysis* is the civil defence organisations in the three countries, which in each case was nominally the 'national emergency organisation', and examined the roles they played in the 1997–1998 event. Its principal finding is that at the outset of that event, as it was perceived that the 'firebreak' had been breached, these organisations were rapidly pushed to the sidelines by one or more new but temporary governmental organisations charged with managing the response, in all three cases responsible to the highest levels of government. It concludes that while there is evidence of *intra*-organisational learning in all three countries as a result of the 1997-1998 event, examples being in the ministries of health and in various scientific offices, there remain major problems at the level of *inter*-organisational and multi-sectoral coordination.

Thus there is a likelihood of continuing marginalisation of the nominal 'national emergency organisations' in future major events.

Factors identified as contributing to this situation include national institutional elements such as short-term political 'horizons' in planning for the future and the lack of permanent civil service structures which can provide for administrative stability and organisational 'memory'. However, and given the study's chosen *unit of analysis*, the civil defence organisations themselves are seen to a considerable extent as contributors to their own lack of success.

Traditionally, such organisations have tended to be event-oriented, focussed primarily on preparedness and response, and limited in capability in dealing with major events. Perhaps more critically, however, they are generally seen as having low political salience and as only marginally relevant, if that, to the needs of governments having to deal with the *complex political, social and economic* problems which come with disasters. The study suggests that managing the *situation* created by a major ENSO event ideally requires the same approach to managing national development in general—ENSOs themselves are so complex that they really should not be defined as just 'events'.

Particularly for those of us involved in developing risk management approaches to the management of community safety risk and concerned about the proper ownership of the community safety risk management process, there are clearly policy implications in the present NHRAIC study.

Reviewed by:
Roger Jones, TEM Consultants Pty. Ltd. (formerly Director, Australian Emergency Management Institute).

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The Brisbane–Gladstone transport corridor: identification of risk and vulnerability for the bulk transport of dangerous goods

by Iraphne R.W. Childs School of Humanities and Social Sciences, QUT;
Ralph D. Carlisle, CHEM Unit, Qld. Dept. of Emergency Services;
Peter A. Hastings, School of Humanities and Social Sciences, QUT

Introduction: the hazard

With the ever-increasing variety and quantity of chemicals used by industrialised societies, communities continue to face risks of injury from *hazmat* (hazardous materials) emergencies. This is despite the implementation and continual improvement of regulatory and technological systems for the safe management of hazardous materials. Of particular concern in the context of public exposure to hazardous chemicals is their release during transportation. Along transport routes this may result from an accident involving one or more vehicles carrying dangerous goods, or from failure of containment systems due to factors such as inadequate equipment or loading procedures.

Public risk from transport-related hazmat emergencies relates to a variety of factors, including the hazardous properties of the chemicals involved and the likeli hood of potential exposure to the chemicals. The latter is significantly determined by the environmental conditions under which the transport is conducted and the geography of population and settlement. Experience shows that the great majority of such hazmat emergencies are minor, with effects limited to the immediate vicinity. In a small number of cases, however, the surrounding community has been placed at risk, or could readily have been so had circumstances (e.g. location, time, weather conditions) been slightly different.

The aim of this paper is the initial consideration of levels of risk and vulnerability relating to potential hazmat emergencies from the transport of bulk dangerous goods along the Brisbane-Gladstone transport corridor. Geographical regions at risk will later be used in a more detailed assessment of vulnerability within selected communities, building upon some initial comments made in this paper. *Community vulnerability* is defined here in accordance with Young (1998) as 'the coping capacity of those at risk'. This is a function of factors such as the demography and socio-economic status of the community which may be affected and the level of preparedness within the community for dealing with the adverse event.

The Brisbane to Gladstone transport corridor

Brisbane and Gladstone, located some 600 km apart on the east-coast of Queensland, are the two major heavy industrial centres of the state. Both have significant chemical industries. Brisbane has two oil refineries and two fertiliser works. Gladstone has two cyanide manufacturing plants (at nearby Yarwun), an alumina refinery and an aluminium smelter. In addition to these major hazard facilities, which use large quantities of hazardous chemicals, both cities host numerous other industries that use and store hazardous materials. The potential of using and transporting dangerous goods throughout the region must, however, be balanced against the many economic, employment and other benefits that accrue from the development of these facilities.

Transport of dangerous goods[1] between these two centres utilises both road (the Bruce Highway, National Route 1) and rail (the North Coast railway). For much of the corridor, the road and the rail line closely parallel each other, often within one kilometre and generally less than ten kilometres apart. In one section, however, between Maryborough and Gladstone, they follow very different routes and can be up to 40 km apart (*Map 1*).

The road link

The major chemical industries in Brisbane are located to the east of the city at the mouth of the Brisbane River with other important concentrations in southern and south-western suburbs. Transport of goods northwards from these facilities is generally through the north-eastern part of the Brisbane metropolitan area. Under a policy established by Queensland Transport, dangerous goods road transport northbound from these areas is directed to the Gateway Motorway which passes to the east of the metropolitan area to connect with the Bruce Highway at its commencement in the northern suburb of Bald Hills. From here the road passes through the populous Sunshine Coast hinterland. The current alignment of the Highway by-passes many towns and villages through which it previously passed directly, but it still comes within one or two hundred metres of residential areas at some locations, e.g. Nambour. At the small cities of Gympie and Maryborough, the Highway skirts the CBD but passes through, or adjacent to, residential areas. In several small towns, such as Childers, the Highway becomes the main street of the settlement. The Highway passes some 40 km west of Bundaberg and 20 km west of Gladstone with feeder roads providing access to those cities.

The rail link

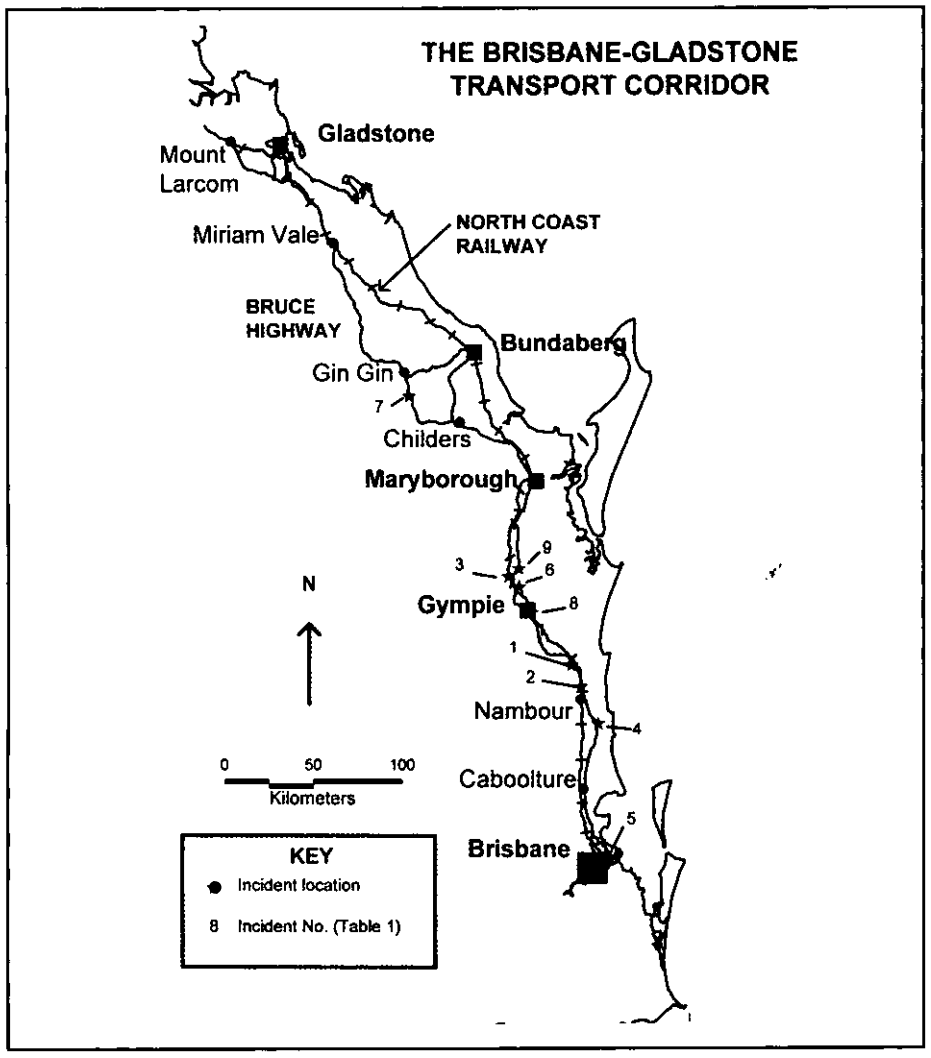
From the Brisbane CBD, the North Coast railway extends through northern suburbs and near-northern townships, before proceeding through the Sunshine Coast hinterland and passing through the major towns and cities en route to Gladstone (*Map 1*). Because it was a historical focus for growth, the North Coast rail line passes through the heart of most cities, towns and villages which lie on its route.

Dangerous Goods transport along the corridor

There is considerable movement of dangerous goods along the Brisbane-Gladstone corridor, either for use in those centres or for destinations beyond. Much of this transportation is in bulk loads. For example, travelling northwards are petrol (flammable liquid), liquefied petroleum gas (flammable gas), liquefied ammonia

Notes

1. The term 'dangerous goods' is used in relation to chemicals considered to be sufficiently hazardous to require regulation of their transportation under the *Australian Dangerous Goods Code* (the ADG Code).



Map 1 : The Brisbane-Gladstone transport corridor.

Date	Location (No. on map)	Incident	Result	Deaths/ Injuries
Sept 1992	Nambour (1)	Collision between LPG tanker and ethanol tanker (road)	no loss of containment	nil
Nov 1992	Yandina (2)	Rollover of semi-trailer with large load of compressed gas cylinders (road)	fire; explosions resulting in gas cylinders being projected large distances	driver killed and incinerated
June 1994	Gunalda (3)	Derailment of petrol tanker (rail)	spill of petrol; fire	
July 1995	Caloundra turnoff (4)	Rollover of petrol tanker (road)	spill of petrol; fire	driver killed and incinerated
Oct 1996	Murarrie (5)	Rollover of anhydrous ammonia tanker en route to Gladstone (road)	release of ammonia; toxic gas plume	2 minor injuries from ammonia exposure
July 1998	North of Gympie (6)	Collision between petrol tanker and car (road)	spill of petrol; possibility of fire	2 killed by impact
Jan 1999	Near Wallaville (7)	Collision resulting in rollover of anhydrous ammonia tanker (road)	no release of ammonia	Injuries from impact
Feb 1999	Gympie (8)	Semi-trailer carrying paint rolled over on banks of Mary River (road)	Major spill of paint into river	Nil
Mar 1999	Glenwood (9)	Fire in truck carrying calcium nitrate fertilizer	Fire	Nil

Table 1 : Selected hazmat transportation incidents involving bulk or large loads of dangerous goods along the Brisbane-Gladstone corridor, 1992-1999.

(toxic gas) and molten sulfur (flammable) in bulk tankers (often 20,000 litres capacity) as well as liquefied chlorine (toxic gas), concentrated hydrochloric acid (corrosive) and compressed hydrogen (flammable gas) in smaller containers. In the southward direction, sodium cyanide (toxic solid) is carried in briquette form in IBCs (Intermediate Bulk Containers of 1 cu.m. capacity) and bulk tankers. Liquid fuels are also distributed southward from Gladstone.

Many aspects of the transport of dangerous goods by road are already regulated, but there is no centralised recording of individual loads to provide a comprehensive picture of this activity. Information on the types, quantities and frequencies of dangerous goods loads is held by individual transport operators on a commercial basis. By contrast, comprehensive information on dangerous goods transported by rail is available through Q-Rail's centralised computer system.

Recent hazmat emergencies along the Brisbane-Gladstone corridor

Since 1992 a number of accidents, involving vehicles carrying dangerous goods, has occurred along the Brisbane-Gladstone corridor. A selection of these incidents is shown in *Table 1* and their locations are shown on *Map 1*. The outcomes of these accidents ranged from no loss of containment of the dangerous goods through to loss of the major part of the load leading to a fire or the generation of a toxic gas plume. Four drivers and/or passengers have been killed as a result of these accidents over the seven year period. No significant injury or death to the public has occurred, but outcomes could have been more serious in at least two cases had circumstances been slightly different, as the following examples show.

Yandina, 1992

A truck accident occurred less than a hundred metres from houses and a caravan park. The resultant fire caused numerous compressed gas cylinders in the truck's load to explode and debris was projected in excess of a hundred metres away. Minor differences in the trajectories of projectiles could have caused casualties. Had the truck been carrying bulk LPG, there could have been the potential for a major BLEVE (boiling liquid expanding vapour explosion) to have occurred.

Murrarie, 1996

A Gladstone-bound ammonia tanker travelling through Murrarie, an eastern suburb of Brisbane, overturned and ruptured resulting in the release of some

12 tonnes of liquid ammonia which rapidly boiled away to form a toxic gas plume. Fortunately, the atmospheric conditions prevailing at the time allowed the plume to rise quickly into the atmosphere and disperse. The nearest residential area was about one kilometre away from the accident scene and there was no significant public exposure. Had the accident occurred closer to a built-up area and had stable atmospheric conditions (e.g. a cold, still night) held the ammonia plume at ground level, numerous casualties from exposure to ammonia gas might have resulted.

Risk factors and vulnerability

With the resultant expected increase in the quantity of chemicals passing along the corridor commensurate with projected population[2] and industrial growth[3] in Southern and Central Queensland, there is a need to assess risks and community vulnerability associated with the bulk transport of dangerous goods along the Brisbane-Gladstone corridor. While the probability of a catastrophic accident is very low, the consequences of such an accident, should it occur in a built-up area, could be very severe.

In a community risk and vulnerability analysis of this hazard, factors which would need to be considered include: the nature of goods being transported; frequency and amounts of transport; population potentially exposed; socio-economic characteristics of communities; impact radius of potential *hazmat* emergencies; local geographic characteristics; highway conditions and levels of emergency resources and community preparedness. An evaluation of potential levels of risk and vulnerability along the Highway has been attempted as a first step in the process of selecting locations for more detailed analysis. Initial consideration of some of these factors are outlined below in the context of the study area.

Impact radius of potential hazmat emergencies

The impact radius of a hazmat emergency represents the distance over which there may be effects on people or the environment. Events that are likely to have the largest impact radius are fires/explosions and toxic gas releases. For such events, the emergency services are advised to consider evacuation of people for distances of up to 1500 metres in all directions (Standards Association of Australia 1997). For the present analysis, built-up areas within 1500 metres of the road are considered to be within the impact radius. Quantitative modelling of relevant hypothetical emergency scenarios supports the conclusion that an impact radius of hundreds of metres can be expected[4].

Population potentially exposed

Large sections of the Bruce Highway traverse open country with no permanent settlements and therefore risk to public safety is limited to isolated homesteads and passing traffic, and to the environment (creeks, soils, etc.).

Larger population centres may be at greater risk from a hazmat emergency because of (i) the longer distances traversed by the dangerous goods within their built-up areas and (ii) the greater population density within the impact radius. While, by this logic, smaller centres may be at lesser risk, they may be less able to cope with a hazmat emergency because of the lower levels of emergency response resources available locally and the need to rely on resources from further afield. For this reason, attention must be given both to sections of the highway that pass through, or adjacent to residential zones in the larger population centres, and also to smaller, more remote and less well-resourced settlements along the corridor.

Local geography and highway conditions

Geographic characteristics and the condition of roads can increase the likelihood of a traffic accident occurring at any particular location or time, which could lead to a hazmat event and the potential flow of hazardous materials into the atmosphere. These can include the following:

- terrain and drainage characteristics
- prevailing weather conditions
- higher speed limits
- single carriageway (as opposed to dual carriageway)
- intersections or entrance ramps
- highway alignment/sharp bends[5]

In the event of a hazmat incident, these same factors can also affect emergency response and levels of community disruption.

Level of emergency response resources

A major hazmat emergency requires appropriate responses by Police, Fire, Ambulance, Local Government and probably medical and hospital personnel. In the Brisbane metropolitan area these resources are readily available. In larger urban centres along the route they may be all available, but to a relatively limited extent. In small centres not all these resources may be available, and what is available may be very restricted in capability.

Risk and vulnerability along the Brisbane-Gladstone corridor

Qualitative consideration of the combination of these factors along the Brisbane-Gladstone corridor suggests several levels of potential risk and vulnerability for the hazards associated with the bulk transport of dangerous goods for given geographical regions.

Brisbane metropolitan area

The Gateway Motorway is a dual-carriageway, high-speed (100 km/h), limited access road which passes through or adjacent to built-up areas including residential suburbs such as Bracken Ridge. The consequences of a major hazmat emergency along the Motorway would be severe because of the levels of population potentially exposed within the identified risk zone. The severity of an emergency could be moderated, however, by the high level of emergency response resources available in the Brisbane area.

Near-northern corridor

From Bald Hills to Nambour-Yandina, the Bruce Highway is a dual carriageway, high speed road which passes adjacent to a series of rapidly growing residential areas such as Burpengary and Caboolture. While the overall populations potentially exposed within the risk zones in these localities may be less than for the metropolitan area, the levels of emergency response resources are commensurately less, thus tending to increase community vulnerability.

Notes

2. *Monitoring Brisbane and the South East Queensland Region,* (1998) Australian Housing and Urban Research Institute (AHURI).

3. Planned developments include a new alumina refinery at Gladstone and a magnesium production facility at Rockhampton, about one hour's drive north of Gladstone.

4. Computer modelling indicates that a BLEVE (boiling liquid expanding vapour explosion) of a 14 tonne LPG tanker would have injurious thermal effects within a radius of 240 metres. A leak rate of 0.25 tonne per minute from an anhydrous ammonia concentration in the air sufficient to cause injury by inhalation up to a radius of 900m. In stable atmospheric conditions.

5. Apart from some minor road options, there is little scope for reducing risks to communities from dangerous goods transport along the corridor by using alternative routes. Where alternatives do exist, they usually entail a lower grade of road and/or pass through additional settlements. Their use could arguably increase the overall risk. Continuation of the strategy of building by-pass roads around population centres would generally be effective in reducing the risk to communities.

6. For disaster planning purposes Queensland is divided into Disaster Districts which usually consist of several

Regional cities and major towns

At the regional centres of Gympie and Maryborough the Bruce Highway bypasses the CBD but still passes through residential suburbs for a considerable distance. For example, in Gympie, this distance is 10 kilometres, largely of single carriageway at speeds of 60 or 80 km/h with numerous intersections adjacent to suburban shopping centres and commercial strip development. The consequences of a major hazmat emergency at any of these intersections could be severe and the availability of resources in such smaller centres may be limited.

Small towns and settlements

From Yandina north the Bruce Highway is largely single carriageway with small towns and settlements dotted along it between the major centres. In some cases the road passes through the centre of the settlement with a reduction in the speed limit (e.g. Childers), while in others it passes near residential areas at the edge of town without a reduction in speed limit (e.g. Cooroy). In such locations the smaller population may reduce the potential severity of a major hazmat emergency but local resources to deal with it would probably be inadequate. Such smaller centres have lower levels of emergency response resources and would have to rely on resources from the nearest larger centre some distance away, resulting in delayed response time and increasing vulnerability.

Towards assessing community vulnerability

The above analysis is a first step in the assessment of community vulnerability to the transport of dangerous goods from Brisbane-Gladstone. The relative vulnerability of different communities is not adequately measured simply by parameters such as location of route or population size, but must also take into account community preparedness and resilience in the recovery phase.

In the case of chemical disasters, the speed of onset of the hazard is usually rapid and, consequently, warning time for evacuations is most likely to be minimal or non-existent. Public warning systems, such as may be implemented within coastal communities aimed at reducing vulnerability to flood or cyclone damage, are of little assistance in the case of potential chemical hazards. Thus, in terms of community vulnerability, one is dealing basically with questions of the capacity of the community, in particular the resources of the emergency services, to evacuate *post-event* and to cope with potential casualties and injuries resulting primarily from the effects of fire, blast or toxic gas release.

While the availability of physical resources is an important factor, the effectiveness of such resources can largely be determined by the quality of emergency preparedness and planning at the local level. Preparedness and counter-disaster planning begins from the point of perception of risk. Current research is examining these issues and other relevant local parameters in a selection of centres representing localities at varying levels of risk and vulnerability. Focus group discussions with key personnel in Disaster District Control Groups[6] are yielding valuable data on perception of risk and local resources and conditions. The community vulnerability assessment includes activities related to the five-stage methodology outlined by Hunter (1996) which is set within an emergency risk management framework in the Australian context[7]. Description of the hazard and analysis of its interaction with the community is being achieved through the use of scenario setting and application to the particular environmental conditions of geographical regions identified above. Assessment of risk perception focuses on emergency service operatives, as those who would have primary responsibility for dealing with local emergencies and disasters.

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Refereed

Local Government Areas. The Disaster District Control Group is usually chaired by a district Police Officer, and includes representatives from Fire, Ambulance, local medical services, SES and local government.

7. Hunter's (1996) model includes several stages of risk evaluation and assessment: (i) description of the hazard, the community, the environment and the emergency services; (ii) analysis of interaction between the hazard, the community, the environment and the emergency services; (iii) assessment of community risk perception; (iv) ranking of vulnerabilities; and (v) comparison of risk to existing risk criteria.

Direct and vicarious experience of volcanic hazards: implications for risk perception and adjustment adoption

by Douglas Paton, School of Psychology, Massey University, Palmerston North; David M. Johnston, Institute of Geological and Nuclear Sciences, Taupo; Mark S. Bebbington, Statistics, Institute of Information Sciences and Technology, Massey University, Palmerston North; Chin-Diew Lai, Statistics, Institute of Information Sciences and Technology, Massey University, Palmerston North; and Bruce F. Houghton, Department of Geology and Geophysics, University of Hawaii.

Introduction

While the direct effect of volcanic hazard activity is generally immutable, some of the emergent social, economic and physical consequences are amenable to reduction through the adoption of risk reduction behaviour and adjustments (e.g. storing food and drinking water, purchasing insurance). Consequently, determining the precursors of these reduction activities is an important issue. A key focus in this area has been on risk perception and its implications for reduction. Despite the intuitive appeal of their being a link between perceived risk and adjustment adoption, this may not always be justified, even when a hazard is well understood (Burger & Palmer 1992; Lindell & Whitney 2000; Mulilis & Duval 1995).

Two issues that affect interpretation of data in this context are the timing of its assessment and the nature of personal hazard experience. Hazards can be experienced directly or vicariously (e.g. where individuals are aware of hazard activity in other parts of the country but are not themselves directly affected). Although little work has been done to test this possibility for infrequently occurring natural hazards, some authors have suggested that vicarious experience can influence risk perception (Sjöberg 2000). Others have argued that only direct experience is influential (Lindell & Perry 1992). Assessing the capabilities of indirect or vicarious experience is important for several reasons. For example, because volcanic ash fall can, depending on meteorological conditions, affect communities that are some distance from the source of the hazard, indirect or vicarious experience could provide a valuable means of generating awareness of the kinds of effects that people need to prepare for. The rarity of hazard activity and the fact that most hazard education occurs during periods of hazard quiescence makes it important to test whether vicarious hazard experience or risk communication initiatives can positively influence risk perception and adjustment in a manner that increases resilience to hazard effects.

While resilient capacity must also be developed at community and institutional levels, understanding the mechanisms that underpin individual adjustment adoption is important in areas vulnerable to potentially destructive earthquake and volcanic hazards. The potential disruption to utilities and social institutions from hazard activity means that residents in affected areas must be capable of meeting essential needs for several days. High levels of personal and household adjustment adoption is also required to minimise damage and costs (e.g. insurance) resulting from hazard activity (e.g. minor shaking or ashfall) capable of, for example, toppling furniture, disrupting hot water systems, or blocking air conditioning units. These initiatives also aim to encourage insurance adoption to reduce subsequent financial demands on households from repairing or replacing items destroyed or damaged.

This paper compares the role of direct and vicarious hazard experience on risk perception and adjustment adoption. It focuses on the role of the 1995 Ruapheu eruption, but also draws upon a study of the effectiveness of a public information campaign (the Auckland survey). Risk perception and preparedness were examined before the campaign was conducted and then again some 6 weeks afterwards (Ballantyne, Paton, Johnston, Kozuch & Daly 2000). Although focusing on volcanic hazards, the findings have more general implications for understanding the dynamics of personal risk perception and adjustment adoption.

Longitudinal assessment of hazard impact

Several studies have measured perceptions of volcanic hazards and risk either during periods of quiescence at a volcano (D'Ercole, Rancon & Lesales 1995; Johnston & Houghton 1995; Perry 1990; Ponter, Doorman & Feist 1993) or after a volcanic crisis (Kartez 1982; Saarinen & Sell 1985; Yoshii 1992). While such studies provide valuable information, the lack of pre-event data makes it difficult to assess the specific role of experience in forging beliefs about risk or changing behaviour. For example, when relying on post-event comparisons, particularly when data is derived from self-report public surveys, findings could be biased by over-representation of those with appropriate beliefs or who engage in appropriate behaviour to start with. While longitudinal analysis does not eliminate this potential sampling bias, it does provide a more objective basis for assessing the specific influence of an event on beliefs and behaviour.

A survey of hazard perceptions was conducted in two communities prior to the 1995 eruption (Johnston 1997). By comparing post-event responses with similar data obtained prior to the eruption it was possible to more objectively determine the specific influence of this event on hazard knowledge, risk perception, and preparedness. By conducting this analysis in two communities (one of which was not directly affected) it was possible to explore the implications of both direct and vicarious experience for these parameters.

Because communities can be vulnerable to several hazards, a core facet of contemporary emergency management is the need for intervention to be applicable with across all hazards. Consequently, a salient issue for emergency managers concerns the generalisability of hazard beliefs. If people group similar classes of experience together, experience of one hazard (e.g. volcanic eruption) could lead to improvements in hazard beliefs and preparedness for other salient hazards (e.g. earthquakes)

(Sjöberg 2000; Spedden 1998). By examining perception of risk attributed to a range of hazards, it was also possible to examine the efficacy of this process.

Contrasting communities

The characteristics and hazard experience of the communities discussed in this paper, Hastings and Whakatane, are described in *Table 1*. Comparisons between the two communities should be treated cautiously because they are subject to different magnitudes and frequency of hazards. They do, however, have broadly similar hazard histories and both have experienced impacts from historic earthquake and volcanic hazard activity.

The major difference between these communities, from the perspective of this paper, concerned the fact that Hastings was exposed to ash fall from the 1995 eruption, while Whakatane was not. This difference was used to frame questions regarding the influence of direct and vicarious experience respectively on residents threat knowledge and perceptions of risk from volcanic hazards, and how each type of experience influenced hazard adjustment adoption.

Awareness, risk and preparation

Eruption activity occurred over an 8-9 week period. Such sustained activity provided a substantial period of time within which information could be obtained, beliefs tested, and adjustments adopted. In order to attribute risk to a hazard, awareness of hazard activity and its threat potential is an essential precursor. Threat knowledge and risk perception have been linked to hazard salience, level of past activity and contact with hazard information sources (Lindell 1994; Lindell & Whitney 2000; Perry & Lindell 1990). These factors were used to guide the selection of the variables discussed here. Both towns have a history of vulnerability to volcanic hazards and have experienced damage and ash fall (*Table 1*) from historic eruptions (Johnston 1997), allowing the inference of a comparable degree of hazard salience. Both had comparable levels of access to media coverage (regarding ash fall and its effects) of the eruption and to information from local emergency management offices (*Table 1*).

Threat knowledge was measured by assessing knowledge of local eruption history and, in particular, ash thickness. The importance of this information lies with its role as a guide to what could happen and what protective measures could be necessary. Risk perceptions were assessed in terms of the perceived threat of volcanic activity to personal safety and to daily life (i.e. residents perception of the likelihood of volcanic ash fall causing disruption to their work, leisure activities or property) (Lindell 1994). In order to examine the role of experience within an all-hazards framework (i.e. whether experience of the effects of one hazard influenced beliefs regarding others), perception of the risk attributed to earthquakes as a result of exposure to volcanic hazard effects was also examined.

Next, the influence of each type of experience on preparation was examined. The relationship between the above variables and adjustment adoption is more complex. While this link has been described in several studies (Perry & Lindell 1990), more recent studies have suggested caution in assuming this relationship (Lindell & Whitney 2000). Here, residents were asked if, in regard to any natural hazards, they had adopted adjustments such as purchasing insurance, planning evacuation routes, obtaining a battery powered radio, and having supplies of food and water. Respondents levels of perceived preparedness were also assessed.

	Hastings	Whakatane
Population	27,000	14,000
Location from Ruapehu	110km SE	190km NE
Hazard history		
Earthquake	1931 (magnitude 7.2)	1987 (magnitude 6.2)
	93 deaths	
Volcanic	Minor ash fall	7-8cm ash
	1896	1886
	1948	100 deaths
	1975	
1995 Impact	2mm ash	No ash
1995 Information Sources		
Authorities (e.g. Civil defence)	11%	26%
Newsmedia	60%	75%

Table 1: The hazard histories and characteristics of the experience of the 1995 eruption of Ruapehu volcano in Hastings and Whakatane

		Hastings		Whakatane	
		N	%	N	%
Survey 1	March 1995	216	48	203	45
Survey 2	November 1995	99	46	102	50

Table 2: The hazard histories and characteristics of the experience of the 1995 eruption of Ruapehu volcano in Hastings and Whakatane

Method

A survey assessing individuals' hazard knowledge, risk perceptions and actual and perceived preparedness was administered first in March 1995 and then again in November to establish the immediate influence of the 1995 Ruapehu eruption on these parameters.

The survey was initially distributed to 450 households in each centre. The rates of return of the questionnaire and the sample sizes are described in *Table 2*. Of those who completed the first survey 50% in Whakatane and 45% in Hastings completed the second.

Data were analysed using the ANU sign test. A significant proportion of the respondents did not change their mind between the two surveys and hence there are many tied observations.

There are many sign tests that deal with ties, but the sign test of Putter (1995) was recommended by Coakley and Heise (1996) after different procedures were reviewed and compared.

This test is the uniformly most powerful (UMP), and performs very well in most settings, even when the sample size is small.

Results

Threat knowledge

Threat knowledge was measured using the proportion of respondents indicating an accurate knowledge of ash fall from previous eruptions (*Table 3*). Prior to the 1995 eruption, 19% of Whakatane respondents identified the correct range. This dropped to 15% following the eruption (*Table 3*). The vicarious experience of Whakatane residents neither affected their knowledge of ash thickness nor encouraged the search for information about the nature or extent of hazard effects (despite their having more access to information from the media and emergency management agencies *(Table 1*). In contrast, the direct experience of Hastings residents resulted in a shift in hazard knowledge, increasing from 32% prior to the eruption to 93% after it (*Table 3*). Direct experience of ash fall stimulated the search for information about past activity and increased threat awareness.

Hastings		Whakatane	
Pre	Post	Pre	Post
32	93	19	15

Table 3: Percentage of respondents with accurate knowledge of eruption history (ash thickness)

Hazard	Hastings		Whakatane	
	Pre	Post	Pre	Post
Volcanic eruption	3.75	3.15 (p<0.000)	2.74	2.75 (p= 0.896)
Earthquake	1.76	1.92 (p<0.01)	1.96	2.09 (p = 0.226)

1= high risk – 5 = lowest risk

Table 4: Risk Perception: Perceived threat to personal safety

Hazard	Hastings		Whakatane	
	Pre	Post	Pre	Post
Volcanic eruption	3.67	2.88 (p<0.000)	2.49	2.46 (p = 0.352)
Earthquake	1.87	2.03 (p=0.124)	1.87	1.97 (p = 0.363)

1= high disruption – 5 = low disruption

Table 5: Risk Perception: Perceived disruption to daily life

Risk perception

Risk perception has been linked to direct and indirect hazard experience (Lindell & Whitney 2000; Sjöberg 2000). Risk perception was assessed by asking residents to rate the risk to personal safety and to daily life attributed to earthquake and volcanic hazards. The results are described in *Tables 4 and 5* respectively. It can be inferred from these data that, for Whakatane residents, vicarious experience resulted in their perception of risk attributed to volcanic hazards remaining unchanged (*Tables 4 &5*).

In Hastings, direct experience of this eruption increased the perceived risk to personal safety and daily life (*Tables 4 & 5*). Another interesting finding was the significant decrease in the risk to personal safety attributed to earthquake hazards (*Table 4*). Although failing to reach significance, a similar trend was evident with respect to the risk of disruption to daily life (*Table 5*). A similar trend was evident in Whakatane. These results reiterate those obtained for hazard knowledge. Direct experience is an essential precursor to a shift in risk perception. The compensatory decrease in the perception of risk attributed to earthquake hazards was unexpected.

An additional measure of risk examined here concerned community perceptions of volcanic threat to the economy and the environment. In addition to providing information on the salience of these issues, these data also provide an indication of the likely commitment to community-wide mitigation. Communities which acknowledge a shared risk (e.g. loss of economic integrity) are more likely to engage in reduction activities dependent upon collective action for their success (Paton & Bishop 1996). When asked if they thought that the threat to the regional economy or environment from volcanic eruptions was over-rated, the risk attributed to volcanic hazards in Hastings increased significantly, but remained unchanged in Whakatane (*Table 6*).

Adjustment to volcanic hazards

Two measures of preparedness were used. One asked about actual measures adopted. The other asked respondents to indicate the perceived level of their, their community, and local government preparedness.

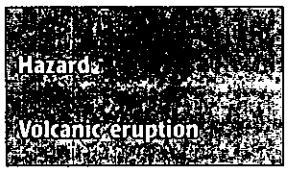
The proportion of respondents reporting the adoption of preparatory measures is described in *Table 7*. While no change was observed in Whakatane, the proportion of Hastings respondents adopting these measures dropped from 63% prior to the eruption to 53% following the 1995 eruption. From these data, it can be inferred that neither direct experience nor increased threat knowledge and risk perception automatically translate into better preparedness. Additional factors are operating to influence the nature of this relationship.

This issue was further examined by asking respondents to rate their perceived preparedness as well as that of their community and local government (emergency management). In both Hastings and Whakatane perceived preparedness levels increased for all groups (*Table 8*). Despite a shift to better perceived preparedness, the absolute levels of the scores still indicate relatively low levels of perceived preparedness.

Discussion

Vicarious experience and risk perception

Both the communities studied here have been, and remain, objectively vulnerable to volcanic hazards. That Whakatane, in this instance, was spared any direct effects was more a function of fortuitous meteorological conditions. Despite this common vulnerability, it was only those individuals residing in the community that experienced consequences directly that positive shifts in threat knowledge and risk perception were evident. Vicarious experience of this eruption did not influence hazard awareness or risk perception.



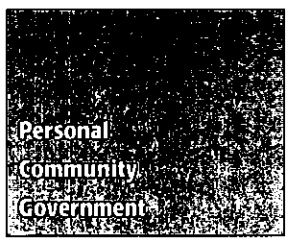
	Hastings		Whakatane	
	Pre	Post	Pre	Post
Volcanic eruption	3.00	3.41 (p<0.000)	3.29	3.27 (p = 0.704)

1= strongly agree – 5 = strongly disagree

Table 6: Risk perception: Do you think the volcanic threat to the region is overrated?

Hastings		Whakatane	
Pre	Post	Pre	Post
63	53	66	66

Table 7: Preparedness: Proportion undertaking protective measures (%)



	Hastings		Whakatane	
	Pre	Post	Pre	Post
Personal	3.24	2.94 (p<0.000)	3.03	2.73 (p<0.000)
Community	3.43	3.13 (p<0.000)	3.17	3.04 (p<0.05)
Government	2.60	2.19 (p<0.000)	2.30	2.20 (p = 0.219)

1= very prepared – 4 = not prepared at all

Table 8: Perceived preparedness at personal, community and local government levels

The fact that vicarious experience of an actual eruption did not influence these beliefs raises questions about the effectiveness of risk communication initiatives undertaken during periods of hazard quiescence. It can be inferred from this that, during quiescent periods, hazard salience will be lower, lessening the likelihood of information or advice being attended to. This possibility was tested in the Auckland survey of the effectiveness of a volcanic hazard public information programme (Ballantyne, et al. 2000). The efficacy of this form of vicarious experience was assessed by comparing knowledge and beliefs of 405 respondents prior to and after the campaign. N o significant change in awareness of volcanic threat (pre: x=0.88; post: x=1.08, t = -2.02, p = 0.331) or risk perception (pre: x=1.62; post: x=1.57,t = 1.59, p = 0.119) was found. Since most hazard education and reduction initiatives are conducted during quiescent periods alternative strategies for education and the encouragement of adjustment adoption are required.

Other findings from the Auckland survey are informative in the context of the present discussion. Not only did the provision of information not result in the desired changes in hazard beliefs, it also resulted in some 28% of respondents reporting that they were *less* concerned about volcanic hazards, the opposite of what was intended. When faced with issues about which they have little knowledge, people may infer responsibility for protection to those they perceive as having the requisite expertise (in this case the agencies responsible for the public information campaign). Mulilis and Duval (1995) and Lindell and Whitney (2000) concluded that attributing responsibility for personal safety to others would result in a reduction in adjustment adoption.

A secondary objective of this paper concerned the examination of the potential for the experience of one hazard to positively influence beliefs regarding others. This possibility was based on the assumption that people group similar events (in this case, 'natural hazards') together so that decisions and beliefs regarding one member of this class are automatically applied to others (Spedden 1998). In Hastings the opposite was found. An increase in risk attributed to volcanic hazards was accompanied by a decrease in risk attributed to earthquake hazards even though both are objectively salient hazards. A similar trend was evident in Whakatane.

While these data indicate that experience of one kind of hazard activity can have cross-over effects on beliefs regarding others, the nature of the relationship was contrary to expectations. From the data available, it is not possible to determine the duration of this effect. These data suggest that more research is required to elucidate the processes that underpin the issue of risk sensitivity (Sjöberg 2000), and its implications. For example, with respect to risk communication within an all-hazards framework, if the operation of a compensatory mechanism is confirmed, it will be necessary to frame communication in ways that does not link behaviour to a specific hazard. It also raises the possibility that community responsiveness to natural hazard issues will be sensitive to the salience of other societal events. For example, an increase in the salience of social 'hazards' such as crime, economic adversity, or unemployment, could lessen the perceived importance of natural hazard issues. While additional work is required to elucidate this issue, this possibility suggests that hazard reduction and readiness initiatives could benefit from inclusion within community development programmes.

Vicarious experience and adjustment adoption

In regard to the effect of direct and vicarious experience on adjustment adoption and perceived preparedness, the situation is more complex. In Hastings, despite improved hazard awareness and risk perception, the proportion of respondents making adjustments (given that the eruption continued for 8-9 weeks) such as planning evacuation routes, purchasing insurance, storing food, water, torch, radio and spare batteries dropped following the eruption. In Whakatane the proportion stayed the same. While having a substantial majority prepared may seem to indicate reasonable levels of preparedness, caution in the interpretation of these data is required.

The assessment of preparation in the Ruapehu study did not examine the validity of claims made by respondents. This is an important issue. For example, in the Auckland study, some 41% of respondents stated that they could describe the list of protective actions described in the Civil Defence pages of the Yellow Pages. When asked to do so, however, only 15% of them (i.e. only 6%

of the total sample) could actually recall them. While respondents had a better (though still poor overall) recognition of the existence of these actions, their ability to recall them was significantly poorer, suggesting that people tend to overestimate their knowledge and preparedness. This is likely to lessen their attentiveness to new information and reduce their perceived need to develop better preparedness. Anecdotal (e.g. from respondents actually checking their emergency supplies and finding that they did not posses items assumed to be present) and contradictory (e.g. the number of people keeping spare batteries for torches outnumbered those with torches) reports also suggests that people overestimate their preparedness. Self-reports regarding actual and perceived preparedness must be verified.

Despite both direct and vicarious experience resulting in respondents reporting positive shifts in perceived preparedness, the ratings obtained here suggest that this remains a problematic issue. Perceived personal and community preparedness was low both before and after the eruption (*Table 8*). While a significant improvement in perceived preparedness was observed in both communities, these data should be interpreted cautiously. Despite the increased threat knowledge and risk perception recorded in Hastings, a reduction in preparatory activities was observed. In Whakatane, an improvement in perceived preparedness was observed despite their not recording any change in other parameters. Taken together, these data are consistent with the operation of a 'normalisation' bias (Mileti & O'Brien 1993). This described how individuals infer from their ability to cope with an (objectively) minor impact the ability to cope with any future occurrence or assume that future events will not exercise an adverse effect upon them. The ensuing increase in perceived preparedness could result in their vulnerability to more exacting levels of hazard activity being increased.

A similar picture emerged from the Auckland survey. The provision of information on volcanic hazards and protective activities failed to influence adjustment adoption (pre: x=0.34; post: x=0.37,t = -0.669, p = 0.447). Nor was their any correlation between risk perception and adjustment adoption (r = 0.007, p = 0.831). Collectively, these data reinforce the need for caution in assuming a link between risk perception and preparation. This is an important issue given that most public education programmes operate on the assumption that a better informed public will be a better prepared public.

Also if interest was the pattern of results in *Table 8*. Within each community, respondents rated local government preparation as greater than their own preparedness and theirs as greater than that of the community in general. These data raise several issues. For example, they are consistent with the operation of an unrealistic optimism bias (Weinstein & Klein,1996; Sjöberg 2000) whereby respondents rate themselves as less vulnerable and more skilful than average. Individuals may be aware of possible shortcomings in preparedness within their community, but these attributions do not extend to themselves. While individuals may appreciate a need for risk reduction activities, they may be less likely, as a consequence of the influence of differential attributions regarding preparedness (i.e. they attributed greater existing preparedness to themselves), to act on warnings or participate in community activities presented in public information campaigns.

The perceived preparedness that community members attributed to local government emergency management agencies (*Table 8*) could also reflect a tendency of people, when dealing with hazard effects they feel they know little about, to transfer responsibility for safety to those perceived to have greater knowledge. Data concerning perceived preparedness should thus be viewed with caution and the possibility that it signals the delegation of responsibility for safety from themselves to emergency management agencies cannot be discounted. Further, if perceived personal responsibility for safety is low, adjustment adoption is likely to be correspondingly compromised (Mululis & Duval 1995).

Conclusion

A number of general conclusions can be drawn from this study. While direct experience of hazard effects heightened threat knowledge and risk perception, vicarious experience did not. If the occurrence of an actual eruption did not influence threat knowledge and risk perception in residents in a community with known vulnerability to volcanic hazards, the likely success of reduction and risk communication strategies undertaken during periods of hazard quiescence is low. This conclusion was reinforced by the results of the Auckland survey which was conducted under just these circumstances. These findings reiterate the need for caution in assuming a direct relationship between risk perception and adjustment adoption.

The data discussed here illustrate the dynamic nature of the relationship between individuals, hazard activity, and readiness strategies. The social environment within which natural hazard reduction and readiness activities are conducted is not stable. Several mechanisms influence how people interpret experience, make decisions regarding responsibility for their protection, and develop preparedness beliefs and behaviour. These relationships must be understood and their contingent implications incorporated into planning agenda.

More work needs to be done to investigate how compensatory mechanisms link beliefs regarding different hazards and how these change with experience of specific hazards (given that even in areas vulnerable to diverse hazards, not all will be experienced at any one time). This issue has implications for strategies designed to promote all-hazards preparedness. One approach to countering this constraint would involve incorporating risk management activities with community development initiatives. While acknowledgement of the existence of a threat from a hazard remains a precursor, more research is required to articulate the processes that mediate between risk perception and behaviour change and adjustment adoption.

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Authors contact details
Associate Professor Doug Paton
Department: School of Psychology
Massey University, New Zealand
E-mail: D.Paton@massey.ac.nz

A strategic research agenda for emergency management

One of the Strategies defined in the National Emergency Management Strategic Plan 2000-2005 is to: 'Facilitate and Set Priorities for Directed Emergency Management Research'. In April 2000 the National Emergency Management Executive Group (NEMEG) endorsed the development of a collaborative research program based on a cooperative centre incorporating RMIT, ANU and EMA. The *Risk and Community Safety Research Initiative* has been established (pending final agreement between the three parties) to develop that program.

One of the first tasks of the *Risk and Community Safety Research Initiative* is to establish an agenda of strategic research needs for Australian emergency management.

The *Initiative* is collecting ideas and suggestions about what the research agenda should contain. We would like you to tell us the research areas or topics you think are important, and to indicate the order of importance. Reasons for your choice would be appreciated.

A paper setting out some initial suggestions is available from the address below. The plan is to have the agenda finalised by the end of February. It will then guide the work of the *Initiative* and be available to other research groups.

Possible research topics set out in the paper are (here the topics are in abbreviated form):

1. *Emergency management capability*: What is it now and what could it consist of? How do emergency services contribute to the development of sustainable communities?

2. *Value:* What is the value of emergency services? What sort of performance indicators should be used?

3. *Volunteers:* How do we best find, motivate, keep and value volunteers? Should emergency management try to become more or less dependent on volunteerism?

4. *Understanding communities.* Three elements: conceptualising community safety, vulnerability and resilience; community capacity, participation and policy; and what role should the private sector have?

5. *Information management:* How can an "information culture" be built? How can we ensure that the information needed for risk management is available to those who need it?

6. *Risk assessment*: What is needed to help with implementation of the risk assessment process? How to cope with the ethical, legal and political aspects of risk assessment?

7. *Uncertainty*: How to deal with uncertainty in risk and emergency management?

8. *Institutional and legal change*: What sort of changes are likely and how can emergency management gain from them (eg privatisation)? How to clarify legal uncertainty where it interferes with information exchange?

9. *Essential services*: How to best assess and manage the vulnerability of essential services?

10. *Costs of disasters*: Making sure that the true costs of disasters are documented.

Contact details:
Fax: 03 9663 2517
Phone: 03 9925 3279/2307
Email: risk@rmit.edu.au

Enquiries on this process can be sent to johnhandmer@hotmail.com

Funding for Disaster Prevention/Management Projects

Emergency Management Australia (EMA) has project funding to support disaster prevention and management projects during 2001/2002. Project proposals aimed at reducing disaster-related loss of life, property damage, and economic and social disruption in Australia are now encouraged from individuals, community groups, businesses, non-government organisations and agencies at all levels of government.

EMA is looking for projects that will:

- improve Australia's capabilities for preventing or dealing with natural or technological hazards and disasters;
- improve community awareness of the risks posed by natural and technological hazards;
- focus on prevention, preparedness, response or recovery strategies; or
- reduce the vulnerability of communities or essential services to natural and technological hazards.

Projects focusing on the following themes identified for 2001-2002 are strongly encouraged:

- cost-benefit analysis of mitigation measures and initiatives;
- emergency management in rural and remote areas of Australia;
- understanding and assessment of community vulnerability and resilience;
- land use planning
- volunteers (2001 is the International Year of the Volunteer).

While the maximum amount of funding will normally be $40,000, applicants should note that in the past the average funding granted to approved projects was $16,000. To obtain further information, please contact Rob Cameron at EMA: Phone: (02) 6266 5408; fax: (02) 6266 5029 email: projects@ema.gov.au
Proposals should be addressed to Director Development, Emergency Management Australia, PO Box 1020, Dickson ACT 2602 by 28 February 2001.

Instructions on how to submit an application for EMA Projects Program funding are available on the EMA website at www.ema.gov.au.

Disaster Events Calendar

March/April 2001

An Internet conference: Enterprise, risk and the management of uncertainty

Hosted by:
White Rose Centre for Enterprise (The Universities of Leeds, Sheffield and York) Research Forum

Topics to cover:
Risk and small business failure; Risk and innovation/technical change; Organisational problems in high tech environments; Business continuity planning and the small business; Innovation, technical change and risk; Social aspects of new technologies; Managing new technologies in an enterprise culture.

As part of the conference process, debate and interaction will be facilitated through the provision of discussion rooms and bulletin boards.

Contact:
E.L.Coles@sheffield.ac.uk, or
Denis.Smith@sheffield.ac.uk
Sheffield University Management School
9 Mappin Street
Sheffield S1 4DT, UK

March 5-7, 2001
Pilani, Rajasthan India

Conference on Disaster Management with Special Sessions on Lessons Learnt from the Orissa Cyclone and Gujarat-Rajasthan Drought

Sponsors:
Birla Institute of Technology & science (BITS)

The main objective of this conference is to bring all concerned in the task of disaster management and discuss the management techniques applied with lessons learnt from these disasters for possible improvement.

Contact:
Prof. Satyendra P Gupta
Group Leader, Civil Engineering Group
BITS Pilani, 333 031
Rajasthan, India
Phone: 91-01596-45073 Ext.:353 or 254 (Office)
91-01596-43066 (Residence)
Fax: 91-01596-44183
Email: spgupta@bits-pilani.ac.in
www.bits-pilani.ac.in.

March 8-9, 2001
London, Heathrow

Fires in Trains: International Seminar incorporating Escape and Crash Survival

Before the tragic events, which took place, outside Paddington in the UK in 1999, it was widely thought that a train crash would not result in serious fire. Since then, there has been a number of incidents ion other countries with similar severe consequences. The Seminar will cover aspects on Emergency & Disaster Planning, Escape and Evacuation, Human Behaviour in exercises and real life situations, Legal issues and moral dilemma's and emergency Management Strategies. The Seminar will be Co-Chaired by Mr Vic Coleman HMRI Chief Inspector of Railways and Mr Alan Cooksey, HMRI Deputy Inspector of Railways.

Contact:
Stephanie Whitham
Independent Technical Conferences Ltd
PO Box 452
Kempston, Bedford MK43 9PL, UK
Phone: 44 (0) 1234 854756
Fax: 44 (0) 1234 841375
www.itc-conferences.com

March 19-April 6, 2001
Melbourne, Australia

HELP 2000— Health Emergencies in Large Populations Course

Sponsors:
International Committee of the Red Cross (ICRC), American Red Cross, and Pan American Health Organization

Contact:
International Committee of the Red Cross
GEN_SAN Help Courses
19, avenue de la Paix
1202 Geneva, Switzerland
Phone: +41 22 730 28 10
Fax: +41 22 733 96 74
Email: pperrin.gva@icrc.org
www.icrc.org.
Email: azogopou@nat.redcross.org.au

March 21-23, 2001
Canberra, Australia

GDIN-2001: Fourth Annual Conference of the Global Disaster Information Network

Disaster Events Calendar

Contact:
Emergency Management Australia
P.O. Box 1020
Dickson, ACT 2602
Phone: 61 2 6266 5219
Fax: 61 2 6266 5029
Email: gdin@ema.gov.au
www.ema.gov.au/gdin -or- http://www.gdin-international.org/.

March 28-April 1, 2001
Tampa, Florida

22nd Annual International Disaster Management Conference: Commanding Solutions

Hyatt Regency Tampa
Two Tampa City Center
Tampa, FL 33602
Phone: (813) 225-1234

Sponsor:
Florida Emergency Medicine Foundation

Contact:
Suzanne Lobb
Conference Coordinator
Florida Emergency Medicine Foundation
3717 South Conway Road
Orlando, FL 32812
Phone: 800 766 6335 (toll free) or 407 281 7396
Fax: 407 281 4407
Email: info@fcep.org
www.fcep.org

Audience:
EMS Personnel, EM Managers, Hospital Administrators, Physicians, Nurses, DMAT Personnel, Medical Facility Administrators, and others who play an important role in critical incidents.

Topics:
Los Alamos Fire, Lowes Motor Speedway Walkway Collapse, Wild Turkey Distillery Warehouse/Kentucky River Fire, Ybor City Historic District Fire, Bio-Terrorism Panel Discussion, Donations Control, Swift Water/Flood Rescue, Major Aviation Disasters

March 29-30, 2001
Alexandria, Virginia

Risk Assessment and Policy Association Third Biennial International Conference

Contact:
John M. Gleason
RAPA Conference
Department of Information Systems and Technology
College of Business Administration
Creighton Universit
Omaha, NE 68178
Phone: 402 280 2624
Email: rapa@creighton.edu
www.fplc.edu/tfield/rapa.htm

March 30-April 3, 2001
Emmitsburg, Maryland

International Association of Emergency Managers (IAEM) 2001 Mid-Year Meeting National Emergency Training Center

Contact:
IAEM
111 Park Place
Falls Church, VA 22046-4513
Phone: 703 538 1795
Fax: 703 241 5603
Email: iaem@aol.com
www.iaem.com

April 2-6, 2001
Madrid, Spain

Safety in Road and Rail Tunnels: Fourth International Conference & tmi Trade Show

Organised and Sponsored by:
The Independent Technical Conference Ltd., University of Dundee

This fourth conference in the series will present more than 80 papers during three days, in which experts from around the world will meet to debate and discuss the latest ideas, philosophies and recommendations for safety in road and rail tunnels. Technical Papers will be presented in Plenary and Parallel Sessions. Formal Discussion Forums each day will cover topics such as Regulation, Design and Response. Tunnel Management International will be hosting a Trade Show during 2-4 April alongside the conference.

Contact:
Stephanie Whitham
Independent Technical Conferences Ltd
PO Box 452, Kempston, Bedford MK43 9PL, UK
Phone: 44 (0) 1234 854756
Fax: 44 (0) 1234 841375
www.itc-conferences.com

April 8-11, 2001
Cambridge University, U.K

XIIth Global Warming International Conference and Expo (GWXII): Kyoto Compliance Review— Year 2001 Conference

Sponsors:
Global Warming
International Program Committee and Global Warming International Center

Contact:
Professor Sinyan Shen
GWIC-USA, 22W381 - 75th Street
Naperville, IL 60565, USA
Phone: 630 910 1551
Fax: 630 910 1561
Email: syshen@megsinet.net
http://GlobalWarming.Net

April 16-20, 2001
Tokyo, Japan

Second International Civil Engineering Conference in the Asian Region

Organiser:
Asian Civil Engineering Coordinating Council

One of three conference tracks is 'Sustainable Development, with Emphasis on Natural Hazard Reduction.'

For more information:
www02.u-page.so-net.ne.jp/tg7/cecar/ or

contact:
Noel Raufaste
American Society of Civil Engineers
1801 Alexander Bell Drive
Reston, VA 20191-4400, ASCE
Phone: 703 295 6169
Email: nraufaste@asce.org

April 18-22, 2001
Baltimore, Maryland

Sixth World Congress on Stress, Trauma and Coping

Sponsor:
International Critical Incident Stress Foundation (ICISF)

Contact:
Shelley Cohen
World Congress Coordinator, ICISF
10176 Baltimore National Pike
Unit 201, Ellicott City, MD 21042
Phone: 410 750 9600
Fax: 410 750 9601
Email: scohen@icisf.org
www.icisf.org

April 21-25, 2001
Dallas, Texas

2001 National Disaster Medical System (NDMS) Conference

The conference is designed to promote interaction between local, State and Federal public health practitioners and policy makers. The conference targets practitioners from the fields of clinical medicine, public health, emergency medical services, mental health, veterinary medicine, law enforcement, fire service, mortuary service, disaster response, emergency management and Federal, State and local specialized response teams. Over 75 accredited educational sessions will be held focussing in areas such as planning, health, medicine, counter-terrorism, tactical tools, mentoring, and communications will be featured. Additional, pre-conference works will be held.

Contact:
NDMS
12300 Twinbrook Parkway, Suite 360
Rockville, MD 20857
Phone: 301 443 1167 or 800 872 6367
Fax: 301 443 5146 or 800 872 5945
Email: ndms@usa.net
www.oep-ndms.dhhs.gov

April 24-25, 2001
Boston, Massachusetts

CPM (Contingency Planning and Management) 2001

Sponsor:
Contingency Planning and Management Magazine

Contact:
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Conference Coordinator
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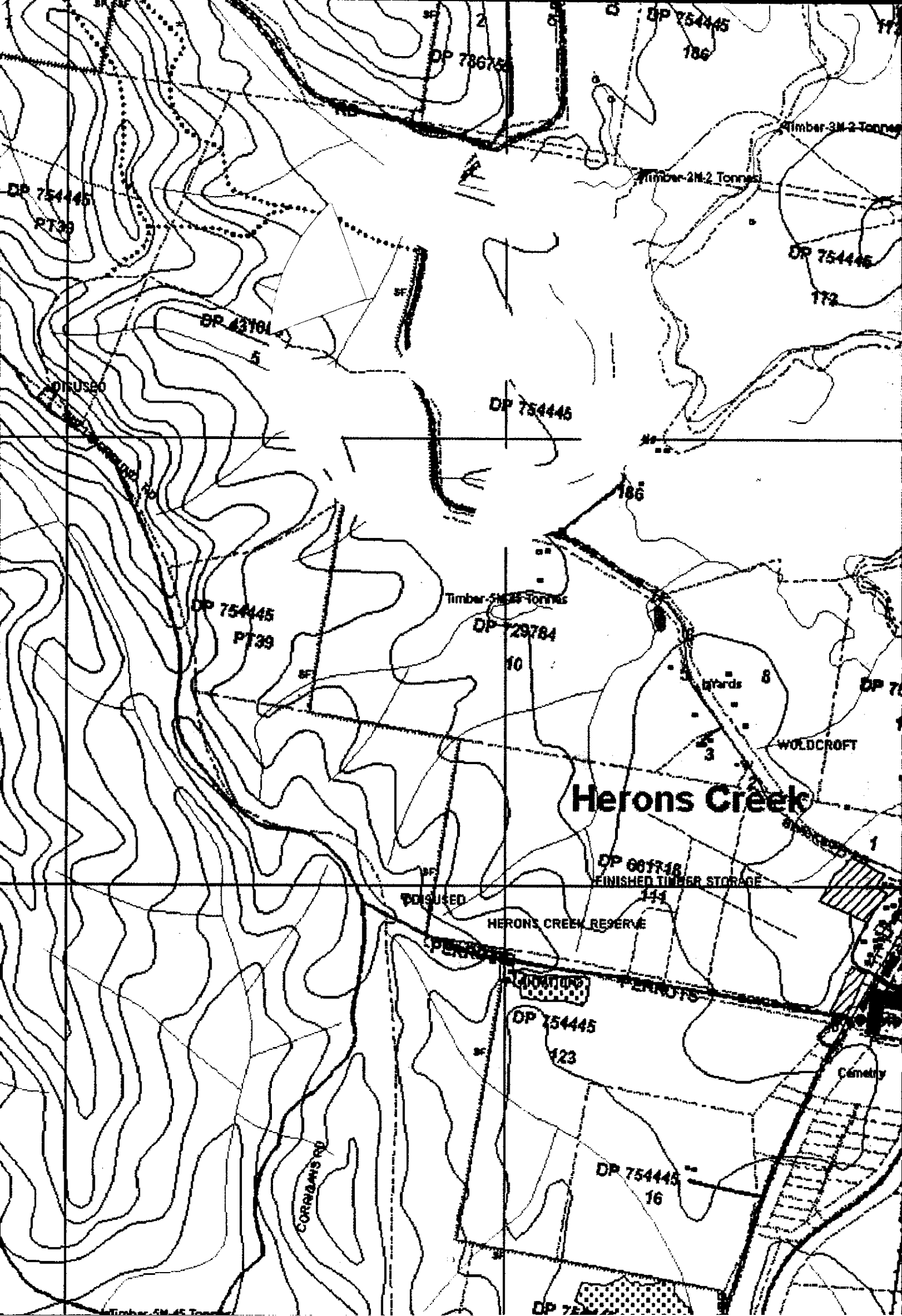
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