Queensland Floods Commission of Inquiry

Addendum To Statement of Russell Keith Cuerel

October 2011

QUEENSLAND FLOODS
COMMISSION OF INQUIRY

ADDENDUM TO STATEMENT OF RUSSELL KEITH CUEREL

I, **RUSSELL KEITH CUEREL**, of c/- 41 George Street Brisbane in the State of Queensland, Manager, Infrastructure Management, Office of the Water Supply Regulator, Department of Environment and Resource Management (DERM), solemnly and sincerely affirm and declare:-

1. I have previously provided two sworn statements both dated 14 September 2011 to the Queensland Floods Commission of Inquiry (the "Commission") in responding to the Commission's Requirement to Provide Information Reference 1679734 and Requirement to Provide Information Reference 1690693.

2. Further to my sworn statement dated 14 September 2011 in responding to the Commission's Requirement to Provide Information Reference 1679734 (the "Requirement"), I wish to make the following amendments: -

   a. At paragraph 6(a) of my statement (in response to Item 3 of the Requirement), a document titled "Urban Flooding in Queensland – A Review" prepared for the department in 1998 by Mr David Ingle Smith and various discussion papers have been located relevant to the development of the State Flood Risk Management Policy. These documents are attached at attachment **RKC-12** and are additional to the documents previously referred to in my statement at RKC-03.

   b. Further, at paragraph 6(a) of my statement (in response to Item 3 of the Requirement), additional internal departmental correspondence relevant to the development of the State Flood Risk Management Policy have also been located. These documents are attached at attachment **RKC-12** and are additional to the documents previously referred to in my statement at RKC-03.

   c. At paragraph 7(b) of my statement (in response to Item 4 of the Requirement), various email correspondence had between the department and the then Department of Emergency Services in relation to the Bundaberg City Council's Draft Planning Scheme is attached at attachment **RKC-13**. These documents are additional to correspondence previously referred to in my statement at RKC-05.

   d. The additional documents referred to in paragraph 2a above attached to this Addendum Statement have been previously provided to the Commission under a previous Requirement for Information dated 20 July 2011 however, whilst preparing to give evidence before the Commission, I realised that these documents were potentially relevant to the Requirement.

   e. The additional documents referred to in paragraph 2b and 2c above attached to this Addendum Statement were only located by me on or about 3 October 2011 whilst preparing to appear to give evidence before the Commission.

3. During my preparation to give evidence before the Commission, I also identified that the attachments provided in my statement to the Commission were incorrectly indexed. For clarification:

   a. documents referenced in my statement as RKC-02 are provided at index RKC-08;

   b. documents referenced in my statement as RKC-03 are provided at index RKC-02;

   c. documents referenced in my statement as RKC-04 are provided at index RKC-03;

   d. documents referenced in my statement as RKC-05 are provided at index RKC-04;

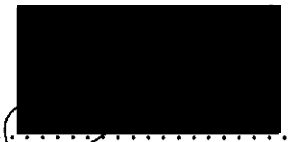
   e. documents referenced in my statement as RKC-06 are provided at index RKC-05;

   f. documents referenced in my statement as RKC-07 are provided at index RKC-06;

   g. documents referenced in my statement as RKC-08 are provided at index RKC-07; and

   h. documents provided in my statement at RKC-09 are correctly indexed.

I, **RUSSELL KEITH CUEREL**, make this solemn declaration conscientiously believing the same to be true, and by virtue of the provisions of the *Oaths Act 1867*.



Signed(.....)
Russell Keith Cuerel

Taken and declared before me, at Brisbane this 4th day of October 2011.

.....
Solicitor/~~Barrister/Justice of the Peace/Commissioner for Declarations~~

URBAN FLOODING IN QUEENSLAND

A REVIEW

David Ingle SMITH

Prepared for the Department of Natural Resources, Queensland

February 1998

Centre for Resource and Environmental Studies
Australian National University
CANBERRA ACT 0200

ACKNOWLEGEMENTS

NHT Support
This Report is part of a Floodplain Management initiative of the Queensland Government which is jointly funded through the National Landcare Program of the Natural Heritage Trust.

Queensland Newspapers - Cover Photo's of Flooding in Queensland

Mr K Durham - Cover Photo's of Flooding in Queensland

Mr B Barchard - Cover Photo's of Flooding in Queensland

Additional information on this document is available from:

Regional Planning Group
Water Infrastructure Planning and Development

12th Floor, Mineral House
41 George Street
BRISBANE Q. 4000

Telephone: (07) 322 42719
Fax: (07) 322 47999

DNRQ980129
ISBN 0 7242 7445 6

TABLE OF CONTENTS

List of Figures

List of Tables

Executive Summary

The aims of the study are to:

- assess the size of the urban flood problem in Queensland;
- to advise on deficiencies in floodplain management; and
- to recommend how to overcome the shortcomings.

The major source of information was from an extensive questionnaire circulated to all local councils in Queensland. The total number is 125 and questionnaires were returned from 103 of these. Discussions with State and federal agencies established that 18 of the non-respondents did not have an urban flood problem, defined as a minimum of ten buildings at risk from the 1 in 100 year flood event.

Visits were made to five councils, Brisbane, Cairns, Logan City, Carpentaria and the Gold Coast. The last of these, is thought to have more flood prone buildings than any other local authority in Australia. Detailed accounts are presented for Brisbane and the Gold Coast.

Size of the Problem

Assessment of the size of the problem, in terms of number of buildings at risk, is handicapped by the lack, for many councils, of reliable information on flood hydrology. The best estimate of the total number of buildings liable to flooding to the level of the 1 in 100 year flood event is 65,000. This is very similar to the number for New South Wales, estimated in Smith (1996) to also be 65,000. Queensland and New South Wales together account for over 80% of flood prone buildings in Australia. A ranked list of the 12 Queensland councils with the largest number of buildings at risk to the level of the 1 in 100 year flood event is presented below, these account for at least two-thirds of the State total. The poor quality of the data does not allow further sub-division into residential, commercial and industrial buildings.

Local Government Authority	Number of buildings
Gold Coast	16,650
Mackay	8, 500
Brisbane	8, 000
Dalby	3, 300
Ipswich	3, 000
Logan	2, 375
Hinchinbrook	2, 175
Charleville	1, 350
Rockhampton	1, 200
Burdekin	1, 000
Cairns	728
Caboolture	455
TOTAL	**48,733**

It is not possible to provide reliable estimates of those buildings at risk from floods that have recurrence interval between that for the 1 in 100 year event and the probable maximum flood, i.e., the worst flood that could occur. Only 11 councils in Queensland have such information and, of those, only 8 have the information in map form. The number of buildings liable to flooding at the level of the probable maximum flood could be in excess of 200,000.

The need for hydrological information to the level of the probable maximum flood is stressed throughout the report. This is necessary in order to assess potential flood damages, the risk of building failure and to provide a basis for effective emergency management at times of flood. For localities with a high flood range, a measure of the depth of flooding, there is a very real risk of the failure of lightweight structures (such as detached weatherboard dwellings) at time of extreme flood.

Damages

Because of the limited data on flood hydrology and vulnerability, ie. what is at risk from flooding, it is not possible to provide reliable estimates of flood losses. However, a guesstimate for the average annual actual damages (AAAD) for tangible losses to the residential, commercial and industrial sectors, to the level of the 1 in 100 year flood, is close to $100m (at 1990 values). The corresponding AAAD, if the damage estimates are extended to the level of the probable maximum flood, would be very much higher perhaps by a factor of two.

The report has established that Queensland has the highest AAAD for any State in Australia. The number of buildings at risk are comparable to those in New South Wales but there, the steadfast application of effective urban floodplain management has progressively reduced the AAAD for many flood prone urban localities and dramatically slowed the construction of new buildings in areas subject to the 1 in 100 year flood. In contrast, Queensland has not reduced flood vulnerability and for many urban flood prone communities the lack of land use controls or building regulations is such that potential damages increase year by year. A report, in 1978 by a National Committee investigating a National Scheme for Natural Disaster Insurance reached virtually the same conclusions.

It needs to be stressed that some of the major flood prone communities were greenfield sites at the time of the extensive floods of 1974. It is not possible from the questionnaires to give any firm data on the increase of the size of the urban flood problem since then, but there is no doubt that it is has been significant. The Gold Coast is a prime example but undoubtedly the expansion of developments, many of which are dominantly residential, onto flood prone sites has been a State-wide phenomenon.

Mitigation measures

The use of structural mitigation measures is limited. Although not necessarily a recommended procedure, only 13 councils in Queensland report the use of levees to reduce flood losses. Other strategies, some of which can be applied to individual buildings are rarely used. Examples are flood proofing, the raising of weatherboard dwellings above flood level or the purchase of especially hazardous buildings. Compared to other states, this restricted use of structural measures is thought to reflect paucity of funds, lack of background information and of urban flood policy.

of structural measures is thought to reflect paucity of funds, lack of background information and of urban flood policy.

The provision of flood forecasts, in part based on local instrumentation, is of a comparatively high standard. Exceptions are for some remote inland communities, the coastal settlements of the Gulf of Carpentaria are examples. Analyses, provided by the Bureau of Meteorology, indicate that the warning times for flood forecasts for 100 flood prone urban locations (about 70% of the total) are less than 12 hours. Thus, the best possible preparedness and response are necessary if the benefits of the forecasts are to be fully captured. Improved information on flood hydrology and the availability of flood maps are required together with the provision of flood markers at the local level. Only 25% of councils report that such flood markers are in place, their use should be obligatory.

Need for a State Policy

Only 35 of the council responses indicated that they had an `urban flood policy' and in many cases these fall short of being `state of the art'. This number is unacceptably small and often, where such a policy exists, the information on which it is based in inadequate.

Queensland is unusual among the Australian States in that it does not have a State-wide policy for urban floodplain management. Action is left to individual councils and the 35 responses that provided information on the under-pinning legislation, demonstrate that the institutional arrangements are unclear. The burden of costs, both for the necessary flood studies and for possible subsequent mitigation, have been frequently borne solely by local councils. This is marked contrast to New South Wales, where the contribution of state funding is close to 40% of the total costs, normally matched by similar federal funding.

The need in Queensland is for a co-operative, locally-based approach to urban floodplain management that is formulated to accord with an established State policy. This would require the provision of technical advice and a contribution to council funding from State sources (especially for assistance with flood studies).

Steps towards these aims would be for the State government to produce a flood manual specifically designed for use by local governments. This should present guidance to all aspects of best practice floodplain management. It should include guidance to all relevant planning legislation in order that floodplain management by local government is integrated into the State's overall planning policy.

A clear statement on the legal liability of council decisions that allow building in flood prone areas may aid improved floodplain management. Indemnity from such liability for councils following accepted procedures (as indicated in the proposed manual) is a strategy that could be investigated.

Until Queensland adopts an acceptable policy for new urban developments in flood prone areas, the damage bill will continue to escalate. It is important to note that Commonwealth contributions to flood relief, under the Natural Disaster Relief Arrangements, have decreased over recent years. This places additional burdens on the State Treasury and it is surprising that this has not resulted in greater pressure to reduce future flood losses by way of improved planning. Many mitigation measures would have favourable benefit-cost ratios and would

Storm Surge

The questionnaire also provides background information of coastal inundation for storm surge (alternatively referred to as 'storm tide'). A total of 25 councils replied that they had a storm surge problem which equates to virtually all coastal LGAs in Queensland. These are listed below with the date of the last occasion on which buildings were damaged.

Local Government Authority	Location affected	Date of most recent damaging event
Bowen	(Queens Beach)	1980
Burnett	(Bundaberg Point)	1942
Caboolture	(Several locations)	
Cairns	(City and Northern Beaches)	1979
Calliope	(Tannum Sands, Boyne Is.)	
Caloundra	(Kawana Waters)	
Cardwell	(Tully Heads, South Mission Beach)	
Carpentaria	(Karumba)	1976
Cook	(Ayton, Cooktown)	
Douglas	(Port Douglas)	
Gladstone		
Gold Coast		1974
Hervey Bay		1992
Hinchinbrook	(L. Tully)	
Johnstone1996		
Livingstone		
Mackay	(City and North Mackay)	1918
Noosa		1992
Pine Rivers		1993
Redcliffe		1994
Redland	(Bay Island)	
Sarina	(Several locations)	1918
Thuringowa		1971
Tiaro		
Townsville	(City)	1971

Information on storm surge risk is generally poor, the study estimates that between 40,000 and 50,000 buildings may be at risk from extreme surge events. This problem is compounded by the fact that it is unusual for councils to have any restrictions on development in areas liable to the storm surge.

by the fact that it is unusual for councils to have any restrictions on development in areas liable to the storm surge.

Unlike river flooding, the problem of surge is concentrated in Queensland and therefore, there is not the same opportunity for the transfer of methodologies and experience between States. Succinctly, inundation of urban areas from storm surge is a Queensland problem. Surge flooding requires similar land use planning regulations to those for river flooding, the major difference is that the occurrence of a major surge event could cause, at a single urban locality, the structural failure of several hundred dwellings.

The responses to this question indicate that to date effective development controls have been lacking and that there is an urgent need to better define the areas at risk, to introduce appropriate land use and building regulations and for improved arrangements for emergency management.

The Future

Actions to improve current practices are necessary to prevent the occurrence of major disasters with extensive damage and loss of life.

Section 11, *Towards Better Urban Floodplain Management*, outlines the steps that are required to improve urban floodplain management in Queensland. The essential first step is the provision of detailed studies, for flood hydrology and vulnerability, for all urban flood prone communities liable to flood. Without such information further progress is severely handicapped.

Overall, the current state of knowledge of flood risk in Queensland is poor and far below the standard of that elsewhere in Australia.

Conclusions

(i) Reliable estimates of the number of localities and the number of buildings subject to urban flooding in Queensland are severely hampered by the paucity of information on flood hydrology.

(ii) It is best estimated that the number of buildings (residential, commercial and industrial) at risk from the 1 in 100 year flood event is 65,000.

(iii) The majority of councils in Queensland have no information available on the risks associated with extreme floods, i.e. those in excess of the 1 in 100 year flood event. Only eight councils have such information available in map form.

(iv) The tangible annual average urban damage in Queensland, to the level of the 1 in 100 year flood event, is thought to be about $100m. The paucity of information on flood hydrology and vulnerability is such that that this estimate should be regarded as tentative; the data base for commercial and industrial losses is especially poor.

(v) Notwithstanding the quality of the background data, Queensland has the highest average annual urban flood damage of any State in Australia.

(vi) Continued development in flood-prone areas is of special concern, this leads to an ever-increasing escalation in vulnerability and flood damage.

(vii) The warning time that can be provided for some 70% of urban floodplain locations within Queensland is less than 12 hours.

(viii) In comparison to other Australian States, Queensland is unusual in that there is no clear or comprehensive State-wide policy to guide urban floodplain management.

(ix) Only thirty-five councils have a policy for urban floodplain management and, in many cases, these do not meet national or international best practice.

(x) Twenty-three councils report that they have urban areas at risk from storm surge (storm tide).

(xi) Overall, information available on liability for damage from storm surge, and the potential for catastrophic losses (including widespread building failure) are even less well developed than even those for riverine flooding. A guesstimate is that some 40-50,000 buildings in the State are at risk from the 1 in 100 year storm surge event.

(xii) Urban inundation from storm surge is essentially a Queensland problem, the risk likely exceeds that of the combined total for all other Australian States.

Recommendations

Flood studies

(i) There is an urgent need for information on flood hydrology for all flood-prone urban locations. The ranked list of flood liable locations could be used to prioritise such studies. Attention should also be given to providing information on flood hydrology for areas likely to be developed in future years.

(ii) Studies of flood hydrology should include information of the areal extent of the probable maximum flood and give, at least, a semi-quantitative assessment of over-floodplain velocities.

(iii) When studies of flood hydrology are complete they should be used to assess vulnerability, flood damage and be integrated into emergency management.

(iv) The resultant flood studies (combining hydrology, vulnerability and damage) should then be used as a basis for comprehensive urban floodplain management including evaluation of the full range of mitigation measures - structural and non-structural.

Forecasting and awareness

(v) There is a need to better use flood forecasts to capture the full benefits for all forms of loss reduction. One simple measure would be to make it obligatory for councils to

install flood markers in order that forecasts of flood height could more readily used to give an indication of the extent and severity of flooding. Such measures are cheap and effective.

Policy and legislation

(vi) There is an urgent need for the Queensland government to clarify, and ideally to revise, legislation relevant to the implementation of effective urban floodplain management.

(vii) A clear statement of the legal liability of councils that allow development in flood-prone sites should be provided by the State government.

(viii) To assist with the recommendations outlined above, the State government should fund and distribute a comprehensive urban floodplain manual specifically designed for use by local councils in Queensland. This should provide guidance on how to undertake studies of flood hydrology, vulnerability and damage together with information on mitigation options and the appropriate legislative basis for locally-based flood policy.

(ix) Analysis of the risks of catastrophic damage in urban areas from storm surge (storm tide) should be a given a high priority. Policy for the planning, and for the reduction of damage to existing structures, in storm surge areas should be integrated into that for riverine flooding.

Introduction

The study was commissioned to review all aspects of the urban flood problem throughout Queensland.

Specific aims included:

- the design, distribution and analysis of a questionnaire survey to all local government authorities (LGAs) in the State;
- estimates of the size of the urban flood problem;
- a review of the current state of urban floodplain management, including flood warning systems, mitigation measures etc.
- a prioritised list of flood prone communities for future detailed study;
- a review of best practice methods to assess urban flood losses;
- recommendations on how State agencies can assist and encourage LGAs to attain more effective flood management.

An outline consideration of inundation from storm surge was also included, as this is considered to represent an extension of riverine flood policy.

It is clear that many of the respondents to the questionnaire expended valuable time to complete the extensive range of questions. The author would like to thank all those involved for their cooperation. Special thanks are also due to senior staff of the following councils: Brisbane, Cairns, Carpentaria, Gold Coast and Logan, who, in addition to completing the questionnaire, were willing to discuss urban flood problems face to face.

Peter Baddiley and Terry Malone of the Hydrological Section of the Brisbane Regional Office of the Bureau of Meteorology, and Doug Angus and the staff of Queensland Emergency Services, willingly gave advice at all stages of the project.

Dr Darryl Muller of the Department of Natural Resources was responsible for assembling the questionnaire while Russell Cuerel, and other staff at the Department were responsible for the circulation of the questionnaire and chasing up recalcitrant respondents. Their diligence resulted in a remarkably high rate of return from local government officials who are undoubtedly over-worked and over-questionnaired.

Finally, my personal thanks to Katie Ellis in CRES, who skills, assistance and good humour at all stages of the project have been exemplary. These ranged from organising the computer data base for replies to the questionnaire, to proof reading and lay-out of the final report.

1

Background and Definitions

1.1 Definitions

A key factor in assessing the susceptibility of urban areas to flooding is the number of buildings liable to inundation. However, in order that urban flood locations can be ranked in terms of need for further study or for flood mitigation priority, this simple statement requires further definition. Necessary definitions are:

- how to define flood prone?
- what is an urban locality?
- how to classify the buildings and infrastructure at risk?

1.2 How to define flood prone?

Theoretically, a building or installation would be classified as flood prone if it is at risk from inundation by the probable maximum flood, this can be regarded as statistically the largest possible flood. 'Inundation' also presents a definitional problem with a choice between water over-ground on the property block, or restricted to a flood that exceeds floor level. For the various forms of infrastructure, the definition is more complex with the choice between over-ground inundation or the flood level that corresponds to a critical level that interferes with normal service provision, i.e., over roadbed level, or at a critical height for an electricity transformer.

However, data on the magnitude of the probable maximum flood is rarely available and the number of flood prone buildings is usually reported in terms of over-ground inundation for the 1 in 100 year event. This convention will be followed in this report except that, wherever possible, additional data will be given for liability to the level of the probable maximum flood.

1.3 What is a flood prone urban locality?

For the purposes of this study it was necessary to define what constitutes a flood prone urban locality. The decision was made to include all urban localities for which at least 10 buildings were liable to flooding from the 1 in 100 year flood event or were inundated by the flood of record. In practice, this refers to buildings that would have over-ground inundation, i.e., not necessarily over-floor level.

Any definition of this kind is arbitrary but the selection of a lower limit of 10 buildings corresponds to the criterion used in the first national survey of urban flooding undertaken by Devin and Purcell (1983).

1.4 How to classify the buildings and infrastructure at risk?

It is common practice for urban flood studies to report risk in terms of the number of buildings liable to inundation. Many studies do not differentiate between residential buildings (in Australia normally detached dwellings) and those that are commercial or industrial. Other

accounts sub-divide business enterprises into 'commercial and 'industrial'. In many Australian flood studies these are defined on the basis of likely flood damages and the commercial sector is restricted to the more commonly occurring buildings used for retail or office functions with 'industrial' used for larger enterprises (sometimes incorporating a number of individual buildings) often engaged in some form of manufacturing. An example that occurs relatively frequently in small urban centres is the regional milk factory. These finer divisions are usually related to studies that are designed to assess potential flood losses.

Thus the most frequently used definition of buildings in flood studies recognises residential and commercial sectors with a possible further sub-division to recognise large industrial concerns. Some flood damage surveys recognise an additional category, often termed 'public buildings'. Examples in this category are schools, hospitals and council offices.

In Australia and overseas, studies of urban flood risk are normally limited to the analysis of buildings, however defined. In recent years more emphasis has been placed upon the susceptibility of 'lifelines' to flooding. 'Lifelines' are usually restricted to services of which roads, bridges, water supplies, sewerage and electricity form critical elements. A limited number of surveys of actual floods give descriptions of such infrastructure damage and sometimes these are included in estimates of flood damage. Even more recent studies, often based on the use of Geographical Information Systems (GIS), have begun to analyse the significance of the potential damage to lifelines in order to better plan for emergency management.

However, such studies are relatively uncommon and it standard practice in Australia and overseas to evaluate urban risk in terms of building damage. This approach forms the main thrust of this report although additional descriptions are given to the problems of infrastructure where such information is available.

To a large extent the detail and definition of buildings used in flood studies reflects the purpose of the investigation. If the aim is to assess flood damage, often as a basis for cost benefit analysis of flood mitigation options, the classification of buildings into residential, commercial and industrial is necessary. If the aim is to provide the background for emergency management, the emphasis is upon the safety of the inhabitants and this focuses attention on the residential sector and upon lifelines.

1.5 What is a designated flood?

It is near universal practice for floodplain management, in Australia and overseas, to select the level of the 1 in 100 year event as the designated (or standard) flood. Once established the designated flood forms the basis for new developments which for residential buildings are usually related to the habitable floor level. This is usually set at the 1 in 100 year level plus extra 'freeboard' which is typically a foot or 300 mm. Some jurisdictions permit floor levels for commercial and industrial establishments at lower levels, with higher levels for especially vulnerable buildings such as hospitals, police stations etc.

The adoption of a designated flood is the key step in introducing land use zoning to control the growth of new developments on flood prone land. A detailed hydrological study is required in order to satisfactorily establish the position of the 1 in 100 year flood line, as a temporary measure LGAs sometimes substitute the flood of record for the design flood. It is common practice for the extent of the design flood to be shown on large scale maps or orthophotos. This however, is not universal and in New South Wales there is a reluctance to produce flood maps. The background to this unusual stance lies with community

dissatisfaction with such maps in the mid-1980s, a detailed account of this hiatus is given in Handmer (1985).

The widespread adoption of the 1 in 100 year flood as the designated flood, however, represents an imperfect solution to the definition of 'flood prone'. There are three reasons why it is often unsatisfactory. They are:

- the large variation in flood height range between locations
- the possibility of building failure from extreme events
- the problems posed by the probable maximum flood.

Each of these is outlined below.

1.5.1 Flood height range

The flood height range (FHR) is a term frequently used in the USA to provide a measure of the difference in stage (height) between the 1 in 10 (or 1 in 20) and 1 in 100 year events. The FHR can differ markedly from one location to another, a range from a metre or so to ten metres is not unusual. Figure 1.1 demonstrates the variation in stage for two locations. In Case A the FHR is less than a metre and in case B is about four metres. Many inland locations in Queensland would be similar to Case A, this is because when the river exceeds bankfull there are extensive flat floodplains that provide very large natural storage's for the flood waters. Case B is commonly associated with sites upstream of river gorges so that flood flows back up to considerable depths during floods.

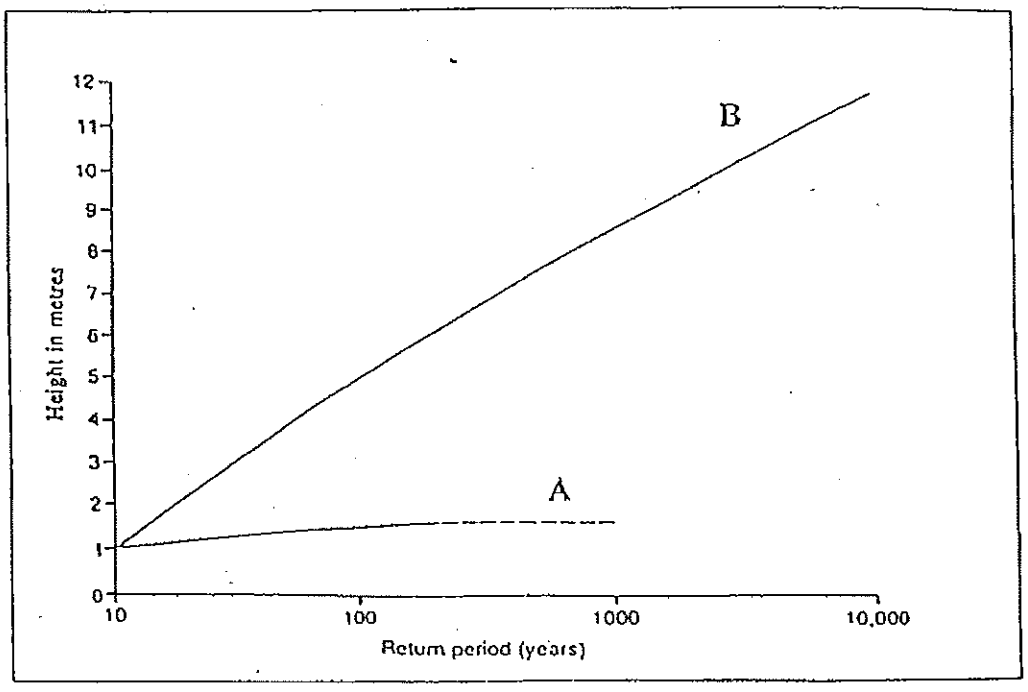


Figure 1.1 Low and high flood height range

The significance of the FHR is that buildings located close to the 1 in 100 year line in Case A would only experience limited over-floor inundation from floods greater than the 1 in 100 year, while for Case B water could be several metres over floor level. For locations similar to case B there is an additional risk of building failure (see below) and loss of life.

Data on flood height range is relatively poor for many locations in Queensland but there is little doubt that there is a wide range of values.

A surrogate for FHR can be obtained from the Flood classification for Queensland flood warning river height stations, compiled by the Hydrological Section of the Brisbane office of the Bureau of Meteorology. This lists flood warning heights for several hundred flood gauges distributed throughout the State. It is not designed to give FHR *per se* but it does report minor, moderate and major warning heights for each station. The classification of the level of risk is given as an aid to emergency management. For example, 'moderate' corresponds to '... inundation of low lying areas requiring the removal of livestock and the evacuation of isolated houses' and 'major' is defined as major disruption ... 'evacuation of many houses and business premises may be required'.

For many urban settlements the Bureau of Meteorology also produces booklets describing key aspects of the flood warning system, notes on the flood history etc. In the absence of detailed hydrological studies such information forms an invaluable guide to urban flooding. The major limitation is that the 'major' flood heights are often well below the level of the 1 in 100 year flood or the flood of record. Table 1.1 illustrates the problem of FHR for a selection of flood prone urban communities.

Table 1.1 Flood height range and flood warning levels for a selection of Queensland towns, all heights are in metres

	Flood warning levels			Flood height range	Flood of record
	Minor	Moderate	Major		
Brisbane City gauge	1.7	2.6	3.5	4.0	5.45 (1974)
Ipswich City gauge	7.0	13.0	15.5	10.0	20.73 (1974)
Rockhampton City gauge	5.0	6.0	7.0	1.75	10.1 (1918)
Ingham City gauge	10.0	11.0	15.0	1.5	16.4 (1967)
Logan River, Macleans Bridge	10.0	13.5	16.0	8.0	21.67 (1974)

All values in metres. Estimate based on limited information

The data demonstrate both the variations in the FHR and the relationship of the flood of record to the warning levels. The flood height ranges given in Table 1.1 are the best estimates of the range between the 1 in 10 and 1 in 100 year flood events; the minor, and major flood warning levels are related to the effects upon those at risk and not to flood recurrence intervals.

Interpretation is further blurred by local factors. For instance for Ingham the height difference between the 1 in 2 and the 1 in 10 year floods is 4.5 m but only a further 2.0 m between the 1 in 10 and 1 in 100 year. In many cases the hydrology is imperfectly known and the data given in Table 1.1. should be regarded as indicative of high or low flood height ranges rather as precise estimates.

1.5.2 Building failure

Data that present critical combinations of flood depth and velocity that lead to building failure are available. These are based on studies from the USA, for instance Black (1975), but the results are also relevant to a range of Australian building styles. A more accessible review of these relationships and their importance for damage and emergency management is given in Smith (1991). Examples of these relationships are reproduced here as Figure 1.2.

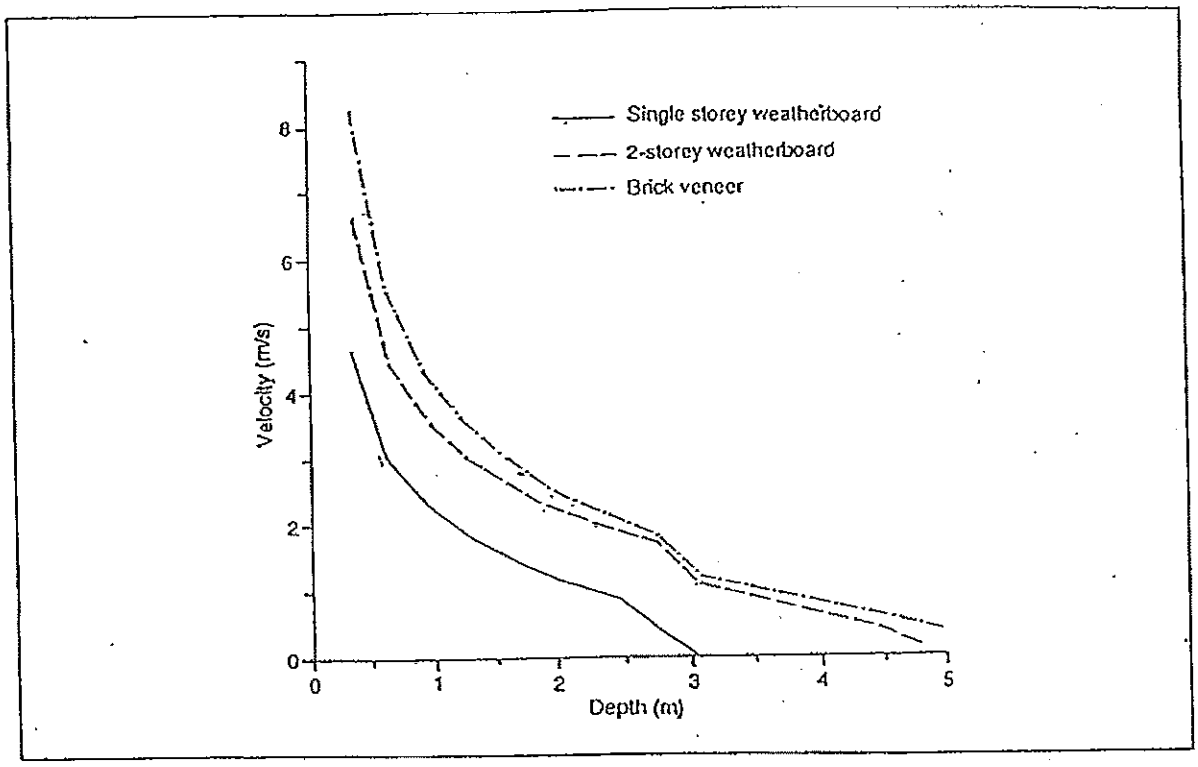


Figure 1.2 Critical flood velocity and depth for residential building failure

Detached, single storey weatherboard houses, a style common throughout Queensland, are particularly susceptible to failure which is often related to their buoyancy in flood water causing the building to 'float off its stumps'.

To use these failure relationships it is necessary not only to know the flood depth but to also have reliable estimates of the velocity of the flood waters. The velocities are those for over-floodplain discharges, not in-channel flows. Such data are rarely available in Queensland.

It should be obligatory for any future hydrological flood studies to estimate over-floodplain velocities for flood flows. This should not be difficult to achieve as many contemporary computer-based hydrological models have the capacity to estimate such velocities. In many areas, especially where the FHR is small, the chances of building failure are remote. However, for other sites the risk can be considerable and may well be judged to be unacceptable. The significance of potential building failure for emergency management and for damage estimation is large. The possibility of building failure should be a key factor in the selection of the designated flood.

1.5.3 Less frequent floods including the probable maximum flood (PMF)

The worst flood that could occur is termed the probable maximum flood (PMF). This is clearly a very rare and extreme event and it could be replaced by estimates of the 1 in 5,000 or 1 in 10,000 year flood. In any new hydrological study it should be obligatory to provide estimates of the full range of floods including the PMF although it is accepted that, for the less frequent events, the estimation error bands will always be large.

The major reason for estimating the PMF is to use it in conjunction with Figure 1.2 in order to assess the potential for building failure from rare events. All too often the perception of the 1 in 100 year (or other) design flood is that this divides areas that are considered as flood prone from those (erroneously) thought to be flood free. However, residual risk from the PMF (and the other large events) is not only due to building failure. An additional reason for assessing the less frequent events is to ensure that emergency measures to deal with the residual flood risk (like access for evacuation and refuge points) can be implemented as part of a flood disaster response plan

It would be economically unacceptable to prohibit all new development below the level of PMF but if there would be widespread building failure from such extreme events this should be recognised in any land use zoning restraints. Knowledge of this worst case flood should be fully understood by the emergency services, the problem of isolation of flooded areas as islands is of special concern.

Such risks of failure are generally greatest for locations where the flood height range is large. Although precise hydrological data are not available, dwellings close to the 1 in 100 year at Ipswich would have several metres of water over floor level for a near PMF which, in many cases, would result in widespread building collapse.

The risk of failure for existing developments below the level of the 1 in 100 year flood line can be very severe. For Ipswich, with the high FHR shown in Table 1.1, it is likely that several hundred buildings would be totally submerged by such extreme floods. The loss of more than thirty dwellings in the 1974 flood demonstrates that this risk is very real. The fact that similar houses were re-built on the sites is an example of very poor urban floodplain management.

1.6 Definitions – a summary

In this account a flood prone urban location is defined as a place at which at least 10 buildings would be subject to the 1 in 100 year flood event. Buildings are regarded as flood prone if their grounds are within the limits of the 1 in 100 year flood. Wherever possible the buildings are sub-divided into residential and commercial. For many localities hydrological studies that define the extent of the 1 in 100 year flood are lacking, in such cases the flood of record is substituted.

Such definitions are used because:

- they give comparability between places
- they represent the most commonly available data
- it is common practice for floodplain management to use the 1 in 100 year (or flood of record) flood line as the basis for building and land use controls

The questionnaires used in the study were designed to provide this basic information but also provided the opportunity to report more detailed information where it is available, ie properties liable to flooding from the probable maximum flood, susceptibility of infrastructure etc.

It needs to be stressed that, although the 1 in 100 year event is very widely used as the basis for floodplain management, it is far from an ideal standard for universal application. Further, for emergency management and flood damage assessments over-floor flooding is much more critical than over-ground inundation.

For the purposes of floodplain management it is necessary to select a designated flood which forms the basis for controls on new developments. Although the 1 in 100 year flood line is often used, this is not necessarily a good choice due to large variations in flood height range which have, in extreme cases, the potential to cause structural failure especially for lightweight buildings.

Hydrological studies of flood prone areas should always include estimates of the magnitude and extent across the full range of floods to the level of the probable maximum flood. This is especially important because of its implications for emergency response planning.

2

Urban Flooding in Queensland: Early Estimates of Size

2.1 Early estimates

Any estimates of the number of properties at risk from flooding made in Australia prior to the mid-1970s are little more than guesses. The impetus to flood studies from the widespread flooding of 1974 resulted in the first systematic attempts to assess the magnitude of the problem. These estimates were hampered by the lack of flood maps, which are essential to define the urban areas at risk. The first estimates based upon a growing data base were made by a Technical Committee of the Australian Government Actuary (AGA, 1978) which reported its findings in 1978. In 1976 Douglas, in a paper at the National Hazards Symposium held in Canberra (available as Douglas, 1979), presented a review of flooding in Australia. This suggested that some 5 per cent of dwellings in Australia were liable to river flooding, the information base for this estimate was derived from the information gathered by the Technical Committee.

Irish and Devin (1978) discussed methods to estimate mean annual damage to dwellings. Their account gave estimates of the number of dwellings exposed to damage from the 1 in 100 year flood for 135 urban areas throughout the Commonwealth. These included all major urban centres plus smaller urban areas known to have a significant flood risk.

Irish and Devin, commented, in comparing the estimates for Queensland and New South Wales, that:

> ... Mean annual flood damage for New South Wales was estimated to be much less than for Queensland despite the disparity in State populations. This is thought to be due to the flood mitigation program which has been carried out in many NSW towns over the last two decades, the tighter town planning controls and the absence of major flood hazards in Sydney, Newcastle and Wollongong (Irish and Devin, 1978: 106).

A recent review of urban flooding in Australia is also given in Smith (1996).

2.2 Estimates by Australian Water Resources Council (AWRC)

The study undertaken by Water Studies Pty Ltd, and reported in *Floodplain management in Australia* (AWRC, 1992), provides the most recent nationwide flood estimates. These include information on the numbers of buildings at risk, together with estimates of annual average damage (AAD) for rural and urban sectors for both mainstream and stormwater flooding. The background data were assembled after discussions with the responsible agencies in each State and Territory. The survey is comprehensive but reflects the deficiencies outlined in Section 1.

The major limitation is that all the estimates are restricted to the 1 in 100 year flood event, the additional losses that could be expected from extreme floods and building failure are omitted. To an extent the two are linked, building failure would be a much larger factor for the rarer

extreme events. The reasons for these omissions are the paucity of available data and the restricted approach taken by most State agencies to the definition of flood.

2.2.1 Number of properties at risk in Queensland

A convenient starting point for the present study is to consider the data on the number of properties at risk in Australia from the 1 in 100 year flood as reported in Appendix D of the AWRC (1992) report. These are given in Table 2.1.

Table 2.1 Number of properties, by State, at risk from 1 in 100 year mainstream flooding, from AWRC, see Appendix D (1992)

	Protected	Unprotected	Total
New South Wales	21,800	36,100	57,900
Northern Territory		2,000	2,000
Queensland			21,000
South Australia	1,350	1,350	1,350
Tasmania		715	715
Victoria	3,600	10,600	14,200
West Australia	4,440	1,350	5,750
Total	**29,800**	**73,115**	**102,915**

Table 2.1 also divided properties into 'protected' and 'unprotected'. The protected are those where structural mitigation measures lessen the impacts of the flood events, such protection is dominantly provided by levee systems. These are of major significance in New South Wales, Victoria and Western Australia, but much less so for Queensland. Protected residences pose problems for damage estimation, this is because the levees have a design limit and when this is exceeded, severe flooding can result. An additional complication is that such levees can fail at heights below the design (i.e. overtopping) level.

The AWRC report (1992) gives the official estimates of flood prone properties, as provided by the former Queensland Water Resources Commission (now part of the Department of Natural Resources) as 17,000. Of these 14,600 were urban and 2,400 rural. These were known to be under-estimates and they were revised in the AWRC report to a state-wide total of 21,000. This too, was undoubtedly a major under-estimate. Reliable estimates of the numbers will not be available until the areas subject to flood are delimited on the basis of good quality flood studies.

2.3 The Insurance Council of Australia (ICA)

A more recent unpublished study was undertaken for the Insurance Council of Australia (ICA), this included estimates of the number of residential buildings at risk from flooding for each State and Territory (Smith, 1996). The results are summarised in Table 2.3, with the exception of Queensland, the numbers of residential buildings are similar to those in AWRC (1992), given in Table 2.2.

Table 2.2 **Revised State estimates of residential buildings at risk from 1 in 100 year mainstream flooding, from Smith (1996)**

	Inland	Coastal	Protected	Total
New South Wales	9,700	27,800	27,500	65,000
Northern Territory	2,000	0	0	2,000
Queensland	10,000	40,000	0	50,000
South Australia	0	1,500	0	1,500
Tasmania	375	375	1,000	1,750
Victoria	4,150	7,200	3,650	15,000
Western Australia	0	1,350	4,440	5,750
Total	**26,225**	**78,225**	**36,550**	**141,000**

NOTE: The Queensland data reported in AWRC (1992) does not differentiate between 'protected' and 'unprotected' buildings, however the number of protected buildings is small.

The ICA report acknowledged that the data base for Queensland is poor but suggested a working estimate of 50,000 residential buildings, i.e. those subject to over-ground inundation from the 1 in 100 year flood event.

2.4 Summary

Regardless of the imperfections of the estimates the overall conclusion of the existing surveys is that the combined buildings at risk in New South Wales and Queensland account for over 80% of the national total. In terms of both buildings and damage (assessed in terms of average annual loss) the magnitude is similar in both States.

These earlier accounts are all restricted to inundation from mainstream flooding, ie urban storm drainage surcharge is excluded, although the AWRC (1992) report separately assessed flood risk from storm water drainage. These earlier studies also excluded inundation from storm surge which is limited to those areas of northern Australia exposed to risk from tropical cyclones.

In practice, storm surge inundation is dominantly a Queensland problem, this is because there are only a few small urban settlements in Western Australian and the Northern Territory that are at risk from major surge events. The major urban surge locality in these other northern States is Darwin but zoning to exclude new developments from areas liable to surge was undertaken in the late 1970s, ie after Cyclone Tracey. Although the current study is focussed on urban mainstream flooding in Queensland a preliminary account of urban exposure to storm surge will be included.

Detailed studies of flood hydrology, vulnerability and loss are well-advanced in New South Wales but are only known with any precision for a few localities within Queensland. The risk of urban flood in Queensland is undoubtedly large but how large, and which localities have the major risks, provides the impetus for the present study.

3

The Questionnaire: The Size of the Problem

3.1 Questionnaire distribution and response

The questionnaire, *Urban flood risk in Queensland*, was distributed to all LGAs throughout the State over the period September to November 1996. The number of LGAs totalled 125, a list is given in Table 3.1. Responsibility for circulation, the collection of returns and contacting recalcitrant respondents was undertaken by staff of the DNR. By April 1997 completed questionnaires had been received from 102 LGAs, 15 of which provided information for more than one flood prone location within their area of jurisdiction, these are also indicated on Table 3.1. Of the completed forms, 15 LGAs did not meet the criteria used to define a flood prone community, i.e. more than 10 flood prone buildings at a single locality. These are also shown on Table 3.1.

The areal coverage of LGAs who responded, also including those with an insignificant urban flood problem, are given in Figure 3.1.

In order to obtain this degree of participation, the DNR repeatedly contacted those LGAs who had not sent in completed questionnaires. In reviewing progress in early 1997, it was decided not to further harry those non-responding LGAs who were considered not to have an urban flood problem. The decision on LGAs in this category was based upon discussions with the Hydrological Section of the Bureau of Meteorology and with staff of Queensland Emergency Services. The 18 LGAs in this category are indicated on Table 3.1 and as a result of their elimination, there were only 4 LGAs of interest who did not respond.

In total, responses were received from 102 LGAs covering 133 localities.

A further modification to the original intention of the questionnaire, that it should be completed for each flood prone location within single LGAs, was for Brisbane and Gold Coast City Councils. This is because for both of these the size of the urban flood problem, in terms of numbers of buildings at risk, was especially large and because flood prone buildings were distributed over a number of catchments. The detail for Brisbane and the Gold Coast are outlined in Section 4.

Overall, the level of response and detail given by those LGAs that have a risk of urban flooding was good. Where known, separate estimates of the size of the urban flood problem for these, and for respondents who did not complete individual questions, are included in the discussion of the results.

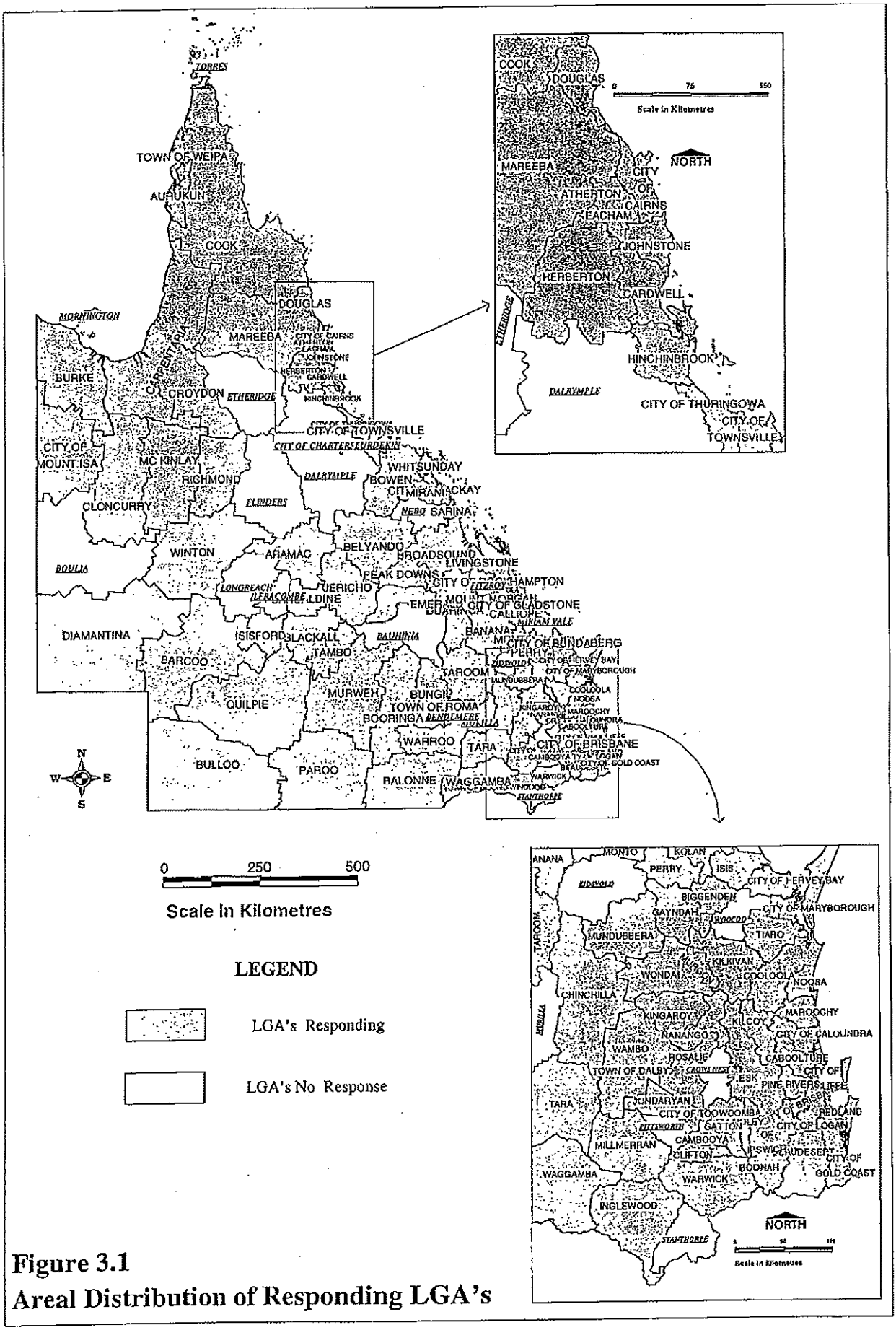


Figure 3.1
Areal Distribution of Responding LGA's

Table 3.1. Queensland LGAs, responses to the questionnaire

1.	Aramac Shire	
2.	Atherton Shire	*
3.	Aurukun Shire	
4.	Balonne Shire	(5)
5.	Banana Shire	(4)
6.	Barcaldine Shire	
7.	Barcoo Shire	(3)
8.	*Bauhinia Shire*	1
9.	Beaudesert Shire	
10.	Belyando Shire	*
11.	*Bendemere Shire*	/
12.	Biggenden Shire	
13.	Blackall Shire	
14.	Boonah Shire	
15.	Booringa Shire	
16.	*Boulia Shire*	/
17.	Bowen Shire	
18.	Brisbane City	
19.	Broadsound Shire	*
20.	Bulloo Shire	
21.	Bundaberg City	
22.	Bungil Shire	*
23.	*Burdekin Shire*	
24.	*Burke Shire - received but not included*	
25.	Burnett Shire	
26.	Caboolture Shire	(8)
27.	Cairns City	(2)
28.	Calliope Shire	
29.	Caloundra City	
30.	Cambooya Shire	
31.	Cardwell Shire	
32.	Carpentaria Shire	(2)
33.	*Charters Towers City*	/
34.	Chinchilla Shire	
35.	Clifton Shire	*
36.	Cloncurry Shire	*
37.	Cook Shire	(3)
38.	Cooloola Shire	
39.	*Crows Nest Shire*	/
40.	Croydon Shire	
41.	Dalby Town	
42.	Dalrymple Shire	1
43.	Diamantina Shire	*(2)
44.	Douglas Shire	
45.	Duaringa Shire	*
46.	Eacham Shire	
47.	*Eidsvold Shire*	/
48.	Emerald Shire	
49.	Esk Shire	
50.	*Etheridge Shire*	/
51.	*Fitzroy Shire*	
52.	*Flinders Shire*	/
53.	Gatton Shire	
54.	Gayndah Shire	
55.	Gladstone City	
56.	Gold Coast City	
57.	Goondiwindi Town	
58.	Herberton Shire	
59.	Hervey Bay Shire	(2)
60.	Hinchinbrook Shire	
61.	*Ilfracombe Shire*	/
62.	Inglewood Shire	
63.	Ipswich City	
64.	Isis Shire	*
65.	Isisford Shire	
66.	Jericho Shire	(2)
67.	Johnstone Shire	
68.	Jondaryan Shire	(2)
69.	Kilcoy Shire	
70.	Kilkivan Shire	*
71.	Kingaroy Shire	
72.	Kolan Shire	*
73.	Laidley Shire	
74.	Livingstone Shire	
75.	Logan City	
76.	*Longreach Shire*	/
77.	Mackay City	
78.	*Mareeba Shire*	
79.	Maroochy Shire	
80.	Maryborough City	
81.	McKinlay Shire	
82.	Millmerran Shire	*
83.	Mirani Shire	
84.	*Miriam Vale Shire*	
85.	Monto Shire	*
86.	*Mornington Shire*	/
87.	Mount Isa City	
88.	Mt Morgan Shire	
89.	Mundubbera Shire	
90.	Murgon Shire	*
91.	*Murilla Shire*	/
92.	Murweh Shire	(2)
93.	Nanango Shire	
94.	*Nebo Shire*	/
95.	Noosa Shire	
96.	Paroo Shire	
97.	Peak Downs Shire	*
98.	Perry Shire	*
99.	Pine Rivers Shire	
100.	*Pittsworth Shire*	/
101.	Quilpie Shire	
102.	Redcliffe City	
103.	Redland Shire	(2)
104.	Richmond Shire	
105.	Rockhampton City	
106.	Roma Town	
107.	Rosalie Shire	(2)
108.	Sarina Shire	(5)
109.	*Stanthorpe Shire*	/
110.	Tambo Shire	
111.	Tara Shire	
112.	Taroom Shire	
113.	Thuringowa City	
114.	Tiaro Shire	
115.	Toowoomba City	
116.	*Torres Shire*	/
117.	Townsville City	
118.	Waggamba Shire	
119.	Wambo Shire	
120.	Warroo Shire	
121.	Warwick Shire	
122.	Whitsunday Shire	*
123.	Winton Shire	
124.	Wondai Shire	*
125.	*Woocoo Shire*	/

Italic = no response received
[1] = not chased up - believed to have no problem
Bold = response received
* = no obvious problem
(#) = multiple responses received

3.2 Discussion of the questionnaire

Responses to the questionnaire are used as a basis for discussion throughout the remainder of this report.

This Section (Section 3) concentrates on the size of the problem, Section 5 *on Hydrological information, mapping, damage studies, mitigation and policy, Section 6 on Flood warning systems and counter disaster plans and Section 7 on The largest known flood - the effects on lifelines.*

An overall summary to the questionnaire results is given in Section 10.

Appendix 1 provides detail on responses from each LGA. This omits qualifying comments. The original forms and a spreadsheet of responses with included comments are held by the Department of Natural Resources.

Appendix 2 is a copy of the questionnaire with, where appropriate, indications of the responses to each question.

3.3 Interpreting questionnaire responses

Before presenting an analysis of the responses it is important to the note difficulties in designing a questionnaire to cover LGAs that differ in size from Brisbane City Council to remote locations in the north and west of the State that cover areas of several thousand square kilometres but have populations of only a few hundred. There are also difficulties in that the questions were designed to obtain information from LGAs that had undertaken hydrological and vulnerability studies as well as those that had no detailed information whatsoever.

The analysis presented below does not give detailed quantitative information for each section of each question on the questionnaire. However, Appendices 1 and 2 to the report present a summary of all questions from each questionnaire received.

Because of the comprehensive nature of the questionnaire, it was not possible for all respondents to provide answers to each question and sub-question. Therefore, the number of answers to each question varies. This is indicated by presenting the results to individual questions in the form of '55 of the 101 respondents'.

A limited number of questions were included that allowed LGAs to comment on whether they had a risk from storm (tide) surge. This was not intended to be a detailed survey but to gain some overall indication of the perceived size of the storm surge problem which has much in common with overland mainstream river flooding. The results for storm surge are discussed in Section 9.

3.4 Size of the urban flood problem

Ideally the first step in analysing the size of the urban flood problem in Queensland would be to present data on the numbers of buildings at risk from overground (or over-floor) inundation from both the designated flood (usually that associated with the 1 in 100 year event) and the probable maximum flood. The latter is rarely available in Australia or elsewhere and it is standard practice to use the 1 in 100 year flood to define numbers of buildings, see Section 1.2. However, in Queensland only a limited number of LGAs have undertaken the detailed

hydrological studies necessary to define this level, in such circumstances the best estimate (although far from ideal) can sometimes be obtained by considering the flood of record.

3.4.1 Definitions used to define the number of flood prone buildings

The questionnaire was designed to obtain information on numbers of buildings for both the *Largest recorded event* (Questions 4.4 to 4.7) and the *Total number of buildings flooded by the adopted designated event* (Questions 6.8 to 6.11). Where possible the respondents were requested to classify the number of buildings into residential, commercial, industrial and caravans (including mobile homes). In both cases information was requested from the best available data. In a limited number of cases this aspect of vulnerability was known in detail, eg. for Mackay and Charleville both based on detailed GIS studies of individual buildings, but for many other locations the size is often that of an educated guess.

In order to preserve comparability, the number of flood prone buildings are in terms of over ground flooding. This is because it is the simplest, and most commonly used procedure, to estimate the number of buildings located below the level of the 1 in 100 year flood. The numbers of buildings that would experience over-floor inundation would be considerably less. The importance of this distinction will be illustrated in section 4 with data from the Gold Coast.

There are also difficulties in whether the data are expressed in terms of 'buildings' or 'properties'. The questionnaire was quite deliberately worded in terms of 'buildings'. This was because the use of the word 'property' is often interpreted at local government level to represent a building block, with or without a building on it. The other problem is that in the residential sector a 'building' can sometimes contain more than one dwelling unit, for example when the building is divided into flats or apartments. For much of Queensland this is a not a serious problem. However, for some localities (the Gold Coast is a prime example), they can be a significant difference between the number of residential buildings and dwelling units. The difference is important both for assessment of potential flood losses and for the emergency services, i.e. in converting residential buildings to numbers of people in order to plan for emergency evacuation.

For consistency, the numbers below are expressed in terms of flood prone buildings liable to over-ground flooding and with no allowance for the conversion of residential buildings into dwelling units. Similar assumptions are made in comparable flood studies in Australia and elsewhere, and in the AWRC (1992) report. For floodplain and emergency management at local level the details of numbers of buildings flooded over-floor and the number of individual dwelling units are however, important.

To provide even a provisional estimate of the numbers of flood prone buildings in Queensland is a difficult task. Using the survey responses to arrive at a total figure involved assessing the following components :

- numbers of buildings given in direct response to Questions 6.8 to 6.11, i.e. where the flood problem was relatively easily described by a number in the questionnaire answer box (these are described in Section 3.4.2 and summarised in Table 3.2)

- numbers of buildings for LGAs that did not provide a direct answer to Questions 6.8 to 6.11; these were in two groups:

a) more complex responses where the flood problem was large or involved numerous catchments - typically the larger LGAs (responses for these are included in Section 3.4.3 and summarised in Table 3.4)

b) estimates for councils known to have large numbers of buildings at risk that did not respond to Questions 6.8 to 6.11, these are also given in Section 3.4.3 and summarised in Table 3.4,

- allowance for missing data (i.e. those not considered in Sections 3.4.2 and 3.4.3), these are given in Section 3.4.4.

For many of the authorities with a small number of flood prone buildings the estimates are taken directly from the questionnaire, the totals for these are given in Table 3.2. The detail can be obtained from the precis of the individual questionnaires given in Appendix 1. Those with a larger number of buildings at risk fall into two categories. Some have information based on detailed hydrological and vulnerability studies, others base their estimates on very poor quality data. The councils with larger numbers of buildings at risk, with either poor or good quality data, are listed in Table 3.4.

Thus, Table 3.4 lists those authorities with a substantial urban flood problem for which the numbers of buildings at risk were not given directly in response to Question 6.8 to 6.11. For many of the authorities in this category, numbers were not given because the information was too complex for a simple answer. For the two councils with the largest numbers of flood prone buildings, Brisbane and the Gold Coast, the problems of providing estimates are described in detail in Section 4. Where the number of flood prone buildings is poorly known this is indicated in Table 3.4. For these larger authorities a short description is given for each in Section 3.4.3.

Care has been taken not to double count estimates from the responses, given in Table 3.2, with those listed in Table 3.4. Attention however, is drawn to the number of flood prone buildings in the Nerang catchment of the Gold Coast. Initial, and provisional, Council estimates were given on the questionnaire but more detailed information was made available to the study at a later stage. In this instance, the initial estimate of 5,000 flood prone buildings given on the questionnaire has been omitted from the totals in Table 3.2 and the new estimate (of 16,650) added to Table 3.4.

Table 3.5 presents a consolidated ranked list, based on the information given in the questionnaire responses and from the data in Table 3.4. Of the twelve councils in Queensland that have the largest number of buildings at risk from urban flooding to the level of the 1 in 100 year flood event.

3.4.2 Numbers of flood prone buildings – reported in the questionnaire

The response to Questions 6.8 to 6.11, which requested the best estimates of the number of buildings at risk from flooding to the level of the designated flood, provided direct information for 34 urban locations from 23 LGAs. The totals for these locations are given in Table 3.2.

Table 3.2 **Total number of buildings at risk from flooding to the level of the designated flood, direct responses to Questions 6.8 to 6.11**

Number of buildings				
Residential	Commercial	Industrial	Caravans (mobile homes)	Total
7,189	345	217	474	8225

The provisional estimate for the Nerang Catchment given in the questionnaire response by the Gold Coast City Council has been omitted from Table 3.2.

The poor number of direct responses to this question is perhaps not surprising, this is because only 43 out of the 108 locations reporting to have carried out a 'flood' study in the questionnaire (Question 6.1), have designated flood levels.

There is also a difficulty in converting these data to number of buildings liable to flood from the 1 in 100 year event. This is because there are variations between the locations in the definition used for the designated flood. These variations are summarised in Table 3.3.

Table 3.3 **Definitions of the designated flood, based on Question 6.5**

Designated floods (numbers of LGAs)			
1 in 100 year	1 in 50 year	Below 1 in 50 year	Flood of record
27	11	4	2

The four locations that used a value below that of the 1 in 50 year have a variety of levels for the designated flood. For example, Ipswich uses the 1 in 20, Mt Isa the 1 in 15, Townsville the 1 in 10 and Hinchinbrook the 1 in 3 year level. Such criteria would not be acceptable by those States and nations that have urban floodplain management guidelines or regulations. Beaudesert and Mirani use the flood of record.

A further complication is that for some councils the designated flood level varies, for instance different criteria for mainstream and creek flooding. Examples of this kind are provided by Laidley and Logan.

There is also a problem in distinguishing between 'commercial' and 'industrial' buildings and for the overall State summary it is recommended that the two are combined into a single class. Any subsequent survey should aim to list major flood prone industrial complexes.

An example from Gladstone indicates that much of the large port complex is at risk from flooding, and for Brisbane industrial flood damage would be large.

3.4.3 Estimates of the number of buildings NOT included in the direct responses to Questions 6.8 to 6.11 and for which information is known to exist

The most significant feature of the response to the questions that describe the number of buildings at risk from the designated flood is that many of the LGAs with a known flood risk

provided no information (ie did not complete Question 6.8 to 6.11, by reporting the number of buildings flooded to the level of the adopted designated flood). Table 3.4 lists estimates from other sources for many of the missing LGAs known to have a significant number of buildings at risk.

Also included in Table 3.4 are figures for those LGAs, such as Gold Coast and Brisbane, which were unable to provide a response by simply entering a number in answer to Question 6.8 to 6.11 but did however provide detailed data.

Table 3.4 Estimates of the number of buildings at risk for LGAs not completing Question 6.8 to 6.11

Local Government Authority	Number of buildings to 1 in 100 year level
Mackay	8, 500
Brisbane (Brisbane River and Creeks)	8, 000
Gold Coast	
Nerang catchment	14,650
Other catchments	2,000 ± 1,000
Dalby	3, 300
Ipswich (All catchments)	*3, 000
Charleville	1, 350
Rockhampton	1, 200
Burdekin	*1, 000
Total	**43,000**

* Poor quality estimates

An outline to the sources for each of the locations listed in table 3.4 is given below.

Gold Coast

Revised estimates for the Gold Coast based on detailed studies for the Nerang catchment (available after the questionnaire was completed) are discussed in detail in Section 4. The figure used in the estimates of numbers of buildings at risk in Table 3.4 (i.e. 14,650) is for 400 commercial and 14,250 'residential properties'. The Gold Coast is unusual in the large number of 'residential properties' (this equates to buildings) that contain a number of individual 'dwellings', i.e. multi-occupancy as flats or apartments, are relatively common. The number of 'dwellings' is estimated to be 28,600 ±2,000. For reasons of consistency, the figure of 14,650 has been used in Table 3.4.

Other catchments in the area administered by the Gold Coast City Council also contain urban flood prone land, studies for these is less complete than for the Nerang catchment The Council provisionally estimates a combined total of 2,000 ±1,000 flood prone buildings for the remaining catchments.

Mackay

A study of storm surge for south and north Mackay (the latter was then in Pioneer Shire) also provided a building by building data base that could be used to estimate the numbers liable to flood from the Pioneer River, see Smith and Greenaway (1994). The problem for the estimation of mainstream flooding is that precise definition of the 1 in 100 year flood is not available (i.e. extent and slope). Despite this limitation, the combined estimate for south and north Mackay for residential, commercial and industrial buildings is 8,500 (to the level of the 1 in 100 year flood).

Brisbane

Details of the estimates for the main Brisbane River (post-Wivenhoe Dam) and for the various creek catchments in the area administered by the Brisbane City Council are given in Section 4. The favoured official figure is about 8,000 (all types of buildings) although there are reasons to consider that this may be an under-estimate. There is no doubt that some very large industrial enterprises are included. With the completion of a revised hydrological study, currently in progress, for the Brisbane River and the impending AGSO Cities Project study of vulnerability these estimates will be greatly improved.

Ipswich

Information for Ipswich is poor, although detail is known for Bundamba Creek, one of the sub-catchments. Based on the 1974 flood, 2,500 buildings were flooded. Although this would come close to a 1 in 100 year event such data are over twenty years old and with a 1 in 20 year designated flood level it is certain that the current number of buildings at risk would be larger, hence an estimated total of 3000 has been adopted.

Dalby

A Flood Management Study was commissioned by Dalby Town Council, after a series of major floods in the early 1980s. That study forms the basis for the estimation of the number of urban buildings at risk. Of the total of 3,300, about 400 are used for commercial or industrial purposes.

Charleville

Extreme floods occurred over a wide area of western Queensland in April 1990 and this led to detailed studies of the flood hydrology and of the vulnerability of the community affected. The study is reported in the *Western Queensland Flood Study*, Camp, Scott and Furphy (1991) The largest of the urban communities was Charleville which was estimated to have 1350 buildings within area subject to the 1 in 100 year flood. Of these, 1225 were residential and 125 commercial.

Rockhampton

Detailed consultant studies are available for the City of Rockhampton and these include estimates of the number of buildings, see Camp, Scott and Furphy (1992). However, these were not reported in the questionnaire and a provisional figure of 1,200 is used. Further detail could be obtained from the flood studies available to the council.

Burdekin

Unfortunately questionnaire information from Burdekin is lacking. Urban locations within the area administered by the council are thought to have a significant flood problem, especially for low probability flood events. The number of 1,000 is merely indicative of the size of the problem.

Combining the questionnaire results, consolidated in Table 3.2, with those in Table 3.4 gives a provisional estimate for the number of flood prone urban buildings in Queensland at the 1 in 100 year flood level. The total is close to 51,000, this combines residential, commercial, industrial and mobile homes. A ranked list of the twelve most flood prone LGAs, based on the questionnaire and Table 3.4, is presented in Table 3.5.

Estimates of the number of buildings liable to inundation for floods of greater severity than the 1 in 100 year event are discussed in Section 3.5 and summarised in Section 3.6.

Table 3.5 A list of the twelve LGAs with the largest number of buildings at risk from the 1 in 100 year flood

Local Government Authority	Number of buildings[1]
Gold Coast	16,650
Mackay	8, 500
Brisbane	8, 000
Dalby	3, 300
Ipswich	3, 000
Logan	2, 375
Hinchinbrook	2, 175
Charleville	1, 350
Rockhampton	1, 200
Burdekin	1, 000
Cairns[2]	728
Caboolture	455
TOTAL	**48,733**

1 Includes residential, commercial, industrial and caravans

2 Limited to the extent of the former Mulgrave Shire, riverine flooding in the area of the former Cairns City is, in comparison, limited (refer Section 9 for surge inundation estimates for Cairns and other coastal centres)

3.4.4 Missing data

The total of 51,000 buildings at risk from flooding at the 1 in 100 year level is not fully inclusive. As indicated, some of the questionnaire responses are for a designated flood that is lower than the 1 in 100 year flood level (and as a consequence are an underestimate of the

number of properties at risk from the 1 in 100 year flood). It should be noted however, that the estimates in Table 3.4 are for the 1 in 100 year flood.

There remains the problem of LGAs who did not complete Ques 6.8 - 6.11 (Table 3.2) and for which estimates are not given in Table 3.4. It is unlikely that, to the level of the 1 in 100 year flood, any of the missing LGAs have exceptionally large numbers of flood prone buildings, say more than 500 at any single location. Even this statement needs caution as the very large numbers for the Gold Coast were unknown until recently, the size of flood risk at Mackay was not appreciated until the storm surge study undertaken in 1991 and Charleville was not thought to have a serious flood risk until the floods of 1990.

Further, the floods of early 1997 drew attention to a number of relatively small urban locations that had previously been considered, erroneously, as flood free. It is also salutary to note that whenever detailed, building by building, surveys are undertaken, the size of the problem increases over that for earlier estimates! This certainly was the case for New South Wales as building by building surveys replaced the original estimates provided by Councils. Undoubtedly, future floods will provide similar surprises.

3.4.5 Overall estimate of the number of flood prone buildings in Queensland

The estimate, given above, of 51,000 buildings at risk from the 1 in 100 year flood need modification to account for the missing and incomplete data indicated above.

A cautious estimate would be 60,000 but it is considered more likely that, if and when local urban flood studies are complete, that the number could be nearer to 65,000. It is also pertinent, to stress that without basic hydrological information and designated floods for planning purposes that the number is increasing year by year.

3.5 Probable maximum flood

Comprehensive studies of urban flood damage should consider the potential impact of the probable maximum flood (PMF). This is not in order that the limits of the PMF should be used as a designated flood for planning purposes but it is necessary in order to evaluate potential flood damage, the risks of building failure and to provide the emergency services with information to enable reduction in flood losses, especially the risk to life. The need is to estimate PMF although it is stressed that for many localities the increased risks could be relatively small, the significance is that for other locations the risks could be high. The background to the need for PMF information is given in Section 1.5.3.

3.5.1 PMF and the questionnaire

The lack of hydrological studies for most prone locations in Queensland is such that data on the extent of extreme events are often lacking. Only about 20% of responses (23 out of 108) indicated that they have data on the discharge of the flood of record. Such information is of course, invaluable for the subsequent estimation of the PMF.

Ques 6.3 specifically asks '*... has the PMF discharge been estimated*', less than 10% of the respondents (11 out of 109 replies) indicate that they had; examples of those that have such information are St George, Bowen, Gladstone and Rockhampton. Only 8 of the 10 with PMF discharges have converted the data into map form, LGAs that have include Cairns (Mulgrave), Noosa, Pine Rivers and Redland.

The questionnaire did not ask whether hydrological studies had included estimates of over-floodplain velocities, but it is extremely unlikely that this has been undertaken by more than a handful of authorities. Logan is one example that has information on velocity which has been used to assess the likelihood of building failure.

It is clear that, with few exceptions, information on the PMF or extreme floods (i.e. those in excess of the 1 in 100 year event) is not normally available. To follow best practice, estimates of flood discharges up to and including the PMF, their areal extent and over-floodplain velocities should be incorporated into all hydrological studies for flood prone urban locations.

This applies to existing urban developments and, equally important, for those yet to be developed above the level of the designated flood. It is crucial that the community perception does not consider that areas above the designated flood, regardless of its annual recurrence interval, are flood free. The PMF and velocity information are of significance for the emergency services and are necessary to establish comprehensive flood loss data for use in any form of cost benefit analysis. Often insurance companies are one of the few institutions to take cognisance of the risks involved from such extreme events.

Although detailed data are uncommon, there is little doubt that a near PMF for locations with a high flood range would result in structural building failure especially for many existing residential developments. Ipswich is one such example, some 30 dwellings failed during the 1974 flood and an event of greater magnitude would dramatically increase the number of such failures. This would clearly, pose a very real risk for loss of life.

3.5.2 Probable maximum flood – buildings at risk

Precise estimates of the number of buildings at risk from flooding to the level of the PMF are rarely available in Australia or overseas. Such studies in Australia are restricted to a limited number of urban flood prone communities in New South Wales.

Currently there are no detailed estimates of the numbers of buildings at risk from PMF or extreme floods for any location in Queensland.

Thus, evaluation of the risk to buildings above the level of the 1 in 100 year flood is essentially unknown. The account below attempts to describe the problem and its likely significance.

3.5.3 Increases in the number of flood prone buildings at the level of the probable maximum flood

The AWRC (1992), and earlier reports, specifically limit the numbers of flood prone buildings to those at risk from the 1 in 100 year event. This is done for the very good reason that few maps exist that show flood lines for events that exceed the 1 in 100 year level. Indeed, the only examples that consider this problem in any detail have been produced by CRES at ANU, see Smith (1991). A detailed account of these studies is given in Appendix 3.

For the case studies discussed in Appendix 3, (the Hawkesbury-Nepean region of western Sydney, the Georges River and Prospect Creek in Sydney, Queanbeyan in inland New South Wales and Canberra) the number of buildings subject to inundation at the level of the PMF are three to six times greater than the number for the 1 in 100 year flood event. The increases in flood height from the 1 in 100 year flood to the PMF for these localities are in the range from about 3 metres to greater than 10 metres. The larger the flood height range, the larger

the increase in the number of buildings at risk when compared to those for the 1 in 100 year flood event.

Table 3.6 lists a selection of flood prone locations in Queensland known to have large height ranges. Although local site factors are significant, it is likely that increases in the number of buildings subject to inundation from a PMF would be comparable to those for the examples listed above in New South Wales and the ACT.

Table 3.6 Increases in flood height from the 1 in 20 to 1 in 100 year flood for a selection of Queensland towns

Ipswich, Brisbane-Bremner River	15.0+m
Kenilworth, Mary River	7.0 m
Gympie, Mary River	12.0 m
Taroom, Fitzroy River	7.0 m

The increases are related to the valley topography but are exacerbated by development guidelines that use the 1 in 100 year event as the definition of flood prone. This is because once floods exceed the 1 in 100 year level a large number of buildings, located just above the 1 in 100 year line to conform with development regulations, are inundated.

Of significance for urban locations with large flood ranges is the depth of inundation experienced by buildings that are located at, say, the 1 in 50 year level. These will have water over their rooves for near PMF events. It is this factor which is largely responsible for structural failure.

It is important to stress that all the case studies in Appendix 3 and in Table 3.6 are for locations which have relatively high flood level ranges. Such effects are not universal or even widespread. For example, they would be insignificant for most inland locations in New South Wales, along the Murray, in Adelaide and for most of Tasmania and Western Australia. However, high flood ranges occur in Ipswich, much of Brisbane and for some of the coastal flood locations in New South Wales and Queensland.

Attempts to allow for the markedly increased damage for locations with high flood ranges will be made in Section 8. Suffice it to say that such effects must be considered if the aim is to obtain realistic damage estimates on which to base flood mitigation strategies and their cost benefit ratios.

3.6 Probable maximum flood – summary

The responses to the question 6.3 illustrate the paucity of PMF data for Queensland, less than 10% had estimates of the PMF discharge and even fewer had converted this to maps showing the extent of the PMF event. There is clearly, an urgent need to consider the impacts of extreme floods to the level of the PMF. This is necessary to improve both the effectiveness of the emergency services to reduce all forms of loss from such extreme events and as a basis for

acceptable and comprehensive cost benefit analyses of flood mitigation measures to lessen the losses to existing flood prone developments, especially those below the level of the 1 in 100 year flood.

Background data from New South Wales for locations with moderate to high flood height ranges, have been used to illustrate the nature of the problem (see Appendix 3). As a preliminary (and conservative) value it is not unlikely that the number of buildings in Queensland liable to inundation from the PMF are up to three times the number at risk from the 1 in 100 year flood event, i.e. close to 200,000 buildings.

Given the overall lack of PMF data for Queensland, it would be necessary to prioritise those LGAs with the major risk, ie those with a moderate or high flood ranges. The most significant of these is Ipswich, other locations include Brisbane River, Logan River, Mary River, and Taroom with others selected in consultation with the Bureau of Meteorology. Once the discharge and areal limits of the PMF are available, ideally with estimates of over-floodplain flow velocities, the risk of building failure could be assessed.

The selection of designated flood levels for urban floodplain management should incorporate the analysis of the effects of extreme floods especially for those localities that are known to have a high flood range. In some cases it would be inadvisable, if only on the grounds of safety, to use the 1 in 100 year flood for such purposes.

4

Brisbane and the Gold Coast

4.1 Brisbane and the Gold Coast

Brisbane City and Gold Coast City Councils completed the questionnaire circulated to all Queensland LGAs. However, in both cases the responses were limited to individual river catchments, the main Brisbane River and (for the Gold Coast) the Nerang catchment. As both councils have particularly large and complex urban flood problems interviews were held with senior staff to gain further information on the other flood prone catchments in their areas of jurisdiction. This section reports on the overall problem for both councils, first for Brisbane and then for the Gold Coast.

For Brisbane, the current study had access to an extensive series of reports of flood studies undertaken for the Creek catchments over many years. The section below combines this information with that given in the questionnaire for the main Brisbane River.

The Gold Coast also has a number of separate catchments, many of which contain major flood prone urban developments. Until the last year or so information on flood risk and vulnerability was not known in any detail, however comprehensive studies for the Nerang catchment were made available after the completion of the questionnaires. For the other catchments similar studies are not yet fully complete and the information reported below is limited to an outline of the likely situation. The flood studies for the other Gold Coast catchments, have yet to be finalised.

4.2 The flood problem for Brisbane

The Brisbane floods of the Australia Day week-end of 1974 still represent the most severe example of urban flooding in Australia, with an estimated damage bill of at least $200m at 1974 values. It is important to note that this widely quoted figure, based upon the SMEC (1975) flood study does not include the severe flooding of the Bremer River or of the Brisbane creek catchments. Even before the 1974 flood, inundation maps were available for parts of Brisbane and subsequent to the event Brisbane City Council embarked on a major series of flood studies for the creek catchments followed, in many cases, by the construction of flood mitigation works. Flood information on flood hydrology for the Brisbane Creeks is likely the best for any major metropolitan area in Australia. From the late 1970s, the City Council has progressively imposed land use controls and building regulations for new developments in flood prone areas.

The flood problem in Brisbane has two major components, flooding along the main stream of the Brisbane River and flooding in the smaller catchments, many of which are tributaries to the Brisbane River. This second category is often referred to as 'Creek flooding', some 26 separate creek catchments are recognised although many of these are conveniently grouped into larger catchments. The relationships between the Brisbane River and the Creeks are illustrated in Figure 4.1.

The questionnaire completed by Brisbane City Council, and the data reported in the Tables in other sections, relate solely to flooding along the main channel of the Brisbane River. The Creek catchments that pose major flood threats to buildings and infrastructure are named on Figure 4.1.

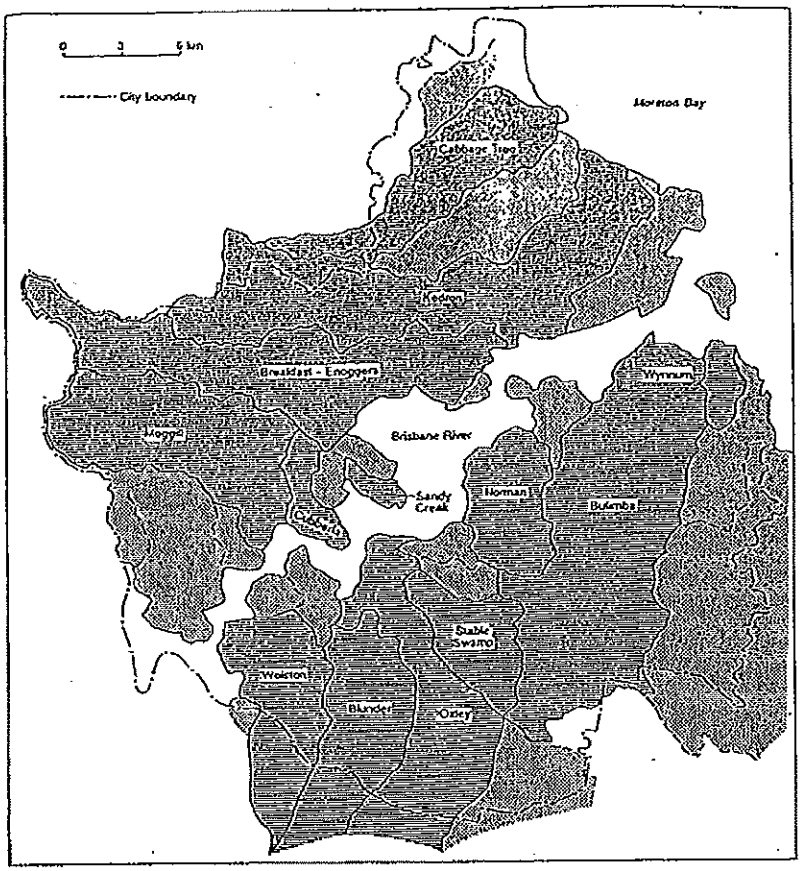


Figure 4.1 The Brisbane River and creek catchments in the area administered by Brisbane City Council

The nature of the flood risk differs markedly between the main river and the Creeks. The most significant difference is in the time interval between rainfall and downstream flooding. Oxley Creek is the largest of the Creek catchments with a length of about 53 km, the corresponding values for the other major Creeks are Bulimba at 41 km, Kedron 27 km, Breakfast/Enoggera 24 km, Cabbage Tree 23 km, Moggill 22 km and Norman 13 km. Carroll (1991), in a study of the warning times and flood forecasting in the Brisbane region, estimated that the time between rainfall and downstream flooding is about 18 h for Oxley Creek with all the other creek catchments having times of nine hours or less. Carroll estimates the effective warning time for Oxley Creek to be about 11 hours, for all the other catchments the effective warning times are 5 h or less. For Wynnum, one of the smaller creeks, the effective warning time is less than an hour.

These relatively short warning times contrast to the main Brisbane River where the warning times are in the range 12 - 24 h, for the 1974 floods the Creeks peaked more than 24 h before

the main river. The differences between the times for the main Brisbane River and the Creeks is significant for measures designed to reduce risk of life and contents damage to dwellings and to commercial and industrial enterprises.

4.2.1 Problems with the assessment of flood vulnerability

Hydrological information for the Creeks is excellent and is used to define flood regulation lines on which land use and building controls are based. The only shortcoming is that detailed information on the number of buildings at risk from flooding is not known. This stems from the problem that, although both flood data and property boundaries are combined into a long established and well designed GIS for the whole of the region administered by the Brisbane City Council, there is no differentiation between those blocks on which there is a building and those that have not been developed. It is likely that this deficiency will be addressed in the near future as a part of the Australian Geological Survey Organisation (AGSO) Cities Project. Once such building information is incorporated into the GIS, the ability to use the data base for emergency management will be greatly enhanced.

This restriction on information on the type and number of flood prone buildings applies to both the Brisbane River floodplain and to the Creeks. For the main river, and for some of the Creeks, the earlier flood studies estimated the number of buildings at risk. For the main river these were based on the data collected by the SMEC (1975) study, those for the Creeks were much less precise although some have been revised on the basis of additional field studies. This is the case where economic assessments were undertaken in order to evaluate the costs and benefits of a range of floodplain mitigation options many of which were of a structural nature. To undertake such analyses it was necessary to assess flood damage under current conditions and this required data on the number and type of existing buildings. However, progressively the Creek studies were restricted to assessment (or re-assessment) of the flood hydrology and the evaluation did not include assessment of structural mitigation options.

Thus, information on the numbers of buildings at risk from flooding in Brisbane is not consistent across the catchments. This has been further complicated by other factors. These include:

- increases in upstream flood storage after the completion of the Wivenhoe Dam in 1985, this decreased downstream flood risk for the floodplain of the Brisbane River,
- in several of the Creek catchments structural works have lessened the flood risk
- the possibility of construction of new developments in flood prone locations.

Each of the factors is considered below.

4.2.2 The effects of the Wivenhoe Dam

The extra flood storage provided by the Wivenhoe Dam undoubtedly reduced downstream risk but the widespread community perception that it eliminated the flood problem is false. Data reported in CRCE Water Studies (1986), reproduced here as Table 4.1, provide estimates of the changes in risk for the Brisbane River floodplain due to enhanced upstream dam storage and compares the 1974 flood data to that for a re-run of that event under post-Wivenhoe conditions. These data suggest that the mainstream flooding for a 1974 event (close to the 1 in 60 year event) under current conditions would affect 4,900 dwellings and 1,600 commercial and industrial enterprise. It is estimated that the peak height of the 1974 flood in central Brisbane would be reduced by 1.45 m.

Table 4.1 **Effects of Wivenhoe Dam on 1974 flood levels and damages for the Brisbane and Ipswich areas. From CRCE Water Studies (1986)**

	1974 Flood Pre-Wivenhoe	1974 Flood Post-Wivenhoe
Flood height (AHD) Brisbane City gauge	5.45	4.00
Flooded houses	9,800	4,900
Flooded commercial/industrial enterprises	2,700	1,600
Total damage ($10^6 at 1974 values)	180	80

A re-assessment of flood hydrology for the Brisbane River is listed as a priority by Brisbane City Council and is currently in progress. Studies are also in progress to re-assess the flood hydrology of Oxley and Wynnum Creeks. It is Council policy to re-assess the hydrology of the Brisbane Creeks on a 15-year cycle. This enables the effects of developments to be incorporated, offers the opportunity to utilise additional runoff and rainfall data and ensures that best practice techniques are employed. It needs to be stressed that developments that effect urban runoff are not restricted to buildings within the flood prone parts of the catchments but include a wide range of changes to land use modifications throughout the Creek catchments.

The policy of a 15-year rolling cycle of hydrological studies is to be commended and is not generally practised elsewhere in Australia or overseas.

4.2.3 Effects of structural works

The Creek catchments contain residential, commercial or industrial buildings constructed before floodplain management policies were introduced to regulate development in flood prone locations, in some cases before susceptibility to flood risk was known. Post-1974 flood mitigation studies were undertaken for these catchments, and where economic and physical factors allowed, a range of structural measures were undertaken to reduce flood risk. Thus, early estimates of the number of buildings at risk from a re-run of the 1974 event have now been reduced. Precise information on the numbers of buildings involved are not known but locally these could be substantial.

An evaluation of the reduction of flood risk due to structural mitigation works is available for the Norman Creek catchment. The initial study, entitled the *Norman Creek Flood Mitigation Report* was undertaken by Brisbane City Council (BCC, 1984). This noted that some 300 dwellings and 300 commercial enterprises were liable to flooding for a 1 in 100 year flood, the definition of flooding was over-ground level. On the basis of this study structural works were undertaken. A further study to assess the changes in hydrology due to the works was reported in the *Norman Creek Flood Study* (Connell Wagner, 1995). This study concluded that the estimated reductions in flood height due to the implementation of the works recommended in the BCC (1984) report were attained. The reductions in the height of the flood peaks vary throughout the catchment but in some locations achieved values in the range of 0.8 to 0.9 m. The 1995 study did not attempt to convert these changes in flood magnitude and frequency to economic gains but the original study in 1984 considers that these could amount to approximately half of the pre-works average annual damage.

Studies of this kind, i.e. that compare reality against original design, are unusual and this example for Brisbane is testimony to the high standard of the flood studies over the last twenty years.

4.2.4 Possibility of new flood prone buildings

The standard of flood hydrology in Brisbane is matched by the implementation of regulations to restrict development in areas of known flood risk. However, there is always the possibility that some developments have escaped enforcement of such regulations, particularly in the early years, if only because the limits of flooding were imperfectly known for the Creeks. Overall it is unlikely that there have been significant increases in the numbers of flood prone buildings in the area administered by the Brisbane City Council over the last twenty years or so. The reply to the questionnaire by Brisbane City Council, restricted to the main Brisbane River, lists a total of 6,027 buildings to the level of the designated flood (1 in 100 years) but comments, 'based on 1975 data – could be more houses affected now'.

4.3 Estimates of flood prone buildings in the floodplains of Brisbane river and creek catchments

The lack of information on the number of flood affected buildings and the problems of change with time, outlined above, restrict the provision of quantitative data on the size of the flood risk. A summary of the estimates is presented in Table 4.2, together with an indication of the date of the assessment. The details of the flood studies for the creek catchments are given in Appendix 4, they are not reported in the list of references. These present a complex picture which is discussed below.

First, Table 4.2 demonstrates the familiar problems associated with such estimates. They are limited to the risk from either the 1 in 100 year event or the flood of record (in this case the 1974 event) and it is not always clear if the numbers refer to above ground or above floor flooding. In recent years, the studies of flood hydrology commissioned by Brisbane City Council have included estimates of the magnitude of the probable maximum flood and over-floodplain velocities. Thus, when the data for the flood free buildings are fully combined with the City's GIS it will be a relatively simple matter to define precisely the vulnerability to flood in terms of ground or floor level and in terms of any flood frequency from 1 in 5 year to that for the probable maximum flood. It will also be possible to assess liability to potential structural failure of buildings in response to flood depth and velocity, information that is often lacking elsewhere. A listing of many of the major hydrological studies for the Brisbane Creek Catchments undertaken over the last 15 to 20 years is given in Appendix 4.

The official estimates supplied by the Brisbane City Council in the early 1990s, as a contribution to *Floodplain management in Australia* (AWRC, 1992, p.145), are described as follows:

> There are some 3,800 properties in Brisbane and Ipswich subject to flooding from the Brisbane River by the current 100 year ARI event. Brisbane City Council also estimate that there are some 6,000 properties in Brisbane (5,000 residential, 1,000 other) subject to major creek flooding. Some properties may be subject to both major creek flooding and Brisbane River flooding. It was assumed that 8,000 properties in the Brisbane metropolitan area were subject to 100 year flooding by either the Brisbane River or major creeks.

These data should be regarded as presenting a very general picture and are likely to be underestimates.

Table 4.2 Estimates of number of flood prone buildings in the Brisbane region

	Residential	Commercial and Industrial	Total
Brisbane River* (SMEC, 1975)			
Pre-Wivenhoe			
4.0 m (1 in 28 yrs)	4941	1569 (+206)+	6716
6.0 m (1 in 60 yrs)	11614	3125 (+515)+	15284
Brisbane River* (Water Studies CRCE, 1986)			
Post-Wivenhoe	4900	1600	6500
Brisbane Creek catchments (BCC, 1977)			
Oxley		1500	1500
Enoggera/Breakfast		1100	1100
Kedron		1100	1100
Bulimba		50	50
Norman		50	50
Other creeks less than 50 buildings		-	-
Creek catchments from flood mitigation studies			
Oxley (BCC 1981)		1500	1500
Norman (BCC, 1987)	300	300	600
Cabbage Tree (Kinhill, 1991)	617	105	722
Bulimba (Connell Wagner, 1992	475	25	500
Brisbane (BCC estimates from AWRC 1992)			
Brisbane River (Post-Wivenhoe Dam)		3800	3800
Brisbane Creek catchments	5000	1000	6000
Brisbane overall (allowing for Brisbane Rivers and Creeks)		**8000**	**8000**

* Brisbane River and lower reaches of creeks, includes estimate for Ipswich
\+ Miscellaneous buildings

4.3.1 The SMEC flood study

The SMEC (1975) study of the Brisbane floods was the first study of its kind in Australia to accurately assess the number of buildings at risk from flooding and to combine this with stage-damage curves to provide an assessment of flood damage. A summary table from that report (SMEC, p.65, 1975) is reproduced here as Table 4.3. It is important to note that this relates only to flooding from the main Brisbane River although the numbers include buildings located in the lower reaches of the Creek catchments that would be flooded from the main river as well as from any separate floods from the upper reaches of the Creek catchments (at a slightly different time). The flood height (at the City gauge) for the 1974 flood was 5.5 m which gives approximately 15,000 buildings that experienced inundation over ground level,

with most flooded above floor level. For an 8.0 m (1 in 110 year) flood the corresponding number is about 23,500.

Table 4.3 Numbers of buildings affected by various heights of flooding of the Brisbane River, from SMEC (p.65, 1975)

Flood height m	Recurrence interval	Commercial buildings	Industrial buildings	Residential buildings	Miscellaneous buildings	Total
2.0	1 in 11 yrs	165	64	208	32	469
4.0	1 in 28 yrs	708	861	4,941	206	6,716
6.0	1 in 60 yrs	1,230	1,925	11,614	515	15,284
8.0	1 in 110 yrs	1,664	2,615	18,461	786	23,526
9.0	1 in 150 yrs*	1,883	2,879	21,403	889	27,054

* Approximate, interpolated from data in SMEC (1975).
NOTE: Flood frequencies are post-Somerset Dam but pre-Wivenhoe Dam

The flood peaks correspond to the pre-Wivenhoe Dam situation although the flood peak was lower than under pre-1950s conditions due to the flood storage effects of the Somerset Dam. The data which correspond to a re-run of the 1974 event (post Wivenhoe dam), are a city gauge height of 4.0m,and total buildings of 6,716 (see Table 4.2).

There are other features of Table 4.2 which require additional comment. These include:

- all the estimates for flood prone buildings in the Creek catchments that have been updated with field studies show very significant increases from those based on earlier generalised information
- the problem of numbers of flood prone buildings for Ipswich

4.3.2 Increases with detailed field studies

Detailed field estimates of the number of buildings at risk for the Creek catchments are available for Norman (BBC, 1981), Cabbage Tree (Kinhill, 1991) and Bulimba (Connell Wagner, 1992). These all report significantly larger numbers that those in the provisional data of 1977. For example, the early estimates for Bulimba and Norman for the 1 in 100 year flood were both for 50 buildings but the detailed studies increase the listing to 600 and 500 buildings with over-ground flooding respectively. For Cabbage Tree the provisional estimate was for less than 50 buildings but with a field survey this increased to 722.

These discrepancies match experience elsewhere in Australia, that is provisional estimates seem always very much smaller than those found from field surveys of buildings.

Part of the discrepancy in Table 4.2 stems from the difficulty that the lower reaches of the Creek catchments are also subject to inundation from the main Brisbane River, further complicated by tidal and possibly storm surge associated with tropical cyclones which would, in many cases, be the trigger for severe rainfall and flooding. The effects of tides and surge

have been incorporated into all recent hydrological studies commissioned by the Brisbane City Council but these rarely list the number of buildings at risk.

4.3.3 Numbers of buildings in Ipswich

Ipswich is inundated by floodwater from the Bremer River catchment but the flood height is effected by the height of the of the flood in the Brisbane River. The relationship between the two is complex and varies considerably from flood to flood, see SMEC (1975, p.25). For Ipswich, in contrast to Brisbane, there are no detailed hydrological studies or assessment of the number of flood prone buildings, although it is understood that such studies are currently in progress.

Chamberlain *et al.* (p. 9, 1981) report that for the flood of 1974:

> Ipswich City Council records show that over 1,800 buildings in that city, residential and commercial, were completely or partially inundated. Forty-one dwellings were swept away, 620 were completely submerged, and 974 partly submerged. Water entered about 200 other properties, though the buildings were not flooded [indicating over-ground but not over-floor flooding].

Thus, for the 1974 flood (close to a 1 in 100 year event for Ipswich) the number of buildings of all kinds flooded over ground was about 2,000.

These figures are now over twenty years old and, because Ipswich City Council regulations only prohibit new developments below the level of the 1 in 20 year flood event, the number of buildings currently at risk is likely to be much larger. The effect of Wivenhoe Dam at Ipswich would be restricted to the effects of the lowered tail water levels where the Bremer River joins the Brisbane River

4.4 Summary – number of flood prone buildings for Brisbane

Notwithstanding the generally excellent standard of the flood hydrology for both the Brisbane River and the Creek catchments, there are problems in providing detailed estimates for the number of buildings at risk from flooding. These are outlined above and include changes to flood risk due to mitigation works which vary in size from the Wivenhoe Dam to numerous minor structural works on many of the Creeks and lack of detail for developments described in section 4.2.4.

There are grounds for considering the official AWRC (1992) number of 8,000 buildings as given in Table 4.2 to be underestimates. The actual number could be considerably larger, based on supposition, perhaps by a factor of two.

The AGSO Cities Project, which commenced in late 1996, will focus on Brisbane as its major case study and will provide much improved information of the flood risks to buildings and infrastructure. As outlined above, the hydrological data base for the area administered by the Brisbane City Council is excellent but the need is to link this to GIS data for buildings and infrastructure. Such information will be of major value for emergency management and will also enable the further flood mitigation options, especially those of a non-structural nature, to be evaluated. The application of detailed regulations for the development of buildings and structures within the known flood prone areas have been in place for many years.

4.5 The flood problem for the Gold Coast

In this report the Gold Coast region equates to the area administered by the Gold Coast City Council and includes urban areas located in the catchments of the Logan, Albert, Coomera, Pimpama and Nerang Rivers together with a number of small catchments that drain directly into the Pacific Ocean. Prior to amalgamation in 1995 the region was under the jurisdiction of two local government authorities, namely Albert Shire and Gold Coast Council. As is commonly the case in Australia the river catchment boundaries are not coincident with those for local government and for the Logan and Albert Rivers upstream portions of the catchments remain the responsibility of other councils. For the Gold Coast region, this posed particular problems prior to recent amalgamation. An outline map of the major catchments and their relationship to the boundaries of the Gold Coast City Council are illustrated in Figure 4.2.

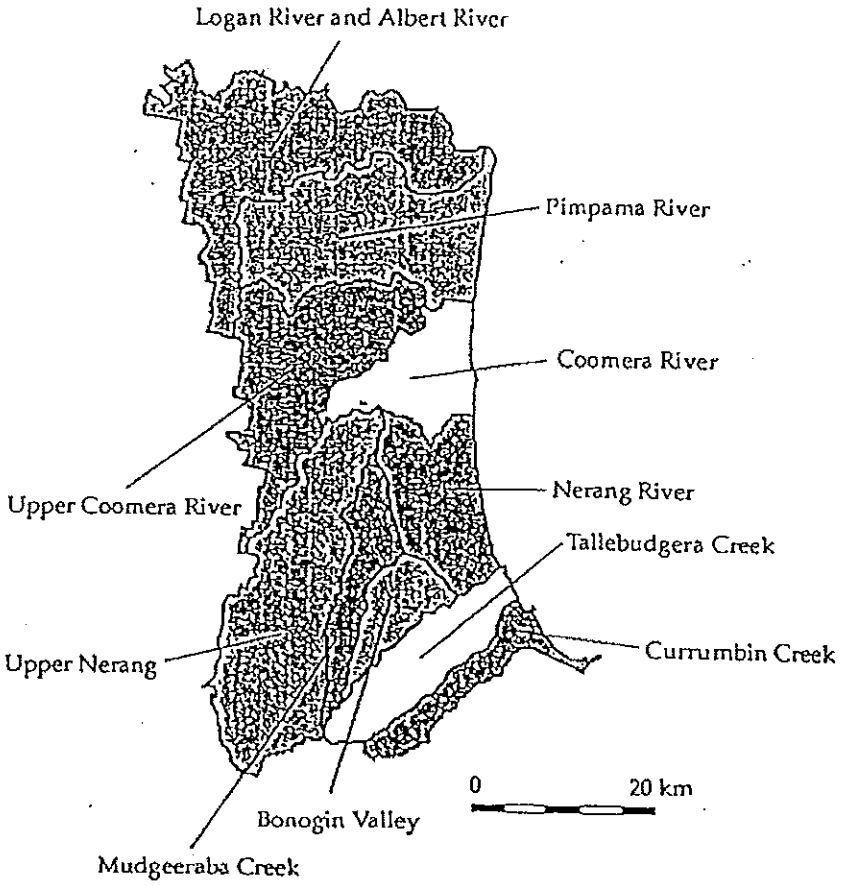


Figure 4.2 Gold Coast catchments

Based upon existing State government modelling, flooding for the Gold Coast region, in terms of the number of buildings, represents one of the largest single concentrations of urban flood risk in Australia. It is also noteworthy that the risk to the residential sector is exceptionally large.

There is abundant historical evidence of the stage height and extent of flooding in the Gold Coast region. A summary of these events is given in the *Logan and Albert Rivers Flood Warning System* (BOM, 1992). The floods of January 1887 and January 1974 represent the largest floods of record although for the former information is less detailed especially as regards the areal extent of inundation. The gauge height and extent of the 1974 flood, which was a major event throughout much of Queensland and New South Wales, is however well recorded and was subsequently mapped in detail for the Albert and Logan River floodplains by the Queensland Water Resources Commission. Maps of inundation for the 1974 flood also exist for the Pimpama, Coomera and Nerang Rivers as well as Tallebudgera and Currumbin Creeks, although the detail is less precise.

For the Nerang River system the January 1974 flood is estimated to have an annual recurrence interval of about 1 in 65-70 years. For the Coomera, Logan and Albert Rivers the 1974 flood is considered to be greater than the 1 in 100 year flood. It is pertinent to note that the 1887 flood was of greater magnitude and, although there is no available estimate of the annual recurrence interval, the gauge heights on the Logan River at Wakefield and Maclean's Bridge were between 0.6 and 0.8 m higher than for the peak of the 1974 flood.

Given this historical information of flood risk for the Gold Coast region it is surprising that data on the number of buildings at risk was not included in any of the earlier State surveys of flood risk; the numbers reported for Queensland are summarised in Section 2.2.1. Whilst there were land use controls provided by planning schemes which usually required compliance with a hydraulic study, individual developments have produced some afflux. It would appear that the cumulative effect of these developments would have significantly aggravated flooding problems if Council had not provided some additional flood mitigation benefit with the raising of Hinze Dam in the Nerang River catchment (the dam is primarily a reservoir to service the region's water supply needs). Developments had to show no adverse impacts in terms of afflux and floor levels were required to have either 150 mm or 300 mm freeboard above 1974 flood levels (former Albert Shire and Gold Coast City respectively). However, the last few years have witnessed major changes in the compilation of information on flooding and the implementation of land use and building regulations on the floodplains. An outline of these changes is given below.

4.6 Current status of Gold Coast urban floodplain management

The 1974 flood is estimated to have directly affected at least 1,000 dwellings in the Gold Coast region which at that time had a population of less than 100,000 people (today's population is about 350,000). Since that time major and widespread residential development has occurred in the area inundated by the 1974 event. The 1974 floods acted as a spur to undertake hydrological studies and, in addition to the map showing the 1974 flood limits, a physical model was developed for the Nerang River in the early 1980s. This was replaced, in 1989 by the production, of a one-dimensional computer model, by the Queensland Department of Primary Industries (now DNR).

In 1996 Council approved the development of two dimensional hydraulic and environmental models which have yet to be commenced. By 1997 a more sophisticated two-dimensional (MIKE 21) model which incorporated 130,000 grid points had been developed by a consultant acting for a landowner.

The overall situation in the Gold Coast region is similar to that described for the Brisbane City Council, i.e. there are a number of individual catchments each with their own hydrology. Each catchment requires detailed hydrological studies before reliable estimates of the number of buildings at risk, potential flood damages and possible flood mitigation options can be assessed. Projects to achieve these aims are actively in progress and the Gold Coast City Council in recent financial years has budgeted in excess of $1 m annually to meets these ends. The current status for the various catchments, provided by the City Council in response to the present study, is reproduced below.

Table 4.4 Localities affected by flooding in the Gold Coast Region

Catchment	Locality	Affected
Logan River	Waterford	Floodplain & Valley flooding
	Bethania	Floodplain & Valley flooding
	Beenleigh	Floodplain & Valley flooding
	Alberton	Floodplain & Valley flooding
	Woongoolba	Floodplain & Valley flooding
	Steiglitz	Floodplain & Valley flooding
Albert River		Valley flooding
Pimpama River	Norwell	Low lying areas and roads affected
Coomera River	Hope Island	Low lying areas flooding
	Upper Coomera	Valley flooding
Nerang River System	Area 65 sq km from Chevron Island in North to Burleigh Waters in South, West of Gold Coast Highway to Mudgeeraba in South West and to Nerang in North West.	Floodplain depths to 3.5 metres, residential areas affected
Nerang River	Upstream of Nerang	Valley flooding
Mudgeeraba-Bonogin Valley	No data available but some houses affected at Q5	Valley flooding
Tallebudgera Creek	Palm Beach	Floodplain
Currumbin Creek	Currumbin Waters	Floodplain

'Floodplain' indicates extensive inundation across the floodplain, 'Valley flooding' corresponds to flooding of more limited areal extent.

The current situation and stage of analysis is as follows:

Logan/Albert Rivers	Flood study by AWE for SOUTHROC has been recently completed. Flood inundation lines for various floods will be prepared and this data can be used to quiz Council's land use map and cadastre electronically.
Pimpama River	No flood study is available, however an approximate 1974 flood inundation line is available and an electronic quiz is possible.
Coomera River	Flood study by Kinhill Engineers has been undertaken, but inundation lines have not been prepared. An approximate 1974 flood inundation line is available for electronic quiz.
Nerang River System	Flood study is complete and inundation maps using early topographic data have been prepared by the Department of Natural Resources' Surface Water Assessment Group. New inundation maps are being prepared using photogrammetric data, and a flood damage study is in progress for Q20, Q50, Q100 and Q200 floods. At Q100 it is estimated there will be about 8,000 properties inundated and about 14,000 flood affected, with a private property damage bill of some $200 million.
Currumbin and Tallebudgera Creeks	Flood study is nearing completion and inundation maps will be prepared.

4.6.1 The hydrology

The hydrology of the of the catchments in the Gold Coast region poses particularly difficult problems: These include:

- the tidal nature of the rivers and creeks,
- the widespread changes to the catchment characteristics,
- surge associated with cyclonic conditions.

The lower sections of the larger rivers, namely the Logan and Albert, and the floodplains of the smaller rivers and creeks are all at low elevations and are therefore, affected by tidal influences. It is these areas that contain the major concentrations of residential growth, in part because of their appeal for water-based canal developments.

The construction of canal estates is but one example of the human-induced changes to the natural fluvial environment. Another is that the natural storage of the low-lying floodplains

has been reduced due to fill to provide mounds on which dwellings are constructed. The network of canals for recreational vessels has also modified the original stream network. In addition to these problems the region shares the universal problem that there are very poor historic records of discharge and stage height for such small catchments.

One of the most probable scenarios for severe flooding in the Gold Coast region is linked to the effects of intense and heavy rain from tropical cyclones. This would be enhanced by the triggering effect of high ground that would cause heavy rainfall in the upper catchments of the rivers and creeks that flow across the floodplains in the Gold Coast. Such flooding could be compounded by the effects of storm surge (alternatively termed 'storm tide') associated with such cyclones. The direct effects of storm surge inundation are thought to be limited, ie in no way comparable with Cairns or Mackay, but the indirect effects could be considerable. These indirect effects would cause the rivers and creeks, especially in the tidal areas, to increase flood levels. The magnitude of the additional inundation depends on a range of meteorological factors and is also related to whether the peak surge and flood flows occur at high or low tide.

It is important to acknowledge the severe technical hydrological problems of the Gold Coast region. However, hydrological information now available, currently in progress and planned, is of a high order and attempts to incorporate the problems outlined above. In addition, the studies provide information on the magnitude of the very low probability floods (including estimates of the probable maximum flood), over-floodplain velocities and changes to flow paths. The Gold Coast Council is also aware of the possible changes (likely to be adverse) of greenhouse climate change.

The current stage of hydraulic information is described in the study undertaken by the DNR in 1992 (DNR, 1992). Such information is an essential first step to assess the vulnerability of existing floodplain developments. The approach is to use a geographical information system (GIS) to link the hydrology and land use (including the built environment). Flood maps showing the extent of flooding and the property boundaries are available in draft form for some of the catchments (the Nerang River catchment for example) and in progress for others. The amalgamation of Albert Shire and the Gold Coast Councils into a single authority has had positive outcomes in that it allows a more comprehensive whole of catchment planning but has also required the blending of two previously separate data sets.

4.6.2 Planning regulations and guidelines

The large number of residential flood prone buildings in the Gold Coast region, the majority of which have been built in the last twenty years, suggests that acceptable floodplain management regulations for land use, the floor height of habitable buildings, the use of fill etc, were poorly applied and enforced. However, the situation has, in the last few years, dramatically changed and comprehensive development assessment criteria for flood plain studies for developments in floodplains. For instance, the Nerang Hydraulic Master Plan was adopted in 1997.

Council requirements for inclusion in a Terms of Reference of any Environmental Impact Study usually include a statement along the following lines:

> 'The Environmental Impact Study shall include a hydraulic study investigating 10, 20, 50 and 100 year ARI, critical duration and the 1974 historical flood events, prepared by a suitably qualified consulting engineer at the applicant's

cost. The hydraulic study is to investigate the base case (undeveloped case) and the developed case. In relation to the design of the development, the following development objectives are desirable:

1. No net loss of floodplain storage – any increase in floodplain storage is an advantage.
2. No net increase in flood level except perhaps locally within the development site.
3. No significant change to flood flow direction.
4. No significant change in flood velocity unless it can be proven that either velocities are lower or will be to the advantage of neighbours. (A "neighbour" in this context is the owner of any property that can be demonstrated to be affected by this proposed development).
5. No net increase in inundation duration where inundation could damage private assets.
6. No loss or adverse change to emergency services access.
7. No net shortening of the warning time from declaration of emergency so as to maintain the ability of neighbours to provide protection to their assets or evacuation.

Should any of the above objectives not be achieved, then the applicant shall lodge a schedule of non-compliance with the design objectives together with an explanation of why the objectives cannot be achieved, and propose measures that would remedy any problems'.

The design flood will be the 1 in 100 year event or the largest recorded flood whichever is the higher. Developers are required to use approved hydrological modelling techniques and such analysis must extend to the level of the 1 in 200 year flood for reasons such as counter disaster planning.

Future floodplain management will be based on best practice hydrological assessment combined with GIS analysis of vulnerability and stringent regulations will be formulated and applied to any form of new development, building or other, that is proposed within the limits of the 1 in 100 year flood. Urban floodplain management will also include whole catchment planning and greater community involvement. An example of the former is the Joint Flood Plain Management Group for the Logan River, established in March 1996, which reports to the Logan River Management Co-ordinating Committee which has representatives from the Gold Coast, Beaudesert, Logan and Redland Councils. Community involvement is evident in such groups as the Merrimac/Carrara Floodplain Advisory Committee, established in August 1996 to consider the future of this portion of the Nerang River catchment. The Committee is composed of a wide range of stakeholders from community representatives to State government officials.

4.6.3 The problem of numbers of buildings and dwellings

Data from the 1997 Nerang River Flood Study, made available by the Gold Coast City Council in late 1997, provide an excellent illustration of the problem of basing flood assessment solely on the number of buildings (or properties). This is because many of the

residential buildings in the Gold Coast region are designed for multi-occupancy, as flats or apartments. In such cases it is better to use the term 'residential dwellings', i.e. a residential dwelling unit is a single household in a multi-occupancy building. The data in the Nerang Study also illustrates the differences in the number of dwellings situated in the flood prone zone and the numbers liable to over-floor inundation. For example, for the 1% (1 in 100 year flood) there are 14,250 residential properties in the flooded area. These equate to 28,600 residential dwellings. Of these, only 8,000 would likely experience over-floor flooding for the 1 in 100 year flood. In part, the large difference in the number of dwellings in the flood zone with an without over-floor flooding is because many are multi-storey buildings.

The number of multi-occupancy and multi-storey residential properties in the Nerang River floodplain, in comparison to most other urban areas in Queensland, is exceptionally large. However, the data outlined above illustrate the necessity for detailed studies in order to adequately assess vulnerability, estimate flood damage or provide good quality information for emergency management. These aspects of the Nerang Flood Study could well be used as an example of how to undertake comparable detailed studies for urban floodplain management elsewhere in Queensland.

4.7 Summary

Notwithstanding the provisional nature of some of the estimates of the number of buildings, the size of the existing flood risk presents a massive problem. Estimates, supplied by the Gold Coast City Council, for direct damage (building structure, internal and external, contents) to residential developments for a re-run of the 1974 event in the Nerang catchment alone is of the order of $200m at current prices. In addition there would be direct and indirect losses in the commercial sector, widespread infrastructure damage and untold intangible losses due to the fall in tourist numbers.

The Gold Coast City Council is faced the management of the largest concentrations of flood prone residential buildings of any local government authority in Australia. The Council is currently addressing this issue by improving its flood information and modelling systems and by ensuring that flood risk forms a central component of its urban flooding policy. The Gold Coast situation provides a salutary lesson for other Queensland councils..

5

Hydrological Information, Mapping, Damage Studies, Mitigation and Policy

5.1 Introduction

The design and implementation of acceptable urban floodplain management policy for flood prone LGAs requires a sound hydrological base. Information on the extent of inundation from floods of differing magnitudes and frequency is an essential step in this process. Normal practice is for such information to be obtained from rainfall/runoff modelling techniques but the accuracy of these depends on the availability of historical data. A less precise procedure is to base policy on information from the flood of record. Ideally, hydrological information is combined with damage studies in order to select effective flood mitigation options from which local policy is formulated.

An assessment of the current situation in Queensland can be obtained from the responses to the questionnaire, especially parts of Question 5, 6, 7 and 8.

Question 5 specifically addresses the information available on past flood events,

Question 6 asks for detail on hydrological studies,

Question 7 enquires if flood damage studies have been undertaken,

Question. 8 deals with the details of flood policy and mitigation measures.

The responses to each of these is addressed below.

5.2 Information on past flood events

Question. 5.1 asks '... *is historical flood data available?*' Two thirds (68 out of 102 responses) of localities reported that it was. The negative responses include those that do not consider they have a serious urban flood problem, but there are others that give the reasons for the lack of data as 'apathy', or 'no engineer' and a number replied that they considered that the responsibility lay with the DNR (or the former Water Resources Commission) or the Bureau of Meteorology. Those who consider that the responsibility lies elsewhere include LGAs who indicated (or thought) that the data were held by those agencies.

The responses on historical data closely match those locations which have a town flood gauge, a little over half of the localities (53 out of 101) are in this category. The length and quality of flood records are, of course, variable. For some locations the records extend back for over a hundred years, eg. Brisbane City 156 years, Rockhampton 137 years, Taroom 133 years, Gympie 128 years and Ipswich 100 years. Conversely, many LGAs have only short records, i.e. less than 10 years. ALERT flood warning installations provide an excellent opportunity to gather more precise rainfall and runoff data although there is a need for in-house LGA expertise to fully capture such information.

For the flood gauge records to be of real value, it is necessary for these to be expressed in terms of the areal extent of inundation. Question 5.10 asks if '*... flood limits for the largest known flood are available in map form*?' Exactly half (53 out of 106) of the localities have the records available in this form. Question 5.11 seeks further detail on the '*... historical flood mapping method.*' Most are available in paper map form but for 17 locations the information is also stored as GIS data and about 10 also have the flood limits superimposed on air photographs. The relatively high proportion who have converted the largest known flood into GIS format is encouraging and this will undoubtedly assist future flood policy design and implementation.

5.3 Hydrological flood studies

Question 6.1 asks if a '*... hydrological/hydraulic flood study has been carried out for this community*?' A positive response indicates that some form of modelling has been undertaken, using the historic flood data and regional rainfall statistics. The latter are much more numerous, and have longer records, than for flood or river discharge. Only 40 out of 108 of localities have undertaken hydrological studies although in some cases (i.e. Brisbane River) these are currently being re-assessed. Those with such studies include the majority of the major flood prone LGAs within the State although in some instances the data are of a relatively poor standard. Ipswich is in the process of undertaking such studies and the Gold Coast has recently completed studies for the Nerang catchment and is in the process of undertaking them for other catchments in their area of jurisdiction.

Question 6.2 invites LGAs with such flood studies to indicate the floods that '*... were studied*'. For the 40 responses the floods studied were to a variety of levels, in many cases the lowest probability flood also formed the designated flood. The lowest probability levels in the flood studies are summarised in Table 5.1.

Table 5.1 Flood studies, lowest probability event for which information is available, based on Question 6.2

Above 1 in 100	1 in 100	1 in 50	Below 1 in 50
4	24	6	6

In urban flood studies, it is common practice for the 1 in 100 year event to be the lowest probability event studied, although the recommended procedure is for such studies to extend to the probable maximum flood. In Table 5.1, the LGAs who extended the study to levels above that of the 1 in 100 year event include Brisbane (including the creek catchments), Logan (in part), Warwick and Rockhampton. An example which reported limits below the 1 in 50 year event was Mt. Isa. Studies at 1 in 50 and below are too limited to form the basis for acceptable urban floodplain policy. However, some of the LGAs with 1 in 50 year information do have other more limited data available, eg. for the flood of record. Some LGAs vary the level of study by catchment, examples are Laidley, Logan and Pine Rivers.

The situation for the probable maximum flood is separately assessed in Section 3.5. Only 8 localities have maps that show the extent of the PMF, among these are Gladstone, Redland, River, Rockhampton, Roma and Warwick.

Question. 6.5 requests information on the '... *adopted designated flood*'. The number of responses and level of adoption are given in Table 3.3. In summary, of the 44 responses 27 used the 1 in 100 year event, two the flood of record and the remainder the 1 in 50 year or even more frequent event.

Question 6.6 indicates that for 42 localities, a large proportion of those that answered Question. 6.5, have maps that show the designated flood line and nearly all of these also have the information in GIS format.

5.4 Damage studies

Question 6.12 enquires '... *has a damage study been carried out?*' There were only 11 (out of 98) positive replies. Such studies are not only critical to the assessment of the costs and benefits of floodplain mitigation options but, since they are based on field surveys of all buildings, provide an invaluable aid to all facets of emergency management.

Table 5.2 lists all the positive responses to this question. The majority are known to be of a high standard although for the Brisbane River the damage study is stated to be 'very old - 1976', i.e. after the 1974 flood. It is noteworthy that many of the damage studies were prompted by the occurrence of a major flood event that served to highlight the need for such information. Examples are given in Table 5.2 and include Rockhampton, Murweh (Charleville and Augathella) and Jericho. For the Gold Coast and Warwick such studies are actively in progress and Ipswich (omitted from the positive response data) has such information for the Bundamba catchment. The situation for the Brisbane Creeks is discussed separately, see Section 4.2, and not included in the questionnaire responses.

The poor coverage of flood damage studies for known flood prone urban locations in Queensland is regarded as a major barrier to the formulation of acceptable floodplain management policies.

5.5 Summary – past events, hydrological and flood damage studies

Historic data on flood events is available for a large number of flood prone locations but only about 40% have undertaken detailed hydrological studies. These include most of the major flood prone localities and 42 have the information available in map or GIS form. However, only 27 localities have used this information to define designated floods to the level of the 1 in 100 year event. Information on the PMF is rarely available and even rarer in map or GIS format. The greatest lack however, is for damage studies which only exist for 11 localities and are absent for many of the most flood prone LGAs.

5.6 Policy and mitigation

Question 7 specifically addresses LGA flood policy, and Question 8 flood mitigation measures. The analysis of responses to several of the questions on policy is reported by LGA and not by flood prone locality.

5.6.1 Policy

There were 79 responses, by LGA, to Question. 7.1 which asked '... *has a flooding policy been developed?*' Of these, 37 reported that there was such a policy and 42 that there was not. It is important to note that there are likely large variations in what is interpreted as

constituting such a policy. However, it is thought that in all cases there are restrictions on new developments in areas below the level of the designated flood. Most of the LGAs with significant urban flood problems indicated that they had a flood policy, exceptions included Bundaberg, Dalby and Emerald.

Table 5.2 LGAs reporting that flood damage studies have been undertaken, based on Question 6.12

LGA and locality	Comment
Brisbane	For Brisbane River based on 1976 data.
Dalby	
Gold Coast	Completed for Nerang Catchment, in progress elsewhere.
Hinchinbrook (Ingham)	For Ingham.
Ipswich	Only for Bundamba catchment.
Jericho	After 1990 flood.
Mackay	
Murweh	Charleville and Augathella, After 1990 flood.
Noosa	
Rockhampton	After 1991 flood.
Roma	
Warwick	In progress.

Question 7.2 requested information on the '... *hydraulic basis for flooding policy.*' Two thirds (24 out of 79 LGAs) indicated that they use a designated flood with the remainder basing their policy on historic flood data. In some cases physical models had been employed to assist with flood policy, Caloundra and Mackay are examples. In many cases the policy is based on a combination of historic data and hydrological modelling.

However, attention is drawn to Section 5.2 which shows that for many locations, information on the extent of floods is limited.

Question 7.3 enquires '... *is the designated flood for residential buildings the same as the designated flood for commercial buildings?*' Of the 41 LGAs that replied, 36 used the same designated floods for both residential and commercial and 5 have different levels. There was only a single reply to Question. 7.4 which requested reasons for the differences. Gympie (Cooloola Shire) commented that it was '... deemed acceptable for commercial to flood', i.e. there were no restrictions for commercial developments in flood prone locations. Caboolture uses the 1 in 100 year as the designated flood for residential buildings and the 1 in 50 year for commercial.

Question 7.5 requests information on the '... *difference between allowable floor levels and designated flood levels*'. This is an example of obtaining more detailed information on the

nature of the flood policy. A total of 22 LGAs provided data, the range was from zero to 1,000 mm. However, approximately half of the LGAs require a minimum difference of 300 mm (likely converted from earlier regulations of '1 foot'). Several LGAs vary the designated flood/floor level by location, e.g. Logan uses 150 mm for the main Logan River and 300 mm for the tributary creeks. Such variations usually reflect the quality of the available hydrological data which is invariably more precise for the main rivers than for the smaller tributary catchments. For this reason, Beaudesert requires a floor height of at least 1,000 mm above the designated flood in some locations.

5.6.2 Fill requirements

Some jurisdictions in Australia and overseas prohibit any new building within the flood prone area as delimited by the designated flood. Others use floor level restrictions, similar to those described above for Queensland, but have restrictions on the building methods employed to obtain the required level. In Queensland many of the regulations are related to fill, in order to form a mound on which to construct the buildings, elsewhere regulations often restrict 'raising' of the building to the use of columns or stumps, similar in form to the traditional high set Queensland dwelling. The reason for such restrictions is to avoid the afflux problems posed by using fill to produce the mound. In Queensland the use of fill is much more widespread and Question 7 was designed to gain further information on this.

Question. 7.6 asks '... if allowable filling requirements are:

a. ad hoc individual approvals,

b. filling policy determined on the basis of hydraulic studies,

c. individual approvals based on the developer demonstrating impacts,

d. other.

The 34 LGAs who responded indicated that there is variation both between LGAs and sometimes within the area administered by individual councils. Nine councils rely solely on the ad hoc approach, 4 on policies based on hydraulic studies and 13 on developers demonstrating impacts acceptable within the overall flood policy. The remainder use combinations of these requirements, often these differ in relation to the detail available from existing hydraulic studies. In such cases the developer is required to provide a detailed analysis to demonstrate whether the development is acceptable or not. The reply from Redcliffe to this question is noteworthy because the council does not allow fill under any circumstances.

If consistently applied, such variations are acceptable and there is often more consultation and detailed analysis where a major development is proposed. However, the continued use of ad hoc or poorly supervised requirements for fill can, and does, lead to significant increases in afflux and therefore, to increased flood risk.

There is a strong case for State guidelines and perhaps, regulation to clarify the arrangements for fill, if only to overcome the problems posed by differing requirements by councils in the same catchment.

Over-use of fill by one council can cause adverse effects for others on the floodplain. A Joint Flood Plain Management Group was established for the Logan River in March 1996 with elected and professional staff from the four LGAs that share the Logan River catchment. One

of the terms of reference is to develop '... an agreed protocol to be followed by the each Local Government in assessing development applications'.

5.7 Legislative mechanisms

To achieve effective local floodplain management there is a need for the policy to have a sound institutional base. It is widely accepted that this is not the case for many Australian States, Queensland is no exception. The situation for the eastern mainland States is reviewed in National Landcare publication, *Issues in floodplain management – a discussion paper* (Smith *et al.*, 1996). To clarify the situation Question 7.7 sought information on the 'legislative mechanisms used' in Queensland.

LGAs were asked to indicate which of four Queensland Acts were used as a basis for their flood policy. The four were:

The Local Government Act (abbreviated to LG)
The Local Government (Planning and Environment) Act , hereafter LG (P & E)
The Water Resources Act (WR)
The River Improvement Trust Act (RIT)
Other

There were 37 responses, the results are given by LGA and not by locality. There was considerable variation between LGAs, some employing a single act and other combining one or more. A summary is given in Table 5.3.

Table 5.3 Legislative mechanisms used to underpin flood policy (Question 7.7)

	LG only	LG(P&E) only	LG/LG(P&E) combined	LG/WR combined	LG/LG(P&E)/WR combined
Number of LGAs	5	16	12	1	3

LG = Local Government Act
LG (P&E) = Local Government (Planning and Environment) Act
WR = Water Resources Act

The LGA and LG(P & E) Acts are the most widely used, either singly or in combination; 33 LGAs fell into this grouping. Neither the WR nor RIT Acts were used as the sole institutional underpinning but were used in combination with the two most frequently used Acts by six LGAs. Warwick is the only LGA to use all four Acts. There were no examples of the use of 'other' legislation as an institutional base for flood policy. From the survey results it would appear that the institutional arrangements are unclear.

5.8 Mitigation

It is standard practice to divide flood mitigation measures into two separate classes, namely structural and nonstructural. In detail there are definitional problems but the structural class normally involves engineering measures which are often costly. In contrast, non-structural measures generally have little direct cost (resumptions and rezoning compensations are two

examples of expensive 'non-structural' measures) to LGAs and typically incorporate features such as zoning and building regulations. Question 8 invites LGAs to indicate any structural measures used for mitigation and Question 7 for non-structural. Although flood warning systems are included as a nonstructural measure (Question 8.2), much fuller information is requested in Question 10 with the results discussed in detail in Section 6. The flood mitigation options are discussed in terms of locality.

5.8.1 Structural mitigation measures

Question. 8.1 invites respondents to indicate '... *flood mitigation measures used to reduce [the] effects of flooding on [the] community*'. Four categories were given with the request to list any additional measures that had been used. The categories listed were:

Levees
Flood control dams
Retention basins
Flood proofing of buildings
Other

Structural measures, often of more than one type, were reported as used at 29 localities. Thirteen localities (out of the 29) use levees, in 6 instances in conjunction with one or more other structural measures. Although the respondents were not specifically asked, many report that the levees are only used locally, ie to protect a relatively small number of buildings or only apply to part of the flood prone locality, Brisbane and Balonne are examples. For two localities, Goondiwindi and Mackay, the levee systems are known to be extensive. At Goondiwindi the levee system has been in place for many years and affords a relatively high level of protection, that for Mackay is much more recent and has a level of protection for floods in the 1 in 30 to 1 in 40 year class.

A fuller list of localities reporting levees, excluding those already mentioned, includes Bundaberg, Emerald, Hinchinbrook (Ingham), Johnstone (Innisfail), Paroo (Cunnamulla) and Thuringowa. In comparison to New South Wales or Victoria, the number of major urban levee systems is relatively small.

Flood control dams are mentioned for only four locations. These are the Somerset and Wivenhoe Dams on the Brisbane River, the Ross River Dam upstream of Townsville and the Hinze Dam in the upper catchment of the Nerang in the Gold Coast. In all of these cases the primary purpose of the dams was water supply, irrigation or urban, with flood control as an additional feature.

Flood detention basins are smaller structures than flood control dams and are specifically designed to retard and decrease flood peaks that could cause downstream damage. They are usually constructed on small catchments in major urban areas. They are specifically mentioned for six localities, these include the Brisbane Creeks, Cairns, Maryborough and Townsville.

Flood proofing of buildings can be considered as a special case of structural mitigation, it differs from most other forms of structural mitigation as it can be undertaken for individual buildings (residential or commercial), only 8 localities report its use. These are Bowen, Dalby, Ingham, Maryborough, Logan, Murweh (Charleville) and Rosalie. This small number is perhaps surprising, in part because the traditional high Queensland detached dwelling provides a ready-made example of flood proofing. Although data are not requested of the

numbers of buildings that are flood proofed, usually undertaken well after construction and in response to a known flood risk, the measure is only used in a minor way. This contrasts with some communities in New South Wales where house raising (the most common form of flood proofing) is widespread. For central Lismore over 1500 weatherboard houses have been raised, some to 3.0 m or more, over the last 60 years or so specifically to reduce flood losses.

'Other measures' are reported for a small number of locations. These include clearing vegetation from channels (Boonah), channel improvement and diversion (Bowen) and the use of flood gates (to lessen the tidal effects on river flooding) at Ingham. Logan also reports a program of acquisition for a small number of dwellings exposed to high velocity flood waters.

5.8.2 Non-structural mitigation measures

Question 8.2 lists three categories of non-structural measures, plus 'others', these are:

Building controls
Land use controls
Flood warning systems
Other

There are 66 responses, by locality, that list non-structural measures, that is more than double the number that report the use of structural measures (29). Some 55% of the localities (36 out of 66) combine building and land use controls. This indicates that some form of designated flood is used and that the buildings within the designated limits are subject to regulation which usually requires the floor levels to be at a specified height above that of the designated flood, see Question 7.5 (Section 6.1) for detail. Ten localities rely solely on building regulations and 8 on land use controls.

Exactly half (33 out of 66) list flood warning systems as a nonstructural measure, in 22 cases employed in conjunction with other measures.

'Other' measures are limited. Cairns reports that a program of acquisition for dwellings that are below the 1 in 10 year flood; interestingly Logan considers such a measure to be structural.

Two features of the replies need comment. The first is that only 36 localities have combined building and land use controls and the other is the relatively large number that report the use of flood warning systems. It was not possible from the survey to consider the details of the mitigation measures or, in the case of building and land controls, the degree of compliance.

5.9 Funding for flood studies and structural works

Flood studies are an essential prerequisite for the formulation of building and land use controls. Question 8.3 asks for information on the source of '... *funding for flood studies*' and Question 8.4 for the source of funding '.... *for structural works*'. In both questions the categories are given as:

Commonwealth government
State government
Local government
Other

It is important, for two reasons, to separate funding for flood studies and structural works. First because flood studies should be basic to any form of structural works and are comparatively, less expensive. Secondly, the various funding schemes between the three tiers of government vary for the two types of activity.

It is understood that State authorities in Queensland rarely provide financial assistance for studies (unless subsidisable capital works are involved). Commonwealth funding has traditionally been available for both studies and for works - indeed, without acceptable flood studies, assistance with funding for structural measures would not be provided. The difficulties of joint assistance from State and Commonwealth sources are outlined in Section 11.2.3.

5.9.1 Flood studies

Of the 52 responses, 49 indicate at least a contribution to the costs of flood studies from the appropriate LGA.

In some 60% of the localities (32 out of the 52 responses) funding for flood studies was borne solely by the LGAs.

Ten localities reported that funding was shared by all three tiers of government, examples are Logan, Paroo, Rockhampton and Mirani. Only 5 indicated that funding was shared between State and local government.

Assistance with funding from other (non-government) sources was limited. Cairns reports assistance from the Cairns Port Authority and in other cases the costs were partly re-couped from developers in the form of fee for service. Caloundra, Thuringowa and Caboolture specifically mention such contributions. For Caboolture, an LGA with a fast rate of growth and development, the costs of the flood study was recovered in two or three years by the sale of the appropriate part of the flood study (i.e. in the form of a computer model) to developers who were then required to demonstrate that their proposals were in accord with the council's flood policy.

5.9.2 Mitigation

In most cases the costs of structural works are very much greater than for flood studies. For example, levee schemes to protect even relatively small numbers of buildings often cost in excess of $1 M. They also require the LGA to take on substantial future costs for maintenance and repair. Thus, for many of the LGAs in Queensland, and elsewhere in Australia, the construction of such structural measures are dependent on assistance from higher tiers of government.

There were 30 responses, by locality, to the question of the funding for structural works. The combinations of funding are several and are summarised, with examples, in Table 5.4.

Table 5.4 Combination of funding sources for structural works (Question 8.4)

	C'wealth only	State only	LGA only	C'wealth/ State	C'wealth, State and LGA
Number of Locations	0	4	14	6	6
Examples		Blackall	Caboolture	Tara	Brisbane Logan Mackay Mirani Paroo Warwick

A small number of responses listed funding from other sources. For Mackay and Wambo these include local River Trusts and Thuringowa specifically mentions developer contributions. Again, the dominance of council contributions in funding is apparent. However, for many of the responses, which include those based solely on local funding, it is likely that the structural works were of a minor type. For example, the eight separate localities listed by Caboolture.

5.10 Summary – flood studies and mitigation measures

Councils play the major role in funding of both structural and non-structural mitigation measures, in many cases without any assistance from either State or Commonwealth sources. This contrasts to New South Wales where, for the early years of the 1990s, the combined annual expenditure on flood studies and works was well in excess of $20 m. The major difference between Queensland and New South Wales was that the latter was prepared to match, dollar for dollar, Commonwealth funding provided under FWRAP or, in later years, from the National Landcare Program. Queensland, with few exceptions was not prepared to match the Commonwealth contribution, exceptions involving major amounts of funding for capital works were Rockhampton and Mackay.

It is likely, although not subject to rigorous proof, that the relatively poor coverage of flood studies and mitigation measures in Queensland, in comparison to New South Wales, is a result of this difference in the approach to funding

Queensland has relatively few major structural flood mitigation works, although such works, (nearly all constructed to reduce flood damage to existing flood prone developments), are not in themselves a major plus for floodplain management. However, in New South Wales the construction of such mitigation measures was closely linked to the adoption of comprehensive land use and building controls usually related to a 1 in 100 year designated flood. This strategy has greatly reduced the potential for flood damage from new developments. For many parts of Queensland this has not been the case and the potential for future losses increases year by year.

6

Flood Warning Systems and Counter Disaster Plans

6.1 Introduction

A flood warning system encompasses the flood forecast, its dissemination and response by the emergency services and the community at risk. It is an essential component of urban flood mitigation both for communities with and without structural mitigation measures. For those with structural measures it is necessary because the majority of these are constructed to a specific design limit (often the 1 in 100 year flood or less) which can be exceeded. Structural measures also have some risk, albeit often small, of failure. If levee protection is used as an example, flood warning systems are necessary to cope with situations where the levee may be overtopped, i.e. the design limit exceeded, or is at risk from other forms of failure. In all cases, structural measures should be accompanied by an emergency plan. Although outside the direct scope of this study, this also applies to downstream inundation from the failure of all hazardous, i.e. large, dams.

The Bureau of Meteorology, for Queensland this is the Brisbane Regional Office, has overall responsibility for the provision of flood warnings and forecasts of river heights. There is however, an important qualification which relates to 'flash' flooding. This is defined as flooding for which the time between rainfall and downstream inundation is less than six hours.

The responsibility for flash flooding lies elsewhere, in practice with local government.

With the exception of flash flooding, for those areas with the necessary field instrumentation to provide input data on rainfall and runoff the Bureau provides quantitative forecasts of flood height. This is normally presented as a forecast of river height and time for a specific flood gauge, often located in flood prone urban areas. The gauge heights are usually combined with a forecast expressed in terms of minor, moderate or major flood. These terms have agreed definitions and are available for several hundred gauges throughout the State. They are often related to the inundation of road crossings, overtopping of bridges, initial flooding of buildings etc. An extract from the Bureau's River height stations flood classifications is given in Table 6.1. The forecast to the public is issued after discussions between the Bureau staff and local agencies for key river height locations (towns, cities etc.) particularly those which involve urban flood inundation.

The Bureau is not primarily responsible for the dissemination of the forecast to the local community or for the response components of the flood warning system but in practice it works closely with LGAs and the emergency services to facilitate best warning practice and to give advice on response. Although Commonwealth policy affirms the Bureau's responsibility for flood warnings, it also calls on State and local governments to share in the upgrading and maintenance of monitoring networks. The Bureau is responsible for the rainfall network, and State/local governments for river height stations.

Table 6.1 An example of the Bureau of Meteorology river height stations flood classifications

Queensland flood warning river height stations flood classifications							
Station Name	**First report**	**Bridge height**	**Minor flood**	**Crops grazing**	**Moderate flood**	**Town houses**	**Major flood**
Leichhardt							
The 16m waterhole TM			3.0		4.0		5.0
Floraville TM		3.0	3.0		5.0		7.0
Flinders							
Hughenden (SYN)	1.0 h	4.00	2.5	4.0	4.0 d/s	4.9	6.0 d/s
Marathon	2.0 h		6.0		8.0		9.0
Richmond (SYN)	3.0 h	5.80	5.0	6.0	6.0		8.0
Richmond TM			5.5		6.5		8.2
Hulberts Bridge	2.0 h	3.90	7.0	10.0	10.0	12.2	12.0
Cloncurry	2.0 h	10.30	3.0		5.0	11.0	7.0
Cloncurry TM		11.00	3.5		5.2	11.0	7.0
Carsland	1.0 h		2.0	2.0	3.0 d/s		5.0
Canobie	3.0 h		3.0		4.0		5.5
Walkers Bend	3.0 h	5.40	6.0	6.0	9.0		12.0
Walkers Bend		5.40	6.0	6.0	9.0		12.0
Norman							
Yappar River	1.6 h	0.60	1.6	2.0	2.5	3.8	3.8
Normanton	2.5 h	5.50	3.5	3.5	4.0	7.0	6.5

All lengths in metres

6.1.1 Flash flooding

Flash flooding is subject to different arrangements, by definition the time between rainfall and downstream flooding is limited. Thus, in order to provide forecasts with sufficient lead time to reduce losses to life and property, the analysis needs to be undertaken locally. For maximum effectiveness such systems require telemetric rainfall and river gauges that can transmit data to a locally based receiving station, ideally linked to a computer system that can convert the information into a forecast for downstream flood prone locations. A commercially available system, normally referred to as an ALERT system, fulfils these requirements. The funding and maintenance of such systems for flash flooding is usually the responsibility of LGAs, not the Bureau. However, the Bureau provides technical assistance with siting, installation, calibration and use and, in return, has access to the output. The majority of

ALERT systems used in Australia were based on a model tested and adapted by the Bureau. A few years ago Brisbane City Council installed a comprehensive flood warning system known as PROPHET, based on the ALERT concept, this is described by Carroll (1993).

6.1.2 Flood warning systems and flood mitigation

Until the late 1980s flood warning systems in Australia were handicapped by inter-governmental disagreement over the responsibility for future funding of the service. A background to this and to the general principles of flood warning systems is given in Smith and Handmer (1986). After that date it was agreed that the Bureau of Meteorology was responsible (with the exception of flash flooding) and additional staff and resources were allocated to the regional offices to provide the forecasting service. As a result there have been major improvements in the instrumentation, areal coverage and quality of the forecasts throughout Australia. The Brisbane Office of the Bureau has been to the fore of these developments.

Flood warning systems however, directly involve LGAs assisting with the process of data collection as an essential input into the forecasts, for interpretation of expected areas of inundation, for local dissemination and, together with the emergency services, for the appropriate response. Where the risk is from flash flooding they also have the responsibility for providing the forecast. This outline is necessary in order to understand the responses to the questions concerning flood warning systems in the questionnaire.

An understanding of flood warning systems is important as they assist with the definition of flood risk and thereby, assist with the prioritisation of future floodplain management needs of LGAs within Queensland. This is because the risk for all forms of damage is much greater for those LGAs that have only short warning times, say less than 12 hours, in contrast to others that have several days.

6.2 The questionnaire responses

The questionnaire responses are designed to obtain a picture of how LGAs contribute to, and gain from, the overall flood warning system.

Question 8.2 asks if LGAs use flood warning systems, assumed to be locally based, as a form of nonstructural flood mitigation measure. Approximately half (33 out of 67) of the responses report that flood warning systems are so used. As the total includes localities that do not have a significant urban flood risk this can be considered as a satisfactory result.

Four specific questions (10.1 to 10.4) were asked in the section of the questionnaire concerned solely with flood warning systems. These were:

Question 10.1 requests information on the type of forecast provided by the Bureau.

Question. 10.2 asks if the Bureau forecasts are further interpreted for use by specific local communities.

Question. 10.3 enquires if the LGA maintains a local flood warning system.

Question. 10.4 invites further detail on the methods used to disseminate the information to the community where a local system is maintained.

6.2.1 Question 10.1. Form of forecast supplied by the Bureau

Two thirds (65 out of 102) of localities receive quantitative forecasts from the Bureau in the form of river gauge heights and in terms of minor, moderate and major flooding. The majority of LGAs and localities that do not receive such forecasts are located in remote areas of the State and/or have only minor urban flood problems. The former, Carpentaria is an example, are in regions with a poor coverage of river gauges.

6.2.2 Question 10.2. Is the forecast further interpreted by the LGA?

Where quantitative forecasts are supplied by the Bureau, approximately 40% (28 out of 67) relay the information unchanged and 60% (38 replies) further interpret this for use by local communities.

6.2.3 Question 10.3. Does the LGA maintain a local flood warning system?

Forty-five localities have information based on local flood warning systems of the ALERT type. Such a high proportion is, to date, only found in Queensland. This is undoubtedly one of the major positive features of urban floodplain management in the State. However, it is worthy of note that the preliminary draft of the *Victorian flood strategy 1997 - 2007*, proposes 29 additional centres for flood warning systems for that State.

As noted, Brisbane City Council maintains its own comprehensive flood warning system and the south-east of Queensland now has a coverage of ALERT-type installations unmatched elsewhere in Australia. A number of systems originally designed for water resource management have been integrated into this coverage. One outcome of this detailed cover is that LGAs with ALERT systems for their local area have the capacity to interrogate or directly receive data from other systems in the region and thereby gain information on the approach of storm cells before they reach their catchments.

6.2.4 Question 10.4. How is the information from locally based systems relayed to the community at risk?

There were 49 replies to this question and the respondents could tick boxes to indicate door knocking, radio, television or loudspeakers as the method(s) used, respondents were also invited to add additional categories. Forty-two of the respondents (about 85%) indicated that they used more than one method to disseminate the forecast. This is particularly important as all analytical accounts of the effectiveness of flood warning systems stress the need for more than one method to be used in order to obtain community acceptance and thereby an effective response.

6.3 Flood warning time

The time that a community has between receiving a quantitative forecast and the inundation of buildings and infrastructure is an important element in defining susceptibility to flood. It ranks with the number of buildings and flood height range in outlining a priority list of communities in most urgent need of comprehensive floodplain management. However, it is difficult to define, with any precision, what is a flood warning time? There are a range of possible definitions, e.g. from the start of rainfall to time of flood rise, time of peak rainfall intensity to flood peak etc. In addition, the relationships between timing and intensity of rainfall to the subsequent downstream flood can vary considerably between events, e.g. it often depends on which sub-catchments received the maximum rainfall.

However, at a broad scale, there are clearly major recognisable differences in flood warning time between LGAs and localities in Queensland, the full range is from an hour or so to several weeks.

6.3.1 Flood warning time - questionnaire responses

LGAs were asked, in Question 4.15, for differing localities in their area, to give estimates for the flood warning time. In this case between '... *commencement of rainfall and initial inundation of the urban area*'. There were 71 responses and these are tabulated in Table 6.2.

Table 6.2 Flood warning time, responses to Question 4.15

	< 12 hours	12 to < 24 hours	24 hours to < 2 days	2 to 7 days	8 to < 14 days	> 14 days
Number of localities	26	14	18	6	3	4

Overall, 55% of the responses indicated a time of less than 24 hours.

At the other extreme 20% (13 replies) indicated a time of 2 days or more. A warning time of this length should be sufficient to enable maximum reduction of damage to take place and for the risk to life to be small.

6.3.2 Flood warning time — Bureau of Meteorology

A separate analysis was undertaken by the Brisbane Office of the Bureau as a specific contribution to the current study. This was to classify, for 143 (mainly urban) locations throughout the State, the flood warning time into three classes. These were less than 12 hours, 12 hours to less than 24 hours and greater than 24 hours. The information from the Bureau is presented in full in Appendix 5.

The analysis by the Bureau was based upon the lead times for the forecast of river flood heights that could be provided with reasonable accuracy for downstream locations using existing '... climatological factors and/or flood monitoring networks and prediction tools'. It is stressed that the classification represents an average case and lead times could vary for specific floods. The results are presented in Table 6.3.

Table 6.3 Flood warning times – the Bureau's analysis

	A < 12 hours	B 12 - 24 hours	C > 24 hours
Number of locations	100	25	18

Tables 6.4 **Questionnaire and Bureau estimates of flood warning time for a selection of flood prone Queensland LGAs**

Local Government/ Locality	No. of Buildings at Risk from 1/100yr Flood	Bureau of Meteorology A<12 hrs;B 12-24 hrs, C>24 hrs	Questionnaire Question 4.15
Gold Coast Overall total	16,650	A	24 hrs
Mackay	8,000	A	6 - 12 hrs
Brisbane	8,000		
Brisbane River		B	48 hrs
Brisbane Creeks		A	< 12 hrs
Dalby	3,300	A	7 hrs
Ipswich	3,000	A	24 hrs
Logan	2,375		
Logan River		B	48 hrs
Scrubby Creek		A	6-8 hrs
Hinchinbrook	2,175		
Ingham		A	36 hrs
Murweh	1,350		
Charleville		B	24 hrs
Augethella		A	< 24 hrs
Rockhampton	1,200	C	up to 14 days
Burdekin	1,000		
Hume Hill/Ayr		A	
Cairns	728		
City		A	2 hrs
Mulgrave		A	30 hrs
Caboolture	455		
Burpengary		A	6 hrs
Blackall	N/A	B	72 hrs
Cooloola	N/A		
Gympie		B	varies
Johnstone			
Innisfail	N/A	A	4 hrs
Carpentaria		C	10 days +
Normanton	N/A		
Mt Isa	70	A	

N/A Detailed estimates not available

Using the Bureau's definition, 87% of the localities fall into the '24 hours or less' category and 77% of the total have less than 12 hours between prediction and arrival of the flood.

The LGAs completing question 4.15 and the localities analysed by the Bureau are not identical and there are differences in the definition of flood warning time. However it is clear that a very high proportion of urban locations in Queensland have warning times of less than 24 hours.

Table 6.4 repeats the list of LGAs with the highest numbers of buildings at risk from the 1 in 100 year flood (see Table 3.5) together with the warning times from the Bureau and, where available, from the responses to the questionnaire. Table 6.4 is also extended to list a selection of other flood prone urban LGAs, for these detailed estimates of the number of properties at risk are not known but the numbers are relatively small.

6.3.3 Why are the flood warning times so short?

The relatively short leads given in Tables 6.2, 6.3 and 6.4 are perhaps surprising, given the length of many of the major rivers systems in Queensland. The reasons for the short times and forecasts include:

- many flood prone communities are liable to flooding from relatively small catchments that are tributaries to the major rivers. Examples are the Brisbane Creeks, the Scrubby Creek catchment in Logan, and Townsville.
- for locations situated on major rivers, damaging floods are often from rainfalls in the lower parts of the catchment, not necessarily in the more remote headwaters. Examples are Johnstone and Cairns (Mulgrave).
- often the Bureau's forecasts are, in part, based on river gauges which, for very good reasons, are not situated in the upper parts of major catchments.

Whatever the reasons, it is very clear that most of the major flood prone urban communities have lead times that are less, often very much less, than 24 hours. Given that rain and floods can occur at night, at week-ends or on public holidays, a time of even 24 hours requires best practice dissemination and response to significantly reduce flood losses.

6.4 Counter Disaster Plans

Counter disaster plans are a requirement for all LGAs in Queensland and throughout Australia. For many areas these include responses to flood events and therefore, are the component of the flood warning system most concerned with loss reduction, of which reduction to loss of life is predominant. Question 11 (11.1 to 11.6) was specifically designed to obtain information on the Counter Disaster Plans at LGA level. As the effectiveness of such plans is related to aspects of community awareness, the responses to Question 9 are also reported in this section.

6.4.1 Question 11. Counter Disaster Plans

Some of the component questions of Question 11 were difficult for respondents to answer. For example, 11.4 and 11.5 ask if the flood plan was activated during the last major flood and for comments on its effectiveness. The difficulties were that, in many cases, the 'last flood' was before the Counter Diaster Plan was developed and comments on effectiveness are subjective. In addition, it was not feasible for the questions to ask for details of the flood section of the Plan. It is suspected that often this is relatively meagre, if only because of the lack of hydrological information on the size and areal extent of the floods which should be basic to such a Plan. These caveats should be remembered in interpreting the responses summarised below.

Question 11.1. Is there a Counter Disaster (Flood) Plan for this community?

Approximately 90% (90 out of 101) of respondents report that there was a flood plan. All of the 10% with a negative response are for localities with only a small number of buildings at risk.

Question 11.2. Is the Counter Disaster (Flood) Plan linked to flood warning systems?

Some 60% (52 out of 88) replied that there was such a link. It would seem surprising that 40% (36) did not link the flood warning system to the disaster plan. Among these LGAs who did not have such a link were Caboolture, Goondiwindi and Mackay. Goondiwindi has levee protection from all but the most extreme flood events, it is therefore an example where a flood warning system should be required to deal with potential overtopping or failure. The recently constructed levee at Mackay, with a much lower level of protection, is a further instance.

Question 11.3. Was the Plan activated for the last major flood?

The responses were confused as the 'last major flood' could be before the plan was implemented. As this question was poorly worded discussion of the responses are omitted.

Question 11.4. Was the plan effective after the last major flood?

The answers were more satisfactory. Out of the 63 responses for localities that had experienced a flood since the Plan was implemented, 80% (51) replied that the plan was effective. Although this is often based on self-assessment, the level of favourable responses is good.

Question 11.5. Was the Plan revised after the last major flood?

Of the localities for which the question was applicable, 75% (50 out of 66) reported that a review had taken place.

Question 11.6. Does the Plan use or contain information from flood studies?

Approximately half of the replies (43 out of 83) are based on information from flood studies and half (40) are not. This confirms the overall lack of flood studies for much of Queensland.

Overall, for most localities with an urban flood problem, LGAs include a consideration of flooding within the Counter Disaster Plan. Although based on self assessments, most LGAs regard the Plans as effective and they are revised after flood events. It is disturbing however, that only half of the Plans are based on information from flood studies, taken to mean hydrological studies of the magnitude and extent of floods and the vulnerability of the flood prone communities. The frequent lack of links to flood warning procedures also warrants improvement and there are undoubtedly examples where flood studies have not been incorporated in the Counter Disaster Plan.

6.4.2 Awareness

Questions 9.1 to 9.5 requested information on the level of community awareness.

Notwithstanding that such responses are subjective, they form an important component of overall urban floodplain management.

Question 9.1. Is the community aware it is located on a floodplain?

Some 90% (91 out of 102) of locations are considered to have such awareness, exceptions include Biggenden, Caboolture and Herberton.

Question 9.2. Is the community aware that it can be flooded?

Approximately 98% (98 out of 102) replied that they were so aware. Toowoomba and Mt Morgan were examples of a negative response.

Question 9.3. Are past flood levels indicated locally (e.g. flood markers)?

About 25% (24 out of 102) replied that there were such flood markers. Among these were Brisbane, Dalby, Eacham, Emerald, Jericho, Isisford, Maryborough, Roma and Taroom.

It is especially significant that many of the communities with a larger number of buildings at risk do not have flood markers.

This is common throughout much of Australia, and although there are no national statistics it is likely that the situation reported for Queensland is better than for some other flood prone States. However, this may represent an over-optimistic interpretation of 'flood markers', for effectiveness in a large flood prone community there should be a series of such markers throughout the area at risk from inundation. It should be a requirement that flood markers are installed for all localities with a flood risk. This is because they are an essential and inexpensive mechanism which give meaning to the forecasts of river gauge heights for individual buildings. Although not requested in the questionnaire, the lack of markers is usually due to the perceived adverse effects on house prices or for future development.

Question 9.4. Are public awareness/education programs conducted?

Only a little over 20% (21 out of 96) communities would appear to have such programs. In a number of instances, especially for coastal communities, it was commented that such programs are associated with seasonal awareness campaigns for tropical cyclones rather than those solely related to flood. Among those LGAs with awareness programs are Brisbane, Ipswich (but qualified as 'limited'), Logan, Mirani, Rockhampton, Taroom, Townsville (linked to cyclone programs) and Warroo. Again there would seem to be a problem with the lack of such programs for many of the more flood prone communities. Finally, the effectiveness of such programs remains an unknown.

Question 9.5. Community awareness of counter disaster arrangements?

Approximately two thirds (64 out of 96) of localities replied that the community is aware of counter disaster arrangements. However, in retrospect this was not a well worded question.

In general, the level of awareness of flood threat would appear to be high among communities at risk. However, the use of flood markers and of programs to promote flood awareness would appear to be limited especially for many of the communities most at risk.

6.5 Summary

Flood forecasts, directly from the Bureau or from local systems, are widely available throughout the State. A notable feature is the growth in recent years of ALERT-type systems for locations liable to flash flooding. It is also clear that many of the LGAs with urban flood

problems have developed a variety of methods to disseminate the forecast to the community at risk.

However, the lack of hydrological studies that define the extent of flooding for many LGAs poses problems for forecasting. Firstly, this limits the usefulness of the forecast as it is unclear what area is actually at risk for a forecast gauge height and secondly, the Bureau's staff can often only add to the list of flood prone locations after a major flood has occurred. There are also problems with the provision of installations in the remote and sparsely populated areas of the State.

A significant feature of flood warnings is that a very large proportion of flood prone communities have lead times that are less than 12 or 24 hours. This emphasises the need for locally based, ALERT-type, systems. The costs and expertise to install and maintain such systems pose very real problems, especially for those LGAs with small populations and thereby limited finance and technical resources. Overall, the provision of flood forecasts and their dissemination in Queensland, relative to the other States, is good. However, as these components of the flood warning system improve the spotlight turns to community response. The question then becomes how to capture the benefits offered by the forecasts and dissemination.

The majority of communities would appear to be aware of their flood risk but few of the Counter Disaster Plans specifically incorporate flood warnings. There is also a lack of flood markers and flood awareness programs, especially for many of the communities with large numbers of buildings at risk. Such issues should form a focus for future enhancement of the flood warning systems in Queensland.

7

The Largest Known Flood Events – The Effects on Lifelines

7.1 The largest known flood

The importance of the probable maximum flood, and the difficulties in its estimation, are discussed in Section 3.5. Questions 4.1 to 4.3 are concerned with the largest known flood event and this is used as a bench mark against which to evaluate the effect on lifelines. There remain two aspects that are worthy of comment, these are the duration of flood inundation and the date of its occurrence. Duration can be assessed in variety of ways and the term is not easy to define with any precision. However it can be used as an indication of the severity of the disruption to the community and is of significance for the provision of services and emergency management.

Analysis of the responses to the date of the largest event are not conducive to statistical analysis, in part because the length of records varies from well over a hundred years to less than five. But the pattern has interest for floodplain management.

7.1.1 Date of the largest known flood

Question 4.1 asks '*for the date of the largest known flood*', for the locality. There were 95 responses and the results are tabulated in Table 7.1. As would be expected the most recent decades have the larger numbers, this reflects the increasing number of flood gauges over time.

Table 7.1 shows that there is a tendency for some earlier decades to have a particularly high frequency of 'largest known events' and for others to be of low frequency. The 1890s and 1970s are examples of the former and the 1920s and 1930s of the latter. The significance of the data, with all their imperfections, is that major flooding would appear to be a sporadic event and therefore, there is a need for the collection of data over long periods. Massive floods, such as the Brisbane flood of February 1893 did not provide the stimulus for care in floodplain siting, however the floods of January 1974 (less severe than in 1893) resulted in Australia's most costly flood event. Despite such reluctance to learn from experience, knowledge of the levels of earlier floods is a key factor for the estimation of even greater floods and for emergency management. For some localities in inland Queensland the floods of early 1997, some reported in the questionnaire some not, achieved 'flood of record' status.

7.1.2 Duration

There were 69 replies to Question 4.3 which asked for estimates of the 'duration of flood inundation' for the largest known flood. The number of responses is less than for the date of the event (Question 4.1) as in a number of cases information on duration was not known. The duration estimates are tabulated in Table 7.2.

Overall, despite uncertainty over definition, durations of 3 days or more are reported for approximately half of the locations (35 out of 69). It needs to be stressed that Table 7.2 refers

to the largest known event, for lesser floods the duration would be considerably less. For example, the Brisbane River duration in 1974 was reported as 4 days.

Table 7.1 Year of the largest known flood by decade (Question 4.1)

Decade	Number+
1890 - 1900	10
1901 - 1910	0
1911 - 1920	4
1921 - 1930	1
1931 - 1940	0
1941 - 1950	9
1951 - 1960	10
1961 - 1970	4
1971 - 1980	29
1981 - 1990	10
1991 - early 1997	18

+ Creek catchments for Brisbane are excluded.

Table 7.2 Duration of inundation for the largest known flood (Question 4.3)

	< 24 hours	1-2 days	3-7 days	8-14 days	> 15 days
Number of locations	20	14	23	7	5

As a guide, duration is related to warning time, i.e. the longer the warning time, the longer the period of inundation. Indications of duration of flood inundation can therefore, be obtained from Section 6 and Appendix 5. There are exceptions to this relationship and locally, low lying areas can remain inundated for much longer periods. However, such sites are usually of greater significance for agriculture rather than for urban flooding.

7.2 Lifelines

Questions 4.8 to 4.14 request information on the '... *effects of the largest known flood on lifelines*'. Individual questions address the following categories:

- Roads
- Rail
- Airports
- Water supply
- Sewerage
- Electricity
- Other (e.g. fire, ambulance, hospital)

There are variations in the degree of severity indicated for the various lifelines, e.g. for roads impacts are described as 'no access roads affected', 'some access roads cut' or 'all access roads cut'. The results are presented by locality.

7.2.1 Transport links

It is important to note that disruption, especially to transport links, can severely effect communities that do not experience inundation of buildings. This is especially true for remote settlements in the sparsely populated parts of the State. There were a number of replies to this question for localities that do not fulfil the study's definition for urban flooding, i.e. more than 10 flood prone buildings.

Road

Close to 75% (70 out of the 93 responses to this question) had all road access cut for the highest known flood, all but 2 of the remaining 23 had some access roads cut. The question did not ask for the length of disruption but for some remote localities this is measured in weeks, eg. Burke and Normanton.

Rail

For the largest known flood, over two thirds (40 out of the 59 reporting) indicated that all rail links were cut. For the larger urban centres, such as Brisbane, such closures were usually for a short duration, for remote localities with rail links the duration of disruption would be very much longer. There are also significant adverse effects on the handling of coal and minerals although these fall outside the scope of this report.

Airports

These vary in size from international airports to outback landing strips. The availability of air strips is especially important for emergency management in remote areas; for evacuation, for the supply of food and other assistance. Of the 56 replies, i.e. those with nearby air services, approximately half remain unaffected by even the largest known flood.

7.2.2 Water, sewerage and electricity

Major disruption to these services can have significant consequential indirect effects, for instance risks to health. These vary from the spread of disease due to contamination of drinking water to the lack of electricity for refrigeration and cold stores. It is also necessary to stress that key installations for water and sewerage are often located close to rivers and creeks and, if precautions are not taken, may be especially liable to disruption and damage by flood. A problem with the responses was that for many smaller communities there is, or was at the time of the largest known flood, no reticulated supply for these services!

Water

Perhaps surprisingly, close to 70% (62 out of 88) of the responses indicate that water supply was not affected by the largest flood.

Sewerage

Approximately 60% (38 out of 66) of localities with sewerage experienced disruption.

Electricity

About half (44 out of 87) of the responses indicate that electricity supplies were disrupted.

Other significant disruption to services

This question invited comment on disruption to other lifelines. A number of localities reported that the communities were isolated from fire, ambulance or hospitals, these include Blackall, the Gold Coast (fire and ambulance), Ingham (fire) and Laidley is isolated from its hospital. In some cases the service buildings are inundated and for others, access was cut. Many other responses commented that the disruption, especially to the road network, hampered the provision of the full range of emergency services.

7.3 Summary

As a general statement, it is not possible to flood proof the transport links. Indeed, a large proportion of the payments under the Natural Disaster Relief Arrangements are too small, but areally extensive, LGAs to repair their extensive road network, including bridges, culverts etc that are usually unsurfaced and therefore, particularly liable to flood damage. However, there is a case to locally provide upgraded transport links especially where these form evacuation routes for the communities at risk. This has special significance for those exposed to storm surge where evacuation is critical and also applies to the siting of all key emergency service installations and buildings, especially police, fire, ambulance, hospitals and communication buildings for emergency management. Special consideration should also be given to the siting of dwellings that house especially vulnerable groups such as the elderly and infirm.

For service provision, water etc, flood proofing of key installations is of importance. Throughout Australia, measures to flood proof especially vulnerable points of all infrastructure should have a high priority. This subject has been highlighted by Emergency Management Australia (EMA) and many of the corresponding State agencies for special attention in the coming years. It needs to be stressed that many individual service providers have well formulated emergency procedures although there is a need to integrate the individual services to take account of consequential effects. For instance, the supply of electricity is often critical to the provision of water and sewerage.

8

The Implication for Estimates of Flood Damage

8.1 Background to flood damage

The questionnaire circulated to all LGAs in Queensland did not include questions that asked for estimates of flood damage in dollar values. This was a conscious decision as such estimates are only of use if they are based on a consistent methodology and definitions of what constitutes damage. Contemporary estimates, say of the kind given in newspapers, are little more than anecdotal and do not represent any form of sound economic appraisal. In order to formulate best practice urban floodplain management it is necessary to undertake detailed assessment of flood losses for a community on a consistent basis. Such assessments require :

- detailed hydrological studies to define the risk
- data on what is at risk - the vulnerability.

This report has demonstrated that hydrological studies of this kind (with information on the magnitude, frequency and extent of all floods to the level of the PMF, with floodplain velocities for flood flows etc.) are only available for a limited number of localities in Queensland. Information on what is at risk (buildings, lifelines etc) is only known for a handful of these.

The paucity of the background information necessary to assess flood losses in economic terms is such that any attempt to evaluate these at the State level is little more than a guess. However, the data from the questionnaire on the number of buildings does enable some comment on losses relative to other States.

8.2 Queensland – estimates of urban flood damage

This section will comment on the likely size of the State's flood losses and is followed by discussion on how this could be improved.

8.2.1 AWRC (1992)

The AWRC report provided estimates at State level for urban damage in Australia. Following normal practice these are most usefully expressed for comparative purposes in terms of **average annual actual damage (AAAD)**. In this context, 'actual' refers to losses after allowance has been made for the reduction to contents loss by the actions of the residents, ie. by lifting or removing items so that they are not inundated. The estimates given below are for tangible losses, ie. they combine direct and indirect losses but do not include any allowance for intangible effects.

The AAAD values given in the AWRC report:

- are at 1990 values,
- only include damages to the level of the 1 in 100 year event,
- do not include losses to lifelines.

With these definitions and qualifications, the AWRC (1992) AAAD values for Queensland, and the number of buildings at risk used in their estimation, are given in Table 8.1.

Table 8.1. AWRC estimates for tangible annual average actual damage (AAAD) for Queensland (AWRC, 1992)

	AAAD in $m	Number of Properties to 1 in 100 year level
Residential	16.4	21,000
Commercial	6.0	2,000
Industrial	7.1	750
Public	4.5	750
Total	**34.0**	**24,500**

The AAAD estimates in Table 8.1, which total $34 m, are based on accepted practice for damage estimation. Indeed, in many respects the methodology ranks among the best available in the literature. The major shortcoming is the poor data base for the number of buildings at risk (to the 1 in 100 flood level), the estimates used by the AWRC were provided by Queensland State agencies.

8.2.2 Flood damage estimates Insurance Council of Australia (Smith, 1996)

In 1996 the Insurance Council of Australia (ICA) commissioned a study to provide estimates of residential flood damage for Australia. The report (Smith, 1996) is unpublished but the following extracts indicate the results for Queensland. The methodology, with the exceptions summarised below, followed that used in the AWRC study.

The major change to the AWRC report was that total number of residential buildings at risk to the level of the 1 in 100 year flood was increased to 50,000. The revised AAAD, restricted to the residential sector, was $31 m, at 1990 prices to allow direct comparisons to the AWRC value.

The ICA study also made a tentative attempt, based on extremely limited information, to estimate the AAAD to the level of the probable maximum flood. The AAAD value to the PMF for Queensland was given as $75 m for the residential sector alone. Most of this additional damage was due to the potential losses from building failure for such extreme events, for example for Ipswich.

8.2.3 Revised AAAD for Queensland.

The revised estimate for the total number of flood prone buildings in Queensland (residential, commercial and industrial etc) to the level of the 1 in 100 year flood is given in Section 3.4.4 as 65,000.

Thus, a very provisional guesstimate of the AAAD for tangible flood losses in Queensland, for all buildings to the level of the 1 in 100 year event, is of the order of $100 m. This is obtained by scaling up the 50,000 estimate given in Smith (1996) and making some estimate for commercial and industrial damage (for purposes of comparability the AAAD is in 1990 values).

If the AAAD is extended to include events to the level of the probable maximum flood, these estimates would be very much higher, perhaps by a factor of two.

The possible doubling of AAAD, when estimated to the PMF, is due both to the increased number of buildings at risk and to the increased risk of failure under extreme flood conditions. The changes to the AAAD should not be confused with the increased number of buildings at risk, estimated to be a factor of three (see Section 3.8). This is because AAAD takes into account event damages and their frequency.

There are grounds for considering that the damages could still be underestimates. This is because there may still be flood prone communities that, on the basis of the questionnaire, are inadequately assessed in terms of the numbers of buildings at risk. Further, the ratio of residential to commercial/industrial buildings in the AWRC report and the inadequate questionnaire responses for building type suggest that the overall losses may be too small. This is because unit losses for commercial/industrial concerns are much higher than for residential buildings.

What is now certain is that the Queensland has the highest AAAD for any State in Australia. Numbers of buildings at risk in New South Wales are comparable but more than twenty years of steadfast application of urban floodplain management has reduced the AAAD for some communities and halted the increase in flood prone developments for the majority of LGAs. At State level, Queensland has not reduced the risk and for many major flood prone urban communities the lack of effective land use controls or building regulations is such that the potential damages increase year by year.

8.3 Assessment of urban flood damage

Need to define direct and indirect costs in this section

Hydrological techniques and models are widely available for the estimation of the magnitude, frequency and extent of flood events, this is now equally true for methods to assess urban flood damage. These are based on the use of stage-damage curves for differing classes of buildings, a technique first described in the USA by White (1945), these methods subsequently became the basis for the Federal Flood Insurance Program in the late 1960s. Refinements of the stage-damage technique, based on work in the UK, are given in Penning-Rowsell et al (1977). One of the first applications in Australia of such methods was to assess the damage after the Brisbane floods of 1974, see SMEC (1975). A study of the flood damages for Lismore in New South Wales (Smith et al, 1979), also prompted by the 1974 floods, led to the development of a commercially available computer package, ANUFLOOD, to assess urban flood losses and as a method to evaluate the costs and benefits of a range of flood mitigation measures.

ANUFLOOD is described in detail in the *User's manual* (Taylor *et al.*, 1983) and the accompanying *Field guide* (Smith and Greenaway, 1983), both have been revised on a number of occasions. The program combines spatial information on flood hydrology (magnitude, frequency and extent), a building data base and stage-damage curves appropriate for the classes of buildings. Together these can provide estimates of flood damage in a variety

of forms, for example as event damages (say for the 1 in 70 year flood) or as average annual damage. Subsequent modifications to ANUFLOOD can (if flood velocity data are available) assess the additional costs due of building failure. The program has been modified, to ANUSURGE, for use to assess damage from storm surge (Smith and Greenaway, 1994). It is also possible to link ANUFLOOD (or ANUSURGE) to existing geographical information systems to produce output in terms in spatial information. This is essentially the basis of the AGSO Cities Program which is currently underway in Queensland.

Although ANUFLOOD and ANUSURGE are convenient packages, the principles are those accepted internationally as best practice for the assessment of flood damage, eg. White (1945), Penning-Rowsell *et al.* (1977). ANUFLOOD has been widely used by consultants and government agencies in New South Wales as a component of flood studies and as a foundation for floodplain management for well over fifteen years. More recently it has been used by consultants for studies in Queensland, for example the studies by Camp, Scott and Furphy for Rockhampton and Charleville, and ANUFLOOD is currently used as a basis by the DNR for flood studies in progress at Warwick.

In short, there are no technical barriers to the assessment of best practice flood damage estimates. A critical prerequisite however, is the availability of good quality hydrological data for the area under study.

The output of ANUFLOOD, and of similar computer-based programs, is usually in terms of direct, actual or potential, flood damage. The estimation of indirect damage is often undertaken outside the program. Indirect effects are much more difficult to define and are often assessed as a proportion of the direct losses. A more detailed discussion of the evaluation of indirect losses is given in Parker *et al.* (1986), a recent Australian account is available in Handmer and Thompson (1996).

Direct damage are those that result from the contact of flood water (and included sediment) with building structures and building contents. Indirect losses are essentially due to disruption caused by the flooding. For instance, a major category for the residential sector is the cost of alternative accommodation. For the commercial and industrial sectors indirect losses include loss of trading profit due to closure as a result of flooding. Indirect loses in the commercial and industrial sectors can be substantial and are relatively much larger than residential indirect losses.

Care is needed with the assessment of indirect losses to the commercial and industrial sectors. The choice is between financial losses (losses to individual firms comparable to insurance payments) and economic losses. The latter are usually less obvious and attempt to evaluate the losses to the regional, State or national economies. For example, if a beer bottle factory is inundated there are two possibilities to ensure continued production. One is that beer bottle production can be made up by other flood free beer bottle manufacturers, perhaps by working overtime, so that there is no overall loss to the economy; the other is that the lost capacity cannot be taken up elsewhere. In the former case the indirect losses, using economic criteria, are very small while in the latter case they are not. In the UK, the Treasury uses indirect losses defined on economic grounds, in Australia it has been the practice to use financial losses. Such questions are of significance in assessing flood damage, the differences in definition of indirect losses can have major effects on the cost benefit analysis of structural mitigation measures which are usually, in part, funded by State and/or national governments.

Direct and indirect damages are combined to give tangible losses. In many studies, especially overseas, these are usually in terms of potential losses and are not adjusted to allow for damage reduction to building contents by the residents, emergency services etc. In Australia

such measures are often incorporated into the estimates, this is the case with damage data given in the earlier part of this section.

Consideration and weighting should also be given to intangible losses, which by definition, are not (easily) converted into dollar terms. It is recognised that such effects can be important and include all forms of stress, illness and, in the extreme case, death resulting from flooding. In the commercial sector the intangible losses can include loss of business confidence, future contracts etc.

8.4 Summary

Due to the paucity of hydrological studies it is not possible to give other than guesstimates for the magnitude of the State's flood damages.

It is however, likely that average annual damages are higher for Queensland than for any other Australian State, that the Brisbane floods of 1974 were the most damaging flood event ever to occur in Australia and that the Gold Coast has among the largest potential for flood losses of any LGA in Australia.

Techniques to assess flood hydrology and damages are available and expertise in their use is widely available in Australia. That this is the case is illustrated by Queensland LGAs that have undertaken such studies, for example Rockhampton and Murweh. However, the number is meagre especially in comparison with New South Wales. The problem becomes how to encourage such studies to be undertaken for all urban flood prone localities in Queensland.

The publication of a manual for use by LGAs in Queensland that describes methods to be used for hydrological studies and especially for damage evaluation, would be a invaluable aid to LGAs to achieve the aim of best practice urban floodplain management.

It is stressed that the available techniques to assess potential flood damage are based on the evaluation of direct losses to buildings and their contents, guidance on a consistent methods to estimate indirect and intangible losses is also required together with advice on how to assess the effects on lifelines.

The comments above apply to the assessment of losses from riverine flooding, the situation for losses from inundation by storm surge is even less satisfactory. In this case there is much less opportunity to learn from the experience of the other States as the risks of damaging storm surge are much greater in Queensland than elsewhere in Australia. State of the art studies in this field are from the southern eastern USA.

9

Surge Inundation

9.1 The background

Surge, alternatively termed storm tide, is associated with the low atmospheric pressure accompanying tropical cyclones. This causes a localised rise in sea level which is at a maximum immediately below the eye of the cyclone. When the cyclone moves into shallow coastal waters the increase in sea level can be enhanced due to wind and wave set-up. It is however, difficult to provide reliable forecasts of the height of the surge at, and landward of, the shoreline.

The magnitude of the surge near-shore is controlled by a variety of factors of which the off-shore bathymetry and the (in plan) shape of the coast are particularly significant. As a guide, extensive off-shore shallow water increases the height of the open sea surge and the effects can be further enhanced if the surge is funnelled into estuaries or embayments. Figure 9.1 taken from Hopley and Harvey (1979) provides an indication of the effects of bathometry, the diagram shows depth correction factors. The higher the correction factor the more likely that open ocean effects will be converted into enhanced coastal zone inundation. In broad terms a factor of 2.0 indicates a doubling of open ocean surge while 0.5 indicates that it would be halved. The Gulf of Carpentaria is noteworthy for its high correction factors, in contrast to the relatively low values for Brisbane, south to the Gold Coast and to the border with New South Wales.

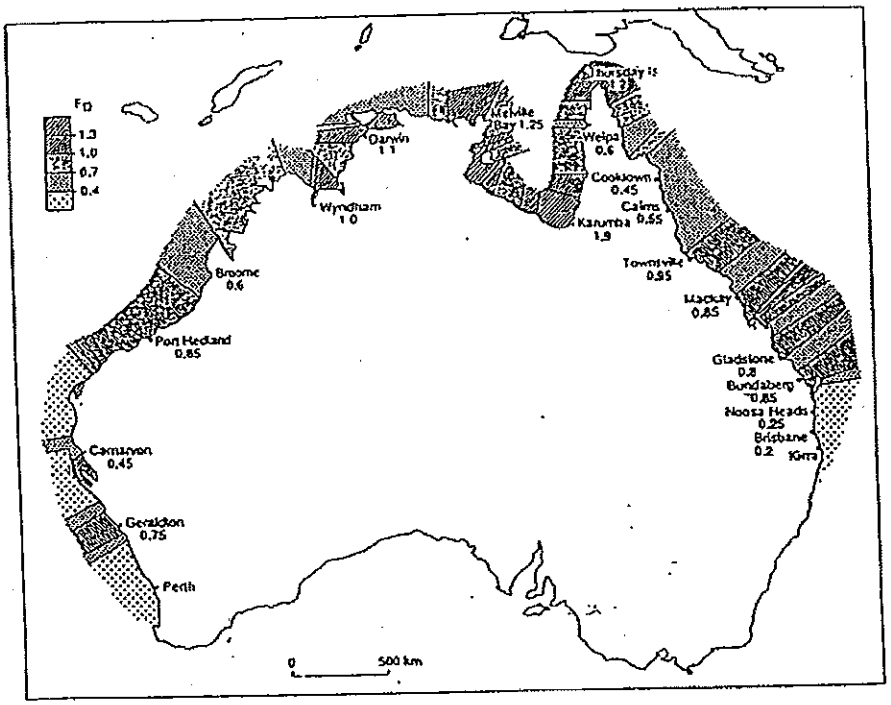


Figure 9.1 **Regional variations in depth correction factors, Fd, for the Australian coast, from Hopley and Harvey (1979)**

The need is for provision of estimates of surge height at specific locations but this requires detailed and complex calculations in order to translate the open sea surge into those that would apply at the coast. Such forecasts will never be precise because even small changes in the track of the approaching cyclone change the area at maximum risk. Over the last few years the Bureau of Meteorology, in part related to the Queensland-based Tropical Coastal Cyclone Impact Program (TCCIP), has undertaken 'state of the art' studies for storm surge at several east coast locations in Queensland. Such studies have included the major coastal low-lying urban areas of Cairns and Mackay. Notwithstanding this work, problems of forecasting surge are further complicated by the timing of the surge in relation to the prevailing tide and the problems of estimating wave height. During the course of a tropical cyclone, open sea wave height can be very large, but for most practical purposes (emergency management, damage estimation etc.) wave height needs to be added to the estimates of the height of storm surge which are normally reported in terms of 'still water'. The problem is especially important where surge inundates land and buildings beyond the landward limit of the highest astronomical tide. As a working rule wave height in inundated areas can be approximated to be half the still water depth, i.e. an inundation of 3.0 m of still water surge requires the addition of a further 1.5 m to allow for wave height.

Within the context of the present study, the focus is upon the risk of urban inundation from storm surge. To some degree, the whole Queensland coast is at risk from surge inundation associated with tropical cyclones and the urban risk applies to coastal settlements at low lying locations.

The inclusion of storm surge within a review of flooding is three-fold. This is because:

- the effects on buildings and services are similar to extreme river inundation,
- in many locations, urban areas subject to surge are also liable to river flooding,
- mitigation is best achieved by land use zoning and building regulations which are similar for riverine and surge flooding.

9.2 Surge inundation

A review of the effects of surge inundation on buildings with reference to Mackay is given in *Tropical Storm Surge, Damage Assessment and Emergency Planning*, Smith and Greenaway (1994). In summary, the effects of surge on buildings are much more severe than from river flooding, this is because of the power of wave impact on structures. In locations close to shore the best estimates, from the USA, indicate that for lightweight domestic or commercial structures there is a strong likelihood of complete failure if the depth of the surge (still water plus wave height) is in excess of 1.0 m over floor level. Severe damage could be expected for much more limited flooding over floor level. In addition, the salinity of sea water causes much greater damage to building contents than is the case for fresh water.

The implications for loss of life are therefore, extreme and far exceed those associated with river flooding.

Further, by definition, surge occurs in combination with extreme winds and rainfall associated with tropical cyclones. These factors are recognised by the emergency services in Queensland who, over the last five years or so, have been actively engaged in improving emergency response for areas liable to surge. A problem for the emergency services is that for the wind effects of cyclones, the preferred strategy is for those at risk to stay indoors, while for surge the need is for evacuation before the wind reaches velocities in excess of about 70 kph.

9.2.1 Surge and river flooding

Many coastal settlements in Queensland were originally sited on river estuaries and subsequent growth has often led to further urban development in low lying, near-coastal locations. Such sites are often, therefore, vulnerable to both river flood and surge. The problem with such sites is that a cyclone landfall in the vicinity of an estuarine town can cause inundation by surge followed, with a variable lag time, by river flooding resulting from intense rainfall in the upstream river catchment.

Mackay, on the Pioneer River, is a prime example for which information is available. In 1918, much of the settlement was destroyed by a surge event which was followed, some 12 - 24 hours later, by the flood of record. Indeed, it is difficult to distinguish from the contemporary accounts of the disaster which buildings were destroyed by wind, surge or river flood!

The conjunction of vulnerability to surge and flood in such locations emphasises the need for mitigation to consider both hazards in an integrated fashion.

9.2.2 Land use zoning and building regulations

The analysis of the questionnaires indicates that many flood prone LGAs in Queensland have regulations that, to some degree, recognise the need to introduce zoning and floor height regulations for river flooding. Similar or linked regulations for surge are uncommon. An exception is the recognition of the threat and related regulations, for new developments, by the former Mulgrave Council which are now in the process of incorporation for the enlarged area of Cairns City Council. Mackay, with a known surge risk, has no related zoning or building regulations.

There are clearly major difficulties for an LGA in introducing regulations for surge but this deficiency is in marked contrast to many other developed countries. The USA is a leader in this field and most States in surge-prone regions have rigorous planning requirements for new developments. Typically these prohibit buildings in the zone exposed to the 1 in 100 year surge unless the floor level is above inundation level and the construction meets stringent engineering standards. In addition, there is a requirement to provide acceptable escape routes in areas liable to surge. In the USA a 'V-zone' is recognised where surge would be accompanied by significant wave height (and therefore an enhanced risk of building failure). For most of the Queensland coast, the physical setting and exposure are such that the majority of the coast would be classified as 'V-zone'. In the USA regulations for surge are similar to those used there for flooding, and stem from the National Flood Insurance Program which is subsidised by the federal government and provides cover for both river flooding and surge - provided that local government adopts planning regulations for new developments.

The occurrence of major surge events for existing urban locations in Queensland is of relatively low frequency but with a magnitude that has potential for huge damages and loss of life. The lack of State or local zoning and building regulations for most of the Queensland coast needs to be urgently addressed.

9.3 Where is the risk?

For over twenty years there have been attempts in Queensland to define the likely magnitude of storm surge, especially for the east coast. In common with overseas studies, there is little information on the vulnerability of the urban areas at risk. The Department of the Environment (notably the Beach Protection Authority) published a series of storm surge

studies, based on computer simulation, in the late 1970s, for a range of locations from Cooktown in the north to the Gold Coast in the south. The component reports include estimates of surge heights for the 1 in 100 year event and many also give estimates for the 1 in 500 year surge, these are for still water levels and do not include wave height, wind set-up etc. The Department is currently preparing a review entitled, *Storm tide threat in Queensland.*

There is also a series of storm tide maps, published in the mid-1970s by the Queensland State Survey Office, again for a selection of east coast locations, these include Cairns, Mackay and Townsville. These are designed for use by the emergency services and are basically shaded layered contour maps.

Other useful information is given in *Storm Tide: Warning-Response Systems* (SCDO, 1992). This lists 'all known centres of habitation on the Queensland coast' and gives the height of 'the assumed highest tide' and highest astronomical tide (HAT), together with comments on evacuation zones (up to 1.5 m, 1.5-3.0 m, and 3.0-4.5 m). It also presents brief comments, where known, on the 'inundation of any developed area'. For some locations SCDO (1992) also provides estimates of the surge height for an event with a 1 in 500 year annual recurrence interval. Where appropriate, this is given in Table 9.1. These values for surge height are added to the sea water level current at the time of the event, i.e. allowing forthe state of the tide etc. The aim is to give a broad indication of relative surge risk rather than any kind of precise estimate. No indication is given of the wave height that should be added to the still-water levels.

9.3.1 Mackay, Cairns and Townsville

More recently detailed building-by-building surveys, suitable for use as geographical information systems (GIS) have been undertaken for Mackay and Cairns. Details of the results for Mackay are available in Smith and Greenaway (1994) and Granger and Smith (1995), at both locations details of the hazard are available from recent studies. A summary of the surge data for Mackay is given in Table 9.2.

A comprehensive building data base has been prepared for Cairns by K. Granger (AGSO) and A. Zerger (CRES, supported by an IDNDR Postgraduate Scholarship). Provisional analysis for a near probable maximum surge height of 5.0 m (above HAT) indicates that a total of some 13,000 buildings would be affected with the majority experiencing over floor inundation. Of the total, approximately 10,000 are dwellings and the remainder commercial buildings including major hotels.

To date, there is no data on potential building failures but it can be anticipated that these would be large in number. The estimates are for a still water level, i.e. wave height is not incorporated. Equally important would be the damage to lifelines which would cut power, water and sewerage; road, rail and air traffic links, and thereby totally isolate the Cairns region. Full details of the analysis for Cairns should be available in the next few months.

Much of Townsville is low-lying and liable to surge but to date, to the best of my knowledge, there are no reliable estimates of the numbers of buildings at risk. However, for a low probability surge event these could likely total several thousand.

Table 9.1 LGAs reporting a surge problem, map availability and SCDO (1992) estimates of height of 1 in 500 year surge

LGA and sites listed		Map available	SCDO Surge height 1 in 500 year
Bowen	(Queens Beach)	yes	2.6m
Burnett	(Bundaberg Point)	yes	
Caboolture	(various locations)	yes (some locations)*	
Cairns	(City and Northern Beaches)	yes	2.5m
Calliope	(Tannum Sands, Boyne Is.)	yes	
Caloundra	(Kawana Waters)	yes	
Cardwell	(Tully Heads, South Mission Beach)	yes	2.35m
Carpentaria	(Karumba)	no	
Cook	(Ayton, Cooktown)	yes (simplistic)*	1.85m
Douglas	(Port Douglas)	yes	
Gladstone		yes	
Gold Coast		no	1.45m
Hervey Bay		yes	4.2m
Hinchinbrook	(L. Tully)	no	3.1m
Johnstone		yes (in part)*	2.45m
Livingstone		yes	4.7m
Mackay	(City and North Mackay)	yes	4.8m
Noosa		no	
Pine Rivers		yes	
Redcliffe		yes	
Redland	(Bay Island)	no	
Sarina	(various locations)	yes	5.0m
Thuringowa		yes (inaccurate)*	
Tiaro		no	
Townsville	(City)	yes	3.7m

* Comments as given in the questionnaire responses.

\+ 1 in 500 year surge height from SCDO (1992) is the still water level, i.e. no allowance for wave height, wave set-up etc. The estimate is added to the tide height predicted for the time of the surge. Given solely as an indication of relative risk.

Table 9.2 **Mackay – number of buildings at risk from inundation and failure in relation to probability of storm tide**

	1 in 20 yr 4.0 m	1 in 50 yr 4.70 m	1 in 100 yr 5.20 m	1 in 1000 yr 6.60 m	1 in 10,000 yr 7.90 m	Probable maximum storm tide 8.50 m
Mackay residential						
No. of buildings, overground flooding	154	2879	3576	5268	6263	6531
No. with overfloor flooding	885	1877	2760	4593	5890	6256
No. of building failures	0	885	1748	3740	5299	5714
Mackay commercial						
No. of buildings, overground flooding	118	355	434	1040	1123	1154
No. with overfloor flooding	66	295	419	1001	1122	1150
No. of building failures	1	66	250	558	1067	1094
North Mackay residential						
No. of buildings, overground flooding	26	82	406	912	1104	1147
No. with overfloor flooding	2	42	207	799	1055	1112
No. of building failures	0	2	20	552	925	1055
North Mackay commercial						
No. of buildings, overground flooding	2	27	63	117	127	129
No. with overfloor flooding	0	26	59	117	127	129
No. of building failures	0	0	10	92	125	127

Based on wave height assumptions given in FEMA (1986)

It is likely that Cairns and Mackay pose the greatest threat in terms of number of buildings but comparable studies are urgently needed for other surge-prone settlements before any reliable estimate can be given as to the overall size of the problem in Queensland.

9.3.2 Gulf of Carpentaria

The quality and detail of information on the potential surge risk for the Gulf of Carpentaria is much less than for the more populous east coast. The risk is known but there is little knowledge of the magnitude, frequency and inland extent for the rarer, i.e. the low probability, events. The vulnerability of Karumba, with a resident of population of about 400, is recognised and there are established evacuation plans for the whole settlement, all of which would be inundated by even a moderate surge. Evacuation is to Normanton along 70 km of low-lying road. However, this link could easily be severed by cyclonic rains and there is a need for better designed surge refuges. Acceptable designs however, require knowledge of the height of extreme surge conditions. Further to the west, Burketown presents an equally severe risk and a number of people were drowned there by surge in 1887.

9.4 Responses to the questionnaire

Only three questions directly address the problem of storm tide.

Question 3.1 Asked '... *does a storm tide problem exist*?'

Question 3.2 Requests the date of the last event which caused the flooding of buildings.

Question 3.3 Enquires if a storm tide map exists.

9.4.1 Does a problem exist?

A total of 25 LGAs replied that they had a storm tide problem, in several cases this applied to several locations within their area. A list of the LGAs at risk is given in Table 9.1. This confirms that virtually all coastal LGAs in Queensland acknowledge the risk of surge. The non-respondents of Burdekin and Torres Is. are also known to have a storm tide problem. The magnitude of the risk, in terms of numbers of buildings, varies and reflects the exposure of low lying structures.

For some locations the height of likely surge events is restricted but even for these localities the indirect effects could be considerable. The Gold Coast falls in this category with the likelihood of surge having adverse effects on flood height together with the additional problem that, in some locations, it is possible that extreme surge could break through the coastal dunes and cause direct inundation.

9.4.2 Date of last damaging surge?

Some two thirds of the LGAs reporting a problem provided dates for the last surge event to inundate buildings. These are listed in Table 9.3. In four cases these were from the 1990s although for all of these the damage was relatively small. Mackay and Sarina, with catastrophic losses in 1918, have not experienced a significant surge event in the last 70 years.

9.4.3 Storm tide inundation maps?

Table 9.1 also lists whether or not LGAs have storm tide maps. Nearly three quarters (16 out of 25) report that they do, although it is significant that several of those draw attention to their limitations e.g. 'simplistic', 'only for some locations' etc. Similar reservations are also likely

to apply to others that responded that they had storm tide maps, it is suspected that in many cases they are limited to coloured-layered contour maps. Although these are of use for evacuation procedures for the emergency services, they have little scientific foundation and do not express risk in terms of frequency, i.e. they are not comparable to flood maps that show the limits of the 1 in 100 or 1 in 50 flood event.

Table 9.3 Local Governments reporting building damage from storm tides

LGA	Year of storm tide damage
Bowen	1980
Burnett	1942
Cairns	1979
Carpentaria	1976
Cook	1976
Gold Coast	1974
Hervey Bay	1992
Johnstone	1996
Mackay	1918
Maryborough	1976
Noosa	1992
Pine Rivers	1993
Sarina	1918
Thuringowa	1971
Townsville	1971

9.5 Surge in Queensland - a summary

Flooding from storm surge is a potential problem for all low lying coastal areas of northern Australia that experience tropical cyclones. In terms of urban surge risk the problem is especially significant for Queensland, a fact recognised by the majority of coastal LGAs responding to the questionnaire. However, there is a paucity of detailed information on hazard risk that is based on 'state-of-the-art' scientific methodology. Where this has recently become available, for example for Cairns and Mackay, studies have demonstrated the massive potential for damage and for loss of life. It is not possible to state with any certainty the numbers of building in Queensland that are directly at risk from extreme storm surge events but a conservative estimate would indicate a value of the order of 40-50,000.

The impact of a major storm surge on an urbanised community would result in building and infrastructure failure that is akin to that normally associated with an earthquake rather than with riverine flooding.

Only a limited range of questions concerning storm surge were included in the questionnaire. However, it is clear that more resources need to be devoted to this problem in order to assist

LGAs to better define the risk. It is noticeable that much of the recent research on hazard risk and vulnerability to surge has been funded by Commonwealth agencies rather than by the State government.

Unlike river flooding, the problem is concentrated in Queensland and therefore, there is not the same opportunity for the transfer of methodologies and experience between States. Succinctly, inundation of urban areas from storm surge is dominantly a Queensland problem.

In order to lessen further impact, better risk definition will need to be followed by the adoption of land use zoning and building regulations similar in form to those discussed for river flooding in Section 11. The implementation of such measures will not be an easy task and should ideally, be linked to changes and improvements to similar measures for river flooding. Such actions should not be delayed until their significance becomes apparent in the aftermath of the next major surge to impact upon a low lying urban coastal community. There is the need for a review of Queensland's planning and management for surge to match that underway for urban river flooding.

10

The Questionnaire – A Summary

10.1 Response to the questionnaire

This study reports on the state of urban floodplain management in Queensland and is based on a questionnaire sent all to LGAs. Responses were obtained from 103 LGAs and provided information on 133 separate locations. These do not include the flood prone creek catchments in Brisbane or those for the Gold Coast, these are discussed separately in Section 4. The majority of the non-respondents were LGAs that are unlikely to have a urban flood problem, in many cases because of their small and dispersed populations. There were difficulties in designing a questionnaire suitable for LGAs that range in population size from Brisbane City Council to areally extensive, but sparsely populated, local government areas in the west and north of the State. Despite these qualifications, the survey provides, for the first time, comprehensive State-wide data which permits comments to be made on the current state of urban floodplain management and provides a background to suggestions for State policy.

The questionnaire indicates that 92 LGAs have an urban flood problem, if non-respondents are included this becomes 96 out of a State-wide total of 125 LGAs.

10.2 Numbers of buildings at risk

The simplest, and most commonly used, indicator of size of urban flood problems is the number of buildings at risk from the 1 in 100 year flood event. Few LGAs have reliable information on the extent of such a flood and even fewer have information on the number of buildings at risk.

Based on the questionnaire, and including an allowance for non-responses, the number of urban buildings in Queensland at risk from 1 in 100 year flood event is estimated to be about 65,000. For an unknown proportion of these properties, 1 in 100 year flood inundation would not exceed building floor level.

The data are inadequate to classify the properties into separate categories, i.e. residential, commercial etc. There is some evidence that the ratio of residential to other buildings is less than in other Australian states, provisionally it could be assumed that some 25% are non-residential.

Table 3.5 provides a ranked list of the 12 most flood prone LGAs in terms of the number of buildings at risk at risk, these account for some 60 % of the State total.

The area administered by the Gold Coast has the distinction of having one of the largest number flood prone properties (dominantly residential) not only in Queensland but in Australia. The council has completed detailed assessment, including potential damage, for the Nerang catchment and has studies in progress or planned for the other catchments in its area.

It is salutary to note that, until the last year or so, there were no detailed data available for the Gold Coast on the number of properties at risk, that Charleville was not regarded as having a major flood problem until the floods of 1990, the potential magnitude of river flooding for Mackay was not known until 1994 and the size of the flood problem in Queensland was

reported to the AWRC national study, in 1990, as comprising only 25,000 properties. It is perhaps, tempting fate to suggest that as a result of the current survey that there will be no more major additions to the list of flood prone communities. However, it is thought unlikely that any major new urban centres will be added to the list given in Table 3.5.

10.3 Extreme floods

It has been stressed throughout this report that the 1 in 100 year flood line should not be regarded as separating flood prone areas from those that are flood free. Only 11 localities had any detail of the size of the probable maximum flood, the worst case event, and of those only 8 had the information available in map form. The number of properties at risk from the probable maximum flood is much larger than for the 1 in 100 year flood and it is not impossible that the number to the limit of the probable maximum flood could be more than three times larger. Many of these additional buildings would only experience over-ground, as opposed to over-floor, flooding but the consequences for some localities is that lightweight structures at lower levels are at risk of structural failure.

10.4 Flood height range

The number of properties at risk from the 1 in 100 year event is only one indicator of flood risk, another is the flood height range which is the difference in flood depth (indicated by heights on flood gauges) between, say, the 1 in 20 and 1 in 100 year floods. There are large variations in the flood height range between localities, examples for some of the major flood prone communities are given in Table 1.1, these range from about 3m to in excess of 20m. Precise data of this kind, i.e. based on detailed hydrological studies, are uncommon in Queensland but a guide can be obtained from the levels of minor, moderate and major floods available from the Bureau of Meteorology.

High flood ranges, associated with even relatively low flood velocities, greatly increase the risk of building failure especially for lightweight structures, eg. detached single storey weatherboard dwellings. The significance of extreme floods, above the 1 in 100 year event to the level of the probable maximum flood, is especially marked for communities with a high flood range.

Table 1.1 can be used as a guide to localities where flood height range is of major concern. The situation for Ipswich, confirmed by the failure of over 30 dwellings in the 1974 flood, is the most severe example in Queensland in the last thirty years.

10.5 Flood warning systems

Much of the State, especially Brisbane and the south-east, is well provided with locally-based flood warnings, most based on ALERT installations. Quantitative flood forecasts from the Bureau of Meteorology are available for many other communities with a known urban flood risk and the situation is one of continued upgrading and extension although smaller and remote communities do not have the benefit of such services. However, the lack of basic data on what localities are flood prone has been a problem for the Bureau, all too often communities with a major urban risk have only become apparent after a major flood has occurred.

Information provided by the Bureau, and reproduced here as Appendix 5, shows that the length of the flood warning time (with the current provision of field instrumentation and techniques) is, for the majority of flood prone locations, less than 12 hours.

Such short warning times form a further indicator of flood risk. A warning time of less than 12 hours gives much less time to evacuate, reduce losses and to reduce stress and anxiety than a warning time of several days.

As is almost universally the case, improvements to flood forecasts demonstrate the need for better community response in order to more fully capture the benefits of enhanced warnings. The questionnaire responses confirm that there is scope to more fully integrate flood warnings into LGA emergency plans and flood policy. The need is now, to incorporate improved forecasts and warning times into a comprehensive flood warning system which includes better community awareness and response.

10.6 Priority listing of flood prone urban communities

The preceding sections have stressed that urban flood risk is an amalgam of the current numbers of properties at risk, the flood height range and the length of warning time that can be provided to reduce tangible and intangible losses. Hence, the three factors that together define vulnerability are:

- size of the existing problem
- flood height range
- flood warning time.

It is not possible to rank these factors in a truly quantitative manner but qualitative guidance can be given based on an A, B, C system. This is presented in Table 10.1, where A represents a high rank for a specific factor, B is moderate and C is relatively less important. Thus, three As indicate a high priority on grounds of overall vulnerability and three Cs a much lower ranking.

The three factors provide a ranking of flood risk but do not of themselves indicate the state of information and response. For example, Brisbane has excellent hydrological background information (although currently under improvement for the main Brisbane River), local flood warning systems but relatively poor information on the buildings at risk. This handicaps measures to increase community awareness and response although it would not be a difficult matter to combine building data with existing geographical information systems. Until the last year or so, the Gold Coast (including the former Albert Shire) had only scant information on the number of properties at risk. Within a short time studies, now complete for the Nerang catchment but underway elsewhere, have completely transformed the information base. Rockhampton and Murweh (e.g. Charleville) are among the few LGAs that have close to best practice information on all aspects of vulnerability, including potential flood losses.

The ultimate test is not restricted to the availability of a full information on vulnerability but its use to formulate acceptable locally based urban floodplain management. Such management requires full data on vulnerability but such availability does not guarantee its use to establish acceptable local policy.

Table 10.1 is limited to communities that are known to have a relatively large number of buildings already at risk from flooding. There are many more small communities which would likely have a high ranking of vulnerability in terms of flood height range and flood warning time. The need here, as with those listed in Table 10.1, is for background studies in order that future developments do not increase future flood risk.

Table 10.1 **A ranking of the vulnerability of major flood prone communities in Queensland**

LGA and location	Number of buildings	Flood height range	Effective warning time
Gold Coast	A	C	A
Mackay	A	B	A
Brisbane			
Brisbane River	A	B	B
Creeks	A	B	B
Dalby	A	A	A
Ipswich	A	A	A
Hinchinbrook (Ingham)	A	B	A
Logan	A		
Logan River		B	B
Creeks		B	A
Murweh			
Charleville	B	B	B
Augathella	C	B	A
Rockhampton	B	C	C
Burdekin	B	B	B
Cairns (inc. Mulgrave)	B	C	A
Caboolture	B	?B	A
Blackall	C	B	A
Gympie	?C	A	B
Johnstone (Innisfail)	B	C	A
Balonne	C	C	A
Gulf Rivers (Normanton)	C	A	C

It needs to be stressed that some of the major flood prone communities were close to green field sites at the time of the extensive floods in 1974. It is not possible from the present information base to give any firm data on the increase in the size of the problem over the last twenty years or so but there is no doubt that it has been significant. The Gold Coast is a prime example of this but undoubtedly the expansion of developments, many of which are dominantly residential, into flood prone sites has been a State-wide phenomenon.

10.7 Background studies in hydrology and mitigation

The survey results show that hydrological studies are available for only some 40% of flood prone urban localities; note that 'localities' are sub-sets of local government areas. However, what is meant by 'hydrological studies' and the purposes to which they are put are quite different questions. It would appear that only 28 localities have used this information as a basis on which to define a designated flood that is at the level of 1 the 100 year flood (or better). A disturbingly large number of the major flood prone communities do not have a designated flood to an accepted level.

Hydrological studies are necessary to define hazard risk and the next step along the path to effective floodplain management is to investigate the potential flood damage to existing developments. This has only been undertaken by for 11 localities, see Table 5.2 for detail. Again many high priority flood vulnerable locations do not fall into this group.

Only 35 responses to the questionnaire reported that there is a 'flood policy' in place. The number of councils that have a policy for urban flooding is unacceptably small and often, where such a policy exists, the information on which it is based is inadequate.

10.8 The use of mitigation measures

Mitigation measures are divided into structural and non-structural, the detailed responses are described in Section 5.8. Only 29 localities reported that they used structural measures. Levees are used at 13 of these although few are extensive systems designed to protect larger urban flood prone communities to the level of the 1 in 100 year event. The use of other structural measures is limited to a small number of localities. For example, dams utilised for flood control are few and in all cases are restricted to locations downstream of dams developed primarily as water resource storage's; although for Brisbane, and to a lesser extent Townsville and the Nerang catchment, they have significantly reduced future flood losses especially for minor and moderate flood events. Their smaller equivalent, flood retention basins, are rarely used to reduce the adverse effects of mainstream flooding although they are more widely used to mitigate the effects of flooding associated with stormwater drainage..

It is especially noteworthy that flood proofing, especially the raising of weatherboard dwellings, located in flood prone locations, is rarely reported and there are no reports of the flood proofing of other types of building. Channel improvements are another example of a structural measure used on a local basis although these have been used more extensively and to good effect in some of the smaller developed Brisbane Creek catchments. Voluntary acquisition of dwellings in especially hazardous locations is rarely used.

The relatively low rate of adoption of structural measures for existing flood prone developments is not necessarily an indication of poor floodplain management. Indeed, the construction of major levee systems and other structural works can have adverse implications for community awareness and behaviour and create problems for emergency management. It is probable, however, that the relative paucity of such mitigation measures in Queensland more likely reflects problems with low level State funding to assist LGAs to construct, what are often, expensive works.

Nonstructural measures, usually involving the use of land use controls and building regulations within the area delimited by the designated flood, are reported as used at some 66 locations. Some 36 of these combine land use and building controls measures although many of these lack essential hydrological information.

The use of fill, to elevate habitable floor levels above the level of the designated flood, is widely used throughout Queensland, to a much greater extent than elsewhere in Australia. For such techniques to be effective it is essential that the impact of cumulative fill decisions on flood levels is fully known. It is suspected that often this is not the case and that the widespread use of fill for new developments is not consistent with sound urban floodplain management. It is certainly necessary to carefully control the afflux effects especially when a catchment extends across a number of LGAs.

Despite the use locally of a range of mitigation measures there is scope for the experience of LGAs who have used such individual measures to share their experiences with others who

have not. This applies especially to structural mitigation. It would invaluable if examples of the successful (and even the unsuccessful) use of such measures could be used as illustrative examples in a State manual designed for use by LGAs throughout Queensland. Relative to urban floodplain management in New South Wales, the adoption rate of structural and nonstructural mitigation measures is low.

10.9 Summary

The details of the individual responses to the questionnaire are given in Appendix 1, and an analysis of the overall pattern for the State in the preceding sections. The responses to the questionnaire have enabled a much fuller account to be presented of the urban flood problem than was previously possible. Caution is urged in placing undue weight on individual responses but the overall pattern provides a valuable background against which to assess the problem of urban floodplain management in Queensland and a basis upon which to recommend future improvements.

There is no doubt that increased contact between elected representatives and professional staff of councils, with and without adequate floodplain management policies, would lead to the sharing of information and experience. Such meetings of councils with urban flood problems have been held annually in New South Wales for over thirty years and, it is suggested, would be invaluable in Queensland

11

Towards Better Urban Floodplain Management

11.1 Effective floodplain management – the steps

The steps necessary to provide the information integral to effective urban floodplain management have been stressed throughout this report. In summary they are:

i. hydrological studies

ii. analysis of what is at risk- combined with hydrology to give vulnerability.

iii. decision on the appropriate designated flood

iv. flood management plans for:

v. new developments

vi. residual flood risk

vii. existing flood prone developments

viii. adoption of measures into local planning regulations.

11.1.1 Steps (i) & (ii) - hydrological and risk assessment studies

'Flood studies' incorporate the first two steps in the process. The hydrological studies define the flood hazard risk, they should use the best available modelling techniques and use all available information on historic floods. The studies should include data on all floods to the level of the probable maximum flood and information on over-floodplain velocities especially for the more extreme events.

Once the hazard is so defined, a survey should be undertaken of all buildings (and ideally infrastructure) that is at risk, this should include all buildings, residential, commercial/industrial etc. Information to be gathered should include ground and floor heights, type of construction and, for the commercial/industrial, size, use and estimates of liability to flood loss. Stage-damage curves should be constructed or obtained for each of the major building classes recognised in the field survey. Guidance to the detail is given, for example, in the ANUFLOOD manuals.

The output can be combined with geographical information systems (GIS). This forms an excellent method for storage and, for many LGAs, can be linked into GIS for other information available for the area. GIS methodology also allows for rapid appraisal of the effects of floods of differing magnitude and frequency.

The flood hydrology and what is at risk (buildings etc), are then combined to give estimates of all forms of flood damage for a range of flood events. Such analysis forms the basis for the adoption of the designated flood level. Background to damage estimation is given in Section 8.

11.1.2 Step (iii) – the designated flood

Decisions on the choice of the designated flood are the key to successful urban floodplain management, this is because the designated flood determines where future developments will be located. Worldwide the tendency has been, regardless of local circumstances, to select the 1 in 100 year flood as the designated flood. There is no scientific or economic basis for a universal selection of this kind. Throughout this report it has been stressed that the flood risk is dependant on local circumstances of which flood height range is especially significant.

Decisions of the designated flood should, be made at the local level and consider all aspects of the flood background; hydrological, socio-economic and safety factors. For some flood prone locations the 1 in 100 year flood would form a sensible choice for the designated flood, for others it would not. In some instances, i.e. where there is a high flood range, a level approaching the 1 in 50 year is likely to be a better choice. For others, say with a lower flood range and low velocity flood flows, it could be closer to the 1 in 200 year event.

Because of the overwhelming importance of local factors and the costs and benefits of the choice of the designated flood, the local community should play a major role in the discussion. However, the decision should be made within floodplain guidelines decided by the State government. There is a case to be made that final approval for local plans should be at State level, if only to ensure that the decision has been made on the basis of best practice analysis from the flood studies.

If LGAs are reluctant or slow to comply with State guidelines, there is the option of superimposing an interim designated flood. Reluctantly, it is suggested that this could be the 1 in 100 year event although even in that case the imposition of a more severe standard for locations with a high risk should be considered.

The role given to the State government is, in part, because it is responsible for relatively large proportions of flood relief payments and for the safety of its citizens. To attain these aims, which will be considered in more detail below, the State government also has responsibility for assistance with funding the studies and mitigation measures.

11.1.3 Step (iv) – flood management plans

New developments

Once the selection of the designated flood has been made, the next step is to consider the regulations that apply to new developments. These will be based on land use zoning and building controls within the area delimited by the designated flood. They may vary from no new construction whatsoever, to controls on habitable flood levels with the possibility of different controls for different uses, eg. restricted residential but allowable commercial and industrial development. Again much will depend on the local flood hydrology. At this stage the possibility of building failure due to extreme floods may require the definition of sub-zones for land use and building controls. For example, especially vulnerable uses (hospitals, emergency service facilities, homes for the elderly etc) may require additional limitations on siting. It is also import to consider the location of flood free evacuation routes and available flood warning times. Locations that could become 'islands' at times of flooding need special attention.

Residual flood risk

A major problem for the formulation of flood policy for urban areas is that there are usually existing flood prone developments, often extensive, located below the level of the designated

flood. Such development frequently forms the major barrier to policy formulation. The problems are several. First, whether or not to provide mitigation measures and secondly, to agree policy for future re-development of existing buildings. Stakeholders representing existing flood prone developments will normally press for structural solutions to reduce their flood risk. Such measures are often expensive and beyond the ability of the LGA to fund and rarely produce a complete solution, i.e. most structural measures retain a residual flood risk. For some locations the upgrading of flood warning systems provides a partial response. The problem is that those at risk are reluctant to pay for the reduction of their risk, those with no risk feel equally strongly that they should not be required to contribute to the costs.

Clearly, there is no easy solution to this problem. It can be said however, that local community debate aided by clear and accessible information on the costs and benefits should be encouraged prior to a decision.

Residual risk

This is of major concern to the emergency services and is an aspect of flood management that is often ignored or poorly handled. First, it is essential that the community is aware that any designated flood (apart from the probable maximum flood!) leaves a residual risk of flooding. Second, that any structural mitigation measure carries with it the risk of exceedance of the design criteria (often the designated flood) or of structural failure. It should be recognised that any structural solution needs to be accompanied by a corresponding emergency plan and that the costs of the emergency measures should be included in the overall costs and benefits.

If the flood study data are incorporated into a GIS, this offers an excellent way of demonstrating the extent and costs of the residual flood problem. A key to the reduction of the effects of residual risk is the availability, or installation, of a flood warning system which should incorporate a well formulated program for community awareness and response.

A simple and inexpensive method to improve awareness and response is the installation a series of flood markers throughout the flood prone areas. These should show the level of the flood of record and also repeat the heights given on the town's flood gauge. This is critical to give meaning to flood forecasts for the residents of the flood prone area. However, in Queensland and elsewhere such simple methods are rarely implemented because of concern of the possible adverse effect on property values. Such flood markers should be obligatory in local and State policy.

11.1.4 Step (v) – implementing a local flood policy

The final step is to implement the local flood policy and to incorporate the designated flood, land use zoning and building controls into the local planning scheme. It would appear from the questionnaire, and in Smith et al (1996), that State planning legislation to allow for effective local planning is confused. If this is the case, and discussions with many Queensland officials confirm that it is, it is necessary to clarify, and perhaps change, the situation. Without such clarification, the implementation of best practice management at LGA level will be jeopardised.

11.2 Background to hazard policy

It can be argued that relationships between national, state and local governments for hazards differ in style to those of other inter-governmental interactions. The higher tiers of government tend to place a greater emphasis on matters of safety and are concerned to establish best practice procedures for hazard management at local level. To this end they are willing, to a degree, to provide assistance to achieve these aims. Such assistance is usually

tied to the lowest tier, local government, adopting planning measures to reduce the risk. In addition to assistance for mitigation and funding emergency procedures, higher tiers of government assist with relief aid in the aftermath of a disaster.

The perception from local government is somewhat different. Frequently local government, which is directly responsible to the local community, perceive attempts to impose planning controls from above as unwarranted interference that is counter to local development. The community, all too often, regard the occurrence of a damaging disaster to be that of a very low risk which can be ignored. When the rare event occurs there are commonly two responses:

- requests for assistance to recover from the event;
- the search for a scapegoat, for example the council '... gave us permission to built here without telling us it was hazard prone'.

This outline of the problems of hazard management and governance is not unique to flooding, to Queensland or to Australia but is common among developed nations regardless of hazard. It is for example, a major on-going problem for planning and building regulations for earthquake risk in the USA. A detailed recent account of the problem, using flood hazard as an example, is available in *Environmental Management and Governance-Inter-governmental Approaches to Hazards and Sustainability*, (May *et al.*, 1996). This presents international comparisons between New Zealand, New South Wales and the USA.

11.2.1 Policy responses

The study by May *et al.* (1996) describes the public policy options available to governments for hazard management as a representing a spectrum from coercive to cooperative approaches.

Coercive policies, as used in for example Florida, are at one extreme and marked by the State government setting rigid rules and timetables to which local governments must comply. Local flood plans, follow a pattern determined by the State, and are required to be submitted by a set date. Non-compliance results in severe fines and reductions in State contributions to a range of services. It needs to be added that there is State assistance for the production of such plans and the possibility of assistance with funds for any subsequent approved mitigation measure.

At the other extreme, a co-operative approach, the State provides flood planning guidelines but leaves local government to decide on local policy within a broad framework. Again funding from the State is required for success.

11.2.2 Lessons from New South Wales

New South Wales was used in May *et al.* (1996) as a detailed case study and a lengthy questionnaire was completed by some 100 LGAs to provide background data. Prior to the mid-1980s New South Wales government had, for some ten years, followed a flood policy that had many elements of a coercive approach. LGAs were required to use the 1 in 100 year event as the designated flood, if they did not they were legally liable for any flood damages suffered by those to whom they gave planning approval. This policy was accompanied by the production, by State agencies, of some 70 high quality flood maps for many of the flood prone urban communities. In 1984 community concern over provisional flood maps on display for public comment for Fairfield (an inner Sydney council) at the time of a State election resulted in a major shift in policy. This event acted as a focus for widespread dissatisfaction with the coercive policy by councils statewide. In 1985 the draft of the New

South Wales flood manual was released (NSW PWD, 1986) and a new 'merits based' policy introduced.

The 'merits based' policy can be regarded as representing a cooperative approach, it has remained in force ever since. LGAs were encouraged to establish community floodplain committees to oversee the steps outlined in the preceding section of this report. Overall, the policy has met with favour from LGAs and a large number of flood prone communities have now progressed to the stage where their decisions are formalised into local planning schemes. Interestingly, virtually every LGA selected the 1 in 100 year as the designated flood, a decision that they violently opposed under a coercive policy. This is in spite of advice from State agencies to consider alternative definitions.

A unique feature of the New South Wales approach is that if LGAs follow the guidelines given in the flood manual that the council and its staff are exempted, in legislation, from future action over duty of care for flooding decisions. This was welcomed by LGAs and undoubtedly played a major role in the favourable response of LGAs to the post-1985 cooperative policy.

It is again necessary to state very clearly that the New South Wales government has been prepared, over many years, to make available financial and technical assistance to flood prone LGAs. In the early 1990s the State contribution was of the order of $10 m annually, matched by a similar sum from the Commonwealth, LGAs in general contributed 20% of the costs. This applied to funding for flood studies and to the cost of structural measures, all of the latter were required to show a favourable cost benefit ratio based on rigorous analysis of the damage costs which were available from the flood studies. Assistance from the State government has also included analysis of flood hydrology and other technical advice on a range of flood related issues. To these ends permanent, well-staffed, well-qualified and resourced units devoted to flood management have been maintained at State level for well over twenty years.

Overall, the cooperative flood policy followed in New South Wales can be counted as a success. Precise data are not available but the rate of increase of developments in flood prone areas is very small and the potential for damage to existing flood prone developments has been reduced. The only problem with a fully cooperative approach is that LGAs, if they so wish, need not participate. Such a decision however, means that funding for mitigation measures is not available and they still face possible liability under duty of care.

11.2.3 Commonwealth assistance

For many years the Commonwealth provided assistance on a 40:40:20 basis (Commonwealth, State, local) funding basis for approved schemes for flood studies and mitigation. This was originally part of the Federal Water Resources Assistance Program (FWRAP) and, later, the flood component was administered by the National Landcare Program. Queensland did not participate, in any major way, in this process as the State lacked information on which to promote claims for assistance.

The Commonwealth, in partnership with the States, separately contributes to flood relief under the long established Natural Disaster Relief Arrangements (NDRA). The assistance is mainly to LGAs to repair infrastructure losses (mainly related to the transport network) and for assistance with personal hardship and distress. Relief of this kind was not linked to programs to improve floodplain management and to reduce flood losses. In mid-1996 the Commonwealth indicated that in future the provision of NDRA relief payments (except for personal hardship) would require evidence of policies and management to reduce future loses.

It is important to note that, over recent years, the contributions of the Commonwealth to the NDRA, relative to those of the States, have been progressively reduced. Thus, it is surprising that State Treasuries have not also pressed for planning to reduce future losses and thereby, State flood relief payments. Without the wider adoption of urban floodplain management in Queensland such payments will continue to escalate and as mitigation measures are usually founded in favourable cost benefit ratios it would be in the State's interest to take such steps to lessen future outlays on flood relief.

11.3 The Queensland Government and LGA floodplain management

In the Australian context the adoption of fully coercive policies, as described from the USA, are not considered as a viable strategy. A cooperative model, similar to that employed in New South Wales for over ten years, offers an alternative. However, for this to be successful it would be necessary for the State government to contribute both in terms of direct funding and with technical advice. Unfortunately changes in Commonwealth funding for assistance with studies and mitigation have declined and it can be expected that this trend will continue.

The expenditures in New South Wales have been large, however much of the outlay was for structural measures to protect existing flood prone developments. This was important to the stick and carrot approach which required the adoption of, and compliance to, land use controls consistent with the choice of a suitable designated flood and thereby, for indemnity from duty of care. The carrot was often in the form of structural mitigation for existing flood prone developments. It could be that the Queensland government could achieve these aims but lessen the expenditure by restricting the use of structural measures.

The need in Queensland is for a cooperative, locally based approach but combined with technical advice, the input of funding (especially for assistance with flood studies), and a limited degree of coercion from State government.

11.3.1 Technical assistance

A major contribution would be for State agencies to produce and publish a Queensland-based manual to acceptable flood management practice. This could include information that is not presented in detail in the New South Wales equivalent. For example, appendices that deal with building methods and flood materials compatible with developments in flood prone locations. Another example, would be guidance to flood proofing, especially that concerned with house raising and for commercial premises. Flood proofing has the advantage that it can be undertaken by individual building owners and a subsidy contribution towards such mitigation may be considered appropriate. Assistance with the analysis of hydrological and rainfall records and rainfall/runoff modelling methods would also be helpful to many LGAs. Queensland has a good exemplar with the Queensland urban drainage manual (QDPI, 1992). Such a manual and appendices could usefully incorporate examples of mitigation measures already used by some LGAs within the State.

The recommendation is to produce a Queensland-based manual for use by local government to give guidance on all aspects of best practice floodplain management. Such a manual should also give guidance to the planning legislation in order that local floodplain management could be fully integrated into the State's overall planning policy.

11.3.2 Funding

The allocation of funding is clearly a decision for the State government but without improved funding the costs to governments, at all levels, and to individual citizens of permitting

developments in flood prone locations will continue to escalate. The linking of flood relief to the adoption of acceptable floodplain management, as prompted by the Commonwealth, should be reinforced at State level.

It is unrealistic, whatever policy stance is adopted, to expect that the total costs of flood studies and mitigation, essential to attain best practice floodplain management, can be borne by LGAs alone.

11.3.3 Duty of care

It is not the aim of this study to persecute LGAs for not pursing acceptable floodplain management, but there remains the legal responsibilities under duty of care. It is thought that such concern has played a major part on prompting a number of LGAs in Queensland to adopt good quality urban floodplain management. The problem is why this does not apply to others?

It is likely that a clear statement on the legal liability for decisions to allow building in flood prone areas would lead to improved floodplain management. Indemnity for such liability for LGAs following acceptable procedures, is a strategy that has much to commend it.

There is little doubt that a local policy that gives as a defence for no action, 'we had no information on liability to flooding' is not acceptable either morally or legally.

11.4 Summary

Urban floodplain management in Queensland is below the standard that could be expected for the State with the largest urban flood problem in Australia. Improvements will require financial and resource outlays by both State and local governments although the benefits of these to the avoidance of losses from poorly sited future developments would outweigh the costs in the medium to long term. State assistance will certainly be necessary for those LGAs with small populations and rate base. The wider use of differential rating by LGAs, although unpopular, could lead to those who benefit from mitigation contributing to the costs.

It is to be hoped that improvements to floodplain management, and to related planning for storm surge, are not delayed so that action is only taken after the occurrence of a major disaster with extensive damage and loss of life. It is the responsibility of governments at all levels to ensure that this does not happen.

References

AEMI (1995) *Flood warning in Australia: an Australian guide.* Mt Macedon: Australian Institute of Emergency Management.

AWRC (1992) *Floodplain management in Australia.* Australian Water Resources Council, Water Management Series 21(2). Main Report. Canberra: Australian Government Publishing Service.

Black, R.D. (1975) *Flood proofing rural residences.* Washington: Report to US Department of Commerce, Economic Development Administration.

BM (1992) *Logan and Albert Rivers flood warning system.* Brisbane: Bureau of Meteorology.

Camp, Scott and Furphy Pty Ltd (1992) *Rockhampton flood management study.* Consultant's report to Water Resources Commission, Queensland.

Carroll, D.G. (1991) *Flood warning and monitoring in the Brisbane City area using event-based radio telemetry systems.* M.Eng.Sci. Thesis, Queensland University of Technology.

Carroll, D.G. (1993) PROPHET – The Brisbane City Council creek flood monitoring and forecasting system. *Proceedings of the 7th National Local Government Engineering Conference, Adelaide 30 August-3 September 1993.* Canberra: Institute of Engineers Australia.

Chamberlain *et al* (1981) *Queensland flood report Australia Day 1974.* Canberra: Australian Government Publishing Service.

CRCE Water Studies (1986) *A revised system of floodplain management for Brisbane.* Prepared for the Brisbane City Council.

Devin, L.B. and Purcell, D.L. (1983) *Flooding in Australia. Water 2000 Consultant's report No.11.* Australian Department of Resources and Energy. Canberra: Australian Government Publishing Service.

FEMA (1986) *Coastal construction manual (FEMA - 55).* Washington D.C.: Federal Emergency Management Agency.

Granger, K.J. and Smith, D.I. (1995) Storm tide impact and consequence modelling: some preliminary observations. In: McAteer, M. and Jakeman, A. (eds.) *International Conference on Modelling and Simulation.* Perth: University of Western Australia. Vol.2: 535-541.

Hopley, D. and Harvey, N. (1979) Regional variations in storm surge characteristics around the Australian coast. In: Heathcoate, R.L. and Thom, B.G. (eds.) *Natural Hazards in Australia.* Canberra: Australian Academy of Science. 107-112.

May, P.J., Burby, R.J., Eriksen, N.J., Handmer, J.W., Dixon, J.E., Michaels, S. and smith, D.I. (1996) *Environmental management and governance: inter-governmental approaches to hazards and susceptibility.* London: Routledge.

NSW (1986) *Floodplain development manual.* PWD Report No. 86010. Sydney: Public Works Department.

Parker, D.J., Green, C.H. and Thompson, P.M. (1986) *Urban flood protection benefits: a project appraisal guide.* Aldershot: Gower.

Penning-Rowsell, E.C. and Chatterton, J.B. (1977) *The benefits of flood alleviation: a manual of assessment techniques.* Saxon House: Farnborough.

Penning-Rowsell, E.C. and Smith, D.I. (1987) Self-help flood hazard mitigation: the economics of house-raising in Lismore, New South Wales, Australia. *Journal of Economic and Social Geography* 78(3): 176-189.

QDPI (1992) *Queensland urban flood drainage manual volume 1 – text.* Prepared for Water Resources Commission Department of Primary Industries, The Local Government Engineers' Association of Queensland and Brisbane City Council by Neville Jones and Associates Pty Ltd and Australian Water Engineering.

SCDO (1992) *Storm tide: warning-response system.* Brisbane: State-Counter Disaster Organisation and Bureau of Meteorology.

SMEC (1975) *Brisbane River flood investigation – final report.* Report by Snowy Mountains Engineering Authority for Cities Commission. Canberra: Australian Government Publishing Service.

Smith, D.I. (1996) *National and State residential flood damages for Australia.* Unpublished report for the Insurance Council of Australia.

Smith, D.I., Den Exter, P., Dowling, M.A., Jelliffe, P.A., Munro, R.G. and Martin, W.C. (1979) *Flood damage in the Richmond River Valley, New South Wales: an assessment of tangible and intangible damages.* Canberra: Centre for Resource and Environmental Studies, Australian National University.

RKC's copy.

NATURAL RESOURCES and MINES
OFFICE MEMO

Your Ref.: **Our Ref.:** IRM/515/000 (0341)
Author: R K Cuerel **Telephone:** [redacted] **Facsimile:** [redacted]

DATE: 12 February, 2004

FROM: [redacted]

TO: Director, Water Reform

CC: General Manager, Water Management & Use
[redacted], Water Reform
[redacted], Water Reform

SUBJECT: **Legislative Provisions for the Introduction of a State Flood Risk Management Policy**

I refer to our meeting on 7 November 2003 to discuss the progress to legislation of the State Flood Risk Management Policy. At that meeting it was agreed that Water Use would provide details of the outcomes it is seeking to implement a State Flood Risk Management Policy. This was to provide a basis for discussions aimed at determining the appropriate legislative provisions (and legislation).

I believe Section 9.4 from the "Consultation Report" suitably outlines the sorts of legislative provisions considered necessary. Further, Section 9.5 provides a potential draft policy and Section 9.6 gives a discussion the appropriate department to be responsible for the policy.

Attached is an extract from the "Consultation Report" including Sections 9 - *Proposed Draft Policy*, 10 - *Conclusions* and 11 - *Recommendations*.

[redacted]

[redacted]
A/DIRECTOR
WATER USE

G:\Water Man & Use\Water Use\Floodplain Management\Policy\SDMC Discussion Paper\SFRMP Legis Developmnt\WM&U-WR Memo re Leg Prov2.doc

Att

9. Proposed Draft Policy

The proposal for a State Flood Risk Management Policy is intended to deliver a holistic approach to the management of floodplains in respect of flood risk, recognising this needs to occur within the context of the sustainable management of flood plain resources and natural ecosystems.

Whilst the policy needs to encapsulate all the issues, its implementation may occur through more than one instrument.

9.1. Flood Risk Management Policy principles and objectives

In formulating a flood risk management policy, it is important to recognise that:

- Floodplains are valuable natural resources which cannot be arbitrarily isolated from all development;
- Floodplains have a major impact on the health of the associated waterways, are important links in the life-cycle chain of many species and frequently include areas of significant ecological importance;
- All development proposals on the floodplain should be treated on their merits in relation to the flood risk, their environmental impacts, and the benefits such development can provide; and
- State government and local government responsibilities must be clearly defined.

The objective of a flood risk management policy should be to ensure sustained actions are taken to minimise long-term risk to life and property so that fewer Queenslanders will be victims of floods in future. The following key principles should guide strategies aimed at achieving this objective:

- Manage risks to public health and safety consistent with ecologically sustainable development (ESD) principles.
- Develop a full appreciation of all the risks and benefits associated with any proposed floodplain use.
- Enable individuals to make informed decisions.
- Adopt a partnership approach between all levels of government and the community (recognising that the costs of flood disasters affect all Australians).
- Aim for proactive prevention rather than reactive response.
- The costs associated with flood risk should be identified and funded transparently.

An effective flood risk management policy requires:

- a cohesive framework of measures
- effective implementation mechanisms.

9.2. Proposed Policy Outcomes

The Discussion Paper proposed that there were some fundamental outcomes required from a State Flood Risk Management Policy. They were:

- acquiring and maintaining comprehensive flood information

- undertaking appropriate risk and vulnerability assessments
- informing all relevant parties in a way that can be easily understood.

The Discussion Paper also considered that local governments, because of their existing responsibilities to the local community, were in the best position to deliver these outcomes - with appropriate support from the State.

Section 8 of the Discussion Paper considered numerous "*Possible Measures for Improving Flood Risk Management*". Local government planning scheme and development approval measures are addressed by the recently adopted *State Planning Policy – Mitigating the Adverse Impacts of Flood, Bushfire and Landslide* however, there remains the need to introduce measures that:

- Deal with legal liability
- Require floodplain management plans
- Establish a State information system
- Make flood information readily available

The Discussion Paper considered that the major barriers to effective flood risk management in Queensland would be removed by the development and implementation of a State flood risk management policy that:

- provides a Statewide strategic direction for the management of flood risk which recognises and facilitates the key role of local governments;
- clarifies the existing roles and responsibilities of agencies and aligns those statutory, administrative and funding programs that impact on flood risk;
- supports local government by providing flood risk management guidelines which promote best practice in accordance with ecological sustainability;
- provides for monitoring of the implementation and ongoing costs of flood risk management by local government;
- clarifies the links between existing legislation and the responsibilities of local governments;
- defines the conditions under which local governments can satisfy any legal obligations in respect of advice given or actions carried out (eg done in good faith and in accordance with accepted best practice);
- ensures that existing government subsidies and other financial incentives encourage a reduction in Queensland's level of flood risk;
- maintains an overview of flood risk management across the State to ensure all flood information is captured, maintained and available – enabling the community, local government and the State to make sound decisions regarding flood risk which avoid potential loss of life and property and to make best use of funding and technical resources; and
- assists the insurance industry to provide flood insurance to property owners by ensuring that the flood risk has been clearly identified and systematically recorded.

The Discussion Paper proposed that flood risk management issues needed to be drawn together as far as possible and to be implemented through legislation. Although this may be an ideal, it is considered highly unlikely that all aspects of flood risk management can ever be implemented through one piece of State legislation. As an example, NR&M administers the *Water Act 2000* and has responsibility for water quantity planning, management, compliance, rural water demand management, infrastructure and service provider standards, and State-wide water statistics under the *Water Act 2000*. Yet many other issues impacting on water as a natural resource and the water cycle in general lie outside the Act and are administered by other agencies, eg:

- water quality (discharge licensing and requirements for environmental management plans for urban stormwater, trade waste, sewerage and water supply), facilitation of urban demand management and recycling are administered by Environment Protection Agency and under the *Environmental Protection Act 1994* and the *Environmental Protection (Water) Policy 1997.*
- urban water supply infrastructure charging and water business reform/competition under the *Integrated Planning Act 1997* and the *Local Govt Act 1993* administered by Department of Local Government and Planning.

Therefore, while a State Flood Risk Management Policy should aim to bring together all the existing State provisions that directly influence flood risk management in one "policy statement" - implementation may remain across a number of instruments (although these should be rationalised as far as possible). This is similar to the NSW model.

9.3. Content of Policy

A State Flood Risk Management Policy for Queensland needs to clarify and rationalise as far as possible (recognising that flood risk management issues already lie across a number of existing instruments) existing measures available to manage risks on floodplains; ensure co-ordination by establishing and maintaining clear links; and introduce new measures that will enhance outcomes.

9.3.1. Providing a Co-ordinated Approach to Managing Flood Risk

Following the NSW example, a State Flood Risk Management policy for Queensland can provide co-ordination through a "policy statement" which draws together all relevant measures, those existing as well as those proposed.

Agency roles and responsibilities likewise could be addressed through the policy statement. However for their long-term viability, roles and responsibilities are best defined in legislation.

As discussed above, four broad actions are required:

- Dealing with legal liability
- Requiring floodplain management plans
- Establishing a State information system
- Making flood information readily available

9.3.2. Dealing with legal liability

Local governments need to be able to:

- inform the public about flood risks on a floodplain (e.g. through maps showing the likely extent of flooding) based either on flood modelling or recorded historical information;
- manage development through planning schemes and development controls; and
- carry-out appropriate flood mitigation works.

There is a significant concern expressed during consultation (at the workshops and in a number of the written submissions) within local government that these actions may expose them to legal liability and claims for substantial compensation (or at least costly court proceedings) either as a result of actual flood losses or because of reduced property values following identification of flood prone land.

The proposed policy would set out how local governments can fulfil their responsibilities in making flood information available, setting development and building conditions, and carrying out works. The policy would clarify local governments' legal position with respect to these activities and remove the question of liability for non-negligent actions.

These provisions of the policy would require legislation (eg a new part to the Water Act 2000)

9.3.3. Requiring floodplain (risk) management plans

Floodplain (risk) management plans are an important requirement for the effective control (and reduction) of flood risk. Such plans provide the supporting information (flood studies, damage and vulnerability assessments, management scenarios and mitigation strategies) for planning and development controls and mitigation works programs.

The plans would also address issues such as social impacts, economic impacts and floodplain ecological values, with respect to the management of flood risk. They would be the principal integrating mechanism for identifying and attempting to balance the competing interests and risks on a given floodplain.

The State Planning Policy for Natural Disaster Mitigation needs the outcomes of a local floodplain (risk) management plan to enable it to be implemented most effectively. Under the proposed policy, each local government would be required to prepare floodplain (risk) management plans for its floodplain areas. This could be "enforced" as a statutory requirement, or as a condition of receiving State flood mitigation subsidy funds (either under the Regional Flood Mitigation Program or the Local Governing Bodies Capital Works Subsidy Scheme).

The long-term maintenance of these provisions of the policy would be best secured by legislation (eg. a new part to the *Water Act 2000*). However, flood mitigation subsidy eligibility could be used through administrative changes.

9.3.4. Establishing a State flood information system

The State Government should have a better understanding of the flood risk in Queensland and how it is being managed. Under the proposed policy, NR&M would oversee the

preparation of local floodplain management plans and set up a State system for recording and monitoring flood information provided by local governments. This information would be used to determine the effectiveness of the Policy; target any assistance; support bids for Commonwealth funds; and assist local governments through shared information, experiences and expertise.

The long-term maintenance of a State flood information system would be best provided by legislation (eg a new part to the *Water Act 2000*). However NR&M could establish an information system without a statutory requirement to do so.

9.3.5. Making flood information readily available

Availability of flood information means individuals and communities are in a better position to manage their own risk. Removing obstacles such as questions over legal liability and compensation should result in existing information becoming more accessible. Where information does not exist or is incomplete, the policy would facilitate the collection/generation of flood information by requiring floodplain management plans.

To further assist local governments make flood information readily available, the policy would include the provision of appropriate flood information standards, in terms of collection, storage and presentation. If feasible, it may be appropriate to include local government flood data on the State land titling system administered by NR&M.

Once again, long-term maintenance of State flood information standards would be best provided by legislation (eg a new part to the *Water Act 2000*). However NR&M could establish guidelines on flood information without a statutory requirement to do so. But without legislation, local governments would not have to adopt the guidelines, or supply data meaning coverage of the State could not be assured.

9.4. Potential Provisions for State Flood Risk Management Legislation

9.4.1. Overall Responsibility for Flood Risk Management

The Chief Executive Officer of the Department of Natural Resources and Mines will be responsible for overseeing the State's Flood Risk Management Policy, and ensuring co-ordination with other State agencies (especially the Environment Protection Agency, Department of Emergency Services and Department of Local Government and Planning) to facilitate its effective implementation and long term maintenance.

9.4.2. Liability

A local government or other statutory agency with flood risk management responsibilities (as may be approved by the State) will not incur any liability for losses or damages arising from any of the agency's responsible actions to best manage flood risk (eg. provision of flood information in any form provided that information has been provided in good faith - refer NSW *Local Government Act 1993*). This provision does not remove liability for negligence.

9.4.3. Floodplain Risk Management Plans

Each local government (or other agency with suitable floodplain risk management responsibilities) will prepare a floodplain risk management plan in accordance with accepted best practice as set out in the Queensland Floodplain Management Manual as adopted and amended from time to time by NR&M.

9.4.4. State Flood Information System

Each local agency with flood risk management responsibility will provide for the areas under its jurisdiction:

- all available flood inundation data
- all available flood damage data
- details of policies and standards used in managing flood risk.

This data will be collected and supplied to NR&M in a format agreed by the State.

NR&M will operate and maintain a State Flood Information System based on data supplied by local governments to allow the ongoing assessment of the State's overall flood risk and the targeting of any special assistance which may be available from time to time. NR&M will also set appropriate standards for the collection and recording of flood data to be supplied by local agencies and provide technical assistance to local agencies so they can met the data standards required.

9.4.5. Flood Information Readily Available

Each local agency with flood risk management responsibility will make available to the community in a readily understandable form:

- all available flood inundation data
- all available flood damage data
- details of policies and standards used in managing flood risk

for the areas under its jurisdiction.

A local agency acting in good faith will not incur any legal liability for losses or damages that may arise from the use or mis-use of this information. Liability can only be incurred if it can be shown that the local agency's actions in deriving the information were negligent.

The State will note, on its land-titling database, land parcels that have been identified as flood affected, and that further information on the extent to which the land is affected should be sought from the relevant local government.

9.5. Preliminary Example of a State Flood Risk Management Policy Statement (based on the NSW Flood Prone Land Policy)

9.5.1. Purpose of the Policy

The primary objective of the policy is to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods, within the context of the sustainable use and management of the State's floodplains.

In fulfilling this objective:

- State and local agencies responsible for making decisions that will affect flood risk shall base all decisions regarding their actions on floodplains on an assessment of both the

benefits and risks of those actions - taking into account social, economic and ecological factors, as well as flooding considerations;

- local government shall prepare and implement floodplain risk management plans that address both mainstream and overland flood risk - whilst preserving as far as possible, the natural function and ecology of floodplains;
- floodplain risk management plans will be the basis for making decisions about actions on floodplains that will affect flood risk such as new development, as well as including measures for the long-term reduction of flood risk to existing developed areas and ongoing flood emergency management;
- appropriate flood mitigation measures for each circumstance will be selected after considering and assessing the full range of structural and non-structural measures;
- the potential for increasing flood losses as a result of proposed development or redevelopment on floodplains shall be contained by the application of planning and development controls – consistent with SPP1/03.

To achieve its primary objective, the policy provides for:

- continuation of subsidy schemes for works to reduce potential flood damage and personal danger in existing developed areas (eg. existing flood mitigation subsidy schemes such as the Regional Flood Mitigation Program and the Local Governing Bodies Capital Works Subsidy Scheme);
- provision of technical support to local government to ensure that the use of flood prone land is consistent with the flood hazard and that such uses do not unduly increase potential flood liability to the occupier or to the community;
- recognition of emergency management and flood recovery programs and their linkage with the flood risk management process;
- protection of councils, government agencies and their staff against claims for damages resulting from their issuing advice, undertaking works or granting approvals on floodplains, providing such action was not negligent and was taken in accordance with the principles and guidelines of the *Floodplain Management Manual – Qld.*[1]
- legislation to support local government flood risk management.
- floodplain risk management plans prepared by the relevant local agencies (i.e. local governments) - or the State where necessary, (eg. large floodplains covering two or more local government areas and under development pressure from rural enterprises).
- floodplain risk management plans being the principal mechanism for addressing all the issues relevant to a particular floodplain in an integrated manner.

The policy shall be implemented in the following manner:

- The management of flood prone land is primarily the responsibility of local government. As such, local government will be responsible for preparing appropriate flood studies and floodplain risk management plans and for their implementation through local planning schemes, policies, procedures and programs determined by councils.

---

[1] At present a Queensland Manual does not exist. Until one is developed it would be proposed that the National manual be adopted.

- The Qld Government, through the Department of Natural Resources and Mines shall provide specialist technical assistance and advice on flood risk management. A Floodplain Management Manual – Qld shall be provided to assist local governments in the preparation of floodplain risk management plans. Assistance on related issues (such as emergency planning and mechanisms for charging for infrastructure) will also be available from the Departments of Emergency Services and Local Government and Planning.
- The establishment of local flood risk management committees by councils, through which local community groups and individuals can effectively communicate their aspirations concerning the management of the flooding problem.
- Continuation of State Government subsidisation of floodplain risk management studies, works and measures (eg. existing flood mitigation subsidy schemes such as the Regional Flood Mitigation Program and the Local Governing Bodies Capital Works Subsidy Scheme; and flood study subsidies under the Natural Disaster Risk Management Studies Program).
- The establishment of a flood risk information database by the State Government

9.5.2. Policy Provisions

The policy provides for:

- a flexible merit based approach to be followed by councils, when dealing with flood prone land management;
- ongoing funding for flood risk mitigation projects;
- recognition of the need to consider the full range of flood sizes, up to and including the probable maximum flood and the corresponding risks associated with each flood;
- councils to be responsible for the determination of flood planning levels and appropriate planning and development controls based on social, economic and ecological impacts and values, as well as flooding considerations;
- an emphasis on the importance of developing and implementing floodplain risk management plans based on an integrated mix of management measures that address the existing, future and continuing risk;
- availability of State Government technical support to councils in relation to flooding matters;
- floodway definition to be based on hydraulic, hazard and potential damage considerations, with provision for restricted development depending on circumstances;
- inclusion of a local Integrated Catchment Management Committee (or Natural Resource Management Board) representative on each local government flood risk management committee;
- explicit recognition that flood risk management needs to take into consideration government policies and legislation allowing for the sustainable usage of the floodplain as a natural resource; and that the planning and assessment requirements laid down in those policies and legislation must be complied with by all agencies associated with the use, development and management of the floodplain;
- an emphasis on the need to consider ways of maintaining and enhancing the riverine and floodplain ecology in the development of floodplain risk management plans;

- recognition of the importance of the continuing flood risk addressed in the State Counter Disaster Organisation Act 1975 and State Counter Disaster Plan, and the close relationship between the emergency management and flood risk management processes;
- recognition of the potential implications of climate change on flooding behaviour;
- the policy and detailed arrangements for implementation to be included in the *Floodplain Management Manual- Qld;*
- protection of councils and other public authorities and their staff against claims for damages, providing they act in accordance with the government's policy at the time; and
- relief from charges on vacant land which cannot be developed because of its flood prone nature. *(This provision requires further negotiation with Treasury and local government).*

9.6. Departmental Responsibility for Development of the Policy

NR&M has the relevant skills and responsibilities (for land and water management) to deal with flood risk management issues across both rural and urbanised floodplains. NR&M:

- has hydrologic and hydraulic engineering expertise (through NRSC)
- has responsibility for riverine management
- through its network of gauging stations, is the custodian of important hydrological data
- arbitrates on floodplain disputes
- undertakes project assessments of Regional Flood Mitigation Program applications,
- is the State Government agency partnering Brisbane City Council and the Institute of Public Works Engineers Australia (Qld) in the ownership of the Queensland Urban Drainage Manual

It also has responsibility for State's land information system which potentially is the basis for a State flood database. This approach is generally reflected in interstate practice where responsibility for flood risk management policy lies with the government agencies which have responsibility for natural resources, particularly water resources ie:

- NSW - Department of Infrastructure, Planning and Natural Resources;
- Victoria - Department of Sustainability & Environment;
- Western Australia - Department of Environment (incorporating the previous Water & Rivers Commission);
- Tasmania - Department of Primary Industries, Water and Environment;
- South Australia - Department of Water, Land and Biodiversity Conservation (with technical assistance from the Department of Transport and Urban Planning); and
- Northern Territory - Department of Infrastructure Planning & Environment.

Other Departments that could be considered to have a significant portfolio interest in the management of flood risk and therefore possibly be responsible for development of the policy are the Department of Emergency Services (flood disasters); the Department of Local Government and Planning (local planning scheme provisions and local government infrastructure) and the Environmental Protection Agency (floodplain environment and water quality issues).

The Department of Emergency Services' core interests lie in disaster risk management and therefore the Department of Emergency Services interest in flooding is as a significant hazard only. Broader floodplain management and "non disaster" floodplain risks such as the potential adverse impacts on floodplain resources, water quality, etc. are of less significance. Although the Department of Emergency Services developed SPP 1/03 (in association with the Department of Local Government and Planning and with considerable assistance from NR&M) and is primarily responsible for its administration; DES does not have the skills or responsibilities to deal with all floodplain management issues whether they lie within or outside the scope of SPP 1/03. The Department of Emergency Services and intends to rely on NR&M for expert advice on flooding matters.

The Department of Local Government and Planning's expertise and interest in flood risk management principally lies with local planning schemes. However charges that may be made on development for funding flood mitigation/stormwater management works and State subsidies for local government infrastructure are also issues for that Department. It should be noted that with respect to administration of State subsidy schemes for flood mitigation works, DLGP also rely on NR&M for expert advice in assessing and approving projects.

The Environmental Protection Agency's interests lie with protection and enhancement of the environment, which with respect to flooding includes water quality and floodplain ecological processes. EPA also has responsibilities under the *Coastal Protection and Management Act 1995* for seeing that issues associated with management of the State's coastal resources (natural and cultural) and the protection of their ecological, economic and social values are addressed including development assessment and permitting.

9.7. Timeframe

Following approval by the Minister, it is proposed that NR&M immediately prepare a Cabinet Submission informing Cabinet that NR&M is proceeding to develop a draft State Flood Risk Management Policy and seeking approval from Cabinet for NR&M to prepare draft legislation. The proposed timeframe being:

- Cabinet Submission on draft State policy statement (refer Section 9.4 for content) and the proposal for legislation for consideration by Cabinet by November2003,
- on approval by Cabinet, preparation of draft legislation by March 2004
- consultation on draft legislation from March to June 2004
- presentation of Bill to Parliament by October 2004

10. Conclusions

Based on the responses received to the Discussion Paper, this report concludes that:

- there is general support for proceeding to develop a State Flood Risk Management Policy for implementing through legislation.
- the objections received to the proposal were minor (relating to issues like resourcing rather than rejection of the aims of the policy)

This report further concludes that:

- As pointed out in the Discussion Paper, floodplain risk management has strong links with wider floodplain management issues and should be addressed in that context;
- In spite of the perceived advantages, it is not practical (and probably inappropriate) for all flood risk management issues to be consolidated and implemented through one State instrument.
- It is probably more practical to aim for a NSW-style approach where a State Policy Statement draws together and co-ordinates all aspects of flood risk management across various legislation – however this would still require some principal flood risk management legislation.
- As different issues vary in significance from one floodplain to another, individual floodplain management plans prepared by the relevant local agencies (eg local governments or possibly river improvement trusts) should be the principal mechanism for addressing all the issues relevant to a particular floodplain in an integrated manner.
- A State policy needs to be able to ensure that floodplain management plans are prepared and that they adequately address all relevant issues. To achieve this the policy should provide for the oversight by the State of floodplain management plans prepared by the relevant local agencies (eg local governments or possibly river improvement trusts);
- Because of its responsibilities for other catchment issues and because of its expertise in water, NR&M is best placed to take responsibility for development of the policy and its implementation
- Based on practice in other States, implementation should be through the preparation of a State Policy Statement and the addition of a new Part/Chapter to the Water Act 2000 (along the lines of NSW practice) with associated amendments to other Acts where required

11. Recommendations

This report recommends the Minister approve:

- NR&M proceeding to develop a draft State Flood Risk Management Policy and amendments/additions to the Water Act 2000 and other acts (in consultation with the relevant agencies) to support its implementation for consultation.
- the draft State Flood Risk Management Policy being prepared as outlined in Section 9.0.
- this report forming the basis of a Cabinet submission informing Cabinet of the outcomes of the public consultation on the Discussion Paper and that NR&M is proceeding with the preparation of a draft policy.

CTS 06426/03

N/03/12988 [redacted]

Advisor ... OK
Dated 8/10/03

Approved / not Approved
Further information required

Minister [redacted]
Dated 8/10/3

☐ MINISTER
☑ SPA
☐ POL ADV .....
☐ MEDIA .....
☐ PERS SEC
☐ ADMIN
for
☐ INFORMATION
☐ ACTION
☐ TIMING

To Brief for:
☐ REPLY
☐ BRIEF
☐ INFORMATION

...../...../.....

Department of Natural Resources and Mines
BRIEFING NOTE FOR APPROVAL

TO **The Honourable Minister**

SUBJECT **Report on Public Consultation on the State Flood Risk Management Policy Discussion Paper (Main & Summary Versions)**

PURPOSE

To provide the Minister with the report (attached) on the public consultation on the State Flood Risk Management Policy Discussion Paper; and to seek the Minister's approval to prepare the draft policy and supporting legislation for further public consultation as recommended in the report.

BACKGROUND

Cabinet approved the State Flood Risk Management Policy Discussion Paper for public release on 23 September 2002 (Cabinet submission 02925 and decision 03632). As part of the submission, it was indicated that the consultation period was intended to be 2 months and that the actual dates would be as nominated by the Minister for Natural Resources and Mines.

On 15 October, 2002, the Minister approved a public consultation period for the State Flood Risk Management Policy Discussion Paper commencing on 1 November 2002 and closing on 28 February 2003. This extended period was in recognition that the end of year/new year period is a difficult time for many organisations and individuals to properly respond to documents such as the Discussion Paper.

The Paper was advertised in the Courier Mail and major regional papers on 19 October 2002 to coincide with the advertisement for the public consultation on the *State Planning Policy for Mitigating the Adverse Impacts of Flood, Bushfire & Landslide* (SPP 1/03) by the Department of Emergency Services. As recommended by the Department of the Premier and Cabinet and indicated in the Department's submission to Cabinet, NR&M co-ordinated with the Department of Emergency Services deliver joint public workshops/presentations on the two initiatives around the State commencing on 7 November, 2002 in Toowoomba and finishing in Longreach on 4 December, 2002.

CURRENT ISSUES

- Public consultation on the Discussion Paper officially closed on 28 February this year, however a number of submissions were received up until the end of March. These submissions have been included in the report.
- Whilst the number of submissions received (35) on the paper is not large, it is considered that many of the most significant stakeholders have provided supportive responses. These include the City Councils of Brisbane, Gold Coast and Townsville City Councils, the Insurance Council of Australia and numerous State agencies.

- Cabinet approval of the release of the discussion paper provided tacit approval for the Minister for Natural Resources and Mines to determine whether or not to proceed with development of a Draft State Flood Risk Management Policy based on the results of the public consultation.
- The attached report has been delayed for a number of reasons including allowing late submissions so as to ensure all issues are considered and all stakeholders are able to have input. In addition, the responsible officer was also required to deal with high priority issues including putting in place arrangements for the continuation of the Rural Water Use Efficiency Initiative, interaction with the Department of Emergency Services on flood risk related issues (State Planning Policy 1/03, Disaster Mitigation Australia Package and the review of the State Counter Disaster Act), and the transfer of the Regional Flood Mitigation Program to the Department of Local Government and Planning.

SOLUTIONS

- The report on the public consultation concludes that:
  - there is general support for developing a State Flood Risk Management Policy implemented through legislation. Objections received were minor – relating to issues like resourcing rather than rejection of the aims of the policy;
  - flood risk management has strong links with wider floodplain management issues and should be addressed in that context. However, it is not practical (and probably inappropriate) for all flood risk management issues to be consolidated and implemented through one State instrument;
  - a State Policy will draw together and co-ordinate all aspects of flood risk management across various legislation, supported by some principal flood risk management legislation.
  - local flood risk management plans should be the principal mechanism for addressing all the issues relevant to a particular floodplain. A State policy needs to be able to ensure that flood risk management plans are prepared by the relevant local agencies - local governments (or possibly river improvement trusts) - and that they adequately address all relevant issues in an integrated manner;
  - because of its responsibilities for other catchment issues and because of its expertise in water, NR&M is best placed to take responsibility for development of the policy and its implementation; and
  - based on practice in other States, implementation could be through the preparation of a State Policy and the addition of a new Part/Chapter to the *Water Act 2000* with associated amendments to other Acts where required.

RECOMMENDATION

It is recommended the Minister approve:

- NR&M proceeding to develop a draft State Flood Risk Management Policy and amendments/additions to the *Water Act 2000* and other acts (in consultation with the relevant agencies) to support its implementation for further public consultation;
- NR&M conduct another round of public consultation following development of the draft Policy and legislation.

MINISTER'S COMMENTS

Cuerel Russell

From: Cuerel Russell
Sent: Thursday, 27 May 2004 3:07 PM
To: [redacted]
Cc: [redacted]
Subject: Main Policy objectives

Attachments: Main Policy objectives.doc; STATE FLOOD RISK MANAGEMENT POLICY 2.doc

Folks,

second installment to yesterdays email. Represents white board notes and discussion between myself and [redacted] on 5/5/04.

Main Policy objectives.doc (39...

Also slightly amended version of "paper" (extra bit on stormwater under 3, Contents of a Flooplain Management Plan).

STATE FLOOD RISK MANAGEMENT PO...

cheers

STATE FLOOD RISK MANAGEMENT POLICY- LEGISLATION PROVISIONS

1. Background

In late October 2002, the Department of Natural Resources & Mines released a public Discussion Paper proposing a State Flood Risk Management Policy and recommending its implementation through legislation.

The Discussion Paper proposed the Policy deal with the core issues of:

- acquiring and maintaining comprehensive flood information;
- undertaking appropriate risk and vulnerability assessments; and
- informing all relevant parties in a way that can be easily understood.

Public consultation on the proposed State Flood Risk Management Policy was undertaken in conjunction with the public consultation by Department of Emergency Services on SPP 1/03 – "Mitigating the Adverse Impacts of Flood Bushfire and Landslide."

Based on the responses to the Discussion Paper, the Consultation Report to the Minister concluded that:

- there is general support for proceeding to develop a State Flood Risk Management Policy with implementation through legislation; and
- the objections received to the proposal are minor (relating to issues like resourcing rather than a rejection of the aims, strategies and mechanisms of the policy).

The report also recommended implementation through legislation – with the amendments to the Water Act seen as the preferred option.

The Minister approved the preparation of a Draft Policy in October 2003.

The proposed State Flood Risk Management Policy seeks to, as far as possible, clarify existing responsibilities, rationalize existing provisions and their use, and introduce new measures, not currently dealt with such as:

- providing a co-ordinated approach to managing flood risk
- dealing with legal liability
- requiring floodplain (risk) management plans
- establishing a State information system
- making flood information readily available

The policy would aim to ensure co-ordination by establishing and maintaining clear links between existing provisions and additional measures that may be introduced.

2. Legislation provisions sought to implement a State Flood Risk management policy are:

- Requirement for the preparation of floodplain management plans by responsible local agency (generally local government, Regional Organisation of Councils (ROC) or river improvement trust (RIT)). Note, funding of up to 2/3 is available for local agencies to undertake flood studies through the Commonwealth-State Natural

Disaster Risk Management Studies Program. The NDRMSP funds generally apply to floodplains with an urban flood risk.

- Give NRM&E the power to prepare a floodplain management plan where one is required and the local agency is unable or unwilling to (eg poorer rural Council, floodplain involving numerous local governments). This process would only be necessary if the local agency were unable to prepare a plan;

- Floodplain Management Plan to include stormwater master drainage plan;

- Local agency (and State Government) to make flood information available to public;

- Local agency to provide its flood data to State to allow a state-wide database on flood information.

- Protection for local floodplain management agency (provided it was not negligent) from legal action:
  - seeking damages as a result of published flood information – provided agency has not been negligent;
  - seeking damages as a result of implementing and maintaining flood mitigation works – provided they have not been negligent;

  by defining steps a local agency should take to demonstrate it has fulfilled its responsibilities with respect to flood risk.
  The basis for a local agency to demonstrate it has fulfilled its responsibilities would be to show it has followed current State guidelines (State may produce guidelines for Qld or adopt National guidelines).
  State government may also need to define how its actions can be considered to satisfy its responsibilities. In this case the State should be judged for negligence against the national guidelines.

3. Contents of a Floodplain Management Plan:

- *Floodplain Characterisation* - determine the make-up of the floodplain land uses (agriculture, urban, conservation, utilities/infrastructure, riverine corridors, etc.) and floodplain management objectives/values.

- *Flood Hazard Assessment* (*Flood Study*) including: topography, historical flood data, hydrology and design floods, hydraulics/inundation extents and depths, flood flow paths, mapping flood inundation and extent in format for public – flood model;

- *Flood Impact Assessment* (*Risk Study*) – identify and cost impact of flooding on people, property and economy for the range of floods, determine average annual damage for floodplain; look at future development scenarios and the potential increase in flood risk;

- *Flood Standards* -design (or defined) flood event(s) (DFE) adopted for controlling floodplain activities - based on assessment of risk study outcomes; DFEs may vary for different locations and types of floodplain uses/development;

- *Flood Risk Mitigation Strategy* - investigation of mitigation options – structural and non structural (structural usually to deal with existing risk and non-structural with

future risk) and development of an implementation program – includes mitigation infrastructure plan, development controls and response strategy.

- *Flood Mitigation Infrastructure Plan* – plan for implementation of flood mitigation capital works

- *Development Controls* for the floodplain, implemented through planning scheme/development approval process (link here with SPP1/03) – includes use of models to determine whether development proposal has acceptable impacts. There is a significant issue here regarding the interaction of development approvals for works on rural floodplains that are built to harvest and store river flood flows and overland flows. These works typically involve a large storage (ring tank) which affects flood flow distribution and may cause damage to either the owner's property or his neighbours' properties during flood events. Hence the "water taking" impact and the "flood risk modifying" impact both need to be assessed. As noted for many years, the "works" aspect (whether a suitable site is available for a storage of required size, given designated flood flow paths and limit to afflux caused by the structure) should be considered and resolved before the allocation aspect is considered.

- *Flood Response Strategies* - develop response strategies (flood warning systems, evacuation plans, etc.) together with local counter disaster committee.

- *Drainage Masterplan* – development and plan for implementation of stormwater management strategy to deal with safety and convenience issues – needs to be linked/integrated with stormwater quality management under EPP water plan for implementation of flood mitigation capital works

4. Information

- *Flood Maps* identifying the full extent of the floodplain (ie at Probable Maximum Flood extent and the chosen design flood event or events) at sufficient detail so as members of the public can determine whether they are affected and thus need to seek more detail on the extent of the impact on them (ie there would be a two step process – large scale map and property level information)

- *Disclosure* provisions on property transactions (ie available flood information must be provided by the vendor)

- *State Database* on flood info across Qld - local agency data to be provided to State in suitable format.

- *Access to State Database* – include flood information on BLIN so as local governments and the public have access (albeit for a fee) and it is "discoverable" in a property search. (*Note: no discussions with lands people on this as yet*)

5. Guidelines

- NRM&E to be responsible for preparing and maintaining State Floodplain Management Guidelines – based on National guidelines

- Local governments to gain protection from legal action based on them following best practice as set out in the Guidelines (as per NSW)

6. NRM&E Co-ordinating Powers – *NOTE this was not canvassed in the discussion paper and could need additional Cabinet approval.*

- Power to instruct or take over responsibility for preparation of a Floodplain Management Plan where local agency is unwilling or unable to prepare a plan and the need for a plan is identified as "urgent". Process to allow NRM&E to levy Councils involved (if appropriate) giving NRM&E the option to outsource some or all the preparation of the plan. Triggers for identifying "urgent" need would involve:
  - substantial pressure for development on the floodplain
  - potential impacts of flood damage significant (eg infrastructure and property at high risk)
  - local agency response to the situation has been inadequate (eg no management plan in place, no suitable development controls or mitigation program in place);

  Department could then initiate a process to develop a plan. The process would include:
  - consultation with the relevant local governments and affected community;
  - advice to the Minister that a plan is required and the proposed method of delivery (eg who prepares, who pays, any cost recovery, who will administer, etc);
  - Minister approves preparation of the plan and its implementation;
  - local government(s) formally advised of Minister's decision;
  - plan prepared and administrative arrangements implemented.

7. Stormwater

- *Stormwater Master Drainage Plans* (major flow component at least) to be part of floodplain management plan/ flood mitigation infrastructure plan – refer above.

- Other stormwater issues such as defining "legal point of discharge" in legislation and improving on the use of common law nuisance to determine stormwater disputes could be looked at. (*NOTE these points were canvassed in the discussion paper, however feedback was poor. Will need additional consultation with local government practitioners to distil issues).*

8. Other Acts

The proposed policy will require recognition of any complementary provisions or amendments to the following Acts:

- Water Act – proposed home for policy provisions

- Local Government Act – gives local government power to make local laws controlling levee bank construction. There has been a lot of debate around the continuation of this power; with the introduction of IPA it was supposed to have been extinguished around 1998, however it continues in use in a number of local

government areas. Local levee bank laws are supposed to be superseded once an IPA town plan is prepared)

- Environment Protection Act, EPP Water – general environmental duty of care and water quality protection provisions, also requires stormwater quality management plans which will need to be integrated with Floodplain Management Plans/Master Drainage Plans

- Integrated Planning Act – local laws for development control, planning schemes (SPP 1/03), infrastructure planning and charging

- Disaster Management Act – disaster response arrangements, disaster mitigation planning

- Building Act – Standard building regulation – habitable floor levels

- River Improvement Trust Act – trusts will need to be subject to the FRMP. Trusts could opt to be local agency responsible for preparation of the floodplain management plan, works programs and collection of contributions, however implementation will require local government (development approval and planning schemes). RIT Act long-term future is under debate.

- Coastal Protection and Management Act – works in tidal areas

ATTACHMENT 1

Executive Summary

(of Consultation Report to Minister for Natural Resources, Mines and Energy)

State Flood Risk Management Policy Discussion Paper

In late October 2002, the Department of Natural Resources & Mines released a public Discussion Paper proposing a State Flood Risk Management Policy and recommending its implementation through legislation.

The Discussion Paper proposed the Policy deal with the core issues of:

- acquiring and maintaining comprehensive flood information;
- undertaking appropriate risk and vulnerability assessments; and
- informing all relevant parties in a way that can be easily understood.

The Discussion Paper considered that the major barriers to effective flood risk management in Queensland would be removed by the development and implementation of a State flood risk management policy that:

- provides a Statewide strategic direction for the management of flood risk which recognises and facilitates the key role of local governments;
- clarifies the existing roles and responsibilities of agencies and aligns those statutory, administrative and funding programs that impact on flood risk;
- supports local government by providing flood risk management guidelines which promote best practice in accordance with ecological sustainability;
- provides for monitoring of the implementation and ongoing costs of flood risk management by local government;
- clarifies the links between existing legislation and the responsibilities of local governments;
- defines the conditions under which local governments can satisfy any legal obligations in respect of advice given or actions carried out (eg done in good faith and in accordance with accepted best practice);
- ensures that existing government subsidies and other financial incentives encourage a reduction in Queensland's level of flood risk;
- maintains an overview of flood risk management across the State to ensure all flood information is captured, maintained and available – enabling the community, local government and the State to make sound decisions regarding flood risk which avoid potential loss of life and property and to make best use of funding and technical resources; and
- assists the insurance industry to provide flood insurance to property owners by ensuring that the flood risk has been clearly identified and systematically recorded.

Public Consultation Process

The release of the Discussion Paper and public presentations were advertised in the Courier Mail and all major regional news papers on 19 October 2002 (refer Appendix D)

The period for submissions on the Discussion Paper was officially open from 1 November 2002 until 28 February 2003. From 7 November to 5 December 2002, NR&M also conducted 12 public presentations on the Discussion Paper in conjunction with the Department of Emergency Services' workshops on SPP 1/03[1]. The total number of attendees at the presentations was 374. This comprised 364 representatives from 140 organisations and 10 members of the general public. The total number of written submissions was 35, 31 from organisations and 4 from members of the general public. A significant 10 were received (and accepted) after the closing date. The break-up of attendees and written submissions is shown in Table 1.0.

A dominant theme from attendees at the presentations was that the State (and Commonwealth) had largely left flood risk management to local government, and had provided very little guidance or tools to assist local governments achieve best practice.

The majority of the feedback, both written (27 out of 35 submissions or 77%) and at the public presentations, was supportive of the proposed policy. Two written submissions were neutral.

The main negative comments were:

- other existing mechanisms are sufficient (including the then draft SPP 1/03);
- the potential workload and cost burden on local government;
- more responsibility for flood risk management should be taken by the State and Commonwealth;
- potential difficulties in existing flood prone areas (i.e. adverse community reactions and unrealistic expectations, property prices, impacts on insurability); and
- practical difficulties in providing information to the community.

Most of the unfavourable feedback is considered either to be incorrect (i.e. the existing mechanisms cannot address all the issues), or to actually highlight the issues identified in the Discussion Paper and to reiterate the need for the policy.

Conclusions

Based on the responses to the Discussion Paper, this report concludes that:

- there is general support for proceeding to develop a State Flood Risk Management Policy with implemention through legislation; and
- the objections received to the proposal are minor (relating to issues like resourcing rather than a rejection of the aims, strategies and mechanisms of the policy).

This report further concludes that:

- As pointed out in the Discussion Paper, flood risk management has strong links with wider floodplain management issues and should be addressed in that context;

[1] SPP 1/03 is the recently adopted State Planning policy foer Mitigating the impacts offFlood Bushfire and Landslide prepared by the Departments of Emergency Services and Local Government and Planning (with significant assistance from NR&M for the flood and landslide aspects). It deals with limiting the growth in flood risk (i.e. future flood risk) through local government planning scheme and development assessment controls.

- In spite of the perceived advantages, it is not practical (and probably inappropriate) for all flood risk management issues to be consolidated and implemented through one State instrument;
- It is probably more practical to aim for a NSW-style approach where a State Policy Statement draws together and co-ordinates all aspects of flood risk management across various pieces of legislation. However this would still require some principal flood risk management legislation;
- As different issues vary in significance from one floodplain to another, individual floodplain management plans prepared by the relevant local agencies (eg local governments or possibly river improvement trusts) should be the principal mechanism for addressing all the issues relevant to a particular floodplain in an integrated manner;
- A State policy needs to ensure that floodplain management plans are prepared and that they adequately address all relevant issues. To achieve this, the policy should provide for the oversight by the State of floodplain management plans prepared by the relevant local agencies (eg local governments or possibly river improvement trusts);
- Because of its responsibilities for other catchment issues and because of its expertise in water resource management, NR&M is best placed to take responsibility for development of the policy and its implementation;
- Based on practice in other States, implementation should be through the preparation of a State Policy Statement and the addition of a new Part/Chapter to the Water Act 2000 (along the lines of NSW practice) with associated amendments to other Acts where required.

Content of Policy

The proposed State Flood Risk Management Policy seeks to, as far as possible, clarify existing responsibilities, rationalize existing provisions and their use, and introduce new measures, not currently dealt with such as:

- providing a co-ordinated approach to managing flood risk
- dealing with legal liability
- requiring floodplain (risk) management plans
- establishing a State information system
- making flood information readily available

The policy would aim to ensure co-ordination by establishing and maintaining clear links between existing provisions and additional measures that may be introduced.

Departmental Responsibility for Development of the Policy

NR&M has the relevant skills and responsibilities (for land and water management) to deal with flood risk management issues (across rural and urbanised floodplains). NR&M:

- has hydrologic and hydraulic engineering expertise (through NRSC);
- has responsibility for riverine management;
- is the custodian of important hydrological data through its network of gauging stations;
- arbitrates on floodplain disputes;

- undertakes project assessments of Regional Flood Mitigation Program applications; and
- is the State Government agency partnering Brisbane City Council and Institute of Public Works Engineers Australia (Qld) in the ownership of the Queensland Urban Drainage Manual.

Interstate practice is that the government agency with responsibility for water resources also has primary responsibility for floodplain risk management. Cases in point include:

- NSW - Department of Infrastructure, Planning and Natural Resources;
- Victoria - Department of Sustainability & Environment;
- Western Australia - Department of Environment (incorporating the previous Water & Rivers Commission);
- Tasmania - Department of Primary Industries, Water and Environment;
- South Australia - Department of Water, Land and Biodiversity Conservation (with technical assistance from the Department of Transport and Urban Planning); and
- Northern Territory - Department of Infrastructure Planning & Environment.

Recommendations

This report recommends the Minister approve:

- NR&M proceeding to develop a draft State Flood Risk Management Policy and draft amendments/additions to the *Water Act 2000* and other Acts (in consultation with relevant agencies) to support its implementation;
- preparation of the draft State Flood Risk Management Policy along the lines of the NSW Flood Prone Land Policy, bringing together existing measures and providing for the preparation of appropriate floodplain management plans for each floodplain in Queensland; and
- this report being the basis of a Cabinet Submission to inform Cabinet of the outcomes of the public consultation on the Discussion Paper and informing Cabinet that NR&M is proceeding with the preparation of a draft policy and legislative amendments necessary to support the policy.

(It has since been determined that no Cabinet Submission is necessary to proceed to a draft policy)

Timeframe

(These were the proposed timeframes at the time of the Consultation Report. Some of these steps are no longer proposed, hence the timeframes will now differ)

Following approval by the Minister, it is proposed that NR&M immediately prepare a Cabinet Submission informing Cabinet that NR&M is proceeding to develop a draft State Flood Risk Management Policy and seeking approval from Cabinet for NR&M to prepare draft legislation. The proposed timeframe being:

- Cabinet Submission on draft State policy statement (refer Section 9.4 for content) and the proposal for legislation for consideration by Cabinet by November2003,
- on approval by Cabinet, preparation of draft legislation by March 2004
- consultation on draft legislation from March to June 2004
- presentation of Bill to Parliament by October 2004

ATTACHMENT 2

BN to Minister for Natural Resources and Mines (& Energy) re Consultation Report

ATTACHMENT 3

State Flood Risk Management Policy
Report on Discussion Paper Public Consultation

MAIN POLICY OBJECTIVES

1.	Floodplain Management plans –	prepared by local government (already partway there with SPP1-03 and NDRMSP); guidelines by NRM&E
2.	Flood Liability –	State Government to define how a local government satisfies its responsibilities
3.	Public Availability of Flood Information–	State Govt. to require local government and state agencies to make flood information readily available
4.	State Information and Overview –	State Government to collate and make available flood data supplied by local government and monitor local government floodplain management plan development and implementation

HOW TO IMPLEMENT?

Existing "Arrangements"

Policy — NRM&E nominated lead agency for flood under State Disaster system.....means what?

Subsidy — Local governing bodies CWSS (State by DLGPS&R)
RFMP (State/Commonwealth by DLGPS&R)
NDRMSP and NDMP (State/Commonwealth by DES)
NRM&E's role covered by admin arrangements and MoU with DLGPS&R and DES

Legislation: IPA – Planning Schemes – SPP1/03 – future risk and new development control; levee banks?
Local Govt Act/Local Govt Finance Std – Good Government and mitigation generally, levee banks?
Water Act – works that affect flow, declared areas?, "riverine zone"
EPA – water quality protection
Coastal Management Act – works in Coastal Zone, Coastal Hazards

New "Arrangements"

Policy — NRM&E lead agency status needs further development/explanation and recognised enunciation

Subsidy — no change to responsibilities, but NRM&E's role in technical administration affirmed

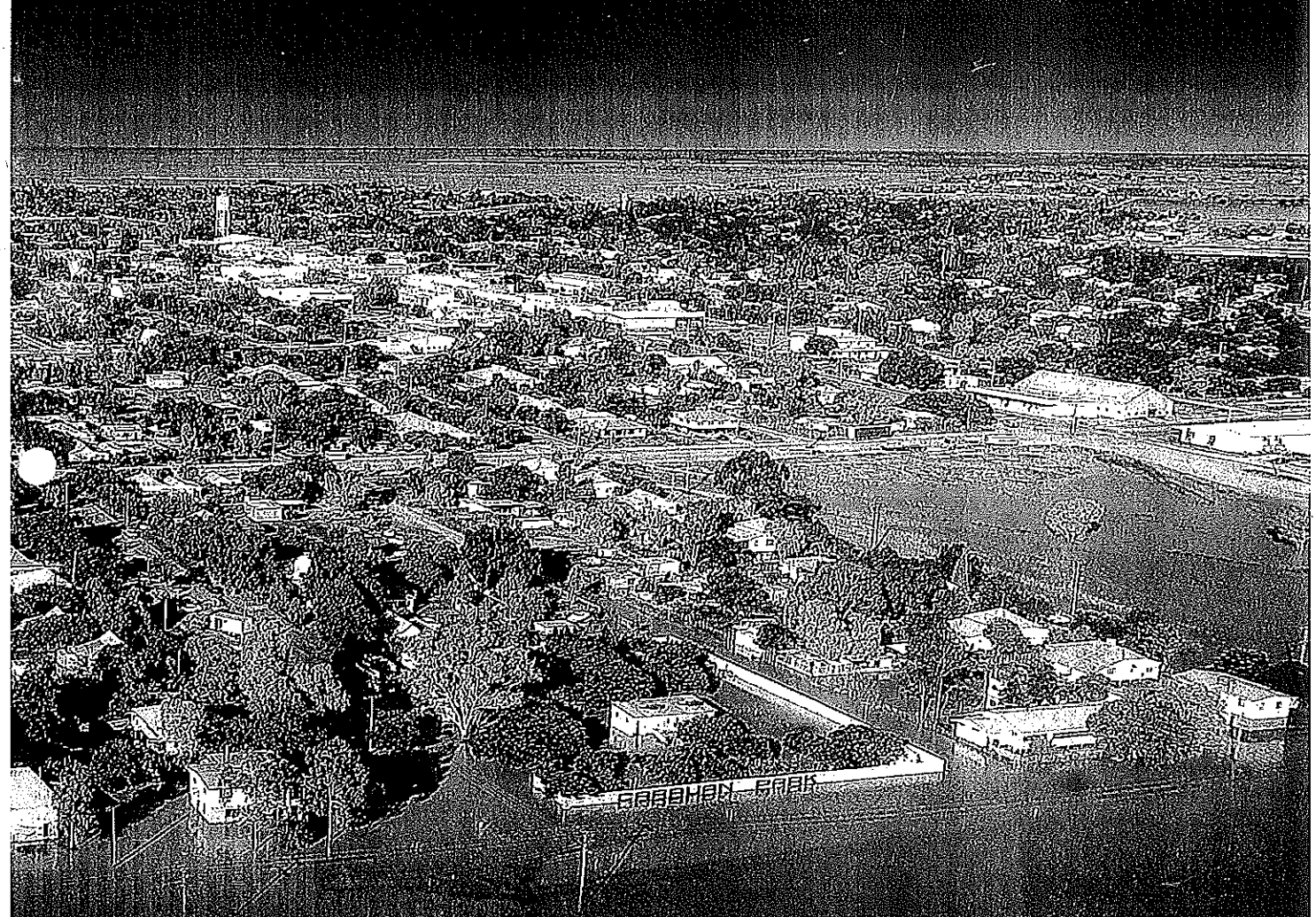
Legislation: New part of Water Act
New stand alone Act – too small
"other Act" – need to negotiate with relevant agency responsible

POLICY MEASURES (Clause Nos refer to consultation Report)	RESPONSIBLE AGENCY/LEGISLATION OPTIONS			
	DLGPS&R/IP Act	DES/SDM Act	NRM&E / Water Act	EPA / EP Act
9.3.1 Coordinated approach to managing flood risk				
Define agency roles and responsibility	X	X	X	
9.3.2 Dealing with legal liability				
Liability for Information	X	X	X	
Liability for Works			X	
9.3.3 Requiring Floodplain Management Plans				
Requiring FPM Plans	X	X*	X	
State overview of FPM Plans			X	
Incorporating Stormwater Issues	X		X	
Power for State to prepare FPM Plan			X	
Prepare and Maintain FPM Plan Guidelines			X	
9.3.4 Establishing a State flood information system				
State Flood Information Database			X	
9.3.5 Making flood information readily available				
State flood information available			X	
Requiring local government to make flood information readily available	X		X	

* State Disaster Management Act requires "Mitigation Plans", relying on these for floodplain management plans may be possible but is not considered ideal as it represents further fragmentation of "flood" responsibilities rather that consolidation.

State Flood Risk Management Policy

Discussion Paper



Queensland Government
Natural Resources and Mines

State Flood Risk Management Policy

Discussion Paper

Not Government Policy

Prepared by the Department of Natural Resources and Mines

Queensland Government
Natural Resources and Mines

QNRM02268

Copies of this publication are available from:

NR&M Information Centre
Phone: +61 7 3237 1435
Email: Sales@nrm.qld.gov.au
Web site: <www.nrm.qld.gov.au>

#15738

Contents

Summary

Purpose

The purpose of this discussion paper is to facilitate consultation with interested stakeholders, and the public generally, on the development of a state flood risk management policy.

The Department of Emergency Services, in consultation with the Department of Local Government and Planning, is currently developing a state planning policy (SPP) for natural disaster mitigation, including flood mitigation. Consultation on the draft SPP is proposed by the end of 2002 and, if feedback is positive, the SPP will be finalised early in 2003. By expressing the state's interest in natural disaster mitigation, the SPP will give local government direction and a basis for the incorporation of natural hazard risk assessment in local planning schemes and development assessment conditions. It will address the potential growth in flood risk *(future flood risk)* as it relates to the management of new development.

Each year, however, flooding significantly affects *existing* development in Queensland. Other issues associated with managing flood risk that fall outside the control of planning schemes and development assessment include:

- liability arising from taking certain actions (including providing information and works),
- statewide oversight of flood risk and flood risk management practice
- coordination across local government boundaries.

Hence, while this paper identifies the full range of flooding issues and how they might be addressed, the thrust of the paper is to deal with those that are not seen as within the scope of local planning schemes or development assessment and, therefore, not subject to the proposed state planning policy for natural disaster mitigation.

In particular, the paper highlights the advantages of a comprehensive state flood risk management policy implemented through legislation. Legislation can formally set out rights and responsibilities of government (state and local), and provide for the integrated management of issues.

Floodplains

Floodplains are natural resources of immense value. They are the sites of most of our towns and cities, and support many of our most productive rural industries. They are also areas of primary environmental significance, and their wellbeing is essential to the survival of many ecosystems. Their development and use should be managed in an ecologically, economically and socially sustainable fashion.

The focus of this paper is floodplains where the potential damage and losses from flooding are, or are likely to be, unacceptable; however, it is recognised that flood risk needs to be managed with the context of wider floodplain values and issues.

Flooding in Queensland

With an estimated 100 000 properties currently at risk from a 1-in-100-year average recurrence interval flood, Queensland has the highest exposure to damages from floods nationally.

The majority of the State's National Disaster Relief expenditure results from response and recovery costs associated with floods—averaging $50 million per year from 1989 to 2001.

A high proportion of Queensland's urban and rural development is located on floodplains. A considerable number of residential, commercial and industrial areas were developed prior to the regulation of development in flood-prone locations by floodplain management policies.

Floodplain management standards adopted by local governments have varied considerably.

Floods are probably the most predictable of natural hazards in terms of the areas they are likely to affect and the best understood in terms of the methods available to estimate their size, likelihood and characteristics. This means that good planning and appropriate development controls by local government can be effective in avoiding the creation of *future* flood risks; however, *existing* at risk communities also need to be considered.

Knowledge of flood risk

Significant findings from the report *Urban Flooding in Queensland—A Review* (Smith 1998, pp. xii–xiii) were that:

- Reliable estimates of the number of localities and the number of buildings subject to urban flooding in Queensland are severely hampered by the paucity of information on flood hydrology and the floor levels of dwellings.
- It is best estimated[1] that the number of buildings (residential, commercial and industrial) at risk from the 1-in-100-year is 65,000.
- Notwithstanding the quality of the background data, Queensland has the highest average annual urban flood damage of any State in Australia..
- Compared with other Australian States, Queensland is unusual in that there is no clear or comprehensive Statewide policy to guide urban floodplain management.
- The tangible annual average urban damage (to private property) in Queensland, to the level of the 1-in-100-year flood event, is thought to be about $100 million. The paucity of information on flood hydrology and vulnerability is such that this estimate should be regarded as tentative; the database for commercial and industrial losses is especially poor.
- Twenty-five councils reported that they have urban areas at risk from storm surge (storm tide) with some 40–50,000 buildings in the State at risk from a 1-in-100-year storm surge event.[2]

Current arrangements

Queensland local governments are key players in flood risk management through their roles as major service providers to communities and their responsibilities for managing development.

Where they exist, river improvement trusts also have an important role in managing flood risk, as they can implement works that manage rivers and the flood hazard they may pose.

---

[1] With later information obtained through the Regional Flood Mitigation Program and updated information now available from the Brisbane area, it is estimated that this figure is closer to 100 000.

[2] The number of buildings affected by a particular surge event would be considerably smaller.

Available legislation to deal with flood risk management is fragmented and covers a diverse range of issues—from planning and corporate responsibility, to emergency response. The principal Acts are:

- *Integrated Planning Act 1997* (Qld)
- *Local Government Act 1993* (Qld)
- *State Counter Disaster Organisation Act 1975* (Qld)

Other Acts have relevance for specific controls, such as works in or on a watercourse for the mitigation of floods; habitable floor levels for development; works in tidal waters; and development on coastal floodplains. These include the:

- *Building Act 1975* (Qld)
- *River Improvement Trust Act 1940* (Qld)
- *Water Act 2000* (Qld)
- *Environmental Protection Act 1994* (Qld)
- *Beach Protection Act 1968* (Qld)
- *Canals Act 1958* (Qld)
- *Harbours Act 1955* (Qld), s. 86
- *Coastal Protection and Management Act 1995* (Qld)[3]

In terms of flood risk management, the above Acts have greatest applicability to new development and, therefore, can assist in minimising *future* flood risks; however, they do not deal with *existing* risk. More importantly, there is no integrated strategic approach to mitigating the three types of flood risk.

To date, state guidance to local governments in floodplain management has been limited to conditions associated with subsidy schemes for flood mitigation works and *ad hoc* advice to local governments undertaking floodplain management planning exercises. Currently, there is no overall state policy or guidelines for local governments on how best to manage floodplains to reduce flood risks[4]. The Standing Committee on Agriculture and Resource Management (SCARM) published a national floodplain management guideline document in January 2000 and, although it does not address all the issues relevant to flood risk management within the Queensland administrative system, it is nonetheless an applicable reference.

---

[3] Note: Recent amendments made to the Coastal Protection and Management Act as part of the *Coastal Protection and Management and Other Legislation Amendment Act 2001* provide for the integration of development assessment and permitting functions from the *Harbours Act 1955*, the *Beach Protection Act 1968* and the *Canals Act 1958* into the Coastal Act.

[4] The proposed state planning policy for natural disaster mitigation will redress this situation with respect to local government planning schemes and new development approval.

Issues with the current arrangements

The need for improvements in the current arrangements have been identified in the areas of:

- governance
- cooperation and coordination
- local government
- policy and legislation
- financial systems
- information
- insurance.

Above all, a major obstacle to improvements in dealing with flood risk is the lack of complete and reliable information on the extent and frequency of flooding for Queensland communities generally. Until there is a comprehensive understanding of the nature and extent of the flood risk in Queensland, its management will remain problematic.

Queensland Government's priorities

Of the Queensland Government's five priorities, three are particularly relevant to flood risk management. They are:

- *Safer and more supportive communities*
  - minimising the risk and impact of emergencies and flooding disasters.
- *Valuing the environment*
  - promoting sustainable development through responsible use of the state's natural capital and primary resources
  - encouraging Queensland businesses to consider the social, economic and environmental impact of their decisions.
- *Building Queensland's regions*
  - ensuring that development in regional Queensland is not subject to unacceptable flood risks.

The *Queensland Greenhouse Policy Framework* (Sept. 2001) also recognises the potentially adverse impacts of climate change on the exposure of many communities to flood risks as a result of potential sea level rises and changes to rainfall intensities.

Flood risk management policy principles and objectives

In formulating a flood risk management policy, it is important to recognise that:

- floodplains are valuable natural resources which cannot be isolated arbitrarily from all development
- floodplains have a major impact on the health of the associated waterways, are important links in the life-cycle chain of many species, and frequently include areas of significant ecological importance

- all development proposals on the floodplain should be treated on their merits in relation to the flood risk, their environmental impacts, and the benefits such development could provide
- state government and local government responsibilities must be clearly defined.

The objective of a flood risk management policy should be to ensure sustained actions are taken to minimise long-term risk to life and property so that fewer Queenslanders will be victims of floods in future. The following key principles should guide strategies aimed at achieving this objective:

- Manage risks to public health and safety consistent with ecologically sustainable development (ESD) principles.
- Develop a full appreciation of all the risks and benefits associated with any proposed floodplain use.
- Enable individuals to make informed decisions.
- Adopt a partnership approach between all levels of government and the community (recognising that the costs of flood disasters affect all Australians).
- Aim for proactive prevention rather than reactive response.
- The costs associated with flood risk should be identified and funded transparently.

An effective flood risk management policy requires:

- a cohesive framework of measures
- effective implementation mechanisms.

Possible measures for improving flood risk management

In formulating a flood risk management policy, consideration should be given to the following measures:

- consistency, cooperation and coordination
- promotion of best practice
- administrative systems
- legislation
- planning and development requirements
- integrated river planning
- flood records and mapping
- community awareness
- liability issues.

Options for implementation

Implementation options that have been identified fall into two groups and are:

Legislative

a) establishment of 'all hazards' prevention legislation

b) establishment of specific 'flood risk management' legislation

c) amendment of existing legislation (e.g. river management, water or planning).

Planning policy

d) preparation of a state planning policy that addresses flood risk management under the IPA

e) promotion of flood risk management issues through regional planning undertaken by regional planning advisory committees.

The proposed state planning policy for natural disaster mitigation will implement planning policy option (d) by providing for planning scheme and development control measures that limit the growth in exposure to natural hazards (including floods) as a result of new development. Therefore, planning policy option (e) has value only where coordination across local governments that share a common floodplain is required.

This leaves the three legislative options—(a), (b) and (c)—for the implementation of the remaining suggested measures. A specific aim of the option adopted should be to bring as many flood risk management issues together as possible and to clearly define responsibilities. Mechanisms that rely on multiple instruments to manage flood risk management and/or the interpretation by agencies of their responsibilities, run the risk of achieving only a marginal improvement on the current situation with respect to long-term policy consistency and coordination.

The chosen option must deal with the pivotal issue of making reliable flood information available so that:

- the community can make informed decisions when purchasing property or when responding to flood disasters
- local governments can prepare planning schemes, development approval conditions and capital works programs that take full account of flood risk
- the state can maintain an overview of the nature and extent of the flood risk in Queensland to:
  - inform policy decisions
  - facilitate the targeting of any assistance.

The widespread availability of flood information has significant implications both for state and local governments. These are likely to arise principally as a result of:

- the potential adverse reactions from owners of land identified as flood prone; and
- past decisions that may have been made without a proper consideration of the available data and the impact on the level of flood risk.

State planning policy for natural disaster mitigation

As mentioned above, the proposed state planning policy for natural disaster mitigation implements option (d) in this paper (i.e. a state planning policy for flood risk management). Implementation of the SPP will fulfil the local government planning scheme and development assessment aspects of a comprehensive flood risk management policy (i.e. deal with *future* flood risk). However, the SPP will go only part of the way towards offering a holistic approach to flood risk management. The remaining measures identified in this paper will require implementation by different means.

Other related initiatives

Under the auspices of the State Disaster Mitigation Committee, other current government initiatives aimed at reducing the risks associated with natural hazards (including floods) are:

- modifications to the conditions for state subsidy of local government infrastructure requiring evidence that natural disasters, and mitigation of their impacts, were considered appropriately by the local government in planning and designing the works
- a national review of the natural disaster relief and mitigation arrangements by the Council of Australian Governments (COAG) to assess their scope and relevance
- an amendment to the Local Government Finance Standard requiring the inclusion of disaster mitigation as a local and regional issue that needs to be assessed as part of formulating the objectives of a local government's corporate plan
- studies and investigations into natural hazards and the economic cost of disasters.

Conclusions

A comprehensive state flood risk management policy must make complete and reliable flood information available; mitigate *existing*, *future* and *residual* flood risks; reduce the costly impacts of flooding; clarify responsibilities; and result in the best use of resources.

If the need for such a policy is accepted, and as a state planning policy covering *future* flood risks is already being developed, the legislative options are the only ones to consider for implementing the remaining measures identified in this paper.

Legislation can address a the wide range of flood issues—such as formally set out rights and responsibilities of government (state and local); provide for integrated management; ensure flood information is available; and address liability issues and *existing* risk.

In order that all the measures under a state flood risk management policy remain consistent in the longer term and are well understood and easily referenced, they should be consolidated in one place. Hence, the recommended legislative options are either option (b)—*New flood risk management specific legislation*, or option (c)—*Addition of flood risk management provisions to **one** existing Act*

Consultation on the state planning policy for natural disaster mitigation is proposed by the end of 2002 and, assuming feedback is positive, the SPP will be finalised early in 2003. The preferred option presented in this paper—flood risk management legislation —will take longer to implement. Therefore, the state planning policy for natural disaster mitigation will provide a lead in indicating that the state is seeking the improved management of risks associated with natural hazards (including floods) and support

local government planning schemes and development assessment controls which avoid the creation of further exposure to risks from natural hazards.

If the flood risk management legislation option proposed in this paper is supported, the state planning policy for natural disaster mitigation would continue to deal with planning scheme and new development aspects of flood mitigation as an adjunct to the legislation.

The next step

This discussion paper is not government policy. Rather it has been prepared primarily as a resource document for key stakeholders to respond to during the public consultation process. It is intended to assist in identifying the interests of the various stakeholders and facilitate the drafting of a state flood risk management policy.

	State Flood Risk Management Policy	**Timing**
Public comment period	Period during which: ❑ stakeholders can comment on the subject matter and scope of the proposed policy—comments are to be received as written submissions, either in hard copy or electronically. ❑ availability of the discussion papers will be advertised in in the *Courier Mail* and major regional papers ❑ a series of direct consultations will be undertaken with identified stakeholder organisations (and other interested parties, if requested) to promote responses to this discussion paper.	Dates between which public comments will be called are to be determined by the Minister for Natural Resources and Mines
Decision to proceed	❑ Minister for Natural Resources and Mines will decide whether to proceed with preparation of a state floodplain management policy.	To be determined by Cabinet based on the recommendation of the Minister for Natural Resources and Mines—following review of public comments received
Draft policy document	❑ Draft state flood risk management policy document will be prepared.	Date to be determined by the Minister for Natural Resources and Mines

If, based on the recommendations of the Minister for Natural Resources and Mines, Cabinet decides to proceed to prepare a state flood risk management policy, a draft will be available for public consultation in line with legislative requirements.

Your comments

The Department of Natural Resources and Mines welcomes comments on the development of a State Flood Risk Management Policy over the consultation period. Your comments, either as an individual or through an association not already identified as having an interest in flood risk management, are encouraged. Written submissions within the advertised timeframe and can be posted, faxed, or emailed to the Department of Natural Resources and Mines (see contact details below and a proforma for responses in Attachment 4 to this paper).

During the public consultation period, the Department intends to consult with the identified stakeholder organisations listed in Attachment 3. Stakeholder groups not already identified are welcome to seek a meeting with Departmental representatives within the advertised consultation period.

Comments or enquiries may be referred to Departmental officers involved in the development of the State Flood Risk Management Policy, however formal submissions should be in writing.

Written submissions are due by 28 February 2003 and should be addressed to:

Principal Policy Officer, Water Use
Water Management and Use
Department of Natural Resources and Mines
GPO Box 2454
BRISBANE Qld 4001
Email: [redacted]
Facsimile:
Telephone:

1. Purpose

The purpose of this discussion paper is to facilitate consultation with interested stakeholders, and the public generally, on the development of a state flood risk management policy.

The paper outlines the current impediments to the improved management of flood risk in the state, and presents a number of options the Queensland Government may consider to address the challenges.

This paper recognises that flood risk management involves four principal component activities—prevention, preparedness, response, and recovery from flood events. The paper also recognises that flood risk management sits within a context of broader floodplain planning and management issues including land, vegetation and water resource management; environmental protection; and social and economic development. Consequently, it involves many stakeholders with a broad range of interests.

The Department of Emergency Services is currently in the process of preparing a state planning policy for natural disaster mitigation that will address planning scheme and new development assessment aspects of natural hazards, including floods.

2. Floodplains

Floodplain Management in Australia Best—Practice Principles and Guidelines produced by the Standing Committee on Agriculture and Resource Management (CSIRO Publishing 2000) describes Australia's floodplains as:

> ... the commercial, social and ecological arteries of the nation. As such they constitute a national asset ... Most of Australia's towns and cities are located on floodplains ... A significant proportion of Australia's intensive and extensive agricultural output is produced on floodplains including irrigated agriculture. Regular flooding of these areas enhances agriculture by increasing soil moisture, recharging ground water levels and depositing fertile soil ... Many mining operations and transport-related infrastructure are partly or completely located on floodplains ... while ... the interdependence of the health of the river and the floodplain and the role of periodic floods in maintaining this connection has been increasingly recognised.

The report also recognises that:

> ... management decisions taken in respect of human occupation of floodplains need to satisfy the social and economic needs of the community as well as being compatible with the maintenance or enhancement of the natural ecosystems that the floodplain sustains.

Flooding may confer both benefits and costs on a community. Whether flooding represents a benefit or a cost is dependent on the interaction between the use and management of the land and the physical characteristics of flooding (i.e. volume of flood water, sediment load, depth and duration of inundation, rate of rise, and velocity) as they apply to each location. In rural areas, flooding is recognised as having beneficial effects through enriching agricultural lands or enabling the development of higher value uses (e.g. cotton production on western grazing lands). However, in many instances, flooding results in substantial losses to both the public and private sectors.

Floodplains also have important environmental values, both as part of the riverine ecosystem and for their function in protecting biodiversity. Understanding these values and their relationship with development of the floodplain are fundamental considerations in an integrated process of decision making. This is particularly important where wider management decisions impact on flooding characteristics.

Flood risk management is one component of managing floodplains. Other issues include water resource management—sharing flows between consumptive uses and the environment; preservation of riparian vegetation; protection of floodplain lands from degradation; etc.

However, flood risk is a major issue on most of Queensland's floodplains and a dominant issue on many. It affects urban and non-urban developments and its management is critical to the sustainability of communities. Further, in most cases, the tools necessary to manage flood risk are important for the management of other floodplain issues.

The focus of this paper is floodplains where the potential damage and losses from flooding are, or are likely to be, unacceptable. However, while this paper's emphasis is the development of a state policy to facilitate better management of floodplains for the reduction of risks to life and property, the policy will need to address these issues against a background of contemporary natural resource management.

In formulating a state policy to deal with the management of flood risk, it is important to recognise that:

- floodplains are valuable natural resources which cannot be arbitrarily isolated from all development
- floodplains have a major impact on the health of the associated waterways, are important links in the life cycle chain of many species, and frequently include areas of significant ecological importance
- all development proposals on the floodplain should be treated on their merits in relation to the flood risk, their environmental impacts, and the benefits such development can provide
- state and local government responsibilities must be clearly defined.

Floodplains are natural resources of immense value. Their development and use should be managed in an ecologically, economically and socially sustainable fashion.

2.1 The three flood risks

Current floodplain management practice recognises three distinct types of flood risks:

Existing—the risk to buildings and developments on flood-prone land that are exposed to an 'existing' flood risk by virtue of their presence and location.

Future—the risk to buildings and developments that will be built on flood-prone land and, therefore, will be exposed to a 'future' flood risk (i.e. a risk that does not materialise until the developments occur).

Residual—the risk that remains after management measures are in place (e.g. from floods that exceed the adopted design level for mitigation works, or for those areas outside protective works). Unless a flood risk mitigation measure is designed to withstand the probable maximum flood, it will be exceeded by a sufficiently large flood at some time in the future.

3. Flooding in Queensland

Each year floods in Queensland adversely affect the state's economy and the social wellbeing of the community. Floods can cause loss of life and substantial disruption as a result of damage to property, the environment and infrastructure. The cost of flood damage under the Natural Disaster Relief Arrangements (NDRA) averaged over $50 million per year in Queensland between 1989 and 2001, while expenditure in 2000–01 was in excess of $100 million.[5] Due to the primary and secondary effects of floods, serious impacts are also experienced by industries such as tourism, mining and agriculture.

In 1998, the Commonwealth Government released new guidelines for the Natural Disaster Relief Arrangements (NDRA) that link its funding assistance with evidence of disaster mitigation. The extent to which local governments and the state practise disaster mitigation will directly affect the NDRA costs borne by the state and by Queenslanders.

As a consequence of inadequate drainage, many Queensland communities are vulnerable to river flood, coastal surge, combinations of river flood and surge, and flooding. These areas are referred to in this paper as 'flood risk' areas. In February 1998, the Department of Natural Resources and Mines published a report entitled *Urban Flooding in Queensland—A Review* that presented the results of a flood impact and management questionnaire put to local governments. Information was sought on the range of floods studied; the adopted designated flood event for planning and development control; and the current level of exposure of communities to flood risk.

Typically, information was available for 1-in-100 year floods, which implies very infrequent events. (The risk is actually a 1% annual probability that a flood identical same or larger in size will occur.) However, it should be noted that over a 70-year period the probability of at least one flood of this magnitude (or larger) occurring is 50%. The following table has been reproduced from *Floodplain Management in Australia—Best Practice Principles and Guidelines* to give an indication of the likelihood that a particular event will occur in an individual's lifetime.

[5] See the NDRA Statements of Expenditure collated by Treasury Department each financial year.

Table 1: Probability of experiencing a flood of a given size one or more times in a lifetime (70 years)

Likelihood of occurrence in any year (%)		Probability of occurrence in a 70-year period (%)	
		At least once	At least twice
10%	(1 in 10)	99.9	99.3
5%	(1 in 20)	97.0	86.4
2%	(1 in 50)	75.3	40.8
1%	(1 in 100)	50.3	15.6
0.5%	(1 in 200)	29.5	4.9

3.1 Riverine flooding

In terms of the areas they are likely to affect, floods are the most predictable of all natural disasters. They are also, perhaps, the best understood in terms of the methods available to estimate their size, likelihood and characteristics. This means that good planning and appropriate development controls by local government can be effective in avoiding the creation of a future flood risk; however, existing *at risk* communities also need to be considered.

Many communities are located on floodplains adjacent to waterways. A considerable number of residential, commercial and industrial areas were developed prior to the introduction of any floodplain management policies to regulate such development. In addition, floodplain management standards employed by local governments have varied considerably.

The nature of the flood risk can differ markedly between rivers and creeks because flood-warning times (i.e. the interval between rain falling and subsequent flooding) can vary substantially. Flash floods are common, as are floods that develop several days after a rainfall event. In addition, depending on catchment and floodplain characteristics, the nature and size of the flood risk can vary considerably with the frequency of events.

3.2 Surge-prone areas

To a varying extent, most of the Queensland coastline is at risk from storm surge inundation (storm tides) associated with tropical cyclones. This would normally be a relatively localised occurrence impacting on 10 kilometres or so of the coastline adjacent to the point where the eye of the cyclone crosses the coast. The risk to people and property from storm surge flooding is greatest in low-lying coastal communities.

The effects of surge on buildings and services will usually be more severe than that from river flooding because of the power of wave impacts on structures. Lightweight domestic or commercial structures are likely to fail completely if the depth of surge is more than one metre above floor level. At lesser depths, severe damage can still be expected. The salinity of seawater also causes significant damage.

3.3 Combined surge and river flooding

Many coastal settlements in Queensland were originally sited on river estuaries and subsequent growth has led to further development in low-lying coastal locations. Such communities may be vulnerable to both surge and river floods. Potentially, if hit by a cyclone, these communities are vulnerable to a surge followed by river flooding resulting from intense rainfall in the upstream river catchment.

For example, in 1918 much of the Mackay settlement was destroyed by a surge event followed by a record flood 12–24 hours later. From the contemporary accounts of the disaster, it is difficult to distinguish which buildings were destroyed by wind, surge or river flood.

3.4 Drainage problem areas

Many residential areas not subject to river, creek or surge flooding nevertheless experience overland flows to depths that cause considerable hardship by inundating property and interfering with access. These problem areas are usually in drainage paths that have insufficient capacity to deal with local runoff. Sometimes this problem can be exacerbated by allotment filling without consideration of the reduction in availability of overland flow paths and loss of temporary flood storage.

In some cases, developed areas also experience changes in exposure to flood risk as a result of the impacts of new developments in upstream areas of a catchment that increase runoff volumes and rates.

In other cases, recent flood events or changes in planning criteria—for example, increases in design rainfall intensities or changes in policy frameworks, such as drainage design policies—have changed either the understanding or the perception of the flood risk.

Localised flood risks can also be increased due to afflux caused by adjacent or downstream developments, or as a result of the backwater effects of under sized or poorly maintained drainage infrastructure.

4. Knowledge of flood risk

Many of the conclusions in the report *Urban Flooding in Queensland—A Review* relate to the 1-in-100-year flood event, as this has been the generally accepted industry standard for the designated flood level (i.e. the flood event used for planning and development control). The report's conclusions are:

(i) *Reliable estimates of the number of localities and the number of buildings subject to urban flooding in Queensland are severely hampered by the paucity of information on flood hydrology and the floor levels of dwellings.*

(ii) *It is best estimated that the number of buildings (residential, commercial and industrial) at risk from the 1-in-100-year is 65 000.*

(Note: From later information obtained through the Regional Flood Mitigation Program and updated information subsequently available from the Brisbane area, it is estimated that this figure is closer to 100 000.*)*

(iii) *The majority of councils in Queensland have little information available on the risks associated with extreme floods, i.e. those in excess of the 1-in-100-year flood event. Only eight councils had such information available in map form.*

(iv) *The tangible annual average urban damage (to private property) in Queensland, to the level of the 1-in-100-year flood event, is thought to be about $100 million. The paucity of information on flood hydrology and vulnerability is such that this estimate should be regarded as tentative; the database for commercial and industrial losses is especially poor.*

(Note: NDRA costs, damages to utilities and flow-on financial losses are not included in the above estimate and are likely to be more than the $100 million per year. For example, flood disasters in the 1999–2000 financial year resulted in $146 million in damages claimable from NDRA with carry-over commitments of $93 million in 2000–01 and $18 million in 2001–02.)

(v) *Notwithstanding the quality of the background data, Queensland has the highest average annual urban flood damage of any State in Australia.*

(vi) *Continued development in flood-prone areas is of special concern, this leads to an ever-increasing escalation in vulnerability and flood damage.*

(vii) *The warning time that can be provided for some 70% of urban floodplain locations within Queensland is less than 12 hours.*

(viii) *Compared with other Australian States, Queensland is unusual in that there is no clear or comprehensive Statewide policy to guide urban floodplain management.*

(ix) *Only thirty-five councils (out of 103 respondents) have a policy for urban floodplain management and, in many cases, these policies do not meet national or international best practice.* (Note: Queensland has 125 local governments).

(x) *Twenty-five councils reported that they have urban areas at risk from storm surge (storm tide).*

(Note: Around the time of the NR&M survey, the Department of Emergency Services canvassed coastal local governments about their storm surge risk. Forty local governments reported 117 communities exposed to storm surge risk).

(xi) *Overall, information available on liability for damage from storm surge, and the potential for catastrophic losses (including widespread building failure) are less well developed than those for riverine flooding. An estimate is that a total of some 40–50,000 buildings in the State are at risk from a 1-in-100-year storm surge event* (although the number of buildings affected by a particular surge event would be considerably smaller).

(xii) *Urban inundation from storm surge is essentially a Queensland problem; the risk likely exceeds that of all other Australian States.*

No estimates are available for the number of properties at risk of flooding in drainage problem areas, although drainage problems in flat, low-lying coastal areas are known to be significant.

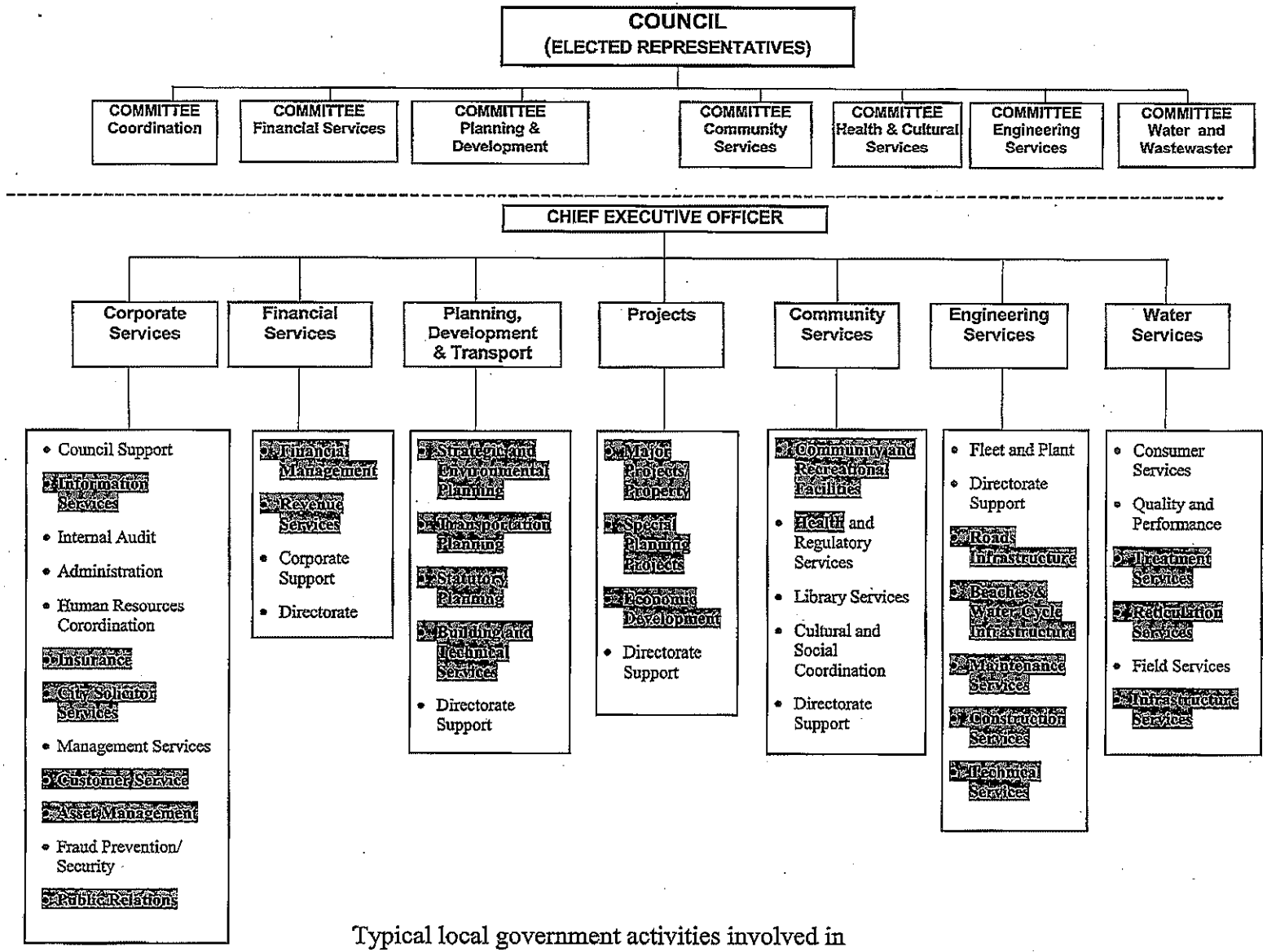
5. Current arrangements

In Queensland, local governments have the prime responsibility for managing flood risk—essentially as major service providers to communities, and through their future land use planning and development control functions.

Potentially, many state and local government activities have a role or influence on flood risk. Figure 1 shows an example of the range of responsibilities across a local government that may have an impact on flood risk management and highlights the importance of coordinating actions to ensure flood risk management objectives are achieved.

Where they exist, river improvement trusts also have an important role in managing flood risk as they can implement works that manage rivers and the flood hazard they may pose.

Figure 1 A Potential Council Structure and the Distribution of Responsibilities that Affect Flood Risk Management



5.1 Legislation

There is no legislation that clearly defines the state's policy on flood risk management or directly deals with the actions necessary to reduce or eliminate long-term risks to people and property from flooding. There are also no state-based guidelines or model policies currently in place[6] to assist local governments in formulating flood risk management plans and development controls for their areas.

Legislation that is available to deal with flood risk management is fragmented and covers a diverse range of issues—from planning and corporate responsibility to emergency response. The principal Acts available to facilitate flood risk management are:

- *Integrated Planning Act 1997* (Qld)
- *Local Government Act 1993* (Qld)
- *State Counter Disaster Organisation Act 1975* (Qld).

Other Acts have relevance for specific actions such as works in or on a watercourse for the mitigation of floods, habitable floor levels for development, works in tidal waters and development on coastal floodplains. These include the:

- *Building Act 1975* (Qld)
- *River Improvement Trust Act 1940* (Qld)
- *Water Act 2000* (Qld)
- *Environmental Protection Act 1994* (Qld)
- *Beach Protection Act 1968* (Qld)
- *Canals Act 1958* (Qld)
- *Harbours Act 1955* (Qld), s. 86
- *Coastal Protection and Management Act 1995 (Qld).*[7]

The ***Integrated Planning Act 1997*** (IPA) is the principal statute that a local government can use to support the sound management of floodplains. Under this Act, the development of floodplains can be managed through the control of land use in a planning scheme, and regulation of development through the integrated development assessment system (IDAS) and related codes.

In addition, regional planning processes can be established for the coordination of planning at a regional level. The regional planning process requires the formation of a regional planning advisory committee (RPAC), which is given statutory recognition under the Act to make recommendations on the regional dimensions of

---

[6] The proposed state planning policy for natural disaster mitigation will include guidelines for the consideration of flood risk mitigation measures in local planning schemes and the assessment of new development.

[7] See Section 5.1 with regard to recent amendments made to the *Coastal Protection and Management Act 1995* as part of the *Coastal Protection and Management and Other Legislation Amendment Act 2001* that provide for the integration of development assessment and permitting functions from the *Harbours Act 1955*, the *Beach Protection Act 1968* and the *Canals Act 1958* into the *Coastal Protection and Management Act 1995*.

planning matters. This recognition means that local governments are required to deal with any regional dimensions of matters in their planning schemes.

Regional plans may address floodplain management matters, particularly those that transcend local government boundaries. Regional plans may coordinate and integrate floodplain management at the regional level and advise local governments in the preparation of their planning schemes and capital expenditure plans for infrastructure, natural resource and environmental protection strategies, community education programs, etc. A discussion of the advantages and disadvantages of regional planning is in section 9.2.2.

In addition to regional plans under the IPA, the state may prepare a SPP about any matter. SPPs are considered by a RPAC during regional planning processes and must be considered by a local government in the preparation of a planning scheme and during development assessment (see discussion at section 9.2). Local governments may also prepare a local planning scheme policy to manage development on floodplains.

The IPA also provides mechanisms for local government to indicate where new development can be serviced efficiently and to recover the costs of infrastructure providing the service in an equitable way. The costs are determined based on infrastructure planning, which must take into account growth assumptions, appropriate planning horizons and desired standards of service to identify the works involved (existing or augmentation) and those deriving a benefit.

Prior to the enactment of IPA, a local law could be established under the ***Local Government Act 1993*** to assist in managing levee bank style development on floodplains. This provision has been used by a number of local governments, particularly those with rural floodplains supporting irrigated agriculture. The Department of Local Government and Planning (DLGP) advises local governments preparing new planning schemes under the IPA to review such local laws as contain development provisions and carry them forward to their IPA planning scheme.

The ***Building Act 1975*** and **Standard Building Regulation 1993** control standards to which building works are carried out. Decisions made with regard to matters dealt with under the Standard Building Regulation, such as minimum habitable floor levels, are more appropriately addressed under the regulation rather than by a local law or scheme. The Building Code of Australia forms part of the Standard Building Regulation 1993 and 'is to be read as one' with the regulation. This has created some confusion as to the ability of a local government to nominate design flood levels and freeboard for habitable floors.

The Standard Building Regulation 1993, Part 4—Site Works states:

> Land liable to flooding
> 53.(1) A local government, by resolution, may declare—
> (a) land to be liable to flooding (including by tidal surge or sewerage discharge); and
> (b) the level to which the floor levels of habitable rooms must be built.
> (2) The local government must—
> (a) keep a register of the resolutions and the information supporting the resolution; and
> (b) keep the resolutions available for inspection.

However, the *Building Code of Australia, Part 2.2, Section P2.2.1—Surface Water* nominates the 100-year average recurrence interval flood level as the flood that must not enter dwellings. The implication is that any challenge to a development condition that requires a more stringent control than that prescribed in the Building Code of Australia might be successful.

Further, as building applications are required by statute to be assessed against the Standard Building Regulations (and the Building Code of Australia), which local governments have no power to alter, there is concern that specialised requirements, such as the use of flood tolerant design and construction materials, cannot be enforced.

The ***State Counter Disaster Organisation Act 1975*** regulates responses to disasters and requires each local government to:

- prepare counter-disaster plans
- establish and maintain a local emergency services.

The ***River Improvement Trust Act 1940*** provides for the establishment of river improvement trusts as statutory bodies and empowers them to raise funds and undertake approved works within, or directly adjacent to, watercourses. The objectives of trusts are to:

- protect and improve the beds and banks of rivers
- prevent flooding
- prevent or mitigate inundation of certain land by flood waters from rivers.

There are 17 trusts in Queensland—largely comprising local government members, with 18 (of 125) councils represented. The trusts are responsible for the management of around $80 million worth of works, including approximately $20 million worth of flood mitigation works.

River improvement trusts are a potential mechanism (albeit currently under-utilised) for the planning, funding and implementation of works that manage rivers and the flood hazard they may pose. Their coverage of the state is by no means complete and they do not have jurisdiction over land-use and development activities on floodplains. Hence, the work undertaken by trusts is generally in response to flood risks once they have developed, and deals mostly with modifying the flood hazard (e.g. construction of levees or hydraulic channel improvements to reduce the likelihood of flood flows spreading out onto the floodplain).

Current best practice recognises that, while works that modify the flood hazard are an important option for dealing with existing flooding situations, they are only one of a number of measures that need to be considered. A comprehensive approach to dealing with flood risk includes having complete flood information and exercising proper land use planning and development controls on floodplains, mitigation works, warning systems and emergency response plans. Where they exist, river improvement trusts are in a position to deal only with some of these issues.

The ***Water Act 2000*** deals principally with the allocation and sustainable management of the state's water resources, the regulation of water service providers, and the administrative structures which support each. Within this framework, the Act provides the Department of Natural Resources and Mines with the jurisdiction for the regulation of works in or adjacent to watercourses, referable dams (i.e. structures which, through a combination of their size, storage volume and location, represent a significant risk), and works that 'interfere' with the overland flow of water in declared areas. The development approval of such works is provided under the Integrated Planning Act. While these approval requirements are based around protecting the integrity of watercourses, managing the water resource and ensuring that owners of hazardous structures meet safety requirements, neither Act provides for a direct role in managing flood risk.

The object of the ***Coastal Protection and Management Act 1995 (CPMA)*** is to:

(a) provide for the protection, conservation, rehabilitation and management of the coast, including its resources and biological diversity; and
(b) have regard to the goal, core objectives and guiding principles of the National Strategy for Ecologically Sustainable Development in the use of the coastal zone; and
(c) provide, in conjunction with other legislation, a coordinated and integrated management and administrative framework for the ecologically sustainable development of the coastal zone; and
(d) encourage the enhancement of knowledge of coastal resources and the effect of human activities on the coastal zone.

The Environmental Protection Agency has prepared a *State Coastal Management Plan* (SCMP), which has the effect of a SPP. To identify the areas within which state interests will apply, regional coastal management plans are being prepared for the state's 11 coastal regions.

These plans are intended to address issues associated with management of the state's coastal resources (natural and cultural) for the protection of their ecological, economic and social values.

On commencement, the *Coastal Protection and Management and Other Legislation Amendment Act 2001*, will provide for the integration of development assessment and permitting functions from the *Harbours Act 1955*, the *Beach Protection Act 1968* and the *Canals Act 1958* into the amended Act. Regulated actions include construction of tidal structures, dredging, reclamation, and the construction of canals and artificial waterways. Development assessment and permit decision making is through the integrated development assessment system (IDAS) under the *Integrated Planning Act 1997*.

The ***Local Government Finance Standard 1994*** outlines the matters to be covered by the corporate and operational plans of a local government. These plans are intended to identify the issues faced by a local government, its objectives in dealing

with them, and the way in which they will be met. Hence, the plans need to provide the basis for all of a local government's activities, including its services, and planning scheme and development controls. The standard now requires local government to include information about its role in disaster mitigation in its assessment of local and regional issues.

Approximately 20 other Acts may affect the implementation of flood risk mitigation measures by requiring permits for certain activities or preventing harm in specific areas such as watercourses, coastal areas, fisheries, forestry, the Great Barrier Reef, marine parks, cultural and heritage matters, etc. However, they do not provide specific impetus for the overall management of flood risk and may be considered largely reactive in their capacity to influence flood risk mitigation.

5.2 Subsidies and grants

Local governments and river improvement trusts largely meet the costs of carrying out flood studies and of implementing structural and non-structural solutions to flooding problems. The federal and state governments, through partnership arrangements such as the Regional Flood Mitigation Program and state subsidies, may contribute towards the cost of capital works and some planning activities.

Federal and state government programs:

- **Provide disaster relief**—under National Disaster Relief Arrangements (NDRA), measures are in place to alleviate personal hardship and provide for restoration of public assets and assistance to primary producers and small businesses. The costs associated with recovery from flooding may also be met through NDRA arrangements. These funds are available both from the state (after threshold contributions from the relevant local government) and the Commonwealth (after threshold contributions from the state). The funds are provided principally for public works; however, discretionary amounts are available for private personal loss. Funds are generally provided on the basis of the estimated costs to restore works to a condition equivalent to those that existed prior to the disaster, but may be used to contribute to upgrades[8].

- **Subsidise disaster planning**—under the Natural Disaster Risk Management Studies Program, the federal and the state governments contribute two-thirds of the cost of approved studies that contribute to the assessment of risks from natural hazards (including floods).

- **Subsidise flood mitigation measures and works**—under the Regional Flood Mitigation Program, the federal and state governments contribute two-thirds of the cost of an approved project. Under the Local Governing Bodies Capital Works Subsidy Scheme, flood mitigation works receive a 20% subsidy.

  River improvement trusts are eligible for state subsidy on approved works, including flood mitigation works. Historically, the subsidy available has been up to 25% of the value of the works; however, the total subsidy funds available each year are limited and, generally not all approved works can be subsidised.

---

[8] The *Review of Natural Disaster Relief and Mitigation Arrangements* by COAG is looking at this, among other issues. Refer Section 5.4.

To make better use of the funds available, recent changes have been made to the way the state pays the subsidy.

- **Subsidise infrastructure**—such as water supply and sewerage head-works by local governments that support community development.

- **Subsidise disaster mitigation and response projects with general application**—funding is provided under Emergency Management Australia's Projects Program to develop approaches for the economic assessment of mitigation measures and the understanding and assessment of community vulnerability and resilience, and for the development of community awareness programs.

Traditionally, the Department of Natural Resources and Mines has been involved with flood risk mitigation subsidies through the technical assessment of flood mitigation projects submitted by local governments for subsidy, the approval of river improvement trust works programs and, until its repeal in the mid 1990s, the approval of local government flood mitigation works under the *City of Brisbane (Flood Mitigation Works Approval) Act 1952.*

5.3 Guidelines

In most fields, best practice and consistency of approach are typically fostered through the use of guidelines. The State Government of New South Wales has had floodplain management guidelines ('the blue book') since the mid 1980s.

Nationally, the Standing Committee on Agriculture and Resource Management has published *Floodplain Management in Australia—Best Practice Principles and Guidelines (SCARM Report 73)*, providing both local and state governments with guidelines for identifying issues and their treatment through a floodplain management planning process.

Victoria and New South Wales have produced complementary guidelines (that expand on the national ones) to cover issues of particular relevance to their states—in particular, the implementation mechanisms adopted in each state. As yet, no state guidelines have been produced for Queensland[9].

The Department of Emergency Services (DES) has produced a reference book as a guide for local governments in addressing disaster risks. Based on the Australian and New Zealand standard for risk management (AS/NZS 4360), it is entitled *Disaster Risk Management.* DES also publishes the *Disaster Risk Management Guide,* which provides a particular focus on implementation of disaster risk management in a local government setting.

These publications were used to conduct awareness and education programs in disaster risk management for local governments in Queensland, and have assisted local governments apply for state and federal government funding (under the Natural Disaster Risk Management Studies Program) and in the preparation of interim disaster mitigation plans.

---

[9] The proposed state planning policy for natural disaster mitigation will include guidelines for the consideration of flood risk mitigation measures in local planning schemes and the assessment of new development.

Strategic river management plans prepared by river improvement trusts are another form of guidance for local governments. Although these plans currently have no statutory basis, they may address flood mitigation.

5.4 National policy context

Under the Natural Disaster Relief Arrangements (NDRA), the Commonwealth has stated that prerequisites for the provision of assistance (other than personal hardship and distress) are that:

a) natural disaster mitigation strategies are in place in respect of likely or recurring disasters

or

b) a commitment is made to develop and implement such strategies within a reasonable timeframe.

If local governments develop and proceed to implement mitigation strategies, the Commonwealth Government will not withhold payments for the restoration of assets under the NDRA.

The scope and relevance of natural disaster relief and mitigation arrangements was the subject of a recent review conducted under the Council of Australian Governments (COAG). Entitled *Review of Natural Disaster Relief and Mitigation Arrangements,* the objectives were to:

- determine whether current arrangements provide an effective framework to meet the needs of those affected by natural disasters
- assess the scope and relevance of programs and arrangements aimed at mitigating against potential natural disasters.

Broadly, with respect to mitigation, the review has recommended that all levels of government put more effort into planning (and the necessary support activities) to avoid exposure to natural hazards, the provision of incentives for good practice, and promoting self-reliance.

5.5 Queensland policy context

In its latest *Statement of Priorities*, the Queensland Government has committed itself to improving the quality of life for Queenslanders, strengthening democracy, engaging the community in decision making and valuing the environment. The priorities with which state policies and services should be aligned are:

- More jobs for Queensland (skills and innovation, the 'Smart State')
- Safer and more supportive communities
- Community engagement and a better quality of life
- Valuing the environment
- Building Queensland's regions.

Agencies with responsibility for floodplain planning and management decisions have an impact on these priorities by affecting:

- the liveability of cities, towns, regions and remote communities
- economic opportunity and sustainability
- societal equity
- the sustainable access to, and development of, Queensland's natural resources
- the protection of the environment for the benefit of current and future generations.

Specific state government priorities that can be linked to improved floodplain planning and flood risk management are:

- *Safer and more supportive communities*
  - minimising the risk and impact of emergencies and disasters
- *Valuing the environment*
  - promoting sustainable development through responsible use of the state's natural resources
  - encouraging Queensland businesses to consider the social, economic and environmental impacts of their decisions
- *Building Queensland's regions*
  - ensuring that development in regional Queensland is not subject to unacceptable flood risks.

The *Queensland Greenhouse Policy Framework* (Sept. 2001) acknowledges that 'there is growing scientific consensus that the enhanced greenhouse effect is changing the world's climate' and that 'Queensland will be vulnerable to the effects of climate change'. With respect to flooding, these include potential sea level rises, more intense and/or widespread cyclones (in particular travelling further south), and changes to rainfall intensities that have the potential to result in:

- more extensive storm tide flooding and erosion of coastal areas and infrastructure associated with sea level rise and more intense cyclones
- increased flood risk and damage to transport infrastructure and low-lying human settlements.

Although, to date, changes in rainfall intensities have not been clearly reflected in rainfall records, information is required to ensure up-to-date assessments of flood recurrence intervals are available to support planning controls, mitigation works programs, building level controls and emergency response plans. However, the framework notes the following principles for future action that are relevant to managing flood risk:

- *Improved knowledge and understanding* of the greenhouse effect and climate change to underpin the response by government, industry and the community.
- *Focus on sustainable development* to allow opportunities for pursuing nett reductions in greenhouse gas emissions while delivering social, economic and other benefits.
- *Comprehensive and cooperative approach* that considers all opportunities to reduce nett greenhouse emissions and, for adaptation to climate change, enabling priority setting and the facilitation of partnerships for cooperative action.

Under the *State Coastal Management Plan—2001*, coastal hazards, in particular storm surge, are to be recognised by local government in the preparation of IPA planning schemes.

The interaction of storm surge and riverine flooding can be significant in coastal Queensland; hence, any assessment of flood risk needs to include the influence of storm surge.

6. Issues with current arrangements

Under the current arrangements, there is a range of constraints that impact upon the effectiveness and viability of flood risk management measures, including:

- social, environmental, amenity, cultural and heritage issues
- resource issues such as lack of data and technical expertise
- perceived resistance of property owners to flood liability information and flood-related development controls because of their impact on either values or development opportunities
- economic and infrastructure issues
- liability issues associated with flood risk communication or structural mitigation measures.

Deficiencies in the current arrangements have been identified in the areas of:

- governance
- cooperation and coordination
- local government
- river improvement trusts
- policy and legislation
- financial systems
- information
- insurance
- land transactions.

6.1 Current governance arrangements

Both the Commonwealth and the state have a strong interest in protecting communities from harm as a result of floods and reducing their flood disaster outlays and, hence, promote measures for the reduction in exposure to flood hazard (e.g. through funding initiatives such as the Regional Flood Mitigation Program). However, local government has the key role in implementing measures to minimise flood risk. With no clear or comprehensive policy to guide local government decision making in Queensland, there is considerable variation in their adoption of flood risk management practices.

In the survey supporting the 1998 report *Urban Flooding in Queensland—A Review*, only 35 local governments claimed to have a flood policy for urban floodplain management. (There are 125 local governments and 32 Aboriginal and Islander community councils in Queensland.) The report also considered that, in many cases, these policies did not fully meet national best practice standards.

Of the 17 river improvement trusts, 14 have or are developing strategic river management plans. Nine of these (principally in North Queensland) deal directly with flood mitigation issues, while others deal with the issue more broadly—for example, in terms of maintaining the flow efficiency or hydraulic capacity of the river system. However, currently the plans are not a statutory requirement, nor are there guidelines covering the issues that should be addressed. Hence, the standard of

the plans is variable and, although cooperation between trusts and local governments is generally good, local governments have no obligation to recognise or comply with them.

6.2 Cooperation and coordination

6.2.1 Between different levels of government

The promotion of best practice (through the use of policy and legislation, and guidance and direct facilitation by the state and federal governments) is hindered by inconsistencies between financial policies associated with taxation and subsidies, and the intent of planning legislation and best practice guidelines.

Tax write-offs (e.g. stock losses, building repairs) associated with disaster costs and subsidies that indirectly support development on floodplains and disaster recovery can be in conflict with efforts to responsibly manage floodplains by the avoidance of unacceptable flood risks and through appropriate development controls.

Under the IPA, coordination between the plans of state government departments and local government planning schemes has been enhanced; however, there may remain circumstances where the interests of state government agencies with development roles (e.g. those responsible for major infrastructure) and a local government's interests—as the principal manager of floodplain development—are not the same.

6.2.2 Between state departments

The break-up between state government departments of responsibilities that impact on flood risk management requires effective coordination to align policies and priorities. It also requires the clear enunciation of responsibilities in agency core documents.

The State Disaster Mitigation Committee has been formed to assist in addressing this issue by providing a high-level group responsible for overviewing risk management activities and policy development in Queensland.

6.2.3 Interjurisdictional cooperation

On occasion, local governments sharing a floodplain have developed policies allowing different development standards. Significantly, this was a consideration in the amalgamation of the former Albert Shire and Gold Coast City councils in 1995.

6.2.4 Water service providers

For the purpose of deciding licence conditions under the *Water Act 2000*, an owner of a referable dam may be required to provide information about the dam's safety. The relevant assessment information is to be prescribed under a regulation. It may include an emergency action plan and dam operation and maintenance procedures, as determined by the chief executive of NR&M on a case-by-case basis.

Although dam failures have a very low likelihood of occurring, they are high consequence events and need to be put into perspective in relation to other hazards.

Emergency action planning activities associated with potential dam failures require coordination with the State Counter Disaster Organisation, Department of Emergency Services, and the relevant local government. The process requires local governments to respond to advice from dam owners about any threat of failure. This assumes that the relevant disaster management plans are properly formulated and that associated systems are in place. The Department of Natural Resources and Mines and the Department of Emergency Services have invested considerable effort in communicating the potential dam failure hazard on downstream areas, and the Department of Natural Resources and Mines includes linkages between referable dam emergency action plans and local counter-disaster plans as a condition of approval under the dam safety provisions of the *Water Act 2000*. However, improvements in this area are only progressing as applications for dam safety approval fall due.

Dam break scenarios are often not included in studies for local counter-disaster plans, and planning schemes may be developed without regard to them.

6.3 Local government

6.3.1 Implementation of policy instruments/commitment

Local governments have faced difficulties in implementing appropriate flood risk management measures for a variety of reasons, including:

- balancing economic growth and the need to preserve individuals' property rights with the responsibility for ensuring the public is protected from the damaging effects of floods—in particular, this affects the adoption of designated flood levels and leads to inconsistencies throughout the state
- limited financial and staff resources—both in expertise and in staff numbers
- limited information across the state, both on the characteristics and frequency of flood events and their impacts
- legal liability and compensation issues and their exposure to legal action (even when acting with due diligence)
- disparate statutory requirements and associated administrative arrangements.

Guidelines are regarded as insufficient to address these issues. This is because, in the absence of some form of imperative, local governments have not generally been in a position to incorporate existing guideline best practice advice into planning documents (such as corporate plans, planning schemes, operational plans and other specific floodplain management plans).

6.3.2 Resources

Flood risk assessment can be a complex task involving technical appraisals of the magnitude; return frequency; potential physical, social and economic impacts in specific geographic settings; and the presentation of the results in terms that are useful to decision makers.

One of the significant problems faced by local governments in the implementation of flood risk management strategies is limited resources. Flood studies and mitigation programs may involve significant costs and require management by skilled staff.

The joint federal- and state-funded Regional Flood Mitigation Program (RFMP) and Natural Disaster Risk Management Studies Program (NDRMSP) are useful initiatives to assist local government; however, the demand for subsidies under the RFMP exceeds the funds available.

The current RFMP has committed $14 million from the federal and state governments towards flood mitigation measures in Queensland over three years, ending in June 2002. Over the same period, there have been expressions of interest and applications for over $150 million worth of projects, although not all have been eligible.

The NDRMSP provides subsidy funds for $^2/_3$ of the cost of eligible studies, including flood studies. Many of these studies will lead to the identification of flood mitigation capital works proposals and put a further demand on RFMP funds.

6.3.3 Expertise

There is a wide variation in the technical capability within local governments to support the development and implementation of appropriate flood risk management policies and strategies. Some local governments, particularly those with smaller rate bases, require support—even if only to ensure that processes can be implemented and that any government assistance available is properly targeted.

6.4 Policy and legislation

6.4.1 Variable standards

There are considerable variations across the state in the definition used for the designated flood, i.e. the flood event selected for planning purposes. These variations are summarised in Table 2 and are based on the results of the flood risk survey report completed in 1998.

Table 2: Variation in designated floods

Designated floods (numbers of local governments)			
1-in-100 year	1-in-50 year	Below 1-in-50 year	Flood of record[10]
27	11	4	2

Each of the four local governments that used a value below that of the 1-in-50 year has different levels for the designated flood, to as low as 1-in-10 year. This variation is due to financial constraints, local policies, historical development, protection of existing landowners' interests, and changes in the understanding of rainfall and resultant flood frequencies. The lower flood standards do not reflect current best practice philosophy or expectations.

A further complication is that some local governments have adopted variable designated flood levels based on different criteria for mainstream and creek flooding.

[10] 'Flood of record' refers to the largest flood experienced in the locality for which records are available.

6.4.2 State position

To date, Queensland has had no clear or comprehensive statewide policy to guide urban flood risk management. It is important to note that the existing policy and legislative framework is not specific in requiring local governments, or indeed the state, to implement flood mitigation strategies.

The state legislation available to facilitate flood risk management is fragmented. Effective floodplain management by local governments is possible within the existing framework; however, state government policy development and guidelines have been lacking. Further, legislation such as the *State Counter Disaster Organisation Act 1975,* details responsibilities for counter-disaster operations, but is not explicit about responsibilities for mitigation.

The IPA has not provided a statutory obligation for development applications to be assessed in relation to risks from natural hazards. The current initiative to develop a state planning policy for natural disaster mitigation will change this situation and represents a substantial improvement, demonstrating that the state expects the management of new development on floodplains to be commensurate with the risk from natural hazards.

State development has been unavoidably influenced by the way settlement began in low-lying coastal and western areas. Much of Queensland's development is 'land-locked' into narrow coastal strips. Continuing growth is putting significant pressure on local governments to allow development or redevelopment in areas that will always be subject to recurring, well-known natural hazards.

Regional and local government planning has the potential to substantially address the problems; however, local governments and regional planning advisory committees need the support of a clear, consistent policy and legislative framework. Uncertainty exists over a range of issues, including:

- duty of care obligations
- liability for flood damages
- exposure to compensation associated with downgrading of land uses
- rights in common law
- statutory obligations
- potential conflicts in statutes (e.g. between the *Integrated Planning Act 1997* and the *Local Government Act 1993* provisions covering levees)
- the status of river improvement trust Strategic River Management Plans.

For instance, when is a duty of care owed? What triggers liability for flood damages? What rights has an individual to be protected by government from harm occasioned by recurring, known flood hazards? The current approach—that of testing one's rights in a court of law—is inefficient and beyond the financial capacity of most people likely to be affected by flooding (unless pursued through a class action).

Although there is the potential to apply common law principles such as duty of care, and the intention of statutes such as IPA to achieve ecological sustainability, there is no overall policy or legislative framework requiring agencies with floodplain management and/or flood mitigation responsibilities to:

- develop or implement a relevant management or mitigation strategy

or

- implement best practice once a decision is made to develop and implement a management or mitigation strategy.

Under the current arrangements, a planning scheme can be established and development can occur on a floodplain without its full ramifications being known. Therefore, the resulting scheme would not promote the IPA objective of ecological sustainability, defined within the IPA as:

> ...a balance that integrates—
> (a) protection of ecological processes and systems at local, regional, state and wider levels; and
> (b) economic development; and
> (c) maintenance of the cultural, economic, physical and social well being of people and communities.

The importance of the planning process followed by a local government is demonstrated by legal rulings made subsequent to the major flood on the Bogan River that overtopped levees protecting the town of Nyngan in New South Wales. Seven hundred and twenty houses were flooded causing damage estimated at $47 million. The use of appropriate engineering practices by the authorities involved proved to be an adequate legal defence against damages sought by the townspeople. A significant lesson is that all flood mitigation measures can be overwhelmed if the design flood event is less than the probable maximum flood. Further, there are limits to the accuracy with which planning can be undertaken, and it needs to be recognised that there may be potential shortcomings of which the public should be aware.

To be fully prepared for flooding, integration of pre- and post-disaster planning needs to occur.

Recent changes to the ***Local Government Finance Standard 1994*** now call for disaster mitigation to be considered in the preparation of a local government's corporate and operational plans.

6.4.3 Land planning and development approvals

While integral to the concept of 'ecological sustainability' under the IPA, flood hazard issues have not figured significantly in the formulation of planning schemes developed to date. Rarely has planning been based on a rigorous assessment of all the impacts of developing on floodplains. Unless local governments develop planning schemes supported by appropriate hydrologic, hydraulic and damage studies, and suitable guidelines, local government decisions on matters of flood risk will be open to challenge.

In the past, planning schemes may have been formulated recognising the flood hazard on floodplains but, over time, have been amended to allow development on the basis of negligible increases in adverse flooding impacts when individual proposals have been assessed. Consequently, the cumulative impact of developments has not been recognised, resulting in 'development creep' over time and an associated increased exposure to flooding.

In the Queensland Planning and Environment Court case (Nifsan vs. Gold Coast City Council, 1997) the judge could:

> ... not be persuaded that the proposed development would not adversely impact on flood behaviour in and near that development or elsewhere in the Merrimac–Carrara floodplain ...

The judge went on to cite the need for 'consideration of the cumulative effect of loss of storage on the floodplain'. This case demonstrates a number of issues with respect to the management of floodplain development, including:

- the need to be able to provide good flood information (which, in this case, required extensive modelling)
- the need for councils to have clear conditions for development on floodplains
- a recognition by the court of the need to consider the cumulative impacts of developments on flood levels.

6.4.4 Legal liability and compensation

Local governments need to be able to:

- inform the public about flood risks on a floodplain (e.g. through maps showing the likely extent of flooding), based either on flood modelling or recorded historical information
- manage development through planning schemes and development controls
- carry out appropriate flood mitigation works.

In many instances, however, the risk to properties from flood hazard cannot be established precisely. This is due to the inherent limitations of flood modelling, as well as to inaccuracies in historically recorded flood heights, topographic data, and in assumed property boundaries and the difficulty in predicting damaging peak velocities at a local scale. Consequently, the extent of flooding is uncertain both in terms of property location and flood height, while flooding impacts can vary due to localised effects such as peak flow velocities and debris.

As a result, there is a significant concern within local government that publishing flood information could draw strong adverse responses from landholders who consider their property to be incorrectly identified as potentially flood affected and/or significantly reduced in value because of the information. These concerns extend to the possibility of claims for substantial compensation from the local government being successful or at least involving the local government in costly court proceedings, even though the local government's legal obligations may be restricted under IPA (Chapter 5, Part 4).

Local governments also face potential legal liabilities in their management of floodplain development and the conduct of flood management activities if not carried out in a responsible manner. Local government planning schemes should ensure:

- that the flood risk to new development (including building approvals) is acceptable
- there are no adverse impacts on other properties as a result of a new development

However, a local government is not responsible for natural flood conditions and has no duty of care that requires it to build flood mitigation works to deal with natural flood conditions.

Legal claims for compensation under the law of negligence may arise where flood risk management related actions are not carried out in a manner that a reasonable local government could be expected to follow and result in an actual loss during a flood, or while carrying out works.

In addition, there is the issue of legal challenge to a council's development and building conditions to be considered.

Some examples of situations where compensation may be sought, or a legal challenge to a council's action or decision may arise, are given in Attachment 1.

6.4.5 Emergency management

The ***State Counter Disaster Organisation Act 1975*** (SCDOA) provides for the establishment of a state counter-disaster organisation and a state emergency service. The term 'counter-disaster' is interpreted to be:

> ...the planning, organisation, coordination or implementation of measures that are necessary or desirable to prevent, minimise, or overcome the effects of a disaster, upon members of the public or any property in the State.

Interpretation of the SCDO Act could include:

- disaster prevention
- preparedness, response and recovery (PRR) activities for a disaster event.

The major effort of the State Counter-Disaster Organisation (SCDO) and the State Emergency Services (SES) is directed at PRR activities to deal with a disaster as it occurs.

Disaster prevention is largely in the hands of implementing agencies—such as local governments, transport departments, water authorities and various regulators for dams, buildings, mines, hazardous chemicals and the like. Responsibilities relating to flood disaster prevention and management are not articulated and implemented through a recognisable system.

6.5 Financial systems

6.5.1 Local government infrastructure funding mechanisms

Traditionally, infrastructure charges only have applied to water supply and sewerage infrastructure networks and, to date, have had little application in flood mitigation—other than where such a charge is an additional cost of providing water supplies (i.e. the flood storage component of a dam may be included in a water supply

infrastructure charge). However, the range of items for which infrastructure charges can be levied has been expanded, so this situation should change.

In the *Commonwealth Emergency Management Arrangements Performance Audit,* Audit Report no. 41, 1999–2000, Section 9.14, the Australian Auditor-General has recognised that:

> At the core of mitigation planning is the integration of regulatory processes of all three spheres of government so that, at the local level, land use decisions take into account the full cost of development and human settlement in risk-prone areas.

The methods available to local government to reflect the full costs of a development at the development approval stage are:

- developer funded works
- infrastructure charges and payments
- additional cost conditions.

Generally, developers are required to provide (or pay the full capital cost of) infrastructure items required solely for their development. Infrastructure charges are usually levied on developers as a contribution to the capital cost of infrastructure that the development shares with other areas. Infrastructure payments are contributions towards the capital costs of infrastructure applied as a condition on a development approval.

Additional cost conditions are applied to developments which are outside the priority infrastructure area or inconsistent with the growth assumptions expressed in the local government's priority infrastructure plan. These conditions can include the capital cost of the ultimate infrastructure, temporary works to support the under-utilised ultimate infrastructure, and the operational and maintenance costs of both of these works for 5 years.

In any case, the ongoing costs associated with a development (e.g. infrastructure operation and maintenance—except for the 5 years under an additional cost condition, or augmentation to meet higher service level standards) are funded through regular charges levied on the purchasers of the lots created by the development. Hence, where a development increases the flood risk and creates an additional ongoing burden on the community (in terms of disaster damage and recovery costs), it is very difficult to reflect those costs at the development stage. There are also potential difficulties in applying charges for flood mitigation, as the cost of the works is likely to be unaffordable if borne strictly by a limited number of beneficiaries rather than being spread across the wider community.

6.5.2 River improvement trust charges

To fund the undertaking or maintenance of works within their responsibility—generally stream management (including flood mitigation and flood damage restoration works within or adjacent to watercourses)—river improvement trusts are able to raise loans and to levy local governments, port authorities, instrumentalities or corporations created under any Act, and owners and occupiers of land in a river improvement area.

6.5.3 Subsidies/grants

Funding for the management of floodplains is presently not coordinated effectively in its application. The subsidies currently available for flood mitigation generally focus on individual capital works or investigation projects, with the development of overall management plans only partially covered as part of project assessment criteria. It should be noted that the value of planning generally has been recognised by the state government in other areas. State subsidies were made available to local governments in the mid 1990s to assist in the preparation of their water supply and sewerage total management plans.

Current infrastructure subsidies for water supply, sewerage, etc. can lower the costs of all development including inappropriate development.

While funding may be provided under the NDRA to rebuild infrastructure to a standard equivalent to that which existed prior to the damage occurring, the objective of rebuilding should be to ensure that failures do not recur at an unacceptable frequency[11]. Under the NDRA, a local government must meet costs additional to that of restoration to previous standards. Apart from road-base saturation damage, there is no requirement to rebuild to a higher level of immunity.

The review of Australia's approach to natural disaster relief and mitigation arrangements by COAG has examined current limitations and, among its recommendations, has included providing incentives for good practice (i.e. avoiding or reducing exposure to natural hazards) and promoting self reliance.

6.5.5 Tax

Tax write-offs of disaster-related losses to property and business can indirectly support business activities which may be inappropriate on floodplains and do not encourage proper consideration of the impacts of hazards.

6.6 Information

6.6.1 Guidance

Flood risk management in Queensland is also hampered by the lack of Queensland-specific best practice information. The national document *Floodplain Management in Australia—Best Practice Principles and Guidelines*, although not able to address every issue relevant to flood risk management planning in Queensland (in particular implementation mechanisms available in the Queensland system), is a very good guide to floodplain planning for local governments. Supplementary guidelines for implementation in Queensland are required[12]. (Limited specialist technical support to underpin the implementation of these guidelines is provided by the state.)

Structural flood modification measures, such as levees, are a common and proven means of reducing damage to existing properties; however, they are usually costly and have the greatest potential to affect the ecology of the floodplain. Inclusion of guidance on the appropriate use of structural mitigation measures (including environmental impact assessment) is also desirable.

---

[11] The *Review of Natural Disaster Relief and Mitigation Arrangements* by COAG is looking at this, among other issues. Refer Section 5.4.

[12] The proposed State Planning Policy (SPP) for Natural Disaster Mitigation will include guidelines relevant to the preparation of local planning schemes and development assessment conditions to address *future* flood risk.

The Department of Emergency Services has published guidelines for local government on the application of a general disaster risk management process.

6.6.2 Communication and awareness

Public awareness of the flood risks in communities and the steps to be followed during flood events is raised through public education and awareness campaigns, generally run by local governments.

Based on the findings in *Urban Flooding in Queensland—A Review*, only about 20% of local governments (i.e. 21 out of 96 survey respondents) appear to have community awareness programs. In a number of instances, especially for coastal communities, such programs relate to seasonal awareness campaigns for tropical cyclones rather than to flood risk. At the commencement of the cyclone season, the Bureau of Meteorology, in partnership with the Department of Emergency Services and local governments in the major coastal population centres, conducts public awareness programs. Flood awareness sessions are conducted on a less frequent basis at major inland population centres where riverine flooding is a significant threat.

Among the local governments that indicated they had awareness programs are Brisbane, Ipswich ('limited'), Logan, Mirani, Rockhampton, Taroom, Townsville (linked to cyclone programs) and Warroo.

Although a number of local governments indicated they had prepared local awareness guides addressing their major natural hazards, this practice was not widespread. From the survey results, there appears to be a lack of such community awareness programs for many of the more flood-prone communities. Where awareness programs do exist, their effectiveness is not known with any certainty as they are a*d hoc* and, generally, related to recent flood events.

In general, it is indicated in the report *Urban Flooding in Queensland—A Review* that, where a high level of awareness of flood threat exists in a community, it is primarily because of recent first hand experience.

The use of flood markers to promote flood awareness is limited, especially for many of the communities most at risk. About 25% of local governments (24 out of 102 survey respondents) had such flood markers. The report notes that 'it is especially significant that many of the communities with a larger number of buildings at risk do not have flood markers'.

Flood markers are an inexpensive way of communicating flood risk and of giving meaning to the forecasts of river gauge heights for individual buildings. However, to be effective in a large, flood-prone community, there should be a series throughout the area at risk from inundation.

6.6.3 Vulnerability assessments

Vulnerability assessments are fundamental to comprehensive identification of the flood risk to communities. Such assessments involve a quantitative study to determine levels of exposure to flooding and provide a basis to develop relevant flood risk management policies.

Local governments with an urban flood risk problem generally include a consideration of vulnerability to flooding within their counter-disaster plan. Most local governments regard these plans as effective, and they are revised after any activation. However, according to *Urban Flooding in Queensland—A Review*, only half (43 out of 83 respondents) indicated that their counter-disaster plans were based

on information from flood studies (i.e. hydrological and hydraulic studies of the magnitude and extent of floods and the vulnerability of flood-prone communities).

Urban Flooding in Queensland—A Review revealed that there were minimal links between flood warning procedures and counter disaster plans in some areas. It is significant that a very large proportion of flood-prone communities in Queensland have warning times that are less than 12 or 24 hours. An added complication is that often it is not until significant rain has fallen that the potential magnitude of the flood can be estimated. As a result, the time available to respond to the flood threat is further shortened. This emphasises the need for locally based, ALERT-type systems that take into account the magnitude of the flood risk and associated vulnerabilities.

For many local government areas, however, the usefulness of forecasting and warning is limited by a lack of hydrological and hydraulic studies that define the extent of flooding and make clear which areas are actually at risk for a particular forecast flood height.

Another concern is that most local governments adopt a designated flood level for the control of floodplain land use without a full appreciation of the potential impacts of larger, less frequent floods on the resulting development. The tendency is to adopt suggested designated floods from best practice guidelines and thereby avoid the financial costs of undertaking a hazard risk assessment. As a result, an understanding of the relevance of recommendations in best practice guidelines to a given situation is not developed. Consequently, in spite of development decisions being based on a designated flood, inappropriate development can continue to occur on floodplains.

To responsibly set a designated flood level requires a comprehensive understanding of the flood risks based on the full range of potential flood hazards and vulnerabilities.

6.6.4 Flood records

Flood studies can be costly; however, without such studies it is difficult to establish community acceptance of appropriate development controls.

A lack of historical data and information systems on the risks and hazards associated with flooding increases the cost of such studies and reduces the reliability of their outcomes.

Currently, there is neither a consistent policy nor process for recording flood levels and the costs of recovery following significant events. Such records would facilitate improved flood risk management and the allocation of any resources. Some possible measures include:

- establishment of a state flood damage records database
- improved flood mapping/recording
- improved/more extensive stream gauging and rainfall recording, particularly for smaller streams and catchments.

6.6.5 Flood and surge mapping

Generally, the level of information across the state is highly variable and dependent on:

- recognition by the relevant local governments of the need for information
- the flood history at the locality (e.g. Brisbane City Council and the Queensland Government mapping of flood inundation areas following the 1974 Brisbane River floods)
- the conduct of specific flood studies.

Local government attitudes to providing flood map information to the public are equally variable due to:

- varying levels of confidence in the information (due to inaccuracies in base data and plotting)
- a desire to promote economic growth and increase rate bases
- legal liability issues
- the potential for compensation payments where data is proven to be inaccurate (refer 5.4.4 above)
- costs associated with the collection and maintenance of information.

The accuracy of flood map information ranges widely and is dependent on the quality of topographic information, techniques used to acquire the data, availability of calibration data, and the techniques used to present information based on the data.

At the state level, various departments do hold flood data acquired on an *ad hoc* basis as particular flood issues have been addressed; however, the limited information makes an overview difficult.

6.6.6 Land transactions

Property searches can result in inaccurate or false information on flooding being provided to prospective buyers. In a case reported in the media in recent years, a local government was claimed not to have disclosed information in its possession to a buyer in a property search that indicated the property was flood prone.

Section 19(1) of the Standard Building Regulation 1993 requires that a local government keep available for public inspection such information as it has to assist in the making and assessing of development applications. This includes information about:

- the physical characteristics and location of infrastructure
- easements, encumbrances or estates or interests in land likely to be relevant to development applications
- site characteristic information likely to affect the assessment of a development application.

Flood level information is given as an example of site characteristic information.

There are no requirements with regard to how the information is to be held and the basis of its availability, leaving potential flaws in the process.

6.6.7 Performance monitoring and benchmarking

No national or state system similar to WSAA Facts (Water Services Association of Australia) exists to foster monitoring and benchmarking of the performance of local governments in managing development on floodplains. Effective regulation and informed decision making on issues of policy requires robust analysis of performance.

In the United States, the Federal Emergency Management Agency maintains a national overview of flood risk through information from the National Flood Insurance Program (e.g. flood hazard maps).

6.7 Insurance

Affordable flood insurance is not always available to individual householders. More commonly, flood insurance is only available to large commercial/business undertakings as part of overall insurance packages—the higher premiums paid for these policies allowing some scope for covering flood risk.

Notwithstanding this, following major flood events in 1998 in Wollongong, Katherine and Townsville, the insurance industry has sustained significant criticism from policyholders, politicians and the media. These events were estimated to have cost in excess of $170 million in insurance payments. (Katherine—$60 million, Wollongong—$40 million, and Townsville—$70 million) and illustrate that insurance companies have significant exposure to flood insurance claims.

In 1999, as a result of these events and an increasing call on insurance covers, the Insurance Council of Australia (ICA) created the Flood Issues Liaison Committee. Representatives of the federal government and all state and territory governments attended the inaugural meeting in November 1999. From the insurance industry's perspective, the key issue was that the only way flood insurance can be offered on a commercially viable basis is if the availability of insurance and the premium cost is firmly based on the assessed flood risk.

The difficulty for the insurance industry is that flood mapping and other flood risk data are not uniformly available. A recent ICA national survey of local governments confirms that relevant information is limited, despite Queensland having the highest flood risk of any state.

The availability of flood insurance in Queensland on fair and equitable terms will be dependent on the insurance industry's access to flood risk information. However, the responsibility for flood mapping and risk assessment lies primarily with local governments, many of whom are unable to accord this issue a high priority.

In November 2000, the second meeting of the Flood Issues Liaison Committee found that a number of insurers have extended their home and contents policies to cover flood in various ways and that they are developing geo-coded databases (which provide a more accurate location than the traditional use of postcodes) to identify whether a property is has a low, medium, or high flood risk. These databases require accurate flood risk information from state or local governments to support informed underwriting decisions.

Key concerns from insurers are the:

- costs associated with increasing efforts to inform policyholders about the need for flood cover and its availability
- lack of uniformly available flood mapping and other flood-risk data
- difficulties in obtaining flood information for some localities
- difficulty of selling more expensive insurance cover to those most at risk and/or getting other policy holders with little or no risk to subsidise those at risk.

The insurance industry considers that, without further attention to good land use planning and increased funding for mitigation, many Australians will continue to be vulnerable to flood related disasters and will continue to require government disaster relief. It also considers that the lack of flood risk information will severely restrict the availability of flood insurance, and that urgent action is required to raise awareness by all levels of government of the need for better flood information, the development of flood mapping standards, a more cohesive policy framework, and mitigation measures.

The Insurance Council of Australia has identified itself as an interested stakeholder in the development of disaster mitigation measures, particularly in relation to flooding, and will continue lobbying for disaster mitigation issues to be further pursued by all levels of government.

It would be unwise to consider insurance as the primary method of reducing flood losses—it should be considered only as a way of assisting a community to cope with residual flood risks.

7. Flood risk management policy principles and objectives

In formulating a flood risk management policy, it is important to recognise that:

- floodplains are valuable natural resources which cannot be isolated arbitrarily from all development
- floodplains frequently include areas of significant ecological importance, as well as having a major impact on the health of associated waterways
- all development proposals on floodplains should be treated on their merits in relation to the flood risk, the environmental impacts, and the benefits
- state and local government responsibilities should be clearly defined within a statewide strategic direction for the management of flood risk.

The objective of a state flood risk management policy should be to ensure sustained action is taken to minimise long-term risk to life and property so that fewer Queenslanders will be victims of flood impacts in the future.

7.1 Flood risk management principles

The following key principles should guide flood risk management policy:

- Risks to public health and safety should be managed in accordance with ecologically sustainable development principles.
- Decisions on any proposed floodplain use should be based on a full appreciation of the associated risks and benefits.
- Individuals should be able to make informed choices.
- There should be a partnership approach between all levels of government (recognising that the costs of flood disasters affect all Australians).
- Proactive prevention should occur in preference to reactive responses.
- The costs associated with flood risk should be identified and funded transparently.

Although ecological and resource management issues are recognised as important elements of holistic floodplain management, it is not proposed that a state flood risk management policy would directly address such issues. Rather, it would ensure that they are appropriately considered in formulating any flood risk management strategy.

7.2 Flood risk management policy objectives

The primary objective of a state flood risk management policy would be to reduce the effect of flooding on the wellbeing, health and safety of individuals and communities in flood-prone areas of Queensland. Other objectives would be to:

- limit the damage caused by flooding to private and public property
- involve communities in flood risk management
- preserve, and enhance where necessary the natural function of floodplains

- encourage the planning and use of floodplains as a valuable and sustainable resource capable of multiple, but compatible, land uses of benefit to the community.

In considering measures to achieve the above objective, it is desirable to:

- encourage risk reduction strategies that promote long-term rather than short-term benefits, focusing on actions that produce continuing benefits over time
- adopt an 'all-hazards' approach to the development of risk management strategies, ensuring that mitigation of one hazard does not increase exposure to another
- undertake risk assessments to develop a full appreciation of the size, likelihood and potential impacts of flood events
- permit development in hazardous areas only where it is justified by a comprehensive assessment, and with the informed agreement of all parties
- identify the full costs of flood risk management for development on floodplains at the time of development (including costs of studies, hydraulic impacts, mitigation head-works, and potential flood disaster management and operations)
- encourage local action by clarifying responsibility for risk and for managing flood disaster impacts
- ensure the availability of information to foster better decision making and communicate levels of flood hazard and risk to the community
- ensure that the private sector and individuals understand and accept responsibility for being aware of known flood risks and minimising their own exposure in response to good information
- ensure that government subsidies assisting development do not promote development in hazardous areas
- seek to provide sufficient resources to address priority flood problems systematically and objectively
- direct relief subsidies towards achieving acceptable flood risk exposure for infrastructure, not to rebuilding to pre-existing (flood-prone) standards in proven hazardous areas

A state flood risk management policy should also aim to:

- ensure that state and local government responsibilities are clearly defined and that the outcomes of government policies and programs are consistent
- facilitate the generation, recording and ready availability to government and the public of useful information on flood inundation and impacts as a basis for better decision making and clarifying responsibility for risk

- promote the undertaking of appropriate flood risk assessments for every community to support not only local government planning schemes and development controls/decisions, but also mitigation works programs, building standards, funding programs and warning systems
- promote effective communication of flood hazard and risk levels to the community.

8. Possible measures for improving flood risk management

In the following sections, measures that might be taken to improve flood risk management in Queensland are discussed. Before implementation, the measures outlined need to be developed further within an appropriate policy context. Some may prove difficult to fully implement because of associated complexities and/or costs, and local governments may require assistance.

8.1 Policy consistency, cooperation and coordination

Possible measures include:

(a) negotiating with the Commonwealth, to seek

- after a specified time, to discontinue tax write-offs for flood disasters affecting new developments and possibly site redevelopments
- to provide additional tax incentives or low interest loans to relocate or undertake proactive flood mitigation activities

(b) negotiating with the state, to

- ensure state subsidies, which assist development generally, are not aiding the development of areas that will result in an unacceptable flood risk
- ensure that its 'all hazards' interests are incorporated in planning schemes and regional plans with the support of relevant agencies

(c) providing accurate information on flood risk (possibly including flood maps) so it is readily available for major urban centres.

(d) working with the insurance industry to develop options for providing affordable flood insurance for *at risk* areas (on the basis of clearly identified flood risk and taking into consideration actions to mitigate impacts).

8.2 Promotion of best practice/community awareness

Possible measures include:

(a) encouraging assessments of flood risks and the development and implementation of flood management strategies

(b) promoting an 'all hazards' approach for implementation by the state and local governments

(c) preparation of state flood risk management planning guidelines that include the appropriate use of structural mitigation measures (including environmental impact assessment)

(d) promoting hazard identification, risk assessment and mitigation concepts, as well as consideration of all economic impacts (including indirect and secondary impacts) for the provision of infrastructure

(e) establishing a state performance monitoring and benchmarking system for flood risk management practices adopted by local governments

(f) encouraging property buyers to investigate the flood insurability of a property before purchase.

8.3 Administrative systems

Possible measures include:

a) reviewing existing subsidy programs and considering the establishment of planning and mitigation assistance programs to complement existing national programs

b) directing assistance towards communities on a 'needs and means' basis, or where the state and the Commonwealth would benefit directly from the measures to be implemented (including flood mapping and other non-structural measures).

c) establishing formal administrative processes to link the referable dam emergency action plans for dam failure scenarios, the local government planning schemes and the local counter-disaster plans (this measure is currently being implemented progressively as a condition of new or renewed approvals for referable structures under the dam safety provisions of the Water Act)

d) clarifying responsibilities relating to flood disaster prevention and management, and articulating and implementing these responsibilities through recognisable systems that encourage local ownership of actions

e) establishing, in partnership with local government, a formal state system for mapping and recording flood level information (ultimately this might be expanded to capture information on all flood impacts).

8.4 Legislation

8.4.1 Planning and development requirements

Possible measures include:

a) studies (including flood studies, where relevant) to assess the impacts and justify proposed permitted developments on floodplains and associated building controls in a planning scheme—counter-disaster impacts of the proposed land uses and development would also need to be assessed

b) agreement between state agencies on state flood risk management interests and reflecting these in local government planning and development decisions

c) use of flood models for assessing all proposed development and cumulative impacts across the floodplain (including the ultimate level of development) by relevant local governments to provide for consistency in assessment processes (and reduce overall costs)

d) undertaking flood risk assessments (and documentation of these assessments for public inspection) to provide a basis for adoption of a designated flood by a local government

e) development control policies specific to each floodplain for the purposes of mitigating flood impacts[13]

f) property redevelopment to incorporate feasible flood mitigation measures as assessed by the local government

g) coordinated management by local government administrations sharing the same floodplain

h) state agencies acknowledging local flood standards and, where practical, adhering to them—where adherence to local standards is not considered practical, state agencies should be required to consult with the relevant local government to achieve agreement as to standards

i) addressing potential conflicts of interest for local government in the selection of designated floods and publication of flood information—in Victoria, a separate body, the Catchment Management Authority, has responsibility for undertaking flood studies and setting development limits based on flood risk which local governments must then use to assess development applications

j) identifying the full costs of development on floodplains and providing mechanisms for them to be funded in a transparent way

k) reviewing the *River Improvement Trust Act 1940* and the potential role for trusts in the management of flood risk

l) ensuring appropriate guidelines and codes are in place for the planning and design of critical infrastructure items so as they are not subject to unacceptable flood risks (e.g. hospitals, disaster coordination centres, evacuation shelters, power and water supplies).

8.4.2 Flood records and mapping

Possible measures include:

a) local governments maintaining publicly available records on floods, mitigation works and their assessed effect on flood levels

b) local governments registering flood heights for significant events on residential and industrial properties with the Titles Office so that this data can be obtained through property searches (An alternative is to establish a mandatory disclosure requirement when a property is to be sold. The process in New South Wales requires a vendor to furnish a s.149 certificate as part of the contract documentation, which, among other things, details the flood information held by the relevant council. A possible weakness in this process is the quality of information held by councils.)

[13]The proposed state planning policy for natural disaster mitigation currently being developed by DES/DLGP is expected to address flood risk mitigation with respect to planning schemes and new development approvals.

c) mapping of the highest recorded flood heights and flood study results in planning schemes

d) maintaining publicly available maps showing approved and proposed development fill zones in otherwise flood-prone areas.

8.4.3 Community awareness

Possible measures include:

a) regularly reinforcing public awareness of flood warning procedures and historical (and potential future) flood levels in their areas

b) facilitating the interpretation of flood warnings through the installation of flood markers in flood-prone areas that clearly link local depths to flood warning heights

c) providing flood hazard information on property rates notices.

8.4.4 Legal liability

Possible measures include:

a) clarifying the extent of liability and the actions necessary for a local government (and the state) to minimise exposure to possible legal actions arising from:
   - inaccuracy or uncertainty in flood information provided in good faith
   - undertaking or maintaining flood mitigation works with due diligence.

Section 733 of the New South Wales *Local Government Act* gives exemption from liability to local governments for advice provided on flood liable land and land in coastal zones when acting in accordance the New South Wales best practice manual.

8.4.5 Flood mitigation activities

Possible measures include:

a) Providing for state approval of flood mitigation works/expenditure programs, including structural and non-structural measures.

A review of the current approval systems for the various types and locations of works is required.

8.5 Discussion

In the sections above, a range of measures that may be beneficial in mitigating the flood risk exposure of Queensland communities has been outlined. The difficulty lies in determining which would provide the greatest benefit and should, therefore, become a priority.

The results in the 1998 report *Urban Flooding in Queensland—A Review* indicate that a major obstacle to improving flood risk management is the lack of complete and reliable information on the extent and frequency of flooding for Queensland communities. Until the nature and extent of the flood risk is understood, its effective management will remain problematic. It follows that the availability of this information is fundamental in considering possible flood mitigation measures.

Similarly, the incorporation of flood information in local government planning schemes and access to flood information by the public are critical to limiting the growth of flood risk in this state.

However, there are significant implications for both the state and local governments in seeking to improve the flood information base in Queensland. They range from the cost of acquiring relevant data and the necessary flood studies[14], to the sensitivities of affected persons and landholders. Hence, there is a need to adopt measures, such as those outlined above in 8.3—*Administrative systems*; 8.4.2—*Flood records and mapping;* and 8.4.4—*Legal liability*, in a complementary and integrated fashion.

The most basic requirement of any state flood risk management policy instrument is to address the need to acquire and maintain comprehensive flood information that is readily available to the public (in an easily understandable form). Therefore, it is arguably the most fundamental issue to be dealt with when considering implementation options. Almost all the other measures proposed above rely on good flood information to be effective.

To acquire effective statewide coverage, the extent of flood inundation for the full range of flood events needs to be determined for each local government area. This task is best performed by local government with support, where necessary, from the state. Alternatively, the Victorian approach of catchment-based authorities charged with responsibility for mapping flood hazard areas and determining development controls based on acceptable flood risks could be adopted—although this would mean the establishment of an additional bureaucracy. In either case, state oversight would be required to ensure the best use of resources, as well as consistency across the state (and on shared floodplains).

A number of studies have already been commenced or completed—either through the Natural Disaster Risk Management Studies Program, or independently by local governments. The size of the further investment needed to collect the necessary detailed ground level data and perform the flood modelling not already available has not been estimated. However, *Urban Flooding in Queensland—A Review* concludes that it would be 'unrealistic to expect that the total cost of flood studies and mitigation, essential to attain best practice floodplain management, can be borne by local governments alone'.

Probably the next most important action to ensure is that local government planning schemes[15] and state government infrastructure plans[16] are prepared only after appropriate consideration of the flood risks, i.e. measures:

- *8.4.1 (a)*—requiring studies (including flood studies, where relevant) to assess the impacts and justify proposed permitted developments on floodplains and associated building controls in a planning scheme

---

[14]The Natural Disaster Risk Management Studies Program is providing funds to local government that can be used for improving the flood information base.

[15] The proposed state planning policy for natural disaster mitigation currently being developed by DES/DLGP is expected to address flood mitigation in planning schemes.

[16] The *State Infrastructure Plan Strategic Directions 2001* encourages 'all organisations responsible for infrastructure planning and development ... to include disaster risk assessment and mitigation in their project planning and delivery'.

- *8.4.1 (h)*—state agencies to acknowledging local flood standards and, where practical, adhere to them—where adherence to local standards is not considered practical, state agencies should be required to consult with the relevant local government to achieve agreement as to standards.

To assist local governments to implement these measures, the following issues should be addressed:

- the costs to local governments of the supporting studies needed to generate flood information and assess impacts
- appropriate protection from potential litigation that may arise as a result.

Financial assistance for local governments undertaking flood studies is currently available through the Natural Disaster Risk Management Studies Program; however, uncertainty over liability remains a significant issue.

It is intended that the state planning policy for natural disaster mitigation will deal with local government planning schemes and development controls (see section 9.2.2). The proposal in this paper for a state flood risk management policy will, therefore, be required to deal with the remaining issues (see options in section 9.2.1)

8.5.1 Summary

The core issues for a state flood risk management policy are to ensure:

- the generation and recording of useful flood inundation and impact information
- that flood information is readily available to government and the public
- that appropriate assessments of flood risks are undertaken for every community, not only to support local government planning schemes and development controls/decisions, but also mitigation works programs, building standards, funding programs, awareness and warning systems, etc.

Measures to improve flood risk management in Queensland that could be delivered under a state flood risk management policy include:

- a statewide strategic direction to balance the costs and benefits of floodplain use
- alignment of statutory requirements, administrative systems and funding programs
- establishment of a formal system to record, map and interpret flood information to support the state's overview of flood risk, the costs for the implementation and ongoing maintenance of management measures, and the performance of flood risk management practices adopted by local government
- addressing potential conflicts of interest and liability issues for local government in the selection of designated floods and the publication of flood information
- state-supported guidelines for best practice flood risk management
- documented and regularly reviewed local flood risk assessments available for public inspection

- increased community awareness of existing, future and residual risk
- coordination of management by local governments sharing the same floodplain
- equitable infrastructure funding mechanisms/development charges which address life cycle costs associated with flood mitigation
- planning, mitigation and management options for agricultural as well as urban floodplains
- the establishment of flood models where necessary for the consistent assessment of development impacts on floodplains
- review of relevant national codes.

9. Options for implementation

The above discussion suggests a range of measures to reduce flood risk exposure of Queensland communities. Some measures can be implemented readily, while others are more complex and, hence, difficult to implement. Many are complementary and rely on being introduced together to be most effective.

Overall, effective flood risk management policy from the state needs to provide:

- **a cohesive framework of measures**
- **an appropriate implementation mechanism.**

As a measure is only as good as the system that sees it is put into effect; they should not be considered in isolation.

The measures proposed in section 8 are wide ranging. Effective planning scheme controls are believed to be the key to limiting growth in exposure to flood risk. Other elements not associated with future changes in the use of land (such as flood mapping and records collection, community education and awareness, state infrastructure subsidy programs and indemnities) are currently either not part of, or not well covered by, the local government planning scheme and development assessment process.

The identified options for implementing state flood risk management policy fall into two groups:

1. **Legislative —**
   a) **Establishment of 'all hazards' prevention legislation.**
   b) **Establishment of specific 'flood risk management' legislation.**
   c) **Amendment of existing planning and river management legislation.**
2. **Statements of planning policy—**
   d) **Formulation of a state planning policy under IPA (refer *9.2.2 State planning policy for natural disaster mitigation*)**
   e) **Promotion of flood risk management issues through regional planning processes.**

9.1 Legislation

Legislation can provide a framework for addressing issues by being:

- facilitative—in that legislation can set out a process designed to achieve an outcome
- prescriptive—in that legislation can formally set out criteria, specifications and outputs.

Legislation to address flood risk management could establish flood risk management as a mandatory, explicit requirement of specific agencies, rather than as an implicit, optional activity carried out as an interpretation of other requirements (such as town planning under the IPA, good governance under the *Local Government Act*, or as a co-condition of an effective counter-disaster plan under the *State Counter Disaster Organisation Act*).

Additionally, legislation can provide for ongoing maintenance of a management framework through reporting, compliance and enforcement provisions. Primary legislation generally sets out a framework, while subordinate legislation, such as regulations, sets out the provisions in detail. Legislation can formally set out the rights and responsibilities of the two tiers of government—state and local—and provide for the integration management of issues.

In addition, specific provisions can be made which would identify minimum obligations of responsible agencies and define the conditions under which local governments become liable in respect of advice or actions (e.g. where not done in good faith and in accordance with accepted best practice).

The proposed state planning policy for natural disaster mitigation will set out how a local government should integrate matters about flood risk management into its planning instruments; therefore, flood risk management legislation would be required to address non-planning scheme issues such as existing risk.

The advantages and disadvantages of legislation include:

- **Advantages**
  - Becoming a clear responsibility for the relevant department.
  - Establishing the expectations of the state, including its requirements of local government and other agencies with floodplain management responsibilities.
  - Ensuring consistency on floodplain issues which cross local government boundaries.
  - Addressing liability issues.
  - Addressing flood mitigation for existing development.

- **Disadvantages**
  - Lengthy development process.
  - Resource implications for both the state and local government because it would oblige each to undertake certain actions.

9.1.1 Establishment of 'all hazards' prevention legislation

While a comprehensive 'all hazards' legislative approach to disaster risk management may be desirable, the development of such legislation would require very broad consultation across numerous disciplines, jurisdictions and interest groups, and would involve a consolidation of the requirements for each specific hazard. Hence, it would essentially require the process to develop flood risk specific legislation to be replicated for each hazard type (e.g. cyclone, bush fire, land slip, etc.). Therefore, a major consideration would be the practicalities of managing a process even more complex than that required to develop flood specific legislation. In addition, responsibility for the legislation could fall across a number of agencies requiring additional coordination.

Also, it is arguable that the basis for 'all hazards' legislation already exists in the form of the *State Counter Disaster Organisation Act 1975* (or a reviewed/updated version). The Act requires local governments to prepare counter disaster plans covering the:

> ...planning, organisation, coordination or implementation of measures that are necessary or desirable to prevent, minimise or overcome the effects of a disaster upon members of the public or any property of the State...

Although originally considered to apply only in respect of disaster response activities, the scope of counter-disaster planning is amplified in the protocol established between the Department of Emergency Services and the Local Government Association of Queensland in December 1997. The protocol establishes the roles of the state and local government in Queensland's disaster management system and acknowledges local governments' role in:

> ...the development of comprehensive disaster management plans which include prevention, preparedness, response and recovery arrangements' which 'should incorporate mitigation strategies such as those relating to land use planning.

At this stage, these broad provisions do not appear to have had a significant effect on flood risk planning by local governments generally, although this may occur in time. However, the achievement of a particular level of good floodplain management practice is not assured as the specifics required under the *State Counter Disaster Organisation Act* are not set out, and no additional powers or resources are provided. A review of the Act is considered desirable if the expectations had of counter-disaster plans are to be realised.

9.1.2 Establishment of specific 'flood risk management' legislation

The main advantage of specific flood legislation is that all aspects of flood risk management could be integrated and brought together in one, easily recognisable place. rather than the present situation of disparate Acts and the inherent difficulty in coordination, or as an add-on to existing legislation, which may or may not have an obvious relationship with flood risk management. This would greatly assist long-term policy consistency and clarity of agency roles.

9.1.3 Amendments to existing legislation

As identified in section 5, the principal Acts available to facilitate flood risk management are:

- *Integrated Planning Act 1997*
- *Local Government Act 1993*
- *State Counter Disaster Organisation Act 1975*

Other Acts that could appropriately be considered for the addition of flood risk management provisions are:

- *Water Act 2000*
- *River Improvement Trust Act 1940*

These five Acts are relevant to specific actions such as works in or on a watercourse for the mitigation of floods, habitable floor levels for development, works in tidal waters, and development on coastal floodplains.

An important consideration is that amending existing legislation retains something of the current situation where numerous Acts have some relevance to managing flood risk. It would be desirable that this option also aim to rationalise, wherever possible, all legislative provisions dealing with flood risk.

(a) Integrated Planning Act 1997

Planning schemes under the *Integrated Planning Act 1997* provide the policy and management framework for the Integrated Development Assessment System (IDAS) and, therefore, deal with future changes in the use of land. Planning schemes can address flood risk management—however, only to the extent that it affects, or is affected by, proposed developments.

Dimensions of flood risk management not affecting or affected by development subject to a planning scheme or IDAS include:

- existing land use, such as historical flood-prone urban development
- generation, collection, collation and presentation of flood information
- non-land use matters relating to the future of a local government area, such as the capital works program of a local government (that could include the construction of flood mitigation works)
- matters outside the area of the local government to which the scheme applies—floods, tidal surges and other hazards do not respect local government boundaries and flooding in one local government area can be affected by the floodplain management practices of adjoining local governments.

(b) Local Government Act 1993

The objects of the *Local Government Act 1993* include:

(a) providing a legal framework for an effective, efficient and accountable system of local government; and
(b) recognising a jurisdiction of local government sufficient to allow a local government to take autonomous responsibility for the good rule and government of its area with a minimum of intervention by the State; and
(c) providing for community participation in the local government **system; and**
(d) defining the role of participants in the local government system;and
(e) establishing an independent process for ongoing review of certain important local government issues.

The Act principally deals with the machinery of local government; however, sections dealing with specific local government responsibilities, such as roads, malls, water supply, land records, etc., are included. This suggests that inclusion of flood risk management provisions may be achievable, with the advantage that the Act deals with local government—the level of government with the most important and active role in flood risk management.

A disadvantage could be the difficulty there might be aligning state agency responsibilities with an expanded Act. The Department of Local Government and Planning is responsible for the current Act; however, flood risk management would represent a new functional responsibility for that department, raising issues of expertise and resources.

(c) State counter-disaster legislation

Amending the *State Counter Disaster Organisation Act 1975* to include specific flood risk management provisions may be possible; however, given the general application of the current Act to all hazards, it might be more logical for any changes also to cover all hazards. (See the discussion on all hazards legislation in section 9.1.1 above). Also, it may be appropriate for them to take place as part of a wider review of the existing Act.

A similar disadvantage to that raised above with respect to the *Local Government Act 1993* applies here; that is, matching new flood risk amangement provisions with the current functional responsibilities of the Department of Emergency Services may also present difficulties.

(d) Water Act 2000

The addition to the *Water Act 2000* of provisions that deal with flood risk management would have the advantage of linking the regulation of flood mitigation activities with activities associated with the broader management of water resources— for example, the collection of stream flow information and riverine management are linked to the maintenance of flood data and flood risk management. Other measures, not directly related to water (e.g. indemnification of local government and recording of flood data on titles) may not match the current responsibilities quite so well, but may be able to be accommodated.

(e) River Improvement Trust Act 1940

The *River Improvement Trust Act 1940* provides for the establishment and operation of river improvement trusts to undertake and maintain river management works. However, while the opportunity exists to use trusts to implement mitigation works,

the opportunity is not currently universally available because there are only 17 trusts throughout the state. Therefore, the lack of state coverage would have to be addressed (e.g. by establishing a trust in every local government area where flood risk management may be required) before any other amendments might be considered for this Act.

There is also the question of jurisdiction for other flood risk management activities which may be 'remote' from watercourses, such as the control of structures on floodplains.

9.2 Statements of planning policy

9.2.1 Formulation of a state planning policy under the IPA

State planning policies (SPPs) have an effect in both of the following ways:

- as a guide to making a planning scheme
- as an IDAS decision-making tool.

In the first case, the approval of the Minister for Local Government and Planning for a new or amended planning scheme is conditional on the scheme reflecting the SPP.

In the second case, SPPs have to be considered in development assessments and should, therefore, contain policies and other criteria for the assessment of proposed works on floodplains.

It is usually the case that an SPP is of general application, setting out the general intention and objectives of the state in relation to a particular matter. Therefore, when an SPP is given effect through a planning scheme, the local government will attempt to interpret the SPP into the local planning scheme. Achievements may, however, be difficult to measure in that an SPP itself cannot be very specific to a particular planning scheme area.

Key points about a SPP are that:

- it is a policy about a particular state interest[17] or concern—it is *not* legislation
- it is given effect through the IPA
- it is of general application throughout the state, unless the policy states otherwise
- the Minister for Local Government and Planning must be satisfied that the local planning scheme has integrated an SPP (or other state interest)
- any proposed planning scheme must be submitted to the Minister for Local Government and Planning who must consider whether or not a state interest would be adversely affected by a planning scheme.

---

[17] **'State interest' means –**

(a) an interest that, in the Minister's opinion, affects an economic or environmental interest of the State or a region; or

(b) an interest in ensuring there is an efficient, effective and accountable planning and development assessment system.

- an assessment manager must consider any relevant SPP when assessing a development application.

The Minister for Local Government and Planning administers the IPA (the legislative framework that gives effect to state planning policies) and, therefore, must be satisfied that a planning scheme has adequately reflected the intent of an SPP. Where an SPP is developed by another department, the implementation of the SPP is managed jointly with the Department of Local Government and Planning (DLGP).

To ensure that the Minister for Local Government and Planning is fully and appropriately advised on each planning scheme's compliance with an SPP, DLGP currently has arrangements with those agencies that have developed SPPs—as well as a process that seeks to coordinate consultation with state agencies that have an interest in local planning schemes generally.

The advantages of using an SPP as the implementation mechanism for flood risk management best practice by local government are:

- quick implementation is possible[18]
- a 'head of power' for SPPs exists in state planning legislation (i.e. the IPA)
- the state is able to oversee a significant component of flood risk management through an existing system (i.e. the approval of planning schemes)
- SPPs can provide policy and guidelines to assist local governments preparing their planning schemes and development approval processes.

The disadvantages of using an SPP as the implementation mechanism for flood risk management best practice by local government are that:

- an SPP can only deal with planning and future development issues affecting flood risk management; non-planning scheme issues—such as mitigation of existing flood risk (current estimates 100 000 properties at risk of 1-in-100 year flood), collection and publication of flood information, liability and community awareness—would not be affected.
- while the minister can ensure a local government's planning scheme reflects SPPs, a local government can make decisions on individual development applications contrary to the scheme
- SPPs are not applicable to councils that did not have a planning scheme when the IPA was introduced (i.e. most Aboriginal and Torres Strait Islander councils)
- it is outside the scope of an SPP to identify all issues associated with best floodplain management.

[18] Consultation on the draft state planning policy for natural disaster mitigation is proposed by the end of 2002 and, assuming feedback is positive, the SPP will be finalised early in 2003.

9.2.2 State planning policy for natural disaster mitigation

The Department of Emergency Services released a discussion paper proposing the preparation of a state planning policy in September 2001. The paper considered the natural hazards of landslides, cyclones, severe storms, earthquakes, bushfire and floods for coverage by a state planning policy. Feedback on the proposal was favourable, and the ministers for Local Government and Planning and Emergency Services have approved development of a draft state planning policy for natural disaster mitigation for further public consultation by the end of 2002.

The SPP will express the state's interest in planning for the mitigation of natural disasters (such as floods) and the improved management of risks associated with natural hazards in general. It will also provide the basis for local government to implement flood risk management measures in local planning schemes and development assessment decisions.

Adoption of the SPP would implement some of the measures proposed in this paper (i.e. the preparation of local planning schemes and development assessment conditions that avoid the creation of further *at risk* development), and is effectively option (d) for a state flood risk management policy above (i.e. state planning policy—flood risk mitigation).

9.2.3 Promotion of regional planning advisory committee processes

The *Integrated Planning Act* also provides for regional planning advisory committees (RPACs) to address matters that transcend local government boundaries. A regional plan can deal with single or multiple issues. It is up to the Minister for Local Government and Planning to determine the terms of reference for a RPAC.

IPA gives statutory recognition to RPACs and the outcomes of regional planning processes (IPA Part 5). The IPA also requires local governments to address the State and regional dimensions of matters in planning schemes (IPA s 2.1.3 (1) (a)). In this regard, the Act (IPA s 2.1.3(3)) describes a:

> ...regional dimension of a planning scheme matter as a dimension:
> (a) about which a regional planning advisory committee report makes a recommendation; or
> (b) that can be best dealt with by the co-operation of 2 or more local governments.

In practical terms, this formal recognition means regional planning under IPA can be expected to have greater relevance within the planning system and wider public administrative functions.

As discussed in section 5.1, where multiple local governments occupy the one floodplain, regional planning has the potential to address flood risk management issues. Although the role of regional planning processes has been strengthened under the IPA, success in dealing with flood risk management planning still relies on the initiative and will of the individual member councils. In *Community Vulnerability and Planning: Opportunities to Mitigate Against Disaster* (King 1998) the author concluded:

> The regional planning process has not addressed disaster planning issues other than as a passing reference. In regional plans there is no guidance on risk management for local councils.

The Minister for Local Government and Planning administers the IPA—the legislative framework that gives effect to regional plans. Therefore, the Minister for Local Government and Planning must be satisfied that flood risk management is a regional issue of sufficient importance to require a regional planning advisory committee to be established to address it.

Once again, the administrative arrangement between DLGP and the department that develops the flood risk management terms of reference for the RPAC needs to be considered to ensure that the department is able to fully and appropriately advise the Minister for Local Government and Planning on whether:

- the regional plan delivers the flood risk management outcomes required
- the planning scheme complies with the regional plan.

The advantages of using the regional planning process as the implementation mechanism for floodplain management best practice by local government are:

- RPACs can be established under existing legislation (a number of advisory committees already exist and local governments are familiar with the role of the committees) to deal with any issue (within the terms of reference)
- outcomes of the process can be integrated with the existing planning system
- the state can monitor implementation of measures to mange future flood risk through an existing approval system (i.e. approval of planning schemes) and through the advisory committees.

The disadvantages of using the regional planning process as the implementation mechanism for floodplain management best practice by local government are:

- RPAC recommendations are advisory only and must be integrated into a planning scheme before they can have any impact on development assessment decisions
- non-planning scheme issues—such as management/mitigation of existing flood risk, collection and publication of flood information, liability and community awareness—would not be addressed.

9.3 Implementation costs

Statements of planning policy may be of low cost to the state; however, the degree to which local governments pursue the intent of the policy and the amount of assistance the state is prepared to offer would have a major influence on the cost of implementation.

A major cost consideration is the undertaking of flood studies by local governments to provide the basic information for floodplain planning and management decisions. In some cases, this information is already available, while in others, studies are currently underway. The report *Urban Flooding in Queensland—A Review* indicated that, at the time of the questionnaire in 1997, less than half the urban localities responding (i.e. only 46 out of the 118) were covered by a flood study; however, the quality of these studies was highly variable. Since that time the *Natural Disaster Risk Management Studies Program* has been introduced and has assisted in this area by providing state and federal funds for flood and other natural hazard studies. (To date, approximately 30 flood or storm surge studies have been or are being funded.)

9.4 Summary of implementation options

Options initially identified for implementing a state flood risk management policy fell into two groups:

Legislative

a) Establishment of 'all hazards' prevention legislation.

b) Establishment of specific 'flood risk management' legislation.

c) Amendment of existing legislation (e.g. hazard, river management, water, etc.).

Planning policy statements

d) Formulation of a state planning policy under the IPA.

e) Promotion of flood risk management issues through regional planning processes.

Attachments 2A and 2B summarise the measures that may be considered under the two broad implementation mechanisms identified.

As discussed in section 9.2.2, the Department of Emergency Services is currently developing a state planning policy for natural disaster mitigation that will include flooding and, therefore, implements option (d). As a result, although option (e) could be pursued under existing processes, its consideration is of little value—except perhaps where a regional approach may be required (i.e. on shared floodplains). This could be determined on the basis of individual situations.

The proposed state planning policy for natural disaster mitigation addresses the issue of growth in flood risk as a result of future developments on floodplains but cannot address non-development related aspects of managing flood risk.

This effectively limits the options for implementing non-planning scheme/development assessment flood risk management measures to legislation. Legislation can cover all the identified issues necessary to improve flood risk management in Queensland, but would require a full public consultation process.

Option (a)—*all hazards prevention legislation* is a potentially lengthy and complicated option because:

- broad consultation on a wide range of hazards and mitigation measures would be required
- it may be desirable to include a review of the *State Counter Disaster Organisation Act* at the same time
- there is potential to produce a complex document with administrative difficulties due to the range of agencies which would have responsibilities.

Option (c)—*amendment to existing legislation* could be restricted in its ability to deal with all flood risk management issues if the existing Act chosen for amendment had limitations and these were perpetuated. For example, the ability of the *River Improvement Trust Act 1940* to deal with flood risk management is currently limited by both the number of existing trusts and the current scope of trust responsibilities. As a result, other 'flood risk management' provisions may need to be covered by amendments to *other* existing legislation.

Option (b)—*specific new flood legislation* provides the most focused mechanism, as well as the opportunity to ensure all issues are addressed. Option (c) is perhaps the next best option—provided the existing legislation chosen either currently has the broad application necessary, or can accommodate the changes necessary to gain the broad application required.

Implementation mechanisms which either cannot deal with all flood risk management issues, or which rely on multiple instruments to achieve coverage of all the issues, will not promote policy consistency and coordination and could be considered only a marginal improvement on the current situation.

Whichever option is chosen, it must deal with the pivotal issue of making complete and reliable flood information available so that:

- the community can make informed decisions when purchasing property or when responding to flood disasters
- local governments can prepare well-informed planning schemes, development approval conditions and capital works programs
- the state government can maintain a credible overview of the nature and extent of the flood risk in Queensland to inform policy decisions and facilitate targeting of any assistance.

Widespread availability of flood information has significant implications for both the state and local governments, but it is critically important that these implications do not unduly impede the availability of reliable information.

10. Other related initiatives

The need to better address risk exposure (not only to floods, but all natural hazards) so as to protect lives and contain the growth in demand for response and recovery resources has been recognised for some time by state, national and international emergency management agencies. This has led to a wider focus by these organisations, taking in both their traditional role (emergency response and recovery) and a more proactive role in promoting preventative measures which either avoid or reduce risks.

Key preventative actions in dealing with risks from natural hazards are:

- Avoidance (typically where there is the potential to 'create' an unacceptable risk), including:
  - appropriate planning of land use
  - appropriate development controls
  - appropriate building controls.
- Reduction (typically where an unacceptable risk already 'exists'), including:
  - mitigation works
  - warning systems
  - building design/construction standards
  - community awareness.

10.1 State Disaster Mitigation Committee

In 1998, the Queensland Department of Emergency Services, through the Central Control Group[19], initiated (and chairs) the interdepartmental State Disaster Mitigation Committee. The role of the State Disaster Mitigation Committee is:

> ...to provide advice to the Government through the Ministers for State Development and Emergency Services on mitigation issues. In particular they will be responsible for:
> - Developing a definition of mitigation that can be agreed by the three spheres of Government.
> - Establishing the parameters of an all hazard risk management approach that can be used by government agencies and local government in establishing Disaster Mitigation Plans.
> - Determining the criteria to be used in setting priorities for mitigation across the state and establishing a list of priorities.
> - Evaluating the appropriateness on existing Commonwealth and State Programs to fund mitigation activities.

[19] The Central Control Group is established under the *State Counter Disaster Organisation Act* and consists of persons representing any department of the government of the state or statutory corporation appointed by the governor in council. The group carries out the functions of the State Counter Disaster Organisation whose role is to:

- 'coordinate the resources necessary to ensure that all steps are taken to plan for and counter the effects of a disaster;
- to give advice and assistance to the Minister on all matters with respect to counter disaster'.

- Developing funding criteria to support local government to undertake mitigation works (development of Disaster Mitigation Plans and implementation of mitigation strategies) that recognises the need for all spheres of government to contribute.
- Developing an awareness program directed at local government and the community that emphasises the social and economic benefits of mitigation and the responsibility of government and citizens.

The Committee is made up of representatives from state departments and local governments including:

- Department of Emergency Services
- Department of Local Government and Planning
- Department of Main Roads
- Department of Natural Resources and Mines
- Department of Primary Industries
- Department of Public Works
- Queensland Treasury
- Department of State Development
- Environmental Protection Agency
- Department of the Premier and Cabinet
- Local Government Association of Queensland
- Dalby Town Council
- Burdekin Shire Council.

The Committee has been active in promoting and supporting a number of initiatives. Significant amongst these are:

- support for the continuing development of a natural disaster mitigation policy framework for Queensland (consistent with Australia's evolving Disaster Prevention Mitigation Strategy) based on a whole-of-government approach to disaster risk management
- consideration by individual agencies of the potential to include mitigation outcomes in their actions
- modifications to the conditions for state subsidy of local government infrastructure (i.e. through the Local Governing Bodies Capital Works Subsidy and the Transport Infrastructure Development schemes), requiring evidence that natural disasters, and mitigation of their impacts, were appropriately considered by local governments when planning the works
- inclusion of disaster mitigation requirements in the *Local Government Financial Standards* that specify local government corporate planning parameters and in the *Capital Works Management Framework* by the Department of Public Works

- support for projects such as research into the economic cost of disasters in regional Queensland and the study by the Bureau of Transport Economics into the cost of disasters—these raise the awareness in all levels of government and the community of the cost of natural disasters and the long term benefits of disaster mitigation
- Encouragement of and input to a national review of the natural disaster relief and mitigation arrangements by the Council of Australian Governments (COAG) to assess their scope and relevance
- monitoring of the relatively new Natural Disaster Risk Management Studies Program and Regional Flood Mitigation Program which provide state and Commonwealth funding for investigations and works respectively
- support for the development by the Department of Emergency Services of a state planning policy for natural disaster mitigation under the *Integrated Planning Act 1997.*
- support for an education and awareness program being developed by the Department of Emergency Services
- support for projects (including research) to improve the level of knowledge on natural hazards—such as the Greenhouse Project Part A *Climate Change and Coastal Community Vulnerability to Tropical Cyclones* and Part B *Climate Change and Tropical Impact on Coastal Community Vulnerabilities*, and the Economic Cost of Disasters in Regional Queensland.

The State Disaster Mitigation Committee has also provided an important forum to gather support for the development of a state flood risk management policy through an initial level of interagency feedback in developing this discussion paper.

10.2 Department of Emergency Services

The Department of Emergency Services, Queensland has embarked on a 'multi-objective' strategy to encourage local governments to better address the mitigation of risks from natural hazards. The strategy has included:

- risk assessment studies in collaboration with selected local governments and other state agencies
- publication of disaster risk management guidelines
- promotion of natural disaster risk studies by local governments (which assess the overall exposure to risks from all natural hazards in a local government's area) through the Natural Disaster Risk Management Studies Program
- design of an education program to introduce local government practitioners such as town planners and engineers to the Commonwealth- and state-approved disaster risk management methodology
- reducing the threshold/contribution of low-rate-base councils for Natural Disaster Relief Arrangements funding if they submit a disaster mitigation plan
- developing a strategy to support indigenous communities to complete natural disaster risk management studies and mitigation plans
- initiatives under the State Disaster Mitigation Committee (discussed above)
- the project to prepare a State Planning Policy for Natural Disaster Mitigation under the *Integrated Planning Act 1997.* (Refer section 9.2.2)

10.3 Related issues for NR&M

Feedback from public consultation on this State Flood Risk Management Policy discussion paper will be used to assist in the development of future policy and regulatory direction for drainage works and levees within the *Water Act 2000.*

Drainage works and levees have the effect of controlling the flow of water into or out of a watercourse, lake or spring. Improperly managed levees and drainage activities have the potential to impact greatly on water management, water quality and the riverine environment generally. Inappropriate design can cause adverse impacts on downstream and upstream areas and on watercourses as a result of changes to drainage patterns and increased flow volumes and/or velocities. Particular concern has been raised with respect to the regulation of drains and levees in the Wet Tropics region.

Local government is generally responsible for the management of drainage systems and may regulate levees that are not on a watercourse (e.g. on floodplains). Through the water resource planning process under the *Water Resources Act 2000,* NR&M is able to regulate works that take or interfere with overland flow water. NR&M is also able to regulate works within the bed and banks of a watercourse (e.g. drainage outlets) and works that interfere with the flow of water into or out of a watercourse in declared areas (e.g. drainage networks and levees).

NR&M recognises that, along with localised concerns, the cumulative effects of many activities within a catchment need to be considered when proposing how to best manage impacts on watercourses, and that ultimately these impacts are best managed on a catchment scale. It is recognised that other state legislation also has some regulatory effect on drains and levees.

Issues relevant to the regulation and responsibility for drainage works and levees include:

- managing the extent and effects of floods
- clarifying roles for regulatory drainage and levee bank works
- addressing ecological impacts of drainage activities
- maintaining or improving viability of agricultural lands in flood plains
- relationship of this issue with the *Reef Protection Plan*
- relationship of this issue with coastal legislation.

11. Conclusions

Assuming that the need for a comprehensive State Flood Risk Management Policy is accepted and as a draft state planning policy for natural disaster mitigation incorporating floods is already being developed, the only options to consider for the implementation of the remaining measures identified in this paper are legislative.

Legislation can address a the wide range of flood issues such as formally setting out the rights and responsibilities of government (state and local), providing for integrated management, ensuring flood information is available, and addressing liability and existing risk.

To ensure that all the measures under a state flood risk management policy remain consistent in the longer term, and are well understood and easily referenced, they should be brought together in one place. Hence, the legislative options recommended are either:

- *Option (b)—New flood risk management specific legislation*

or

- *Option (c)—Addition of flood risk management provisions to one existing Act.*

Public consultation on the state planning policy for natural disaster mitigation is proposed by the end of 2002 and, assuming feedback is positive, the SPP will be finalised early in 2003, which will be ahead of the preferred option presented in this paper, i.e. flood risk management legislation.

If the flood risk management legislation option proposed in this paper were supported, the state planning policy for natural disaster mitigation would continue to deal with planning scheme and new development aspects of flood risk management as an adjunct to the legislation.

12. Where to from here?

12.1 The next step

This summary paper, along with the main discussion paper, is not government policy. Rather it has been prepared primarily as a resource document for key stakeholders to respond to during the public consultation process. It is intended to assist in identifying the interests of the various stakeholders and facilitate the drafting of a state flood risk management policy.

State Flood Risk Management Policy		Timing
Public comment period	Period during which: o stakeholders can comment on the subject matter and scope of the proposed policy—comments to be forwarded as written submissions, either in hard copy or electronically o availability of the discussion papers will be advertised in the *Courier Mail* and major regional papers o a series of direct consultations will be undertaken with identified stakeholder organisations (and other interested parties, if requested) to promote responses to this discussion paper.	Dates between which public comments will be called are to be determined by the Minister for Natural Resources and Mines
Decision to proceed	o Minister for Natural Resources and Mines will decide whether to proceed with preparation of a state floodplain management policy.	To be determined by Cabinet based on the recommendation of the Minister for Natural Resources and Mines, following review of public comments received
Draft policy document	o Draft state flood risk management policy document will be prepared	Date to be determined by the Minister for Natural Resources and Mines

If the Minister decides to proceed to preparation of a state flood risk management policy, a proposal will be drafted and made available for public consultation in line with legislative requirements.

12.2 Your comments

The Department of Natural Resources and Mines welcomes comments on the development of a state flood risk management policy over the three-month consultation period. Your comments, either as an individual or through an association not already identified as having an interest in flood risk management, are encouraged. Written submissions should be made within the advertised time frame and can be posted, faxed, or emailed to the Department of Natural Resources and Mines (see contact details below).

During the public consultation period, the department intends to consult directly on the discussion papers with authorised representatives of the identified stakeholder organisations listed below. Stakeholder groups not already identified may request a meeting between departmental representatives and spokespersons authorised by their organisation within the advertised consultation period.

Comments or enquiries may be referred to departmental officers involved in the development of the state floodplain management policy; however, formal submissions should be in writing.

Written submissions are due by 28 February 2003 and should be addressed to:

Principal Policy Officer, Water Use
Water Management and Use
Department of Natural Resources and Mines
GPO Box 2454
BRISBANE Qld 4001

Email: [redacted]
Facsimile:
Telephone:

References

Smith, D. I. 1998, *Urban Flooding in Queensland—A Review,* Department of Natural Resources and Mines, Brisbane.

Standing Committee on Agriculture and Resource Management 2000, *Floodplain Management in Australia Best—Practice Principles and Guidelines* (SCARM Report Number 73), CSIRO Publishing.

Environmental Protection Agency 2001, *Queensland Greenhouse Policy Framework: A Climate of Change,* Environmental Protection Agency, Brisbane.

Legislation

Integrated Planning Act 1997 (Qld)

Local Government Act 1993 (Qld)

State Counter Disaster Organisation Act 1975 (Qld)

Coastal Protection and Management Act 1995 (Qld)

Standard Building Regulation 1993

Cases

Nifsan vs. Gold Coast City Council (1997), Queensland Planning and Environment Court.

Attachment 1

Legal liability and compensation

While there may have been no negligence by a local government (and hence no common law basis for legal action), the concept of 'injurious affection' is often promoted as a basis for such compensation claims. The term, which is not a legal one, refers to a loss that either has occurred, or can be quantified and shown *will* occur, as a result of a *non-negligent* action by council (e.g. indicating a flood liability that causes a loss in market value resulting in an actual loss on the sale of a property). Although injurious affection is not recognised in the common law, it has been available as a basis for claims for compensation under some state statutes. Although the IPA now substantially reduces the scope for such claims with respect to natural hazards such as floods, local governments may still feel morally obliged to satisfy such claims.

Examples

Some examples of where compensation may be sought, and/or a legal challenge to a action by a local government may be initiated include:

1. planning scheme changes which, over time, erode the level of protection available to existing residents
2. flood mitigation works which have a detrimental effect on some properties.
3. planning scheme changes which reduce the value of the interest held by a property owner.
4. changes to building controls which make conditions more restrictive than those that applied in the past (e.g. increase in minimum habitable floor levels between original development and new development)
5. provision of accurate information which indicates a change in the understanding of a property's susceptibility to flooding, and hence a drop in its market value
6. provision of inaccurate information which indicates a change in the understanding of a property's susceptibility to flooding and, hence, a drop in its market value
7. withholding existing flood information.

Examples 1 and 2

A local government is exposed to legal action on the basis of *negligence* with respect to its duty of care to the existing floodplain residents, but can generally minimise its liability if it adopts reasonable and sound planning, design and construction practices, e.g. accepted best practice at the time at which the decisions are made.

Example 3

Section 5.4.4 (1) (h) of the IPA rules out compensation for reduced value of interest in land as a result of planning scheme changes which:

> ...affects development that, had it happened under the superseded planning scheme—would have led to significant risk to persons or property from natural processes (including flooding, land slippage or erosion) and the risk could not have been reduced by conditions attached to a development approval.

Example 4

Negligence is determined at the time the particular decision is made. If, as a result of newer or better information, a local government determines that the minimum habitable floor level for a building proposed for development should be higher than for buildings previously approved in the same locality, the local government will not be legally exposed by imposing new requirements. A local government could actually be exposed to an action where it chose not to act on information that showed that habitable floor levels should be raised.

In the past, such development approval conditions have been challenged and overturned. This was in the quasi-legal situation of the Building and Development Tribunal and is not regarded as legal precedent; however, it does demonstrate the potential difficulties in getting consistency in the current situation.

Example 5

Providing *accurate* flood information does not expose a local government to legal liability because whether or not a property floods is a question of fact, regardless of whether the information is published.

Example 6

This scenario would likely result in compensation being payable to the property owner if he/she can establish that loss or damage has accrued as a result of the publication of the inaccurate information. This is a claim in negligence or negligent mis-statement. By publishing the information, the council is holding itself out as providing accurate flood information, reliance on which would likely result in a reduction in property value. It is this decrease in value that would be the subject of a claim for compensation.

Example 7

There is currently no legal obligation under the *Local Government Act* or any other legislation by which councils are under a mandatory duty to specifically supply flooding information. The supply of such information is a voluntary decision; hence, a council is free to determine whether it will supply information and the terms on which it will supply the information.

Provided a properly worded disclaimer is attached to the information or council has a documented policy setting out the basis for the non-supply of information (i.e. records not necessarily accurate or complete and therefore the non-supply cannot be taken as any indication that the property is or is not flood affected) there should be no basis for legal liability for the accuracy of the information or for any implied representation that the land is flood free. (Refer King & Co., comments to LGAQ, 16 Oct 2000.)

While this provides local government with an 'out' for the non-supply of flood information, it is not in the interests of improved flood risk management.

This position is also confused by the requirements of the Standard Building Regulation 1993, which requires a local government to keep information it has to assist in making and assessing development applications, available for public inspection.

Attachment 2A

Measures that could be included in legislative implementation options

Planning and future development controls:

- Require flood risk studies/ impact assessment studies to support planning schemes and development controls.
- Provide state 'flood mitigation planning' guidelines.
- Set out flood disaster prevention and management responsibilities, and ensure agreement on state floodplain management interests to be reflected in planning schemes and development decisions.
- Establish formal links between referable dam emergency action plans, planning schemes and counter-disaster plans.
- Require coordinated management by local government administrations sharing the same floodplain (using regional planning or other processes where necessary).
- Require development and redevelopment control policies to mitigate flood impacts.
- Require all state agencies to acknowledge and, where practical, adhere to local flood standards.
- Require local governments to establish flood models to enable consistent assessment of development impacts on floodplains (especially where multiple developments are likely).
- Promote an all hazards approach for implementation by the state and local governments.
- Include hazard risk assessment and mitigation into the Queensland Treasury 'Project Evaluation Guidelines' (March 1997) and other state infrastructure guidelines.
- Address potential conflicts of interest for local government in the selection of designated floods and the publication of flood information.
- Ensure that the full life-cycle costs of development on floodplains are identified and provide transparent mechanisms to address their funding

Operational controls:

- Establish a state system for mapping and recording flood information based on data supplied by local government.
- Establish a satisfactory state performance monitoring and benchmarking system for flood risk management practices adopted by local governments.
- Require local governments to maintain publicly available flood and mitigation works records.
- Require the registration of flood heights on property titles or mandatory disclosure of flood information when selling.
- Provide low interest loans to owners for individual property modifications which reduce vulnerability to flooding.
- Use state subsidies to promote public flood risk mitigation.
- Require mapping of significant historical floods, flood study results and approved and proposed development fill zones in flood-prone areas in planning schemes.
- Require regular education of residents about historical flood levels in their local areas.
- Require the establishment of flood warning systems and the installation of flood markers to allow interpretation.
- Address liability and compensation issues for agencies by setting the conditions through which local governments (and the state) may satisfy their legal obligations with respect to flood information and undertaking or maintaining works with due diligence.

Works controls:

- Require flood mitigation works programs.
- Authorise flood mitigation works.
- Subsidise flood mitigation works.
- Indemnify responsible actions.

Attachment 2B

Measures that could be included in statements of planning policy implementation option

Planning and future development controls:

- Encourage flood risk/impact assessment studies to support planning schemes and development controls.
- Provide state 'flood mitigation planning' guidelines.
- Clarify flood disaster prevention and management responsibilities, and ensure agreement on state floodplain management interests to be reflected in planning schemes and development decisions.
- Encourage links between referable dam emergency action plans, planning schemes and counter-disaster plans.
- Encourage coordinated management by local government administrations sharing the same floodplain (using regional planning or other processes where necessary).
- Encourage development and redevelopment control policies to mitigate flood impacts.
- Encourage state agencies to acknowledge and, where practical, adhere to local flood standards.
- Encourage local governments to establish flood models to enable consistent assessment of development impacts on floodplains (especially where multiple developments are likely).
- Promote an all hazards approach for implementation by the state and local governments.
- Include hazard risk assessment and mitigation into state infrastructure guidelines.

Operational controls:

- Establish a formal state system for mapping and recording flood level information on floods based primarily on data supplied by local government.
- Establish a satisfactory state performance monitoring and benchmarking system for flood risk management practices adopted by local governments.
- Encourage property buyers to investigate the flood insurability of a property before purchase.
- Provide low interest loans to owners for individual property modifications which reduce vulnerability to flooding.
- Ensure state subsidies promote public flood risk mitigation.
- Encourage mapping of the flood of record, flood study results and approved and proposed development fill zones in flood-prone areas in planning schemes.
- Promote regular education of residents about historical flood levels in their local areas.
- Encourage the establishment of flood warning systems and the installation of flood markers to allow interpretation.

Works controls:

- Subsidise flood mitigation works.

Attachment 3

Identified stakeholder organisations

- ✓ Local Government Association of Queensland
- Selected individual local governments
- ✓ State Council of River Improvement Trusts
- ✓ Institute of Public Works Engineers
- ✓ Urban Development Industry Association
- ✓ Insurance Council of Australia
- ✓ Queensland Conservation Council and/or affiliates
- State government departments
- ✓ Property Council of Australia

Level 17 T+G
UDIA Qld
Brian Stewart
CEO. C/- GPO
Box 2279 4001

[redacted]

Attachment 4

Proforma for submission

The following is a suggested proforma for submissions on the State Flood Risk Management Policy discussion paper. Interested individuals and authorised representatives of organisations are encouraged to make a written submission regarding the discussion paper to:

Principal Policy Officer, Water Use
Water Management and Use
Department of Natural Resources and Mines
GPO Box 2454
Brisbane Qld 4001
Email: [redacted]
Facsimile:
Telephone:

Written submissions close on 28 February 2003.

Name of author or contact person	Mr/Mrs/Ms/
Organisation	
Telephone / Facsimile	During business hours:..... Alternate number:..... Facsimile:.....
Contact address for correspondence	
Email	

Stakeholder group

(please circle applicable group or groups):

Government

- ❑ local government
- ❑ Queensland Government agency
- ❑ government-owned enterprise
- ❑ statutory authority (e.g. board or trust)
- ❑ Commonwealth Government

Industry

- ❑ insurance
- ❑ tourism
- ❑ primary industry
- ❑ mining
- ❑ consultant
- ❑ property/development
- ❑ construction
- ❑ other (please specify)

.....

.....

Professional

- ❑ planning
- ❑ environmentalist
- ❑ engineering
- ❑ social sciences
- ❑ geography
- ❑ natural resource management
- ❑ disaster management
- ❑ other (please specify)

.....

.....

Other

- ❑ general community member
- ❑ property developer
- ❑ property owner
- ❑ other (please specify)

.....

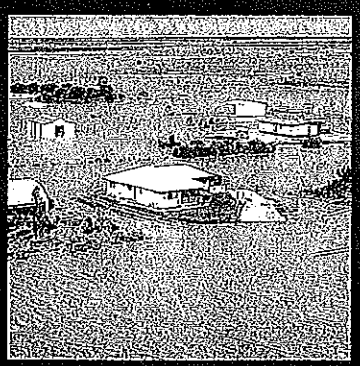
.....

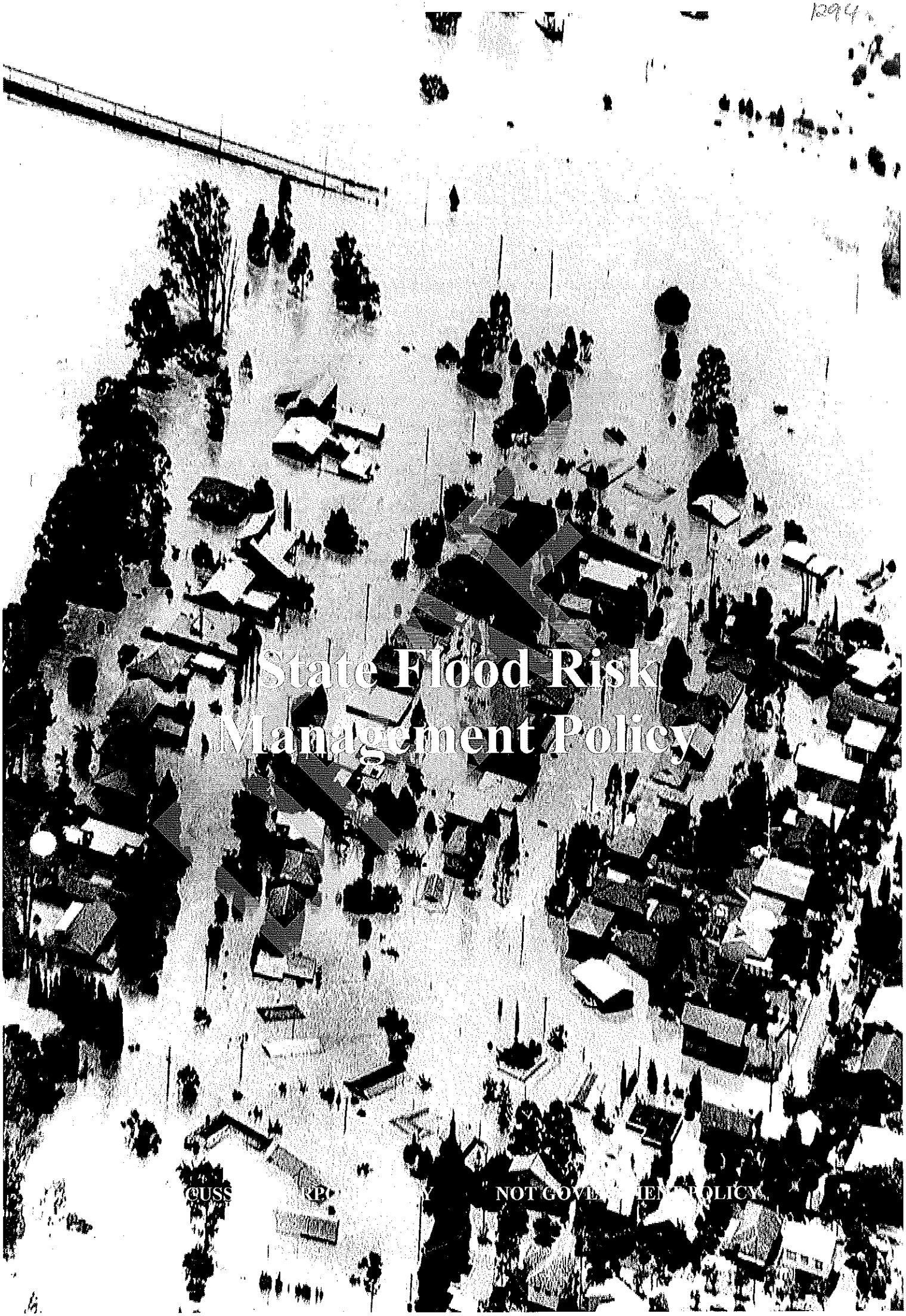
Special interest ☐ community ☐ environment/conservation ☐ other (please specify)	

I support development of a State Flood Risk Management Policy (please tick one box).

strongly agree	agree	indifferent	disagree	strongly disagree
☐	☐	☐	☐	☐

Comments:





State Flood Risk Management Policy

State Flood Risk Management Policy

1.0 Purpose

This policy provides for a comprehensive approach to managing flood risk so as to reduce the impact of flooding on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods, within the context of the sustainable use and management of the State's floodplains.

The policy provides for Floodplain (risk) Management Plans as the principal mechanism for addressing all the flood risk issues relevant to a particular floodplain in an integrated manner

The policy also draws together (as far as possible) all the flood risk management issues and recognises that implementation will be supported by State legislation – *both existing and new.*

2.0 Background

2.1 Floodplains

Floodplains are natural resources of immense value. They are the sites of most of our towns and cities and support many of our most productive rural industries. They are often also areas of primary environmental significance and their well being is essential to the survival of many ecosystems. Their development and use should be managed in an ecologically, economically and socially sustainable fashion.

Floodplain Management in Australia Best—Practice Principles and Guidelines produced by the Standing Committee on Agriculture and Resource Management (SCARM Report Number 73, CSIRO Publishing, 2000) describes Australia's floodplains as:

> *...the commercial, social and ecological arteries of the nation. As such they constitute a national asset... most of Australia's towns and cities are located on floodplains...a significant proportion of Australia's intensive and extensive agricultural output is produced on floodplains including irrigated agriculture. Regular flooding of these areas enhances agriculture by increasing soil moisture, recharging ground water levels and depositing fertile soil...many mining operations and transport-related infrastructure are partly or completely located on floodplains...* while...*the interdependence of the health of the river and the floodplain and the role of periodic floods in maintaining this connection has been increasingly recognised.*

The SCARM report also recognises that:

> *A floodplain is an essential component of a catchment, and floodplain* (risk) *management is a critical part of overall catchment management...*; and
> *...management decisions taken in respect of human occupation of floodplains need to satisfy the social and economic needs of the community as well as being compatible with the maintenance or enhancement of the natural ecosystems that the floodplain sustains.*

2.2 Cost of Flooding

Each year, floods seriously affect Queensland's economy and the social wellbeing of communities.

The cost of flood damage under the Natural Disaster Relief Arrangements (NDRA)[1] alone averaged over $50 million per year in Queensland between 1989 and 2001, with expenditure in 2000–01 in excess of $100 million. The full cost is estimated to be substantially greater that this, with average private losses estimated at a further $100M/year[2].

As a result of the high cost of floods across Australia, all levels of government have become increasingly active in seeking measures to mitigate their impacts.

2.3 Floodplain Management and Flood Risk Management

The State Flood Risk Management Policy is concerned with the management of flood risks associated with occupation and use of floodplains including urban development and agricultural production. Flood risk management decisions need to satisfy the social and economic needs of the community and be compatible with the maintenance or enhancement of the natural ecosystems sustained by floodplains.

Other floodplain issues include water resource management—sharing flows between consumptive uses and the environment, preservation of riparian vegetation, protection of floodplain lands from degradation, etc.

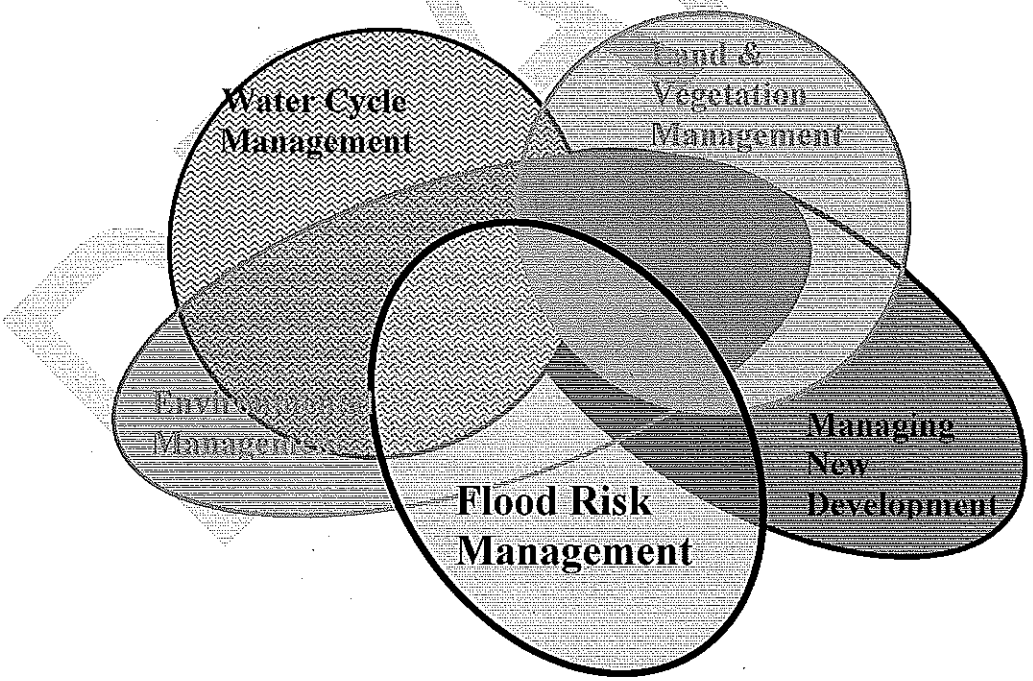


FIGURE 1 – Interconnection of Flood Risk Management with other Management Issues affecting Floodplains

[1] The Natural Disaster Relief Arrangements provide State and Commonwealth funds for recovery from natural disasters and restoration of public assets (i.e. excludes private losses). In Queensland, floods are the predominant cause of natural disaster damages funded under the NDRA.

[2] Smith, D.I. 1998, *Urban Flooding in Queensland – A Review*, Department of Natural Resources and Mines.

Flood risk is the major issue on most of Queensland's floodplains. It affects urban and non-urban developments and its management is critical to the sustainability of communities.

Further, the primary tools (hydrology and hydraulics) necessary to manage flood risks are, in most cases, important for the management of other floodplain issues and form the basis for understanding flooding characteristics.

2.4 State Government's priorities

Flood risk management is particularly relevant to three of the Queensland State Government's five priorities are. They are:

- Safer and more supportive communities
  - minimising the risk and impact of emergencies and flooding disasters.
- Valuing the environment
  - promoting sustainable development through responsible use of the state's natural capital and primary resources;
  - encouraging Queensland businesses to consider the social, economic and environmental impact of their decisions.
- Building Queensland's regions
  - ensuring that development in regional Queensland is not subject to unacceptable flood risks.

3.0 Principles

The following key principles guide the provisions of this policy:

- Floodplains are valuable natural resources which cannot be arbitrarily isolated from all development;
- Floodplains have a major impact on the health of the associated waterways, are important links in the life-cycle chain of many species and frequently include areas of significant ecological importance;
- All development proposals on the floodplain should be treated on their merits in relation to the flood risk, their environmental impacts, and the benefits such development can provide; and
- Government (Federal, State and local) responsibilities must be clearly defined.
- Risks to public health and safety should be managed in a manner consistent with ecologically sustainable development (ESD) principles.
- Assessments of any proposed floodplain use should be based on a full appreciation of all the associated risks and benefits.
- Individuals should be able to make fully informed decisions.
- A partnership approach between all levels of government and the community is necessary in recognition of the fact that the costs of flood disasters affect all Australians.
- Proactive prevention is preferable to reactive response.
- The costs associated with flood risk should be identified and funded transparently.

4.0 Policy Outcomes

The State Flood Risk Management Policy seeks to clarify existing responsibilities; rationalise existing legislative provisions that deal with flood risk and enhance their use; and introduce new measures to:

- provide a co-ordinated approach to managing flood risk;
- deal with legal liability;
- facilitate floodplain (risk) management plans;
- establish a State flood information system (database); and
- make flood information, including maps, readily available to the public

To achieve these outcomes, this policy provides for:

- Floodplain Management Plans being the principal mechanism for addressing all the issues relevant to a particular floodplain in an integrated manner.
- Floodplain Management Plans prepared by the relevant local agencies (i.e. generally local governments) - or the State where necessary, (eg. large floodplains covering two or more local government areas and under development pressure from rural enterprises where local resources are limited).
- legislation to support local government flood risk management activities and provide protection for councils, government agencies and their staff against claims for damages resulting from their issuing advice, undertaking works or granting approvals on floodplains, providing such action is not negligent and is taken in accordance with current best practice principles and guidelines issued by the State Government (i.e. a Queensland Floodplain Management Manual [3]);
- continuation of subsidy schemes for local government works to reduce potential flood damage and personal danger in existing developed areas (eg. existing flood mitigation subsidy schemes such as the Regional Flood Mitigation Program and the Local Governing Bodies Capital Works Subsidy Scheme);
- provision of technical support to local government to ensure that the use of flood prone land is consistent with the flood hazard and that such uses do not unduly increase potential flood liability to the occupier or to the community in general;
- recognition of emergency management and flood recovery programs and their linkage with the floodplain management planning process;

5.0 Policy Provisions

The policy provides for:

- a flexible merit based approach to be followed by councils, when dealing with flood prone land management;
- ongoing funding for flood mitigation projects;

[3] At present a Queensland Manual does not exist. Until one is developed it would be proposed that the national floodplain management manual (SCARM Report No. 73) be adopted.

- recognition of the need to consider the full range of flood sizes, up to and including the probable maximum flood and the corresponding risks associated with each flood size;
- councils to be responsible for the determination of flood planning levels and appropriate planning and development controls based on social, economic and ecological impacts and values, as well as flooding considerations;
- an emphasis on the importance of developing and implementing Floodplain Management Plans based on an integrated mix of management measures that address the existing, future and continuing risks;
- availability of State Government technical support to councils in relation to flooding matters;
- floodway definition to be based on hydraulic, hazard and potential damage considerations, with provision for restricted development depending on circumstances;
- inclusion of a local Integrated Catchment Management Committee (or Natural Resource Management Body) representative on each local government floodplain management committee;
- explicit recognition that the management of flood risk needs to take into consideration government policies and legislation allowing for the sustainable usage of the floodplain as a natural resource; and that the planning and assessment requirements laid down in those policies and legislation must be complied with by all agencies associated with the use, development and management of the floodplain;
- an emphasis on the need to consider ways of maintaining and enhancing the riverine and floodplain ecology in the development of Floodplain Management Plans;
- recognition of the importance of the continuing flood risk addressed in the *Disaster Management Act 2003* and State Counter Disaster Plan, and the close relationship between the planning processes associated with emergency management and floodplain management;
- recognition of the potential implications of climate change on flooding behaviour;
- *Qld Floodplain Management Manual* to include the policy and detailed arrangements for implementation;
- protection of councils and other public authorities and their staff against claims for damages, providing they act in accordance with the government's policy at the time; and

6.0 Key Policy Components

The key components of this policy are:

- Responsible State Agency
- Floodplain Management Plans –responsible agencies to prepare in accordance with State guidelines prepared by NR&M;
- Flood Liability – define how a responsible local agency satisfies its flood risk management responsibilities;

- Public Availability of Flood Information – responsible agencies and the State be required to make flood information readily available;
- State Information, Overview and Support – State Government to collate flood data; monitor development and implementation of floodplain management plans; and provide supporting legislation and guidelines

6.1 Overall Responsibility for Flood Risk Management

The Chief Executive Officer of the Department of Natural Resources and Mines will be responsible for overseeing the State's Flood Risk Management Policy, and ensuring co-ordination with other State agencies (particularly the Environment Protection Agency, Department of Emergency Services and Department of Local Government and Planning) to facilitate the effective implementation and long term maintenance of the Policy.

6.2 Floodplain (risk) Management Plans

Floodplain Management Plans are an important requirement for the effective control (and reduction) of flood risk. Such plans provide the supporting information (flood studies, damage and vulnerability assessments, management scenarios and mitigation strategies) for planning and development controls and mitigation works programs.

Floodplain Management Plans also address issues such as social impacts, economic impacts and floodplain ecological values, with respect to the management of flood risk. They are the principal integrating mechanism for identifying and attempting to balance the competing interests and risks on a given floodplain. Further, the State Planning Policy 1/03 for Natural Disaster Mitigation relies on the outcomes of a local Floodplain Management Plan to enable it to be implemented most effectively.

Floodplain Management Plans will be the basis for both State and local agencies making decisions about actions on floodplains that will affect flood risk such as new development, as well as including measures for the long-term reduction of flood risk to existing developed areas and ongoing flood emergency management.

Under this Flood Risk Management Policy, each local government is required to prepare, and have approved by NR&M, Floodplain Management Plans [4] for its floodplain areas for it to:

a) receive State flood mitigation subsidy funds (either under the Regional Flood Mitigation Program or the Local Governing Bodies Capital Works Subsidy Scheme); and
b) be provided with immunity from legal liability for its flood risk management actions.

Each local government (or other agency with floodplain risk management responsibilities) must prepare a Floodplain Management Plan in accordance with accepted best practice as set out in the Queensland Floodplain Management Manual. The Manual is to be prepared and updated from time to time by NR&M.

Where the responsible local agency is unwilling or unable to prepare a plan and NR&M considers that the need for a plan is "urgent", NR&M may take over responsibility for preparation or updating of a Floodplain Management Plan. NR&M would fund preparation of the plan initially but may subsequently levy the responsible local agency(s) involved if appropriate.

Triggers for identifying "urgent" need include:

- substantial pressure for development on the floodplain;
- potential impacts of flood damage being significant (eg infrastructure and property at high risk);
- inadequate response by the local agency response to the situation (eg no management plan in place, no suitable development controls or mitigation program in place)

The process for the development of a Floodplain Management Plan by NR&M will include:

- consultation with the relevant local governments and affected communities;
- advice to the Minister that a plan is required and the proposed method of delivery (eg who prepares, who pays, any cost recovery, who will administer, etc);
- Ministerial approval of the preparation of the plan and its implementation;
- local government(s) formally advised of Minister's decision;
- plan prepared and administrative and implementation arrangements negotiated with the respective local government(s).

6.3 Liability

Local governments need to be able to:

- inform the public about flood risks on a floodplain (e.g. through maps showing the likely extent of flooding) based on either flood modelling or recorded historical information;

[4] Already partway there with local government responses to SPP1-03 and through the Commonwealth-State Natural Disaster Risk Management Studies Program/Disaster Mitigation Australia Package.

- manage development through planning schemes and development controls; and
- carryout appropriate flood mitigation works.

A local government or other statutory agency with flood risk management responsibilities (as may be approved by the State) will not incur any liability for losses or damages arising from any of the agency's responsible actions to best manage flood risk (eg. provision of flood information in any form provided that information has been given in good faith). Responsible actions are considered those carried out to implement a floodplain management plan approved by NR&M.

Further, the State "?declares?" that no legal action seeking damages as a result of
a) published flood information; or
b) implementing and maintaining flood mitigation works
can lie against a local agency with an approved Floodplain Management Plan – provided their actions are in accordance with the plan and they have not been negligent (refer "a new part" of the Water Act 2000).

6.4 Public Availability of Flood Information

Availability of flood information means individuals and communities are in a better position to manage their own risk. Where information does not exist or is incomplete, the preparation of a Floodplain Management Plan will require the collection/generation of flood information.

Each local agency with responsibility for managing flood risks will collect, collate and make available to the community for the areas under its jurisdiction (in a readily understandable form):

- all available flood inundation data
- all available flood damage data
- details of policies and standards used in managing flood risk

NR&M will provide details of what constitutes "*readily understandable*".

This data will also be supplied to NR&M in a format agreed by the Department for the purposes of develop and maintain a State Flood Information System (refer Section 6.5 below).

The minimum information to be made available are:

- Flood Maps identifying the full extent of the floodplain (i.e. at Probable Maximum Flood extent), the chosen design flood event (or events) and lesser events (where flows leave the water course) in sufficient detail that members of the public can determine whether they are affected and thus need to seek more detail on the extent of the impact on them (i.e. there would be a two step process – large scale map and property level information); and
- Disclosure on property searches/enquiries (i.e. available flood information must be provided by the local government)

A local agency acting in good faith will not incur any legal liability for losses or damages that may arise from the use or mis-use of this information. Liability can only be incurred if it can be shown that the local agency's actions in deriving the information were negligent (refer 6.3 above)

NR&M will note, on its land-titling database, land parcels that have been identified by local governments as flood affected (at the adopted DFE), and that further information on the extent to which the land is affected should be sought from the relevant local government.

To further assist local governments make flood information readily available, State flood information standards, covering collection, storage and presentation are provided in the Queensland Floodplain Management Manual.

Local government flood information will be the basis for a State Database prepared and maintained by NR&M on flood information across Queensland (refer 6.5 below).

6.5 State Information, Overview and Support

The State Government needs to have a full understanding of the flood risk in Queensland and how it is being managed. This information is required to determine the effectiveness of the Policy; target any assistance; support bids for Commonwealth funds; and assist local governments through shared information, experiences and expertise.

NR&M will develop and maintain a State Flood Information System based on data supplied by local governments. Appropriate standards for the collection and recording of flood data to be supplied by local agencies will be set by NR&M. NR&M will also provide technical assistance to local agencies so they can meet the data standards required.

NR&M will collate and make available flood data supplied by responsible agencies; monitor development and implementation of floodplain management plans by responsible agencies; and provide supporting legislation and guidelines

7. *Implementation Actions and Responsibilities*

7.1 Actions

This policy requires the following actions for its implementation:

- development and implementation of Floodplain Management Plans that address both mainstream and local flood;
- selection of flood mitigation measures based on assessment of the full range of structural and non-structural measures;
- the application of planning and development controls, consistent with SPP1/03, to contain the potential for increasing flood losses.
- establishment of local floodplain management committees to assist in the development of Floodplain Management Plans.
- continuation of existing government subsidy for eligible flood risk studies, mitigation works and management measures.
- The establishment of a State flood risk information database by the State Government

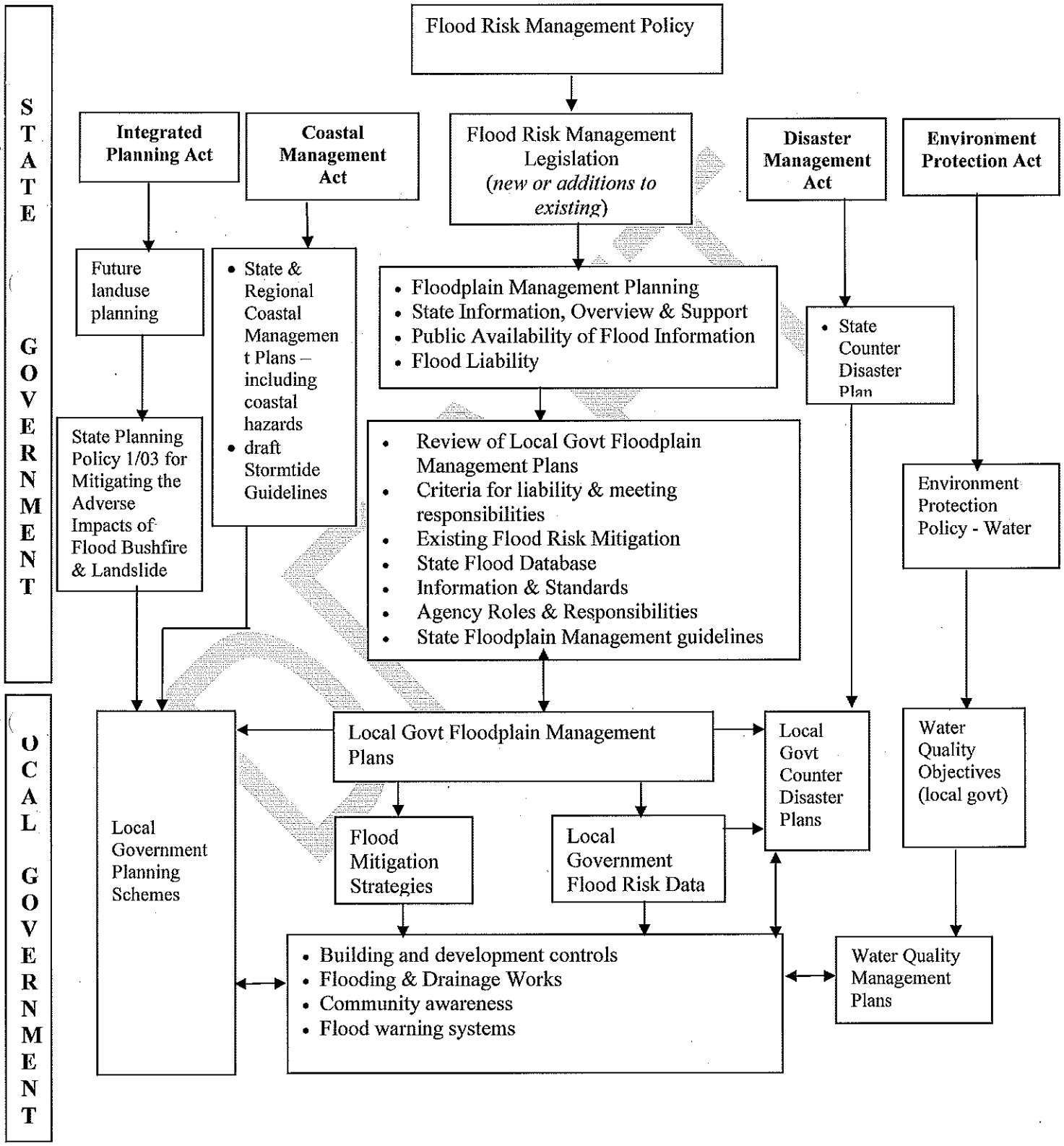
7.2 Responsibilities

The responsibilities under this policy are:

- local government will be responsible for preparing appropriate flood studies and Floodplain Management Plans (Regional Organisation of Councils (ROC) or river improvement trust (RIT) could also be involved);
- local government will be responsible for implementing Floodplain Management Plans through their local planning schemes, policies, procedures and works programs.
- local government will have primary responsibility for collecting, developing, maintaining and making available flood information for its area.
- the Department of Natural Resources and Mines shall provide specialist technical assistance and advice on managing flood risk including developing and maintaining a Qld Floodplain Management Manual to assist local governments in the preparation of Floodplain Management Plans. Assistance on related issues (such as emergency planning and mechanisms for charging for infrastructure) will also be available from the Department of Emergency Services and Department of Local Government and Planning.
- the Qld Government will, through the Water Act 2000, maintain explicit exemption from liability for local governments implementing this policy.
- NR&M will also establish and maintain a State Flood Risk Information Database, based on information supplied by local governments and advise the Government on the performance of assistance programs for local government.
- NR&M will be the approval agency for Floodplain Management Plans - on the basis that their preparation and implementation is in accordance with best practice as set out in current State Floodplain Management Guidelines.

FIG. 2- Flood Risk Management Policy Implementation Components - ☐

(including major interactions with other Government legislation)



APPENDIX A - Contents of a Floodplain Management Plan:

- *Floodplain Characterisation* - determine the make-up of the floodplain land uses (agriculture, urban, conservation, utilities/infrastructure, riverine corridors, etc.) and floodplain management objectives/values.

- *Flood Hazard Assessment* (*Flood Study*) including: topography, historical flood data, hydrology and design floods, hydraulics/inundation extents and depths, flood flow paths, mapping flood inundation and extent in format for public – flood model;

- *Flood Impact Assessment* (*Risk Study*) – identify and cost impact of flooding on people, property and economy for the range of floods, determine average annual damage for floodplain; look at future development scenarios and the potential increase in flood risk;

- *Flood Standards* -design (or defined) flood event(s) (DFE) adopted for controlling floodplain activities - based on assessment of risk study outcomes; DFEs may vary for different locations and types of floodplain uses/development;

- *Flood Risk Mitigation Strategy* - investigation of mitigation options – structural and non structural (structural usually to deal with existing risk and non-structural with future risk) and development of an implementation program – includes mitigation infrastructure plan, development controls and response strategy.

- *Flood Mitigation Infrastructure Plan* – plan for implementation of flood mitigation capital works

- *Development Controls* for the floodplain, implemented through planning scheme/development approval process (link here with SPP1/03) – includes use of models to determine whether development proposal has acceptable impacts. There is a significant issue here regarding the interaction of development approvals for works on rural floodplains that are built to harvest and store river flood flows and overland flows. These works typically involve a large storage (ring tank) which affects flood flow distribution and may cause damage to either the owner's property or his neighbours' properties during flood events. Hence the "water taking" impact and the "flood risk modifying" impact both need to be assessed. As noted for many years, the "works" aspect (whether a suitable site is available for a storage of required size, given designated flood flow paths and limit to afflux caused by the structure) should be considered and resolved before the allocation aspect is considered

- *Flood Response Strategies* - develop response strategies (flood warning systems, evacuation plans, etc.) together with local counter disaster committee.

- *Drainage Masterplan* – development and plan for implementation of stormwater management strategy to deal with safety and convenience issues – needs to be linked/integrated with stormwater quality management plan under EPP water.

APPENDIX B - Departmental Responsibility for the Policy:

NR&M has the relevant skills and responsibilities (for land and water management) to deal with flood risk management issues across both rural and urbanised floodplains. NR&M:

- has hydrologic and hydraulic engineering expertise (through NRSC)
- has responsibility for riverine management
- through its network of gauging stations, is the custodian of important hydrological data
- arbitrates on floodplain disputes
- undertakes project assessments of Regional Flood Mitigation Program applications,
- is the State Government agency partnering Brisbane City Council and the Institute of Public Works Engineers Australia (Qld) in the ownership of the Queensland Urban Drainage Manual

It also has responsibility for State's land information system which potentially is the basis for a State flood database. This approach is generally reflected in interstate practice where responsibility for flood risk management policy lies with the government agencies which have responsibility for natural resources, particularly water resources ie:

- NSW - Department of Infrastructure, Planning and Natural Resources;
- Victoria - Department of Sustainability & Environment;
- Western Australia - Department of Environment (incorporating the previous Water & Rivers Commission);
- Tasmania - Department of Primary Industries, Water and Environment;
- South Australia - Department of Water, Land and Biodiversity Conservation (with technical assistance from the Department of Transport and Urban Planning); and
- Northern Territory - Department of Infrastructure Planning & Environment.

Other Departments that could be considered to have a significant portfolio interest in the management of flood risk and therefore possibly be responsible for development of the policy are the Department of Emergency Services (flood disasters); the Department of Local Government and Planning (local planning scheme provisions and local government infrastructure) and the Environmental Protection Agency (floodplain environment and water quality issues).

The Department of Emergency Services' core interests lie in disaster risk management and therefore the Department of Emergency Services interest in flooding is as a significant hazard only. Broader floodplain management and "non disaster" floodplain risks such as the potential adverse impacts on floodplain resources, water quality, etc. are of less significance. Although the Department of Emergency Services developed SPP 1/03 (in association with the Department of Local Government and Planning and with considerable assistance from NR&M) and is primarily responsible

for its administration; DES does not have the skills or responsibilities to deal with all floodplain management issues whether they lie within or outside the scope of SPP 1/03. The Department of Emergency Services and intends to rely on NR&M for expert advice on flooding matters.

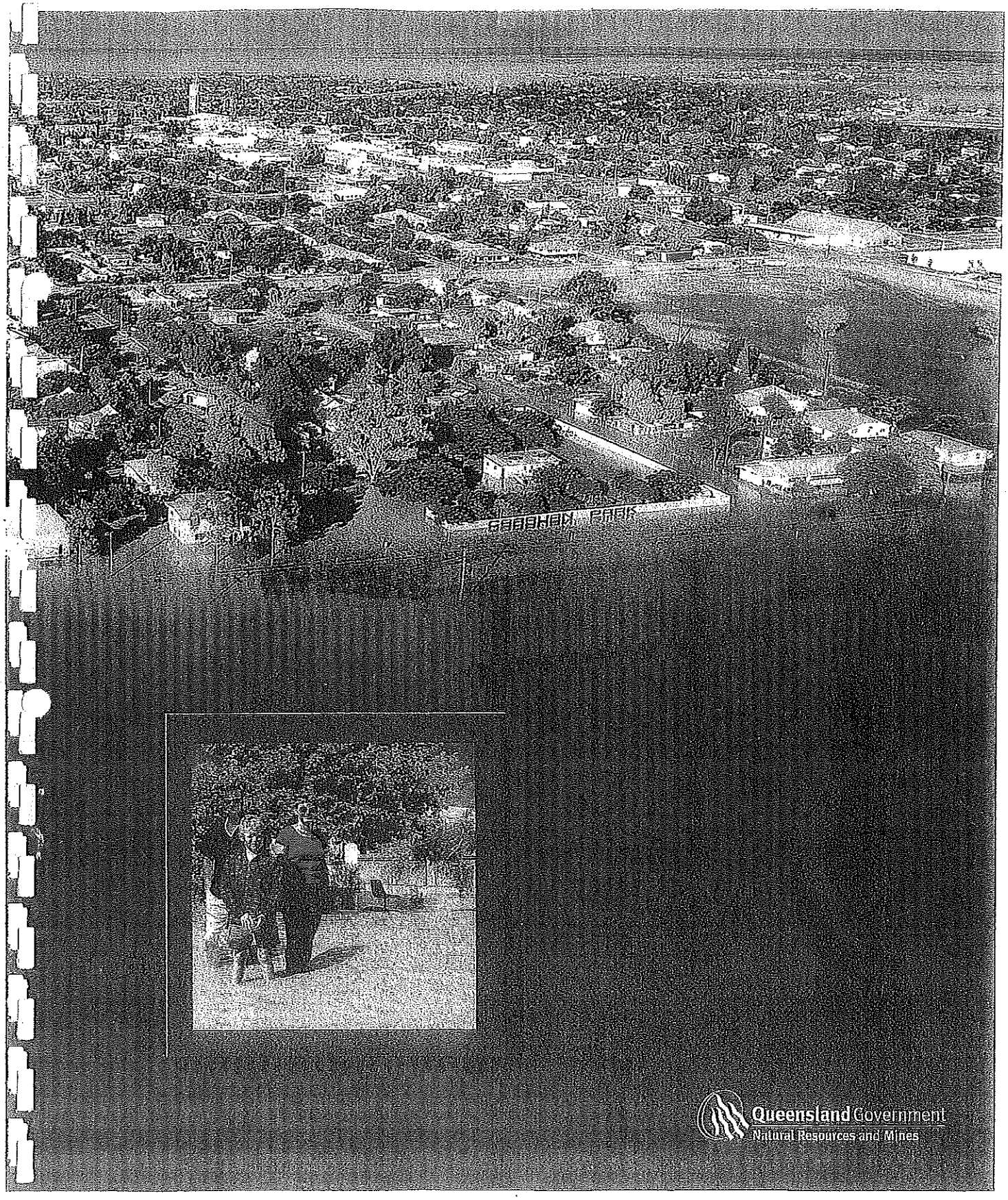
The Department of Local Government and Planning's expertise and interest in flood risk management principally lies with local planning schemes. However charges that may be made on development for funding flood mitigation/stormwater management works and State subsidies for local government infrastructure are also issues for that Department. It should be noted that with respect to administration of State subsidy schemes for flood mitigation works, DLGP also rely on NR&M for expert advice in assessing and approving projects.

The Environmental Protection Agency's interests lie with protection and enhancement of the environment, which with respect to flooding includes water quality and floodplain ecological processes. EPA also has responsibilities under the *Coastal Protection and Management Act 1995* for seeing that issues associated with management of the State's coastal resources (natural and cultural) and the protection of their ecological, economic and social values are addressed including development assessment and permitting.

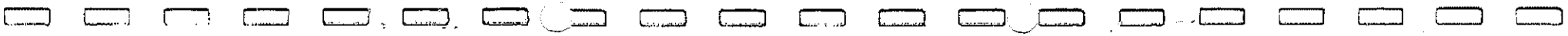
1299

State Flood Risk Management Policy

Report on Discussion Paper Public Consultation



Queensland Government
Natural Resources and Mines



State Flood Risk Management Policy
Report on Discussion Paper Public Consultation

Executive Summary

State Flood Risk Management Policy Discussion Paper

In late October 2002, the Department of Natural Resources & Mines released a public Discussion Paper proposing a State Flood Risk Management Policy and recommending its implementation through legislation.

The Discussion Paper proposed the Policy deal with the core issues of:

- acquiring and maintaining comprehensive flood information;
- undertaking appropriate risk and vulnerability assessments; and
- informing all relevant parties in a way that can be easily understood.

The Discussion Paper considered that the major barriers to effective flood risk management in Queensland would be removed by the development and implementation of a State flood risk management policy that:

- provides a Statewide strategic direction for the management of flood risk which recognises and facilitates the key role of local governments;
- clarifies the existing roles and responsibilities of agencies and aligns those statutory, administrative and funding programs that impact on flood risk;
- supports local government by providing flood risk management guidelines which promote best practice in accordance with ecological sustainability;
- provides for monitoring of the implementation and ongoing costs of flood risk management by local government;
- clarifies the links between existing legislation and the responsibilities of local governments;
- defines the conditions under which local governments can satisfy any legal obligations in respect of advice given or actions carried out (eg done in good faith and in accordance with accepted best practice);
- ensures that existing government subsidies and other financial incentives encourage a reduction in Queensland's level of flood risk;
- maintains an overview of flood risk management across the State to ensure all flood information is captured, maintained and available – enabling the community, local government and the State to make sound decisions regarding flood risk which avoid potential loss of life and property and to make best use of funding and technical resources; and
- assists the insurance industry to provide flood insurance to property owners by ensuring that the flood risk has been clearly identified and systematically recorded.

Public Consultation Process

The release of the Discussion Paper and public presentations were advertised in the Courier Mail and all major regional news papers on 19 October 2002 (refer Appendix D)

The period for submissions on the Discussion Paper was officially open from 1 November 2002 until 28 February 2003. From 7 November to 5 December 2002, NR&M also conducted 12 public presentations on the Discussion Paper in conjunction with the

Department of Emergency Services' workshops on SPP 1/03[1]. The total number of attendees at the presentations was 374. This comprised 364 representatives from 140 organisations and 10 members of the general public. The total number of written submissions was 35, 31 from organisations and 4 from members of the general public. A significant 10 were received (and accepted) after the closing date. The break-up of attendees and written submissions is shown in Table 1.0.

A dominant theme from attendees at the presentations was that the State (and Commonwealth) had largely left flood risk management to local government, and had provided very little guidance or tools to assist local governments achieve best practice.

The majority of the feedback, both written (27 out of 35 submissions or 77%) and at the public presentations, was supportive of the proposed policy. Two written submissions were neutral.

The main negative comments were:

- other existing mechanisms are sufficient (including the then draft SPP 1/03);
- the potential workload and cost burden on local government;
- more responsibility for flood risk management should be taken by the State and Commonwealth;
- potential difficulties in existing flood prone areas (i.e. adverse community reactions and unrealistic expectations, property prices, impacts on insurability); and
- practical difficulties in providing information to the community.

Most of the unfavourable feedback is considered either to be incorrect (i.e. the existing mechanisms cannot address all the issues), or to actually highlight the issues identified in the Discussion Paper and to reiterate the need for the policy.

Conclusions

Based on the responses to the Discussion Paper, this report concludes that:

- there is general support for proceeding to develop a State Flood Risk Management Policy with implemention through legislation; and
- the objections received to the proposal are minor (relating to issues like resourcing rather than a rejection of the aims, strategies and mechanisms of the policy).

This report further concludes that:

- As pointed out in the Discussion Paper, flood risk management has strong links with wider floodplain management issues and should be addressed in that context;
- In spite of the perceived advantages, it is not practical (and probably inappropriate) for all flood risk management issues to be consolidated and implemented through one State instrument;

[1] SPP 1/03 is the recently adopted State Planning policy foer Mitigating the impacts ofFlood Bushfire and Landslide prepared by the Departmnents of Emergency Services and Local Government and Planning (with significant assistance from NR&M for the flood and landslide aspects). It deals with limiting the growth in flood risk (i.e. future flood risk) through local government planning scheme and development assessment controls.

- It is probably more practical to aim for a NSW-style approach where a State Policy Statement draws together and co-ordinates all aspects of flood risk management across various pieces of legislation. However this would still require some principal flood risk management legislation;
- As different issues vary in significance from one floodplain to another, individual floodplain management plans prepared by the relevant local agencies (eg local governments or possibly river improvement trusts) should be the principal mechanism for addressing all the issues relevant to a particular floodplain in an integrated manner;
- A State policy needs to ensure that floodplain management plans are prepared and that they adequately address all relevant issues. To achieve this, the policy should provide for the oversight by the State of floodplain management plans prepared by the relevant local agencies (eg local governments or possibly river improvement trusts);
- Because of its responsibilities for other catchment issues and because of its expertise in water resource management, NR&M is best placed to take responsibility for development of the policy and its implementation;
- Based on practice in other States, implementation should be through the preparation of a State Policy Statement and the addition of a new Part/Chapter to the Water Act 2000 (along the lines of NSW practice) with associated amendments to other Acts where required.

Content of Policy

The proposed State Flood Risk Management Policy seeks to, as far as possible, clarify existing responsibilities, rationalize existing provisions and their use, and introduce new measures, not currently dealt with such as:

- providing a co-ordinated approach to managing flood risk
- dealing with legal liability
- requiring floodplain (risk) management plans
- establishing a State information system
- making flood information readily available

The policy would aim to ensure co-ordination by establishing and maintaining clear links between existing provisions and additional measures that may be introduced.

Departmental Responsibility for Development of the Policy

NR&M has the relevant skills and responsibilities (for land and water management) to deal with flood risk management issues (across rural and urbanised floodplains). NR&M:

- has hydrologic and hydraulic engineering expertise (through NRSC);
- has responsibility for riverine management;
- is the custodian of important hydrological data through its network of gauging stations;
- arbitrates on floodplain disputes;
- undertakes project assessments of Regional Flood Mitigation Program applications; and

- is the State Government agency partnering Brisbane City Council and Institute of Public Works Engineers Australia (Qld) in the ownership of the Queensland Urban Drainage Manual.

Interstate practice is that the government agency with responsibility for water resources also has primary responsibility for floodplain risk management. Cases in point include:

- NSW - Department of Infrastructure, Planning and Natural Resources;
- Victoria - Department of Sustainability & Environment;
- Western Australia - Department of Environment (incorporating the previous Water & Rivers Commission);
- Tasmania - Department of Primary Industries, Water and Environment;
- South Australia - Department of Water, Land and Biodiversity Conservation (with technical assistance from the Department of Transport and Urban Planning); and
- Northern Territory - Department of Infrastructure Planning & Environment.

Recommendations

This report recommends the Minister approve:

- NR&M proceeding to develop a draft State Flood Risk Management Policy and draft amendments/additions to the *Water Act 2000* and other Acts (in consultation with relevant agencies) to support its implementation;
- preparation of the draft State Flood Risk Management Policy along the lines of the NSW Flood Prone Land Policy, bringing together existing measures and providing for the preparation of appropriate floodplain management plans for each floodplain in Queensland; and
- this report being the basis of a Cabinet Submission to inform Cabinet of the outcomes of the public consultation on the Discussion Paper and informing Cabinet that NR&M is proceeding with the preparation of a draft policy and legislative amendments necessary to support the policy.

Timeframe

Following approval by the Minister, it is proposed that NR&M immediately prepare a Cabinet Submission informing Cabinet that NR&M is proceeding to develop a draft State Flood Risk Management Policy and seeking approval from Cabinet for NR&M to prepare draft legislation. The proposed timeframe being:

- Cabinet Submission on draft State policy statement (refer Section 9.4 for content) and the proposal for legislation for consideration by Cabinet by November2003,
- on approval by Cabinet, preparation of draft legislation by March 2004
- consultation on draft legislation from March to June 2004
- presentation of Bill to Parliament by October 2004

1. Purpose

This report presents the results of the public consultation undertaken by the Department of Natural Resources and Mines over the period 1 November 2002 to 28 February 2003 on the proposal to develop a State Flood Risk Management Policy.

It concludes there is support for the development of a State Flood Risk Management Policy and recommends the next steps in the development of the Policy.

2. Introduction

2.1. Floodplains

Floodplains are natural resources of immense value. They are the sites of most of our towns and cities and support many of our most productive rural industries. They are also areas of primary environmental significance and their well being is essential to the survival of many ecosystems. Their development and use should be managed in an ecologically, economically and socially sustainable fashion.

Floodplain Management in Australia Best—Practice Principles and Guidelines produced by the Standing Committee on Agriculture and Resource Management (SCARM Report Number 73, CSIRO Publishing, 2000) describes Australia's floodplains as:

> *...the commercial, social and ecological arteries of the nation. As such they constitute a national asset... most of Australia's towns and cities are located on floodplains...a significant proportion of Australia's intensive and extensive agricultural output is produced on floodplains including irrigated agriculture. Regular flooding of these areas enhances agriculture by increasing soil moisture, recharging ground water levels and depositing fertile soil...many mining operations and transport-related infrastructure are partly or completely located on floodplains...*while*...the interdependence of the health of the river and the floodplain and the role of periodic floods in maintaining this connection has been increasingly recognised.*

The SCARM report also recognises that:

> *A floodplain is an essential component of a catchment, and floodplain* (risk) *management is a critical part of overall catchment management...*and*...management decisions taken in respect of human occupation of floodplains need to satisfy the social and economic needs of the community as well as being compatible with the maintenance or enhancement of the natural ecosystems that the floodplain sustains.*

2.2. Cost of Flooding

Each year, floods seriously affect Queensland's economy and the social wellbeing of the community—their primary or secondary effects have a significant impact on communities and key industry sectors such as tourism, mining and agriculture.

The cost of flood damage under the Natural Disaster Relief Arrangements (NDRA)[2] alone averaged over $50 million per year in Queensland between 1989 and 2001, with expenditure in 2000–01 in excess of $100 million.

As a result of the high cost of floods across Australia, all levels of government have become increasingly active in seeking measures to mitigate their impacts.

2.3. Floodplain Management and Flood Risk Management

The proposal for a State Flood Risk Management Policy is concerned with the management of flood risks associated with occupation and use of floodplains including urban development and agricultural production. Flood risk management decisions need to satisfy the social and economic needs of the community and be compatible with the maintenance or enhancement of the natural ecosystems sustained by floodplains.

Other floodplain issues include water resource management—sharing flows between consumptive uses and the environment, preservation of riparian vegetation, protection of floodplain lands from degradation, etc.

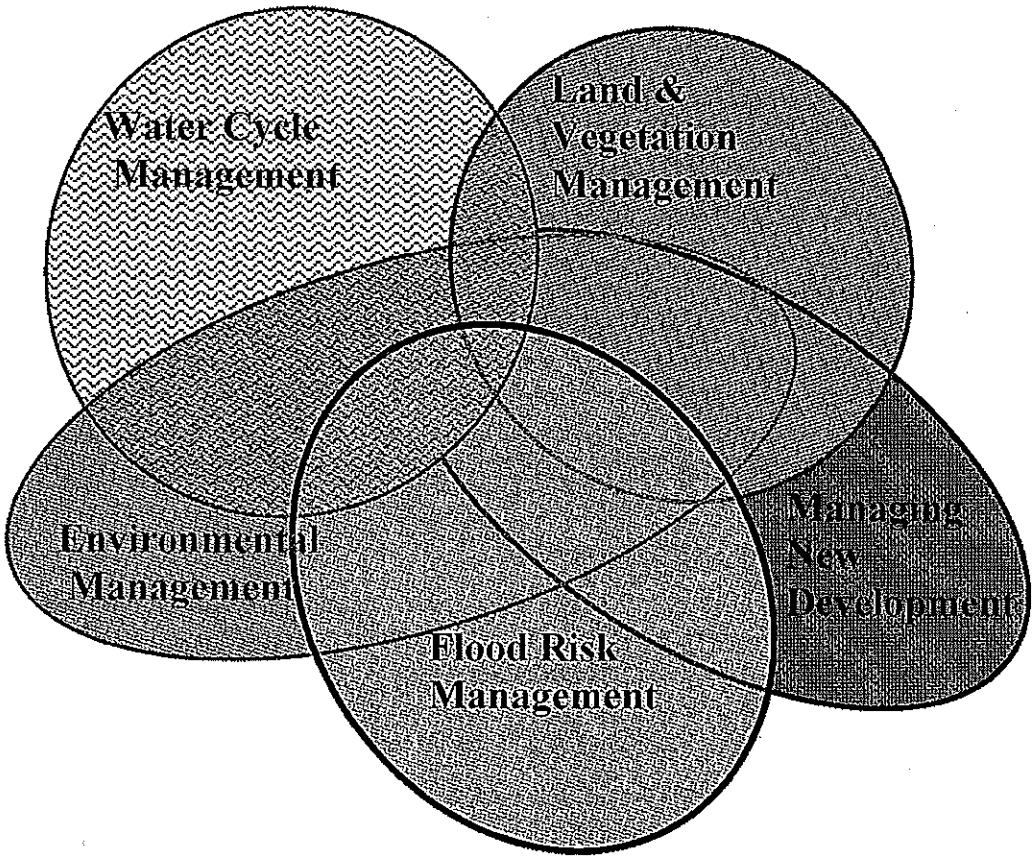


FIGURE 1 – Interconnection of Flood Risk Management with Other Floodplain Management Issues

[2] The Natural Disaster Relief Arrangements provide State and Commonwealth funds for recovery from natural disasters and restoration of public assets. In Queensland, floods are the predominant cause of natural disaster damages funded under the NDRA.

Flood risk is the major issue on most of Queensland's floodplains. It affects urban and non-urban developments and its management is critical to the sustainability of communities. Further, the primary tools (hydrology and hydraulics) necessary to manage flood risks are, in most cases, important for the management of other floodplain issues and form the basis for understanding flooding characteristics.

2.4. State Government's priorities

Three of the Queensland State Government's five priorities are particularly relevant to flood risk management. They are:

- Safer and more supportive communities
  - minimising the risk and impact of emergencies and flooding disasters.
- Valuing the environment
  - promoting sustainable development through responsible use of the state's natural capital and primary resources;
  - encouraging Queensland businesses to consider the social, economic and environmental impact of their decisions.
- Building Queensland's regions
  - ensuring that development in regional Queensland is not subject to unacceptable flood risks.

3. Background

The Department, in collaboration with the State Disaster Mitigation Committee and a Working Group representing local and State Government agencies as well as non-government interests (refer Appendix A), prepared a discussion paper proposing the development of a State Flood Risk Management Policy.

After extensive consultation within Government (see Appendix B), Cabinet agreed on 23 September 2002 to the release for public consultation of the State Flood Risk Management Policy Discussion Paper (Submission No. 02925, Decision No. 03632).

As the Discussion Paper is quite lengthy, two versions were published - the complete paper and a Summary Discussion Paper (the summary section of the Summary Discussion Paper is attached to this report at Appendix C).

Release of the Discussion Paper coincided with release of a draft State Planning Policy for Natural Disaster Mitigation by the Department of Emergency Service. Flooding is one of 3 natural disasters addressed by the SPP. Therefore, a series of joint workshops/presentations on the two documents and their relationship was undertaken through November - December 2002 at centres throughout the State. (refer Appendix E for regional centres where presentations were given).

4. Public Consultation Process

4.1. Advertising

The release of the Discussion Paper and the joint public presentations were advertised in the Courier Mail and all major regional newspapers on 19 October 2002 (refer Appendix D).

In addition, a copy of the Discussion Paper was sent to each local government, aboriginal/islander council and river improvement trust in Queensland, relevant State Government Departments and the following organisations/associations:

- Institute of Public Works Engineering Australia (Qld)
- Urban Development Industry Association.
- Insurance Council of Australia
- Gladstone Area Water Board
- Mount Isa Water Board
- South East Queensland Water Corporation
- Caloundra-Maroochy Water Supply Board
- North Queensland Water
- Property Council of Australia
- Planning Institute of Australia.

Both versions of the Discussion Paper were also available electronically on the Department's web site over the consultation period.

4.2. Period for Feedback

The official consultation period commenced on 1 November 2002 and closed on 28 February 2003. This extended consultation period was adopted because a conventional two-month period for feed-back would have run into the 2002/2003 Christmas-New Year period.

In addition, a significant number of submissions were received after the closing date. These were accepted and considered in the preparation of this report.

4.3. Public Presentations and Attendance

Public presentations outlining the Discussion Paper and the proposal for a State Flood Risk Management Policy were made following the workshops conducted by DES on the Draft State Planning Policy for Natural Disaster Mitigation (subsequently re-titled *State Planning Policy – Mitigating the Impacts of Flood, Bushfire and Landslide* and adopted by the Minister for Local Government and Planning on 19 May 2003).

A total of 12 presentations were held at centres throughout the State. (refer Appendix E for regional centres where presentations were given) over the period from 7 November 2002 to 5 December 2002. The presentations were well attended with a total audience across the 12 localities of 284. This comprised 276 representatives from 119 organisations and 8 members of the general public. Most of those attending had also participated in the preceding workshops on the draft SPP.

Attendance at the presentations was dominated by local government (62) and State agencies/GoCs (20), with a few community groups (8), individuals (8), Commonwealth agencies (4) and private enterprises/associations (25) also represented (see Table 1.0 at the end of Section 5). There was very low attendance/feedback from individuals or organisations identifying themselves as part of the development industry.

Presentations where also made to the Stormwater Industry Association of Qld on 13 February 2003; the Urban Stormwater Information Group on 20 February, 2003; and the Water Panel of the Institute of Engineers Australia, Qld on 21 May 2003.

4.1. Feedback at Public Presentations

A dominant theme from attendees at the public presentations was that the State and Commonwealth Governments had largely left floodplain/flood risk management to local government; and had provided very little appropriate guidance or tools to assist local governments to achieve best practice.

Some other issues raised at the public presentation sessions were:

- Need for better information;
- Dilemma over legal liability and responsibility for compensation;
- Interaction between managing flood risk, managing development and protecting the natural environment;
- Responsibility for the impact of works and potential effect on State agencies;
- Need to also consider stormwater and stormwater flooding in Policy;
- Need to be able to vary flood standards across State;
- Agency(s) administering the Policy (including SPP 1/03) should have necessary expertise;
- Does State "ownership" of all waters, including floodwaters imply State responsibility for damages caused by floodwaters?;
- Limited availability of flood insurance (currently offered by one or two companies only);
- Responsibility for the impact of mitigation works;
- Funding; and
- Liability for damage as a result of floods greater than an adopted Defined Flood Event.

A positive reception was given to the presentations to the Stormwater Industry Association of Qld; the Urban Stormwater Information Group; and the Water Panel of the Institute of Engineers Australia, Qld.

Whilst the number of written submissions was much smaller than attendance at the presentations, it reflected a similar distribution of stakeholders, i.e. State agencies (10) and local government (15), community groups (2), individuals (4) and private enterprises/associations (3).

Responses/discussions at the presentations and some personal communications over the consultation period indicated that there would be greater interest in providing comment once a draft of the actual policy is available.

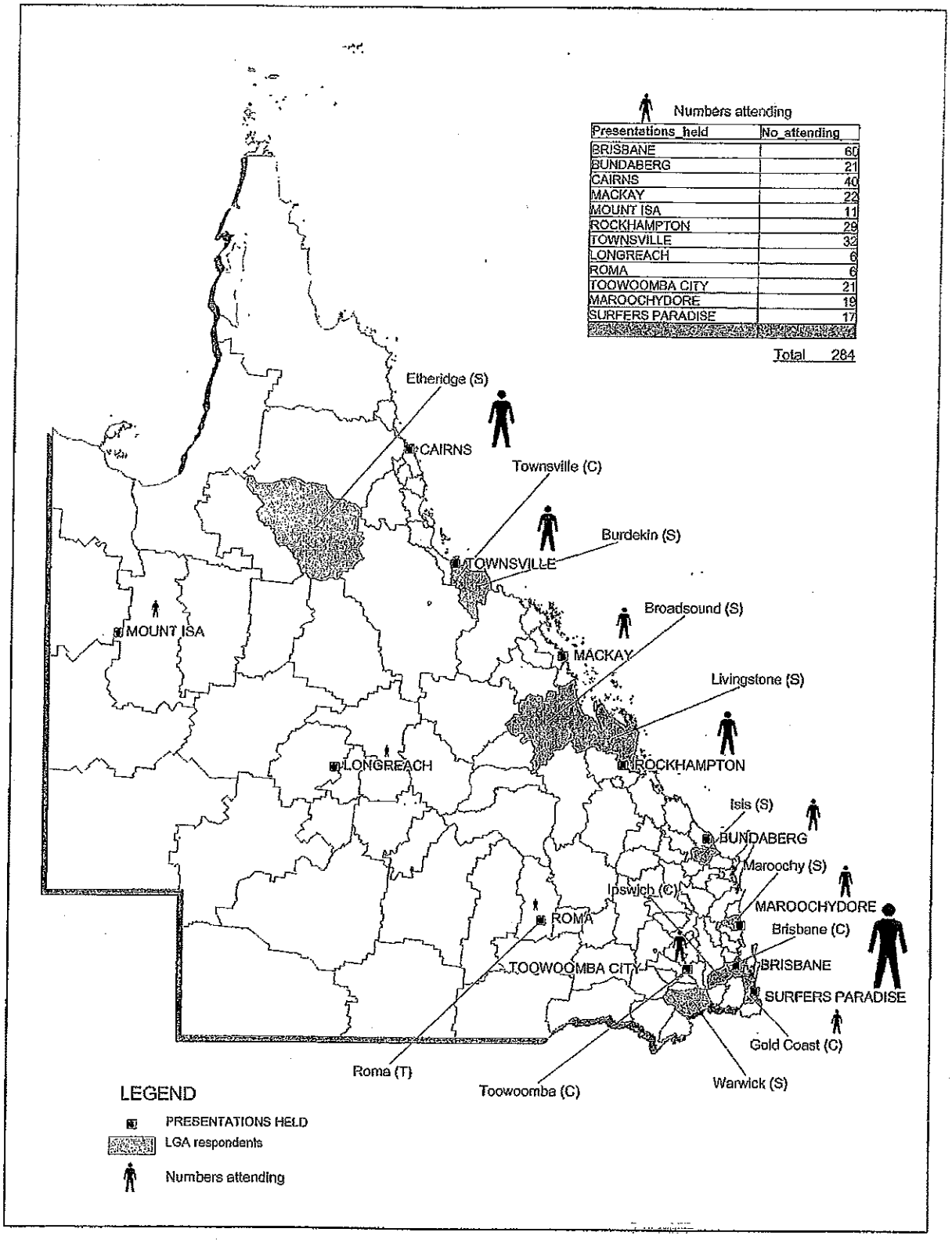


FIGURE 1 - Distribution of Written Submissions and Attendance at Public Presentations

5.0 Major Issues Raised in Written Submissions

The range of written submissions was reasonably varied given the relatively low number of written submissions (35). They ranged from a simple one page letter from Etheridge Shire offering no comment to some extensive submissions from North Queensland River Improvement Trusts Association; State Council of River Improvement Trusts; Brisbane City Council; Gold Coast City Council; Gold Coast and Hinterland Environment Council and the Sunshine Coast Rural Landholders Conservation Council.

A tabulated summary of the written feedback is at Appendix F - *Responses and Comments on SFRMP Discussion Paper*

Support for the proposal far out numbered opposition and legislation was the most popular implementation mechanism. However there were concerns about the detail, particularly the potential workload for local government.

27 out of 35 (or 77%) of the written submissions were supportive. Of the remaining 8 written submissions, 2 (6%) were neutral and 6 (17%) were against the proposal, citing issues such as:

- the belief that other existing mechanisms are sufficient (including the draft SPP);
- the potential workload and cost burden on local government;
- more responsibility for flood risk management should be taken by the State and Commonwealth Governments;
- potential difficulties in existing flood prone areas (i.e. adverse community reactions, unrealistic expectations for mitigation works, and impacts on property prices and/or insurability); and
- practical difficulties in providing information to the community.

Significantly, agencies with a strong interest in flood issues responded positively to the Discussion Paper, eg:

- Brisbane City Council;
- Gold Coast City Council;
- Townsville City Council;
- Environment Protection Agency;
- Departments of Emergency Services;
- Public Works;
- Department of Main Roads; and
- Geoscience Australia .

It should be noted that 8 of the 12 local governments that responded were supportive and that between them, the 8 accounted for 40% of the State's estimated urban flood risk exposure in the report *Urban Flooding in Queensland – A Review* (see Table 1.0 below)

Table 1.0 – COUNCIL RESPONSES				
No.	**Support Policy Proposa**	**Estimated Number of. Props at Risk***	**Do Not Support Policy Proposal**	**Estimated Number of. Props at Risk***
1	Brisbane City Council	8000		
2			Broadsound Shire Council	did not provide figures in the Survey
3	Burdekin Shire Council	1000		
4			Etheridge Shire Council	did not provide figures in the Survey
5	Gold Coast City Council	16650		
6			Ipswich City Council	3000
7			Isis Shire Council	did not provide figures in the Survey
8	Livingstone Shire Council	did not provide figures in the Survey		
9	Toowoomba City Council	did not provide figures in the Survey		
10	Roma Town Council	did not provide figures in the Survey		
11	Townsville City Council	did not provide figures in the Survey		
12	Warwick Shire Council	123		
TOTALS No. –	**8**	**25,773**	**4**	**3000**
% of total	**66.7%**	**39.7%***	**33.3%**	**4.6%***

*** For 1% Average Exceedance Probability Flood (65,000 Total) - Queensland Urban Flood Risk Survey by Smith 1998**

Internally to NR&M, Catchment and Regional Planning Division are supportive of the policy proposal but point-out that it would have been desirable for SPP1/03 to be integral to the Policy. Catchment and Regional Planning also point out that there would be an expectation that NR&M would play a more significant role in managing risks on rural floodplains.

The issues most often of concern in the submissions received are discussed below under the topics of :

- Information
- Costs/Resources
- Legislation
- Consistency
- Role of State

followed by a summary of the submissions against the Proposal.

5.1. Information

Flood information and its availability was raised by 11 submitters as a significant issue. These submitters strongly agreed with the need for good flood information, however they raised concerns as follows:

- current availability of good quality flood information
- liability (real or perceived)
- resources to develop suitable flood information
- level of assistance likely to be available from the State; and
- potential to unrealistically raise expectations for mitigation works

Submitters echoed the discussion paper regards good flood data being frequently unavailable and, in many cases local governments' limited ability to rectify this situation without both technical and financial assistance.

Local governments had concerns over their legal liability when making information available. Their principal concern was that they might suffer claims for compensation as a result of potentially devaluing "flood affected" properties. To a lesser extent some recognised they may be found to have neglected their duty of care to residents by not disclosing information they have. Protection from this exposure would be expected under any legislation.

Finally, a couple of submissions believed that making flood information readily available would increase their community's expectations for the provision of flood mitigation works by Council. The concern for these submitters was that such works were either financially beyond the ability of the Council to provide to the standard the community might expect or, in some cases, physically impossible.

With regard to the liability aspects of information, the Discussion Paper proposes that a State Flood Risk Management Policy would clarify the situation by establishing the conditions through which agencies may satisfy their legal obligations (with respect to information and works). Costs and resources associated with the provision of good flood information are discussed below.

5.2. Costs/Resources

This was a very strong message in the 12 submissions from local government (particularly the small local governments) and is closely linked to the ability to provide good flood information discussed above. Concerns over costs related to both the flood

studies necessary to generate good flood information and the mitigation works that may be necessary to protect against the flood risk identified.

This is a legitimate concern as both studies and works can be expensive. However, there are State and Commonwealth subsidy programs currently available to assist local government with the costs of both of these. They are the Natural Disaster Risk Management Studies Program, which covers studies of any natural hazard and is administered in Queensland through the Department of Emergency Services; and the Regional Flood Mitigation Program which funds flood mitigation works. Administration of the RFMP in Queenland has recently been transferred from NR&M to the Department of Local Government and Planning because of funding constraints within NR&M. *It should be noted that both DES and DLGP rely on NR&M for technical support of both of these programs since neither maintains any expertise in flood engineering (i.e. hydrology and hydraulics) or hold an interest in wider floodplain management.*

Whilst funding subsidy is available, staff resources within local governments (both in numbers and in expertise) to deal properly with flood risk management is highly variable. There will be an expectation that the State Government is able to provide some assistance (especially for small local governments) through appropriate mechanisms such as guidelines, standards and advice.

5.3. Legislation

The majority of submissions (77%) supported the proposal for a State Flood Risk Management Policy with a slightly lesser majority (60%) supporting implementation through legislation. A number of submissions which did not support legislation, did support outcomes which the Department believes can only be achieved for the long-term through legislation, such as:

- clarification of agency roles and responsibilities (including the State);
- dealing with liability; and
- resourcing and commitment

Reasons given in submissions opposed to legislation included:

- legislative tools already exist (SPP and Coastal Management Act)
- a non obligatory approach is more desirable to retain flexibility
- concern over responsibilities that might be forced on local government and their ability to cope; and
- too much legislation

The Department's responses to most of these arguments are given below in Section 5.6 *Submissions Against the Proposal.* In summary it is believed they are either incorrect or they at least highlight the need for the policy – if not legislation.

EPA and the RIT bodies suggested that an option may be to modify the *River Improvement Trust Act 1940* to incorporate the proposed State Flood Risk Management Policy provisions. This not considered an appropriate option because:

- the State is not well covered by river improvement trusts (of the 125 local government areas across the State, only 18 are covered by a river improvement trust);
- many of the local agency actions and responsibilities under the proposed policy would be more appropriately performed by local government.

5.4. Consistency and Co-ordination

Consistency and co-ordination was raised as a concern across a number of areas, including:

- flood information
- riverine flooding, stormwater flooding and storm surge flooding;
- policy approach
- legislation/regulation
- infrastucture planning
- cross local government boundaries/regions
- environmental and natural resource management

Consistent standards for flood information and how it is presented were seen as important by a number of submitters including Brisbane, Gold Coast and Townsville City Councils; Department of Emergency Services (personal communications during combined consultation workshops with SPP1/03) and the Insurance Council of Australia.

Department of Main Roads supported the proposal however were concerned that any requirements be consistent with their current operations. Main Roads did not object to legislation provided it *"provides clear intent and co-ordination of flood risk management between all agencies and levels of government"*.

Department of State Development expressed concern that the policy and legislation be consistent with other State plans and legislation. In particular DSD highlighted the approach in the State Infrastructure Plan where State Government organisations responsible for infrastructure are required to have regard to flood risks in detailed project planning and delivery.

Finally, consistency in terms of the need for regional co-ordination was raised (Roma Town Council) as an issue where the policy should aim to deliver consistency.

EPA and NR&M's Catchment and Regional Planning group also saw the need for co-ordination with other floodplain natural resource management issues/values.

5.5. Role of State

A number of submissions sought a more active role from the State for a number of reasons, including:

- limited local government financial resources;
- limited local government technical expertise;
- need to limit influence of local politics;
- seen as a State (and Commonwealth) responsibility because of benefits to the wider community;
- State responsibility for local government planning and development approval

The Department of Local Government and Planning were keen to see a clear commitment from NR&M to flood policy to support SPP 1/03 while Livingstone Shire Council were concerned that NR&M put insufficient resources into flood policy.

NR&M's Catchment and Regional Planning group acknowledged the need for NR&M to be more proactive and provide more support in some situations (eg. large rural floodplains) and perhaps less in others (eg. urban floodplains) - dependant on the local capacity. CR&P also saw the need for co-ordination with other floodplain natural resource management issues.

A consistent message from the submissions was the need for a support and co-ordination role at the State level.

5.6. Submissions Against the Proposal

As discussed earlier, the great majority of submissions received (27 out of 35) support the proposal for a State Flood Risk Management policy, albeit subject in many cases to seeing the detail. However, there were a number of submissions (6 out of 35) which did not support the proposal. These submitters and their objections were:

- Sunshine Coast Rural Landholders Association – felt paper was not clear on intent, have no enthusiasm for more legislation but if legislation is the result wants local governments held responsible for poor decisions. Also considers the State – as overall approver of local government decisions - is not doing enough, and raised State ownership of flood water and hence State responsibility for damage caused
- Billy Tait (individual from Townsville) – provided a rambling submission in two parts that essentially argues that the Coastal Management Act is applicable and should be used for managing floodplains. This submitter is actually not against the principles raised in the Discussion Paper; he simply argues that a suitable tool already exists.
- Ipswich City Council – concerned about adverse community reaction to publishing flood information and Council's inability to meet potential community demands to eradicate existing flood problems.
- Broadsound Shire Council – concerned about costs, especially small local governments;
- Planning Institute of Australia – Considers State Planning Policy for Natural Disaster Mitigation is adequate and doesn't see need for proposed Policy. Isis Shire Council - concerned about costs, especially small local governments;

Table 2.0 - ATTENDANCE AT WORKSHOPS & WRITTEN SUBMISSIONS RECEIVED						
Organisation Description	Presentation Attendance		Written Submissions			
	Organisations	People	Total	Support	Neutral	No Support
State Agencies (incl. Police & 3 GoC's)	20	130	11	10	1	0
Local Agencies (local govt, LGAQ, community councils, RITs & Boards)	62	173	15	11	1	3
Community groups	8	10	2	1	0	1
Private Business/Assoc.	25	43	2	1	0	1
Individuals	NA	8	4	3	0	1
Other (Commonwealth, Academia, etc.)	4	10	1	1	0	0
Totals	119	284	35	27	2	6

Summarising, these 6 submissions can be grouped as follows:

- 3 foresee difficulties for local government in terms of resources and/or workload;
- 2 consider either the State Coastal Management Planning Act or the State Planning Policy for Natural Disaster Mitigation as sufficient to address flood risk issues; and
- 1 raises potential difficulties in dealing with existing flood prone areas and flood information.

Of these three groups of responses, the second dot point is not correct i.e. the existing mechanisms cannot address all the floodplain risk management issues. The State Planning Policy for Natural Disaster Mitigation deals with future risk but cannot deal with existing at risk areas (except where redevelopment is proposed which is not a development commitment) or the maintenance of a management framework within the State. The remaining two groups of responses are considered to in fact highlight issues identified in the discussion paper and actually demonstrate the need for the policy.

6.0 Approaches In Other Jurisdictions

The Discussion Paper proposed that the State government play a more active role in flood risk management and many of the submissions agreed. Other state governments around Australia (except ACT) were contacted (through their Regional Flood Mitigation Program contacts) to seek current details of their involvement in flood risk management within their jurisdictions. The detail responses have been included as Appendix D of this report.

In summary, only the South Australian state government appears to have as little a role as Queensland – with 1/18 of the flood risk. New South Wales (which has a flood risk exposure comparable with Queensland) has had a management system since at least the mid 1980's co-ordinated by the Department of Infrastructure, Planning and Natural Resources. Victoria also has a reasonably long-standing system in place through its Catchment Management Authorities and the Victorian Department of Sustainability and Environment. Western Australia and Tasmania are moving to establish a policy, although Western Australia is much further down this path. The Northern Territory has had a basic policy since 1981.

7.0 State Planning Policy for Mitigating the Adverse Impacts of Flood, Bushfire & Landslide (SPP 1/03)

The Department of Emergency Services released in September 2001 a discussion paper proposing the preparation of a State Planning Policy for Natural Disaster Mitigation. The paper considered coverage by a State Planning Policy of the natural hazards of landslides, cyclones, severe storms, earthquakes, bushfire and floods.

Feedback on the proposal was favourable, however the coverage of the SPP was reduced to flood, bushfire and landslide. This was because either appropriate mechanisms to deal with the other hazards were considered to be in place or, in the case of cyclones, it was recognised that the fundamental hazards were the consequences of cyclones (i.e. strong winds, floods and landslides). The Ministers for Local Government and Planning and for Emergency Services approved development of a draft State Planning Policy for further public consultation over the period 19 October - 13 December 2002.

Following the consultation period and review of submissions, the State Planning Policy (SPP 1/03) was amended to reflect concerns raised. The SPP was adopted by the Minister for Local Government and Planning on 19 May 2003. There is an administration period of three months for distributing SPP 1/03 and the SPP 1/03 Guideline, and conducting information workshops. SPP 1/03 is expected to take effect on 1 September 2003.

The State Planning Policy expresses the State's interest in the improved management of risks associated with natural hazards in general and provides local governments with a basis for implementing planning measures and development assessment conditions aimed at limiting the growth in development exposed to the natural hazards of flood, bushfire and landslide.

As discussed in the State Flood Risk Management Policy Discussion Paper, SPP 1/03 implements some of the measures proposed for a State Flood Risk Management Policy (i.e. the preparation of local planning schemes and development assessment conditions which avoid the creation of further 'at risk' development). However, there remain issues raised in the Discussion Paper which are outside the scope of local planning schemes and development approvals, such as dealing with legal liability, requiring floodplain (risk) management plans, establishing a State information system, making flood information readily available.

A State Flood Risk Management Policy that deals with these issues will not only provide a comprehensive State flood risk management "framework" but will complement the SPP 1/03 and also enhance the ability of local governments to implement SPP 1/03.

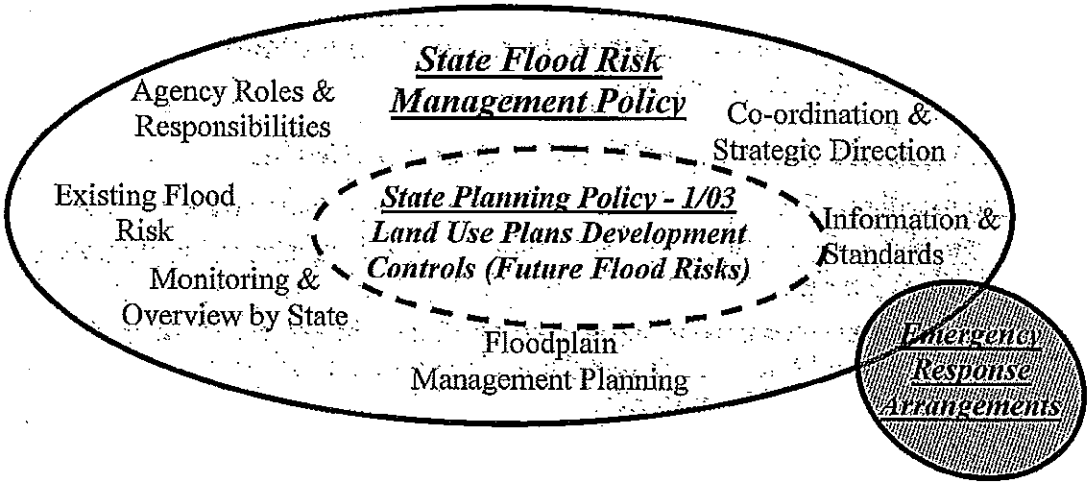


FIGURE 2 - Relationship Between Proposed State Flood Risk Management Policy & flood components of SPP 1/03
(Diagram used at public Presentations)

8.0 Discussion

Queensland's situation is probably closest to that of NSW in terms of flood risk exposure and in terms of agencies with similar responsibilities (i.e. local governments and the Department of Natural Resources and Mines). This leads one to the conclusion that the NSW approach would be most the suitable for adoption by Queensland.

A *State Planning Policy for Mitigating the Adverse Impacts of Flood, Bushfire and Landslide* (SPP 1/03) has been prepared and adopted for implementation by Queensland local governments. The SPP requires local governments to plan for and control approval of future development to minimise the growth in exposure to the natural hazards of flood bushfire and landslide.

This corresponds to one aspect of the NSW system, i.e. local government land use planning controls implemented by using both Regional (prepared by State Government) and Local Environmental Planning Instruments, Development Control Plans, and local flood risk management policies under the NSW Environmental Planning and Assessment Act, 1979. However SPP 1/03 does not provide the kind of overarching policy framework for managing floodplains to reduce all flood risks as exists in NSW.

To adopt a more comprehensive approach like NSW, Queensland must go beyond the SPP and move to adopt a State Flood Risk Management Policy and associated mechanisms.

9.0 Proposed Draft Policy

The proposal for a State Flood Risk Management Policy is intended to deliver a holistic approach to the management of floodplains in respect of flood risk, recognising this needs to occur within the context of the sustainable management of flood plain resources and natural ecosystems.

Whilst the policy needs to encapsulate all the issues, its implementation may occur through more than one instrument.

9.1. Flood Risk Management Policy principles and objectives

In formulating a flood risk management policy, it is important to recognise that:

- Floodplains are valuable natural resources which cannot be arbitrarily isolated from all development;
- Floodplains have a major impact on the health of the associated waterways, are important links in the life-cycle chain of many species and frequently include areas of significant ecological importance;
- All development proposals on the floodplain should be treated on their merits in relation to the flood risk, their environmental impacts, and the benefits such development can provide; and
- State government and local government responsibilities must be clearly defined.

The objective of a flood risk management policy should be to ensure sustained actions are taken to minimise long-term risk to life and property so that fewer Queenslanders will be victims of floods in future. The following key principles should guide strategies aimed at achieving this objective:

- Manage risks to public health and safety consistent with ecologically sustainable development (ESD) principles.
- Develop a full appreciation of all the risks and benefits associated with any proposed floodplain use.
- Enable individuals to make informed decisions.
- Adopt a partnership approach between all levels of government and the community (recognising that the costs of flood disasters affect all Australians).
- Aim for proactive prevention rather than reactive response.
- The costs associated with flood risk should be identified and funded transparently.

An effective flood risk management policy requires:

- a cohesive framework of measures
- effective implementation mechanisms.

9.2. Proposed Policy Outcomes

The Discussion Paper proposed that there were some fundamental outcomes required from a State Flood Risk Management Policy. They were:

- acquiring and maintaining comprehensive flood information
- undertaking appropriate risk and vulnerability assessments
- informing all relevant parties in a way that can be easily understood.

The Discussion Paper also considered that local governments, because of their existing responsibilities to the local community, were in the best position to deliver these outcomes - with appropriate support from the State.

Section 8 of the Discussion Paper considered numerous "*Possible Measures for Improving Flood Risk Management*". Local government planning scheme and development approval measures are addressed by the recently adopted *State Planning Policy – Mitigating the Adverse Impacts of Flood, Bushfire and Landslide* however, there remains the need to introduce measures that:

- Deal with legal liability
- Require floodplain management plans
- Establish a State information system
- Make flood information readily available

The Discussion Paper considered that the major barriers to effective flood risk management in Queensland would be removed by the development and implementation of a State flood risk management policy that:

- provides a Statewide strategic direction for the management of flood risk which recognises and facilitates the key role of local governments;
- clarifies the existing roles and responsibilities of agencies and aligns those statutory, administrative and funding programs that impact on flood risk;
- supports local government by providing flood risk management guidelines which promote best practice in accordance with ecological sustainability;
- provides for monitoring of the implementation and ongoing costs of flood risk management by local government;
- clarifies the links between existing legislation and the responsibilities of local governments;
- defines the conditions under which local governments can satisfy any legal obligations in respect of advice given or actions carried out (eg done in good faith and in accordance with accepted best practice);
- ensures that existing government subsidies and other financial incentives encourage a reduction in Queensland's level of flood risk;
- maintains an overview of flood risk management across the State to ensure all flood information is captured, maintained and available – enabling the community, local government and the State to make sound decisions regarding flood risk which avoid potential loss of life and property and to make best use of funding and technical resources; and
- assists the insurance industry to provide flood insurance to property owners by ensuring that the flood risk has been clearly identified and systematically recorded.

The Discussion Paper proposed that flood risk management issues needed to be drawn together as far as possible and to be implemented through legislation. Although this may be an ideal, it is considered highly unlikely that all aspects of flood risk management can ever be implemented through one piece of State legislation. As an example, NR&M administers the *Water Act 2000* and has responsibility for water quantity planning, management, compliance, rural water demand management, infrastructure and service

provider standards, and State-wide water statistics under the *Water Act 2000*. Yet many other issues impacting on water as a natural resource and the water cycle in general lie outside the Act and are administered by other agencies, eg:

- water quality (discharge licensing and requirements for environmental management plans for urban stormwater, trade waste, sewerage and water supply), facilitation of urban demand management and recycling are administered by Environment Protection Agency and under the *Environmental Protection Act 1994* and the *Environmental Protection (Water) Policy 1997.*
- urban water supply infrastructure charging and water business reform/competition under the *Integrated Planning Act 1997* and the *Local Govt Act 1993* administered by Department of Local Government and Planning.

Therefore, while a State Flood Risk Management Policy should aim to bring together all the existing State provisions that directly influence flood risk management in one "policy statement" - implementation may remain across a number of instruments (although these should be rationalised as far as possible). This is similar to the NSW model.

9.3. Content of Policy

A State Flood Risk Management Policy for Queensland needs to clarify and rationalise as far as possible (recognising that flood risk management issues already lie across a number of existing instruments) existing measures available to manage risks on floodplains; ensure co-ordination by establishing and maintaining clear links; and introduce new measures that will enhance outcomes.

9.3.1. Providing a Co-ordinated Approach to Managing Flood Risk

Following the NSW example, a State Flood Risk Management policy for Queensland can provide co-ordination through a "policy statement" which draws together all relevant measures, those existing as well as those proposed.

Agency roles and responsibilities likewise could be addressed through the policy statement. However for their long-term viability, roles and responsibilities are best defined in legislation.

As discussed above, four broad actions are required:

- Dealing with legal liability
- Requiring floodplain management plans
- Establishing a State information system
- Making flood information readily available

9.3.2. Dealing with legal liability

Local governments need to be able to:

- inform the public about flood risks on a floodplain (e.g. through maps showing the likely extent of flooding) based either on flood modelling or recorded historical information;
- manage development through planning schemes and development controls; and
- carry-out appropriate flood mitigation works.

There is a significant concern expressed during consultation (at the workshops and in a number of the written submissions) within local government that these actions may expose them to legal liability and claims for substantial compensation (or at least costly court proceedings) either as a result of actual flood losses or because of reduced property values following identification of flood prone land.

The proposed policy would set out how local governments can fulfil their responsibilities in making flood information available, setting development and building conditions, and carrying out works. The policy would clarify local governments' legal position with respect to these activities and remove the question of liability for non-negligent actions.

These provisions of the policy would require legislation (eg a new part to the Water Act 2000)

9.3.3. Requiring floodplain (risk) management plans

Floodplain (risk) management plans are an important requirement for the effective control (and reduction) of flood risk. Such plans provide the supporting information (flood studies, damage and vulnerability assessments, management scenarios and mitigation strategies) for planning and development controls and mitigation works programs.

The plans would also address issues such as social impacts, economic impacts and floodplain ecological values, with respect to the management of flood risk. They would be the principal integrating mechanism for identifying and attempting to balance the competing interests and risks on a given floodplain.

The State Planning Policy for Natural Disaster Mitigation needs the outcomes of a local floodplain (risk) management plan to enable it to be implemented most effectively. Under the proposed policy, each local government would be required to prepare floodplain (risk) management plans for its floodplain areas. This could be "enforced" as a statutory requirement, or as a condition of receiving State flood mitigation subsidy funds (either under the Regional Flood Mitigation Program or the Local Governing Bodies Capital Works Subsidy Scheme).

The long-term maintenance of these provisions of the policy would be best secured by legislation (eg. a new part to the *Water Act 2000*). However, flood mitigation subsidy eligibility could be used through administrative changes.

9.3.4. Establishing a State flood information system

The State Government should have a better understanding of the flood risk in Queensland and how it is being managed. Under the proposed policy, NR&M would oversee the preparation of local floodplain management plans and set up a State system for recording and monitoring flood information provided by local governments. This information would be used to determine the effectiveness of the Policy; target any assistance; support bids for Commonwealth funds; and assist local governments through shared information, experiences and expertise.

The long-term maintenance of a State flood information system would be best provided by legislation (eg a new part to the *Water Act 2000*). However NR&M could establish an information system without a statutory requirement to do so.

9.3.5. Making flood information readily available

Availability of flood information means individuals and communities are in a better position to manage their own risk. Removing obstacles such as questions over legal liability and compensation should result in existing information becoming more accessible. Where information does not exist or is incomplete, the policy would facilitate the collection/generation of flood information by requiring floodplain management plans.

To further assist local governments make flood information readily available, the policy would include the provision of appropriate flood information standards, in terms of collection, storage and presentation. If feasible, it may be appropriate to include local government flood data on the State land titling system administered by NR&M.

Once again, long-term maintenance of State flood information standards would be best provided by legislation (eg a new part to the *Water Act 2000*). However NR&M could establish guidelines on flood information without a statutory requirement to do so. But without legislation, local governments would not have to adopt the guidelines, or supply data meaning coverage of the State could not be assured.

9.4. Potential Provisions for State Flood Risk Management Legislation

9.4.1. Overall Responsibility for Flood Risk Management

The Chief Executive Officer of the Department of Natural Resources and Mines will be responsible for overseeing the State's Flood Risk Management Policy, and ensuring co-ordination with other State agencies (especially the Environment Protection Agency, Department of Emergency Services and Department of Local Government and Planning) to facilitate its effective implementation and long term maintenance.

9.4.2. Liability

A local government or other statutory agency with flood risk management responsibilities (as may be approved by the State) will not incur any liability for losses or damages arising from any of the agency's responsible actions to best manage flood risk (eg. provision of flood information in any form provided that information has been provided in good faith - refer NSW *Local Government Act 1993*). This provision does not remove liability for negligence.

9.4.3. Floodplain Risk Management Plans

Each local government (or other agency with suitable floodplain risk management responsibilities) will prepare a floodplain risk management plan in accordance with accepted best practice as set out in the Queensland Floodplain Management Manual as adopted and amended from time to time by NR&M.

9.4.4. State Flood Information System

Each local agency with flood risk management responsibility will provide for the areas under its jurisdiction:

- all available flood inundation data
- all available flood damage data
- details of policies and standards used in managing flood risk.

This data will be collected and supplied to NR&M in a format agreed by the State.

NR&M will operate and maintain a State Flood Information System based on data supplied by local governments to allow the ongoing assessment of the State's overall flood risk and the targeting of any special assistance which may be available from time to time. NR&M will also set appropriate standards for the collection and recording of flood data to be supplied by local agencies and provide technical assistance to local agencies so they can met the data standards required.

9.4.5. Flood Information Readily Available

Each local agency with flood risk management responsibility will make available to the community in a readily understandable form:

- all available flood inundation data
- all available flood damage data
- details of policies and standards used in managing flood risk

for the areas under its jurisdiction.

A local agency acting in good faith will not incur any legal liability for losses or damages that may arise from the use or mis-use of this information. Liability can only be incurred if it can be shown that the local agency's actions in deriving the information were negligent.

The State will note, on its land-titling database, land parcels that have been identified as flood affected, and that further information on the extent to which the land is affected should be sought from the relevant local government.

9.5. Preliminary Example of a State Flood Risk Management Policy Statement (based on the NSW Flood Prone Land Policy)

9.5.1. Purpose of the Policy

The primary objective of the policy is to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods, within the context of the sustainable use and management of the State's floodplains.

In fulfilling this objective:

- State and local agencies responsible for making decisions that will affect flood risk shall base all decisions regarding their actions on floodplains on an assessment of both the benefits and risks of those actions - taking into account social, economic and ecological factors, as well as flooding considerations;
- local government shall prepare and implement floodplain risk management plans that address both mainstream and overland flood risk - whilst preserving as far as possible, the natural function and ecology of floodplains;
- floodplain risk management plans will be the basis for making decisions about actions on floodplains that will affect flood risk such as new development, as well as including measures for the long-term reduction of flood risk to existing developed areas and ongoing flood emergency management;
- appropriate flood mitigation measures for each circumstance will be selected after considering and assessing the full range of structural and non-structural measures;

- the potential for increasing flood losses as a result of proposed development or redevelopment on floodplains shall be contained by the application of planning and development controls – consistent with SPP1/03.

To achieve its primary objective, the policy provides for:

- continuation of subsidy schemes for works to reduce potential flood damage and personal danger in existing developed areas (eg. existing flood mitigation subsidy schemes such as the Regional Flood Mitigation Program and the Local Governing Bodies Capital Works Subsidy Scheme);
- provision of technical support to local government to ensure that the use of flood prone land is consistent with the flood hazard and that such uses do not unduly increase potential flood liability to the occupier or to the community;
- recognition of emergency management and flood recovery programs and their linkage with the flood risk management process;
- protection of councils, government agencies and their staff against claims for damages resulting from their issuing advice, undertaking works or granting approvals on floodplains, providing such action was not negligent and was taken in accordance with the principles and guidelines of the *Floodplain Management Manual – Qld.*[3]
- legislation to support local government flood risk management.
- floodplain risk management plans prepared by the relevant local agencies (i.e. local governments) - or the State where necessary, (eg. large floodplains covering two or more local government areas and under development pressure from rural enterprises).
- floodplain risk management plans being the principal mechanism for addressing all the issues relevant to a particular floodplain in an integrated manner.

The policy shall be implemented in the following manner:

- The management of flood prone land is primarily the responsibility of local government. As such, local government will be responsible for preparing appropriate flood studies and floodplain risk management plans and for their implementation through local planning schemes, policies, procedures and programs determined by councils.
- The Qld Government, through the Department of Natural Resources and Mines shall provide specialist technical assistance and advice on flood risk management. A Floodplain Management Manual – Qld shall be provided to assist local governments in the preparation of floodplain risk management plans. Assistance on related issues (such as emergency planning and mechanisms for charging for infrastructure) will also be available from the Departments of Emergency Services and Local Government and Planning.
- The establishment of local flood risk management committees by councils, through which local community groups and individuals can effectively communicate their aspirations concerning the management of the flooding problem.
- Continuation of State Government subsidisation of floodplain risk management studies, works and measures (eg. existing flood mitigation subsidy schemes such as the Regional Flood Mitigation Program and the Local Governing Bodies Capital

[3] At present a Queensland Manual does not exist. Until one is developed it would be proposed that the National manual be adopted.

Works Subsidy Scheme; and flood study subsidies under the Natural Disaster Risk Management Studies Program).

- The establishment of a flood risk information database by the State Government

9.5.2. Policy Provisions

The policy provides for:

- a flexible merit based approach to be followed by councils, when dealing with flood prone land management;
- ongoing funding for flood risk mitigation projects;
- recognition of the need to consider the full range of flood sizes, up to and including the probable maximum flood and the corresponding risks associated with each flood;
- councils to be responsible for the determination of flood planning levels and appropriate planning and development controls based on social, economic and ecological impacts and values, as well as flooding considerations;
- an emphasis on the importance of developing and implementing floodplain risk management plans based on an integrated mix of management measures that address the existing, future and continuing risk;
- availability of State Government technical support to councils in relation to flooding matters;
- floodway definition to be based on hydraulic, hazard and potential damage considerations, with provision for restricted development depending on circumstances;
- inclusion of a local Integrated Catchment Management Committee (or Natural Resource Management Board) representative on each local government flood risk management committee;
- explicit recognition that flood risk management needs to take into consideration government policies and legislation allowing for the sustainable usage of the floodplain as a natural resource; and that the planning and assessment requirements laid down in those policies and legislation must be complied with by all agencies associated with the use, development and management of the floodplain;
- an emphasis on the need to consider ways of maintaining and enhancing the riverine and floodplain ecology in the development of floodplain risk management plans;
- recognition of the importance of the continuing flood risk addressed in the State Counter Disaster Organisation Act 1975 and State Counter Disaster Plan, and the close relationship between the emergency management and flood risk management processes;
- recognition of the potential implications of climate change on flooding behaviour;
- the policy and detailed arrangements for implementation to be included in the *Floodplain Management Manual- Qld;*
- protection of councils and other public authorities and their staff against claims for damages, providing they act in accordance with the government's policy at the time; and
- relief from charges on vacant land which cannot be developed because of its flood prone nature. *(This provision requires further negotiation with Treasury and local government).*

9.6. Departmental Responsibility for Development of the Policy

NR&M has the relevant skills and responsibilities (for land and water management) to deal with flood risk management issues across both rural and urbanised floodplains. NR&M:

- has hydrologic and hydraulic engineering expertise (through NRSC)
- has responsibility for riverine management
- through its network of gauging stations, is the custodian of important hydrological data
- arbitrates on floodplain disputes
- undertakes project assessments of Regional Flood Mitigation Program applications,
- is the State Government agency partnering Brisbane City Council and the Institute of Public Works Engineers Australia (Qld) in the ownership of the Queensland Urban Drainage Manual

It also has responsibility for State's land information system which potentially is the basis for a State flood database. This approach is generally reflected in interstate practice where responsibility for flood risk management policy lies with the government agencies which have responsibility for natural resources, particularly water resources ie:

- NSW - Department of Infrastructure, Planning and Natural Resources;
- Victoria - Department of Sustainability & Environment;
- Western Australia - Department of Environment (incorporating the previous Water & Rivers Commission);
- Tasmania - Department of Primary Industries, Water and Environment;
- South Australia - Department of Water, Land and Biodiversity Conservation (with technical assistance from the Department of Transport and Urban Planning); and
- Northern Territory - Department of Infrastructure Planning & Environment.

Other Departments that could be considered to have a significant portfolio interest in the management of flood risk and therefore possibly be responsible for development of the policy are the Department of Emergency Services (flood disasters); the Department of Local Government and Planning (local planning scheme provisions and local government infrastructure) and the Environmental Protection Agency (floodplain environment and water quality issues).

The Department of Emergency Services' core interests lie in disaster risk management and therefore the Department of Emergency Services interest in flooding is as a significant hazard only. Broader floodplain management and "non disaster" floodplain risks such as the potential adverse impacts on floodplain resources, water quality, etc. are of less significance. Although the Department of Emergency Services developed SPP 1/03 (in association with the Department of Local Government and Planning and with considerable assistance from NR&M) and is primarily responsible for its administration; DES does not have the skills or responsibilities to deal with all floodplain management issues whether they lie within or outside the scope of SPP 1/03. The Department of Emergency Services and intends to rely on NR&M for expert advice on flooding matters.

The Department of Local Government and Planning's expertise and interest in flood risk management principally lies with local planning schemes. However charges that may be made on development for funding flood mitigation/stormwater management works and

State subsidies for local government infrastructure are also issues for that Department. It should be noted that with respect to administration of State subsidy schemes for flood mitigation works, DLGP also rely on NR&M for expert advice in assessing and approving projects.

The Environmental Protection Agency's interests lie with protection and enhancement of the environment, which with respect to flooding includes water quality and floodplain ecological processes. EPA also has responsibilities under the *Coastal Protection and Management Act 1995* for seeing that issues associated with management of the State's coastal resources (natural and cultural) and the protection of their ecological, economic and social values are addressed including development assessment and permitting.

9.7. Timeframe

Following approval by the Minister, it is proposed that NR&M immediately prepare a Cabinet Submission informing Cabinet that NR&M is proceeding to develop a draft State Flood Risk Management Policy and seeking approval from Cabinet for NR&M to prepare draft legislation. The proposed timeframe being:

- Cabinet Submission on draft State policy statement (refer Section 9.4 for content) and the proposal for legislation for consideration by Cabinet by November2003,
- on approval by Cabinet, preparation of draft legislation by March 2004
- consultation on draft legislation from March to June 2004
- presentation of Bill to Parliament by October 2004

10.0 Conclusions

Based on the responses received to the Discussion Paper, this report concludes that:

- there is general support for proceeding to develop a State Flood Risk Management Policy for implementing through legislation.
- the objections received to the proposal were minor (relating to issues like resourcing rather than rejection of the aims of the policy)

This report further concludes that:

- As pointed out in the Discussion Paper, floodplain risk management has strong links with wider floodplain management issues and should be addressed in that context;
- In spite of the perceived advantages, it is not practical (and probably inappropriate) for all flood risk management issues to be consolidated and implemented through one State instrument.
- It is probably more practical to aim for a NSW-style approach where a State Policy Statement draws together and co-ordinates all aspects of flood risk management across various legislation – however this would still require some principal flood risk management legislation.
- As different issues vary in significance from one floodplain to another, individual floodplain management plans prepared by the relevant local agencies (eg local governments or possibly river improvement trusts) should be the principal mechanism for addressing all the issues relevant to a particular floodplain in an integrated manner.

- A State policy needs to be able to ensure that floodplain management plans are prepared and that they adequately address all relevant issues. To achieve this the policy should provide for the oversight by the State of floodplain management plans prepared by the relevant local agencies (eg local governments or possibly river improvement trusts);
- Because of its responsibilities for other catchment issues and because of its expertise in water, NR&M is best placed to take responsibility for development of the policy and its implementation
- Based on practice in other States, implementation should be through the preparation of a State Policy Statement and the addition of a new Part/Chapter to the Water Act 2000 (along the lines of NSW practice) with associated amendments to other Acts where required

11.0 Recommendations

This report recommends the Minister approve:

- NR&M proceeding to develop a draft State Flood Risk Management Policy and amendments/additions to the Water Act 2000 and other acts (in consultation with the relevant agencies) to support its implementation for consultation.
- the draft State Flood Risk Management Policy being prepared as outlined in Section 9.0.
- this report forming the basis of a Cabinet submission informing Cabinet of the outcomes of the public consultation on the Discussion Paper and that NR&M is proceeding with the preparation of a draft policy.

References

Smith, D. I. 1998, *Urban Flooding in Queensland—A Review,* Department of Natural Resources and Mines, Brisbane.

Standing Committee on Agriculture and Resource Management 2000, *Floodplain Management in Australia Best—Practice Principles and Guidelines* (SCARM Report Number 73, CSIRO Publishing.

APPENDICES

APPENDIX A - DISCUSSION PAPER & PUBLIC PRESENTATIONS ADVERTISEMENT OF 19 OCTOBER, 2002

Public Consultation
State Flood Risk Management Policy
Discussion Paper

The Department of Natural Resources and Mines has produced a State Flood Risk Management Policy discussion paper.

The purpose of this discussion paper is to facilitate public consultation on the development of a flood mitigation policy. In particular, the paper highlights the advantages of implementing a comprehensive state flood risk management policy through legislation. The primary objective of the policy will be to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods.

Public consultation period will commence on 1 November 2002 and conclude 28 February 2003. A detailed paper and a summary version will be available from 21 October 2002 on the department's website www.nrm.qld.gov.au. Printed copies can be requested by contacting:

Mr Upali Jayasinghe
Floor 8, Water Use
Department of Natural Resources & Mines
41 George Street
Brisbane QLD 4001
Telephon[redacted]
Fax [redacted]
Email : [redacted]

The department will conduct presentations of the discussion paper in conjunction with public workshops on the draft State Planning Policy for Natural Disaster Mitigation organised by the Department of Emergency Services. The workshops have been arranged to take place in the following centres:

Toowoomba	Thursday 7 November, 10 am – 1 pm
Brisbane*	Friday 8 November, 9.30 am – 12.30 pm
	Monday 18 November, 9.30 am – 12.30 pm
Gold Coast*	Monday 11 November, 9.30 am – 12.30 pm
Bundaberg	Tuesday 12 November, 10.30 am – 1.30 pm
Townsville*	Wednesday 20 November, 9 am – 12 pm
Cairns*	Thursday 21 November, 9 am – 12 pm
Sunshine Coast*	Friday 22 November, 9.30 am – 12.30 pm
Rockhampton*	Monday 25 November, 9 am – 12 pm
Mackay*	Tuesday 26 November, 10.30 am – 1.30 pm
Roma	Thursday 28 November, 10.30 am – 1.30 pm
Mt Isa	Monday 2 December, 10 am – 1 pm
Longreach	Wednesday 4 December, 10 am – 1 pm

* An additional afternoon workshop may be held at these locations if morning sessions are overbooked.

Further details and bookings can be made by contacting the above.

APPENDIX B - REGIONAL NEWSPAPERS CARRYING THE ADVERTISEMENT FOR THE DISCUSSION PAPER

News Mail (Bundaberg)

The Cairns Post

Western Times (Charleville)

The Northern Miner (Charters Towers)

Central Queensland News (Emerald)

Gladstone Observer

Gold Coast Bulletin

The Gympie Times

The Queensland Times (Ipswich)

The Longreach Leader

The Daily Mercury (Mackay)

The Fraser Coast Chronicle (Maryborough)

The Western Star (Roma)

The North West Star (Mt Isa)

The Morning Bulletin (Rockhampton)

Sunshine Coast Daily

The Chronicle (Toowoomba)

Townsville Bulletin

Warwick Daily News

The Weipa Bulletin

Herbert River Express (Ingham)

Innisfail Advocate

Ayr Advocate

The Central Telegraph (Biloela)

Dalby Herald

Goondiwindi Argus

Torres News (Thursday Island)

The Proserpine Guardian

Bowen Independent

APPENDIX C - RESPONSES AND COMMENTS ON SFMP DISCUSSION PAPER

No	Agency (& Address)	Name Position	Support Y/N	Est. no. of props at risk for 1% AEP flood (Smith 1998)	Summarised Response	State Flood Risk Management Policy Issues	NR&M Response to Submission
1	Department of Primary Industries	Dr Warren Hoey Director-General	Y	Not Applicable	Endorses principals and policy objectives	Endorses the Policy.	
2	Department of Emergency Services	Alan Brunner Executive Director	Y	Not Applicable	Supports development of a SFRMP Outlines DES activities i.e. SPP development and proposed SCDO Act Review	Considers SFRMP and SPP as complementary measures	
3	Department of Local Government and Planning	Tim Kershaw A/Principal Policy Officer	Y	Not Applicable	Generally supports SFRMP proposal. Comments focused on support required for implementing SPP	Concerned to see commitment from NR&M to take a proactive and not rely only on local governments carrying workload / responsibility	
4	Department of State Development	Romila Prasad Cabinet Legislation/Liaison Officer	Y	Not Applicable	Strongly supports flood risk studies by local governments. WRT State Infrastructure, sees flood risk best considered at detailed design stage of projects not strategic planning stage because of potential cost. Business Regulation Reform Unit interested in minimising cost.	Favours risk-based rather than prescriptive approach. Does not favour over regulation Consider aligning with State Infrastructure Plan	DSD response is basically supportive - only concern revolves around costs to State projects of implementation

No	Agency (& Address)	Name Position	Support Y/N	Est. no. of props at risk for 1% AEP flood (Smith 1998)	Summarised Response	State Flood Risk Management Policy Issues	NR&M Response to Submission
5	Insurance Council of Australia Level 3, 56 Pitt Street Sydney NSW 2000	Rod Frail (through Teresa Lane, Corporate Affairs)	Y	Not Applicable	Restates insurance industry's strong desire for flood risk information, agrees with all paper's findings & strongly supports legislative option - even though lengthy process; willing to assist facilitate drafting	Strong support for legislative option – some local governments sceptical of ICA's motives (i.e. likely to not offer insurance to at risk areas although access to cover is already very limited)	Very Strong Support. Policy can't force insurance industry into unsustainable insurance cover.
6	Brisbane City Council Urban Water Management Water Resources	Peter Barnes Senior Waterways Program Officer for Barry Ball, Manager Water Resources	Y	8000	Supports views expressed in paper. Offers BCC's experience regards Council practices; Flood advice (levels, habitable areas, etc); Mitigation; Stormwater flooding and Property notification	Supports aims of proposed policy, i.e.: availability of information mitigate existing , future & residual flood risks; clarify responsibilities; best use of resources	BCC raises issues of stormwater flooding, floodprone residents' ability to pay for insurance; & seeks involvement in further policy development.

No	Agency (& Address)	Name Position	Support Y/N	Est. no. of props at risk for 1% AEP flood (Smith 1998)	Summarised Response	State Flood Risk Management Policy Issues	NR&M Response to Submission
7	Planning Institute Qld 2/56 Gordon Parade Manly Q 4179 President – Gary White	Sharon Boyle Policy & CPD Coordinator	N	Not Applicable	Supports views expressed in paper & sees flood risk management as part of responsible development & resource management. However considers issue mostly addressed by draft SPP from DES. Sees clarification of responsibilities as an issue but not sufficient to justify a 2nd "State Planning Policy"	Submission proposes Regional Planning processes to address flood risk management with some clarification of regional arrangements.	Submission misunderstands the proposed role of the policy in dealing with issues outside the scope of SPPs. Demonstrates the confusion that has been generated in spite of explanation given in public presentations
8	Ipswich City Council P O Box 191 Ipswich Qld 4305	Andrew Underwood	N	3000	Concerned about issues surrounding "advertising" flood data & awareness, eg: property values; completeness & accuracy of flood data; & creating undue concern. Already makes flood info available on enquiry. Also concerned about how to deal with flood-prone existing communities where viable mitigation options are very limited. Hence considers SPP adequate.	Seems to supports thrust of proposed policy, however highlights information issues of : availability; accuracy; & impact; as well as costs for mitigation works.	Proposed policy actually seeks to address most of these concerns by clearly setting out when a local government has met its obligations. Mitigation works will always be subject to cost/benefit tests & affordability

No	Agency (& Address)	Name Position	Support Y/N	Est. no. of props at risk for 1% AEP flood (Smith 1998)	Summarised Response	State Flood Risk Management Policy Issues	NR&M Response to Submission
9	Department of Public Works Level 12, 295 Ann Street Brisbane Qld 4000	John Rossiter Manager Environmental Compliance & Disaster Management Services	Y	Not Applicable	General comments regarding the need for the policy and strong support, also supports legislativer implementation option.	Supports legislative option. Considers benefits - including reduced flood damages - should out-weigh possible arguments regards likelihood of higher land costs	May be some confusion with outcomes from SPP, (ie future development control) but submission speaks also of support for management arrangements
10	Individual c/-Mackay City Council PO Box 41 Mackay Qld 4740	Errol Combs Emergency Management Co-ordinator	Y	Not Applicable	Supports policy, in particular considers the potential protection of legislation as necessary.	Supports legislative option. Supports firm binding guidelines and protection of local governments by legislation as well as determining financial responsibilities.	No comments
11	North Queensland River Trust's Association PO Box 5318 MC Townsville Q 4810	John Woods President	Y	Not Applicable	Supports thrust of policy proposal, however concerns over any adverse impacts on RIT's. Also concerned that State (as well as local government) responsibilities be legislated including role in flood information, across local govt boundary studies & resourcing (funding). Need to include Trusts if policy proceeds to legislation.	More consultation with Trusts and local governments before legislating. Drains and levees (associated with watercourses) should stay under Water Act.	Trusts concerns generally revolve around retaining statutory powers of Trusts and resourcing issues.

No	Agency (& Address)	Name Position	Support Y/N	Est. no. of props at risk for 1% AEP flood (Smith 1998)	Summarised Response	State Flood Risk Management Policy Issues	NR&M Response to Submission
12	Individual c/- James Cook University Post Office James Cook Drive Townsville Qld 4811	William (Billy) Tait	N	Not Applicable	Argues against the need for a specific flood policy – & considers that application of ESD principals generally & the Coastal Management Act in particular covers most flood risk issues. Also considers that regional planning processes (thru Regional Consultative Committees under the CMPA) have potential to address flood risk. Discusses importance of RITs, State ownership of and hence responsibility for overland flows, and funding from insurance companies and developers. Very critical of State's slow progress in implementing Coastal management Plans	Not supportive of further government legislation – considers that State has existing powers & obligations which it is avoiding by trying to pass to local government	Puts a lot of emphasis on (& faith in) the application & detailed interpretation of ESD principles through the CM Act & CMPs to deal with most flood policy issues. Submission actually supports need to deal with flood issues and some of the proposed measures, just disagrees with need for a new instrument for implementation
13	State Council of River Trust, Queensland 3 Aylesbury Street Fig Tree Pocket Qld 4060	Norm Craswell Executive Officer	Y	Not Applicable	As for NQRT submission - plus proposal for consolidating RIT's role & expanding RIT coverage to whole State.	As for NQRT submission.	As for NQRT submission. Proposal for expansion of RIT coverage - needs to be discussed as part of RIT Act review.

No	Agency (& Address)	Name Position	Support Y/N	Est. no. of props at risk for 1% AEP flood (Smith 1998)	Summarised Response	State Flood Risk Management Policy Issues	NR&M Response to Submission
14	Gold Coast City Council PO Box 5042 Gold Coast MC Qld 9729	Ms Anne D'Arcy	Y	16650	Supports proposed policy & legislative option. Sees flood risk assessment & making information available & understandable as very important. Also inclusion of all types of flooding as well as broader community & floodplain management issues, especially ecological.	Policy needs to support activities of local governments, need for guidelines as part of policy; State-wide clear & consistent approach; & co-ordination with counter disaster planning activities.	Agree, all issues are relevant, sub-mission basically matches policy proposal. Inclusion of "all flooding" should be investigated. Wider floodplain issues may be difficult to address in realistic timeframe.
15	Individual (Primary Industry) PO Box 54 Halifax Qld 4850	Bruce Mahony	Y	Not Applicable	Strongly agrees with proposal for policy, concerns relate to uncontrolled levee bank development on floodplains and impact on others.	Supports legislation to deal with works on floodplains and avoid adverse impacts	Highlights rural flood risk dimension required in policy i.e. old local levee bank law type function
16	Toowoomba City Council PO Box 13021 Toowoomba Village Fair Qld 4350	Peter Keane Senior Engineering Infrastructure Planning	Y	Not Provided	Supports proposal for policy and legislative option; Supports requirements placed on local governments provided State sets legal framework and assists with resources.	Seeks increased State subsidy for flood mitigation works under the LGBCWSS from 20% to 40% (i.e same as w.s. & sew.)	Legal framework very important element of proposal. Assuming continuation of the RFMP, current State/Comm subsidy available = $66^2/_3$%. Asssiatnce also available through NDRMSP

No	Agency (& Address)	Name Position	Support Y/N	Est. no. of props at risk for 1% AEP flood (Smith 1998)	Summarised Response	State Flood Risk Management Policy Issues	NR&M Response to Submission
17	Geoscience Australia GPO Box 378 Canberra ACT 2505	Miriam Middelmann Geoscience Australia GPO Box 378 Canberra ACT 2505	Y	Not Applicable	Supports proposal for policy and legislative option. Highlights Geoscience Aust contribution to flood risk data in SEQ.	No real issues for proposed Policy, submission sees policy as necessary to integrate flood risk management in Qld	No comment required
18	Townsville City Council PO Box PO Box 1268 Townsville Qld 4810	Bob Neunhoffer Technical Services Engineer	Y	Not Provided	Supports proposal for policy but highlights need for detail on responsibilities & continuing involvement of the 3 levels of govt. before supporting legislation. Seeks inclusion of water quality management considerations.	Need for ongoing commitment by State Government – ie roles and responsibilities.	Intention is for Policy to commit State as well as local govt. Water quality could be included as far as current responsibilities allow
19	Isis Shire Council PO Box 103 Childers Qld 4660	S D Johnston Chief Executive Officer	N	Not Provided	Concerns regarding the potential costs of flood studies to the Council. Doesn't see current subsidies as sufficient for small councils with large/numerous floodplains.	Support/funding for poorly resourced local governments in producing flood data.	Unlikely to be able to provide more money for studies. Need to address concerns through timeframes for implementation. Should be an issue for Isis under SPP also

No	Agency (& Address)	Name Position	Support Y/N	Est. no. of props at risk for 1% AEP flood (Smith 1998)	Summarised Response	State Flood Risk Management Policy Issues	NR&M Response to Submission
20	Etheridge Shire Council, St George Street Georgetown Qld 4062	David Savory Acting Chief Executive Officer	N/A	Not Provided	No comment	Nil	N/A.
21	SEQ Water PO Box 236 Albert Street Brisbane Qld 4002	Peter Borrows Chief Executive Officer	-	Not Applicable	Believes no impact on SEQ Water. Currently comply with Dam Safety obligations and operate flood mitigation function of SEQ dams as required. Also maintain hydrological data and flood studies and provide information to local governments.	Ensure policy is consistent with Corporations current flood mitigation and dam safety activities and obligations.	Proposed policy likely to have minimal impact on SEQ Water because of their current activities already likely to "fit".
22	Department of Local Government and Planning	Peter Bourke	Y	Not Applicable	Sees need for policy to ensure State support for local governments implementing the draft SPP. Concerned that any policy needs to be consistent with draft SPP & IPA.	Consistency with other policies and legislation and security of State role in supporting local governments	Objective of policy is as much to secure State role as to enable local governments to perform theirs. Policy recognises role of draft SPP.
23	Gladstone Area Water Board PO Box 466 Gladstone Qld 4660	Chris Drinkwater Chief Executive	Y	Not Applicable	Supports discussion paper in principle & priority of recommendations. Suggests need for "milestones" timeline. Prefers non-legislative option, interested in outcome of SPP.	Sees need for NRM to provide a strong lead to local govts including agency responsibilities, community consultation & awareness	Non- legislative implementation cannot address issues raised eg. agency roles and responsibilities.

No	Agency (& Address)	Name Position	Support Y/N	Est. no. of props at risk for 1% AEP flood (Smith 1998)	Summarised Response	State Flood Risk Management Policy Issues	NR&M Response to Submission
24	Cane Farmer Private Mail Bag 71 Mail Service 102 Ingham Qld 4850	John M Mahony	Y	Not Applicable	Submission describes particular issues on the Herbert River floodplain, seeks NRM professionals on the river trusts to balance locals & legislation to deal with floodplain levees. Sees flood risk management as a State Government "job".	Need for powers to control works on floodplains. Appropriate skills available to RITs	Control of floodplain works is an important issue for policy. Make-up of RITs is not directly an issue for the Policy but still may need highlighting.
25	Roma Town Council PO Box 116 Roma Qld 4455	Ian O'Donnell Chief Executive Officer	Y	Not Provided	Supports Discussion Paper, legislation option & regional approaches. Concerns about costs, liability and compensation.	Costs to local govt and availability of expertise in flood mitigation	Highlights resourcing issues for some smaller/poorer local governments..
26	Sunshine Coast Rural Landholders Conservation Council PO Box 243 Palmwoods Qld 4555	R Knight Secretary	N (but almost neutral)	Not Applicable	Submission does not support further legislation. Asserts that local and State Govt could act responsibly now but choose not to. Places responsibility for poor planning decisions on State as much as local government & cites issues such as State valuations & State ownership of water. Is suspicious that Paper's main purpose is to protect State, not to manage flood risk	No more legislation. Might support proposed policy if "realistic" & if it exposes bad local govt decisions	Submission actually supports action by the State, however the proposals in the Discussion Paper appear to have been read as unrealistic & aimed at providing the State with a means of avoiding any responsibility.

No	Agency (& Address)	Name Position	Support Y/N	Est. no. of props at risk for 1% AEP flood (Smith 1998)	Summarised Response	State Flood Risk Management Policy Issues	NR&M Response to Submission
27	Gecko - Gold Coast and Hinterland Environment Council, Gecko House 139 Duringan Street	Sheila Davis President Currumbin Qld 4223	Y	Not Applicable	Submission supports paper. High-lights need for: independent assessments of flooding, mitigation & development conditions(CSIRO) resilient infrastructure, & effective response arrangements. Included SPP submission	Main issue for proposed policy is independent assessment of flooding, mitigation & development conditions	Policy not likely to be able to provide for comprehensive independent checking - will rely on transparent processes & strategic overview.
28	Department of Main Roads PO Box 1425 Brisbane Qld 4001	Mr. Stephen Golding Director-General	Y	Not Applicable	Satisfied with content of Discussion Paper; Some concern re consistency with Main Roads' operations; Sees clear intent & co-ordination as important role for legislated policy	Policy needs to recognise operational policies of other agencies. MRD seeks consistency with its operations	Paper recognises that agencies such as MRD must balance a number of objectives. Should not be a major issue
29	Environment Protection Agency PO Box 155 Brisbane Albert Street Qld 4002	Olwyn Crimp Executive Director, Planning	Y	Not Applicable	Sees need for Policy to also provide guidance on floodplain environmental issues, supports protecting the natural function of floodplains & the inclusion of stormwater management & non-urban flooding. Also sees climate change as needing more attention. Suggests an amended RIT Act as possible legislation & the Beach Protection Act as a possible model.	Submission supports broadest interpretation of flood risk management policy. Need to be investigate Beach Protection Act as model & possible use of RIT Act as basis.	Agree with most points, unlikely RIT Act will be suitable but should investigate. Also will look at BP Act as example.

No	Agency (& Address)	Name Position	Support Y/N	Est. no. of props at risk for 1% AEP flood (Smith 1998)	Summarised Response	State Flood Risk Management Policy Issues	NR&M Response to Submission
30	Department of Natural Resources and Mines 7th Floor, Mineral House 41 George Street Brisbane Qld 4000	Dr Tony Pressland General Manager Catchment and Regional Planning	Y	Not Applicable	Paper is well written outline of all issues; Critical of split between SFRMP & SPP; sees policy promoting comprehensive approach as timely for Dept with current issues like riparian & floodplain land management & water allocation. Policy should define role of Dept (urban vs rural floodplains). Suggests different name & that legislation be part of Water Act. Link to WRPs & possible use of RITs as well as costs & liabilities raised	Submission generally supports Policy & makes links with other NRM issues. Need to explore potential for links with other NRM issues (esp. on rural floodplains) as well as realistic role for NR&M & cost of State database.	Most points raised are valid and need to be investigated. Link with WRPs is not as realistic as suggested. Like-wise a wider role for RITs is possible but would mean many more RITs as well as possible overlaps with local government.
31	Livingstone Shire Council Box 600 PO Yeppoon Qld 4703	Gary Murphy	Y	Not Provided	Paper does not offer a policy example. Submitter has experience under NSW FPM system and sees need for similar approach in Qld. Need to links storm surge and overland flooding. Sees need for adequately resourced State directorate (in NR&M) to assist local governments with floodplain management.	Strong support for policy but also wants an adequately resourced State agency to assistance floodplain management activities of local government, esp. where expertise is limited	A draft policy is next step after Minister approves further work. Basically agree with rest of submission.

No	Agency (& Address)	Name Position	Support Y/N	Est. no. of props at risk for 1% AEP flood (Smith 1998)	Summarised Response	State Flood Risk Management Policy Issues	NR&M Response to Submission
32	Warwick Shire Council PO Box 26 Warwick Qld 4370	M J Ryan Manager, Works	Y	123	Intent of policy very sound. Concerned about realistic flood standards; communicating to developers & public that conditions on development in flood prone areas often makes it impractical; costs of impact assessment where there is a lack of data & exposure to compensation.	Supports proposal for policy. Most issues relevant to SPP	Consider all of the concerns are reasons in favour of the policy
33	Burdekin Shire Council PO Box 974 Ayr Qld 4807	D P Mulcahy Acting Chief Executive Officer	Y	1000	Seeks State lead and support for local governments. Highlights preference for legislation. Outlines numerous issues including information, liability, costs, availability of good advice, constraints of existing settlement patterns, etc.	Details many difficulties that Burdekin Shire perceives with flood risk management generally & implementing SPP in particular. Highlights need for State to address these - particularly for smaller Councils.	Many of the issues raised support argument in Discussion Paper for a policy. Submission should also be forwarded to DES.
34	Department of Emergency Services GPO Box 1425 Brisbane Qld 4001	Alan Brunner Executive Director Counter Disaster and Rescue Services	Y	Not Applicable	Agrees with proposed policy, particularly as a complimentary measure to DES's initiatives (ie the SPP & proposed new SCDO Act)	Supports discussion paper however there are issues of overlap with proposals for Disaster Management Strategies under the proposed re-written SCDO Act	Further debate/negotiation is required with DES regards the roles of their proposed Natural Disaster Mitigation Strategies & Floodplain Management Plans under a SFRMP.

No	Agency (& Address)	Name Position	Support Y/N	Est. no. of props at risk for 1% AEP flood (Smith 1998)	Summarised Response	State Flood Risk Management Policy Issues	NR&M Response to Submission
35	Broadsound Shire Council PO Box 1 St Lawrence Qld 4707	Gordon Webley Chief Executive Officer	NA	Not Provided	Concerned regards resources to implement policy measures, esp. information generation, collection & dissemination. Sees State & Commonwealth better resourced to undertake.	Main issue is financial burden to implement suggested measures, but highlights again perceived role of State by smaller Councils.	Not an out-right objection to the aim of the policy, just to the possibility of burden on local government.

APPENDIX D – DISCUSSION PAPER WORKING GROUP MEMBERS

Working Group Members for the Original Draft of the Paper Presented to the State Disaster Mitigation Committee		
Haydn Betts	Gold Coast City Council	June to August 2000
Steven Cardell	UDIA Representative (Clarke and Kann, Brisbane)	June to August 2000
Jesse Chadwick Johan Pretorius	Department of Local Government and Planning	June to August 2000
Ken Durham Carolyn Honeywill Steven O'Reilly	Department of Emergency Services	June to August 2000
Lou Kamenos	Institute of Public works Engineers – Queensland Representative – SE Qld (Logan City Council)	June to August 2000
Dawson Wilkie	Institute of Public works Engineers – Queensland Representative – Nth Qld (Townsville City Council)	June to August 2000
Lee Rogers Richard Priman Tony Horton Eugene Shannon Ryan Smith Russell Cuerel	Department of Natural Resources and Mines Brisbane	June to August 2000

APPENDIX E - CONSULTATION WITH STATE AGENCIES

NAME OF OFFICER	DEPARTMENT/ AGENCY	DATE OF CONSULTATION
Paul McFadyen Graham White Glenn Poole	Treasury	July to August 2002 September 2000 to August 2001
Magdi El Hag Debra Carter Janet Miller Maurie Tucker	Department of Local Government and Planning	October 2001 to July 2002 September 2000 to August 2001
Amanda Hill Allan Woolard	Department of the Premier and Cabinet	August 2001 to July 2002 September 2000 to August 2001
Michael Kinnine Jack Noye Carolyn Honeywill Richard Wood Dale Leary	***Department of Emergency Services***	September 2000 to July 2002
Ronald Rankin	Department of Public Works – QBuild	September 2000 to August 2001
John Gilmour	Environmental Protection Agency	September 2000 to August 2001
Paul Barnes	Department of Primary Industries	September 2000 to August 2001
Rick Andrew	Department of State Development	September 2000 to August 2001
Russell Fisher	Department of Main Roads	September 2000 to August 2001

Others on the State Disaster Mitigation Committee

Graham Webb	Burdekin S.C. CEO	September 2000 to August 2001
Greg Hoffman	Committee LGAQ CEO	September 2000 to August 2001 and July 2002
Warwick Geisel	Dalby Town Council, Mayor	September 2000 to August 2001

APPENDIX F - QUEENSLAND'S FLOOD RISK IN RELATION TO THE OTHER STATES

NSW and Queensland are estimated to have the majority of Australia's property/population at risk from floods – around 70% of the urban flood risk exposure in Australia (refer *Urban Flooding in Queensland – A Review* and the relative funding allocations of the Regional Flood Mitigation Program - see Table 2.0). It is considered that, Queensland may exceed NSW in total number of urban properties at risk – in spite of Queensland's much lower population.

State	Population (Millions)	Break-Up of RFMP Commonwealth Funds - Based on Estimated Proportion of National Average Annual Flood Cost (%)	Proportion of National Flood Risk Per Million Population (% Per Million)
Qld	3.7	35	9.5
NSW	6.4	35	5.5
Vic	4.6	15	3.3
WA	1.9	5	2.6
Tas	0.5	4	8
SA	1.5	4	2.7
NT	0.2	2	10
ACT	0.3	0	0
Total	19.1	100	NA

Notes:

1 The split of Commonwealth Regional Flood Mitigation Program funds between the States and Territories is based on the current best understanding of their relative flood risk and damage levels.

2 The Urban Flood Risk in Qld Survey Report prepared for DNR was responsible for Qld demonstrating that the magnitude of Qld's flood risk was as large as NSW and therefore in obtaining equal funding for Qld from the Commonwealth

Figures for rural flood risk exposure in Queensland are not known. However the estimate in the 1992 Australian Water Resources Council (AWRC) report - *Floodplain Management in Australia Volume 2:Main Report*; considered the cost of rural average annual flood damages in Queensland was about 15% higher than the urban cost. The AWRC report also estimated that the distribution of rural average annual flood damages between the States was similar to the urban damages distribution. (i.e. NSW and Qld had the highest). On the basis of the estimates for urban flood risk exposure in the 1992 and 1998 report, it is reasonable to suggest that Queensland also has the highest rural flood risk exposure nationally.

APPENDIX G - APPROACHES IN OTHER JURISDICTIONS

A survey of approaches of the other States' to flood risk issues shows that Queensland is remarkable in that it has possibly the highest level of exposure to flood risk, yet until the adoption of SPP 1/03, it has had no State wide policy of any kind which addresses flood risk issues even in part.

G.1 New South Wales

NSW adopted its Flood Prone Land Policy (see Appendix G) in 1984. The policy is supported by the Floodplain Management Manual, 2001. Together these documents outline the responsibilities of both State and local government in floodplain management in NSW and provide a merit-based process for managing flood risk. The policy is supported through key legislative provisions such as Section 733 - Exemption from liability—flood liable land and land in coastal zone, *NSW Local Government Act 1993* (see Appendix H).

The Policy's primary objective is "to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods, utilising ecologically positive methods wherever possible." It should be noted that flood prone land in New South Wales is defined as land below the probable maximum flood.

Actions under the Policy include:

- The State Govt is responsible for the production, maintenance and support of the NSW Floodplain Management Manual through the Department of Infrastructure, Planning and Natural Resources (formerly the Department of Land and Water Conservation);
- Land use planning controls are generally implemented by local government using both Regional (prepared by State Government) and Local Environmental Planning Instruments, Development Control Plans, and local flood risk management policies. These controls are implemented under the NSW *Environmental Planning and Assessment Act 1979*;
- The State Government indemnifies local government for legal liability for development decisions and information provided in good faith, with appropriate duty of care and following appropriate technical standards and administrative processes outlined in the gazetted manual for floodplain management under the NSW *Local Government Act 1993*.
- The State Government can prepare floodplain management plans in rural areas designated under Part 8 *Water Act 1912* , and carried forward into the *Water Management Act 2000*. These plans are statutory plans and are used to control development within specific rural floodplains;
- The State Government subsidises local government for floodplain management works and studies. This is provided both by the State alone, at a funding ratio of $2 State to $1 local; and in partnership with the Commonwealth at the funding ratio of $1 Commonwealth to $1 State to $1 local.

Under the NSW policy:

- It is recognised that the management of flood prone land is primarily the responsibility of local government. Therefore the standards and implementation arrangements are required to be in accordance with the policies, procedures and management plans determined by councils. The Floodplain Management Manual provides the process which enables local governments to make informed floodplain management decisions.
- The NSW Government, through the Department of Infrastructure, Planning and Natural Resources and the State Emergency Service, provides specialist technical assistance on all flooding matters. The Floodplain Management Manual is provided to assist local governments in the preparation of floodplain management plans.
- Local governments establish local floodplain management committees, through which local community groups and individuals can effectively communicate their aspirations concerning the management of the flooding problem. These committees are advisory to councils. A committee may be formed for each floodplain area.
- The State Government continues to subsidise floodplain management studies, works and measures.

The NSW State Government uses the following means to encourage local government to undertake informed floodplain management and associated appropriate land use control, and to provide an appropriate level of advice to prospective property purchasers:

- The liability of Councils is limited under the NSW *Local Government Act 1993* to provide them with indemnity when making appropriate development decisions using the flood risk management process. This indemnification extends to information supplied on Planning Certificates issued under the provisions of the *Environmental Planning and Assessment Act 1979*. It is compulsory for vendors to supply Planning Certificates to prospective purchasers. Certificates must indicate whether local governments have adopted policies in relation to a range of matters which may impact upon the development of the property, including flood risk..
- Departmental directions to local government and the State Environmental Planning Policy provisions of the Environmental Planning and Assessment Act
- Technical expertise on floodplain management through the Department of Infrastructure, Planning and Natural Resources, the Department of Urban Affairs and Planning and the State Emergency Service.
- Subsidies for studies into flood behaviour, assessment of management options, development of floodplain management plans, and associated floodplain management measures (including mitigation works). The State's floodplain management program subsidises local government for flood investigations and mitigation works. Total subsidy available to NSW local governments is approximately $12 million per year – comprising $7 million in State only funds and the remainder from State/Commonwealth partnership programs (Regional Flood Mitigation Program and the Natural Disaster Risk Management Studies Program).
- This subsidy scheme is administered by the Department of Infrastructure, Planning and Natural Resources. Priorities for works are set in consultation with the NSW Floodplain Management Authorities, an association representing approximately 70 NSW local government authorities with an interest in flood risk management issues.

In addition to the Flood Prone Land Policy, NSW has floodplain management provisions within its water legislation (Part 8 of the *Water Act 1912* - amended in Nov 1999 but ultimately to be incorporated in the *Water Management Act 2000*) which give the NSW State Government, through the Department of Infrastructure Planning and Natural Resources, the ability to prepare statutory rural floodplain management plans. These plans provide strategies to reduce the flood risk to rural communities and maintain and restore the flooding regime to flood dependant ecosystems by removing or modifying significant barriers to flooding. Plans are developed in accordance with the provisions and policies of the NSW Floodplain Management Manual and involve a collaborative effort between the Department and community based floodplain management committees.

The NSW State Government has initiated a program to progressively develop rural floodplain management plans for some 70 of the State's key floodplains in the Murray-Darling Basin.

G.2 Victoria

Victoria has a lower flood risk exposure than Qld, around 14.6% of the national exposure. In regional Victoria, nine Catchment Management Authorities (CMA) were established in 1997, under the *Water Act (Vic) 1989* and the *Catchment and Land Protection Act (Vic) 1994*. They have responsibility for flood management, along with planning and managing regional water resources. Melbourne Water manages these functions in the Greater Melbourne area, using the provisions of the *Melbourne and Metropolitan Board of Works Act (Vic) 1958* and delegation of floodplain management responsibilities under the *Water Act (Vic) 1989*. Melbourne Water also has a significant urban drainage function.

Floodplain management strategies prepared by each CMA to reduce the damages from future floods include land-use planning, flood warning, flood control works and emergency planning. Municipal councils in regional Victoria play an important role, in particular in the administration of land use, building and development controls; urban drainage; and emergency response. Municipal councils are required to adopt flood development control lines established by the local Catchment Management Authority when preparing planning scheme or approving development.

Under the *Catchment and Land Protection Act (Vic) 1994*, CMAs' functions include:

- prepare and review regional catchment strategies;
- manage and control waterways, drainage and floodplains;
- advise the Minister on requirements to implement regional catchment strategies and on funding requirements;
- promote community awareness of management of land and water resources; and
- collect fees.

The *Water Act (Vic) 1989* empowers CMAs to carry out floodplain management functions that involve the following:

- determine the extent and height of floodwaters;
- declare flood level, land liable to flooding, floodway areas, flood fringe areas and building lines;
- control developments that have occurred or that may be proposed;

- develop and implement plans and take any action necessary to minimise flooding and flood damage;
- provide advice about flooding and controls on development to local councils, the Department of Infrastructure and the community; and
- undertake investigations and prepare water management schemes by community based committees.

The CMAs work with local government, emergency services and the community to develop floodplain management strategies and are responsible for ensuring that regional flooding issues are managed in an integrated way. In particular, the role of CMAs is to:

- develop, oversee and where appropriate implement regional floodplain management strategies, which integrate local flood management issues and prioritise the development of urban and rural floodplain management plans within their region;
- support and facilitate the implementation of regional flood warning systems;
- maintain and enhance flood information and coordinate monitoring of significant flood events;
- provide for the conservation of natural resources and environmental values of regional significance;
- monitor and report on regional flood management performance; and
- advise Government on regional flood management priorities.

Municipal councils in regional Victoria have operational responsibility for most flood management activities occurring within their boundaries, in particular controlling floodplain development and implementing local floodplain management plans. Their role includes:

- develop and implement local floodplain management plans to reduce the adverse effects of flooding to acceptable levels, in consultation with their local communities;
- incorporate flood provisions into local planning schemes and control development and works on floodplain land through planning scheme provisions;
- provide, own and maintain local community infrastructure within their boundaries in accordance with agreed levels of service;
- implement and maintain local flood warning systems, including systems for flash flooding;
- maintain and enhance local flood information and monitor significant local flood events;
- support, develop and resource the implementation of flood response plans, as part of their municipal emergency management plan; and
- provide for the conservation of natural resources and environmental values of local significance.

The Victorian Department of Sustainability and Environment, is responsible for floodplain management and implementation of the State Flood Strategy.

G.3 Western Australia

Western Australia's flood risk exposure (in terms of property and populations at risk) is low compared to Queensland. However in 1997, the Western Australian Government established a Ministerial Taskforce to review floodplain management in the State. The

Taskforce produced its report to the Minister for Water Resources in July 1998 entitled *"A Framework for Floodplain Management in Western Australia"*.

Key issues and recommendations from the Western Australia document include:

- lack of a clear State policy and vision for floodplain management;
- need to clarify roles and responsibilities and align legislation;
- exposure of floodplain management agencies to litigation is a disincentive for responsible actions - including advice;
- floodplains should be managed for the benefit of the whole community such that risk and damages are minimised and environmental values are protected;
- flooding is an issue of concern to all three levels of government;
- it is appropriate that all three levels of government contribute to flood mitigation/risk management measures;
- key role for the Water and Rivers Commission (now Department of Environment) with responsibility for flood information, developing State legislation, policy, standards and best practices, supporting and assisting communities to implement flood mitigation measures, and development with the Bureau of Meteorology of strategies for total flood warning systems.

Most of these issues are echoed in NR&M's State Flood Risk Management Policy Discussion Paper.

Other recommendations included:

- Establishment of a WA Floodplain Management Council to coordinate the development and implementation of a WA Floodplain Management Strategy;
- Need for State based floodplain management guidelines; and
- Need to review the regulation and institutional arrangements for drainage (State Water Strategy - Feb 2003) including looking at "synergies between floodplain management and rural drainage"

Following on from the work of the Ministerial Taskforce, the Western Australian State Government formed a WA Floodplain Management Council which, in December 2002, released a draft Western Australian Floodplain Management Strategy.

The draft Strategy aims to address the issues identified in the framework document. In particular it places flood risk management in the context of broader floodplain management, recognising the trade-offs required between floodplain ecologic values, use of natural resources and the potential risks to people and property in reaching acceptable outcomes.

The draft Strategy includes guideline material for floodplain managers; an implementation program that identifies actions, lead agencies, timing and costs; and a vision and objectives for floodplain management in Western Australia:

Vision

> *Floodplains are managed for the benefit of the whole community such that risk and damages are minimised and environmental values are protected and the inherent functions of floodplains to convey and store floodwaters are preserved,*

Objectives

- *To ensure floodplain management functions are integrated with broader natural resource management framework*
- *To ensure land use is consistent with flood risk and potential damages*
- *To ensure appropriate floodplain mitigation measures reduce flood risk and are acceptable to the local community*
- *To ensure floodplain management activities have beneficial economic, social and environmental outcomes; and*
- *To provide flood forecasting and warning systems and emergency management arrangements that cope with the impact of flooding*

The draft Strategy has a regional focus with linkages to a possible natural resource management framework. The key programs identified in the draft Strategy, together with agencies responsible are:

• Institutional Reform	WAFMC & DoE
• Information Management	DoE
• Best Practice Planning & Development	DoE
• Management of Environmental Issues	DoE & WAPC
• Insurance	DoE & ICA
• Land Use Planning & Control of Works on Floodplains	DPI & WAPC
• Flood studies & Floodplain Management Plans (including floodplain mapping)	FESA & DoE
• Structural Works & Assets	DoE
• Flood Warning and flood monitoring	BoM & DoE
• Emergency Response	FESA & WA Police
• Recovery Planning	Dept Premier & Cabinet

DoE – Department of Environment, incorporating the previous Water & Rivers Commission;
WAFMC – Western Australian Floodplain Management Council;
WAPC - Western Australian Planning Commission;
ICA – Insurance Council of Australia;
FESA– Fire & Emergency Services Authority;
BoM– Bureau of Meteorology;
DPI – Department of Planning and Infrastructure

G.4 Tasmania

Similar to Queensland, Tasmania has no comprehensive floodplain or flood risk management policy. Efforts were initiated in the 1990's to develop a NSW style system with the State Working Party making use of the NSW and Victorian floodplain management guideline documents. However, these efforts were not completed

Tasmania's flood risk exposure has been estimated at approximately 4% of the national exposure (refer Commonwealth RFMP funding split) or approximately one ninth of Queensland's. However, the two States' flood risk exposure on a percentage per captia basis is comparable (i.e. Tasmania's share of the national flood damages bill is 8.4% per million people and Queenslands' is 9.3% per million).

Control of land-use planning, development and building approval on floodplains in Tasmania rests with local governments (as it does in Qld) through the Local Government Act (Tas). The Tasmanian Department of Primary Industries, Water and Environment

(DPIWE) undertook flood-mapping projects in the early 1990's and made that information available to local government for planning scheme and development approval purposes.

Agencies such as the Bureau of Meteorology, the State Emergency Service, DPWIE, Tasmanian Farmers' and Graziers' Association, Hydro Tasmania, and local government work together at the State level to address issues such as flood warning and response measures.

Tasmania has almost completed a statewide natural disaster risk management study project. A potential treatment strategy is the development of a State floodplain management arrangement as part of a broader catchment management policy.

G.5 South Australia

South Australia (together with Western Australia) has the lowest proportion of the national flood risk exposure per million people. This is because South Australia does not have a watercourse with a catchment area of more than 500 sq km flowing through an urban area (Adelaide or country towns). South Australia also does not have much high value agriculture on floodplain areas.

Consequently floodplain management to date has been largely left to local government to manage within a planning framework provided by the State Government through the Development Act.

Large floods occur on a very infrequent basis and many floodplain areas are poorly defined, varying from flood to flood. South Australia has a number of "perched" streams whose banks become the highest points in the local landscape as they near the sea. Flows beyond the capacity of the channel flow over the banks and never re-enter the watercourse. The River Torrens west of the city centre of Adelaide takes on this form. Fortunately the main channel has sufficient capacity to take a 200-year ARI flow.

Identification of floodplains (areas of inundation at various recurrence intervals) and the planning and implementation of flood mitigation measures again is largely a local government responsibility.

To assist local government in this effort the State Government has provided a $ for $ subsidy and technical advice to local government through a scheme currently named the Catchment Management Subsidy Scheme (CMSS). This Scheme deals with a wider range of water related issues than just flood mitigation.

The CMSS (and its predecessor) has been in operation for about 35 years. State Government funding for the Scheme is currently $2m/year (down from $4m/year three years ago) and is about to rise to $4m/year for the next four years. The State contribution as required under the Regional Flood Mitigation Program (RFMP) is included in the funding for the Catchment Management Subsidy Scheme.

The Department of Water, Land and Biodiversity Conservation has responsibility for the Catchment Management Subsidy Scheme. The Department of Transport and Urban

Planning provides technical and administrative services for the Scheme, including matters related to the RFMP on a service agreement basis.

G.6 Northern Territory

The magnitude of the flood risk exposure in the Northern Territory is only about 6% that of Queensland's. On a per-captia basis however, it is about the same (refer Table 2). The main areas of flood risk in the Northern Territory are Darwin (from storm surge); Katherine and Alice Springs (through river flooding).

Responsibility for planning and development approval in the Northern Territory rests with the Department of Infrastructure Planning and the Environment. The Department has adopted the 1% AEP flood as its standard for new areas. However in-fill development may be allowed at lower flood immunities provided emergency evacuation/refuge and building resilience conditions are satisfied.

The Department of Infrastructure Planning and Environment also chairs the Territory's Floodplain Management Committee, which comprises representatives from the Territory, local and Commonwealth Governments. The Committee oversees the activities of the Territory's Flood Warning Advisory Committee as well as providing the forum for policy and implementation issues.

Floodplain management policy for the Territory is administered and implemented by the Territory Government through the Department of Infrastructure Planning and the Environment. As a result, the Department is able to work towards appropriate flood risk management outcomes directly. Local government does not have direct responsibility for planning or building control. Hence the Northern Territory Government does not have (or require) as complete a system as NSW for ensuring flood risk issues are addressed. In spite of this, the Northern Territory has had an interim floodplain (risk) management policy since June 1981.

APPENDIX H - STATE FLOOD RISK MANAGEMENT POLICY SUMMARY DISCUSSION PAPER - SUMMARY SECTION

The purpose of this discussion paper is to facilitate public consultation on the development of a flood mitigation policy. In particular, the paper highlights the advantages of implementing a comprehensive state flood risk management policy through legislation. The primary objective of the policy will be to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods.

Each year floods seriously affect Queensland's economy and the social wellbeing of the community—their primary or secondary effects have a significant impact on communities and key industry sectors such as tourism, mining and agriculture. The cost of flood damage under the Natural Disaster Relief Arrangements (NDRA) averaged over $50 million per year in Queensland between 1989 and 2001, while expenditure in 2000–01 was in excess of $100 million. As a result of the high cost of floods across Australia, all levels of government have become increasingly active in seeking measures to mitigate their impacts.

Floodplains are natural resources of immense value. They are the sites of most of our towns and cities, significant infrastructure, and support many of our most productive rural industries. They are also areas of primary environmental significance and their wellbeing is essential to the survival of many ecosystems. Their development and use should be managed in an ecologically, economically and socially sustainable fashion.

Flood risk management is one component of managing floodplains. Other issues include water resource management—sharing flows between consumptive uses and the environment, preservation of riparian vegetation, protection of floodplain lands from degradation, etc.

However, flood risk is a major issue on most of Queensland's floodplains and a dominant issue on many. It affects urban and non-urban developments and its management is critical to the sustainability of communities. Further, the tools necessary to manage flood risk are, in most cases, important for the management of other floodplain issues.

Issues with current arrangements for flood risk management

Primary responsibility for achievement of effective flood risk management outcomes rests with local government; however, at present, Queensland has no clear or comprehensive statewide policy to guide urban floodplain management. Consequently there is considerable variability in decision making, and very few local governments have a flood policy.

Where they exist, river improvement trusts also have an important role in managing flood risk, as they can implement works that manage rivers and the flood hazard they may pose.

Local governments have faced difficulties implementing appropriate flood mitigation measures for a variety of reasons, including:

- scarce financial and technical resources
- a lack of statutory powers
- very limited information on flood frequency and intensity

- the need to balance economic growth with resource management.

Local authorities need the support of a clear, consistent policy and legislative framework to assist with the development of appropriate flood risk management measures, and to fulfil their obligations under their duty of care. Other deficiencies in current arrangements lie in financial systems, the cost and availability of flood insurance, and measures to reduce risk to existing developments.

Principles and policy objectives

The following key principles will guide the development of policies for the management of flood risk:

- manage risks to public health and safety equitably and in accordance with the principles of ecologically sustainable development
- develop a full appreciation of the risks and benefits associated with any proposed floodplain use
- enable individuals to make informed choices
- establish a partnership approach between all levels of government (recognising that the costs of floods affect all Australians)
- aim for proactive prevention in preference to reactive responses
- encourage the identification and transparent funding of costs associated with flood risk.

The most basic objectives for a state flood risk management policy are to facilitate the:

- generation, recording and management of useful information on flood inundation and impacts
- ready availability of flood information to government and to the public
- undertaking of appropriate assessments of flood risk by local government to support planning schemes, development decisions and/or controls, mitigation works programs, building standards, funding programs, and awareness and warning systems for every community

Options for implementing a state flood risk management policy

Two groups of options for implementing a state flood risk management policy have been identified—legislative and non-legislative.

The **legislative options** are to:

- amend existing legislation, or
- create a new flood risk management Act.

The *advantages* of legislation are that it can:

- establish flood risk management activities as an explicit responsibility of specific agencies
- provide for the ongoing maintenance of a management framework
- provide for actions which address existing at risk areas
- establish the conditions through which agencies may satisfy their legal obligations

However developing legislation is a lengthy process, and the results may have significant resource implications for the agencies that it obliges to undertake certain actions.

The **non-legislative (planning policy) options** are:

- development of a state planning policy for flood risk mitigation
- using regional planning processes to address flood risk mitigation.

The Department of Emergency Services is currently developing a State Planning Policy (SPP) for Natural Disaster Mitigation, which will include flooding. Public consultation on the draft SPP is proposed by the end of 2002 and, if feedback is positive, the SPP will be finalised early in 2003. It will address the potential growth in flood risk as it relates to local planning schemes and development assessment decisions.

Regional planning processes can influence local planning schemes in a manner similar to, but perhaps less prescriptive than, state planning policies (i.e. by dealing with potential growth in flood risk). With the development of the SPP for Natural Disaster Mitigation, the applicability of regional planning for flood risk management would be limited to situations where issues crossed local government boundaries.

Neither the SPP nor regional planning processes can effectively:

- address existing at-risk areas
- establish flood risk management as an explicit responsibility of specific agencies, or
- address liability and compensation issues for agencies by setting the conditions through which they may satisfy their legal obligations.

Where to from here

Both this summary version and the main discussion paper have been prepared primarily as resource documents to which key stakeholders can respond during the public consultation process associated with the development of a state flood risk management policy. This process should assist in identifying the interests of the various stakeholders, facilitate the drafting of the policy, and guide the selection of an implementation mechanism.

Those interested are encouraged to make a written submission to the Department of Natural Resources and Mines (NR&M). Contact details are included at the end of this paper.

APPENDIX I - NSW FLOOD PRONE LAND POLICY

1 The Policy Statement

The primary objective of the policy is to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods, utilising ecologically positive methods wherever possible. That is:

- a merit approach shall be adopted for all development decisions, which takes into account social, economic and ecological factors, as well as flooding considerations;
- both mainstream and overland flooding shall be addressed, using the merit approach, in preparation and implementation by councils of floodplain risk management plans;
- the impact of flooding and flood liability on existing developed areas identified in floodplain risk management plans shall be reduced by flood mitigation works and measures, including ongoing emergency management measures, the raising of houses where appropriate and by development controls; and
- the potential for flood losses in all areas proposed for development or redevelopment shall be contained by the application of ecologically sensitive planning and development controls.

To achieve its primary objective, the policy provides for:

- financial assistance by the NSW Government for works to reduce potential flood damage and personal danger in existing developed areas;
- the provision of technical support to local government in ensuring that the management of flood prone land is consistent with flood risk and that such development does not cause undue future distress to individuals nor unduly increase potential flood liability to them or to the community;
- emergency management and flood recovery programs and their linkage with the floodplain risk management process;
- the protection of councils, government agencies and their staff against claims for damages resulting from their issuing advice or granting approvals on floodplains, providing such action was taken in accordance with the principles and guidelines in the Floodplain Management Manual.

The policy shall be implemented in the following manner.

- The management of flood prone land is primarily, the responsibility of councils. As such, the standards and implementation arrangements shall be in accordance with the policies, procedures and management plans determined by councils.
- The NSW Government, through the Department of Land and Water Conservation, the Department of

Urban Affairs and Planning and the State Emergency Service, shall provide specialist technical assistance on all flooding matters. The Floodplain Management Manual shall be provided to assist councils in the preparation of floodplain risk management plans.

- The establishment of local floodplain risk management communities by councils, through which local community groups and individuals can effectively communicate their aspirations concerning the management of the flooding problem.

- The State Government continuing to subsidise floodplain risk management studies, works and measures.

2 *Policy Provisions*

The policy provides for:

- a flexible merit based approach to be followed by councils, when dealing with flood prone land management;

- high government priority for floodplain risk mitigation programs;

- recognition of the need to consider the full range of flood sizes, up to and including the probable maximum flood and the corresponding risks associated with each flood;

- councils to be responsible for the determination of flood planning levels and appropriate planning and development controls based on social, economic and ecological, as well as flooding considerations;

- an emphasis on the importance of developing and implementing floodplain risk management plans based on an integrated mix of management measures that address the existing, future and continuing risk;

- the provision of NSW government technical and financial support to councils in relation to flooding matters;

- floodway definition to be based on hydraulic, hazard and potential damage considerations, with provision for restricted development depending on circumstances;

- inclusion of a local Catchment Management Board representative on council's floodplain risk management committee;

- explicit recognition that floodplain risk management needs to take into consideration government policies and legislation allowing for the sustainable usage of the floodplain as a natural resource, and that the planning and assessment requirements laid down in those policies and legislation must be complied with by all agencies associated with the use, development and management of the floodplain;

- an emphasis on the need to consider ways of maintaining and enhancing the riverine and floodplain ecology in the development of floodplain risk management plans;

- recognition of the importance of the continuing flood risk addressed in the State Emergency Service Act 1989 and State Flood Plan, and the close relationship between the emergency management and floodplain risk management processes;

- recognition of the potential implications of climate change on

flooding behaviour (global warming);

- the policy and detailed arrangements for implementation to be included in the Floodplain Management Manual;

- protection of councils and other public authorities and their staff against claims for damages, providing they act in accordance with the government's policy at the time; and

- relief from land tax, council rates and water and sewerage rates where vacant land cannot be developed because of its flood prone nature.

3 Enquiries

General enquiries on the policy, and its currency, should be directed to relevant public authorities, viz, Department of Land and Water Conservation, Department of Urban Affairs and Planning (planning matters) and State Emergency Service (flood warning, evacuation and community education matters).

Enquiries regarding the flood liability of individual properties and proposals for development should be directed to the relevant council.

APPENDIX J - NSW LOCAL GOVERNMENT ACT 1993, SECT 733

733 Exemption from liability—flood liable land and land in coastal zone

(1) A council does not incur any liability in respect of:

(a) any advice furnished in good faith by the council relating to the likelihood of any land being flooded or the nature or extent of any such flooding, or

(b) anything done or omitted to be done in good faith by the council in so far as it relates to the likelihood of land being flooded or the nature or extent of any such flooding.

(2) A council does not incur any liability in respect of:

(a) any advice furnished in good faith by the council relating to the likelihood of any land in the coastal zone being affected by a coastline hazard (as described in a manual referred to in subsection (5) (b)) or the nature or extent of any such hazard, or

(b) anything done or omitted to be done in good faith by the council in so far as it relates to the likelihood of land being so affected.

(3) Without limiting subsections (1) and (2), those subsections apply to:

(a) the preparation or making of an environmental planning instrument or development control plan, or the granting or refusal of consent to a development application, or the determination of an application for a complying development certificate, under the *Environmental Planning and Assessment Act 1979*, and

(b) *- blank in Ac t-*

(c) the imposition of any condition in relation to an application referred to in paragraph (a), and

(d) advice furnished in a certificate under section 149 of the *Environmental Planning and Assessment Act 1979*, and

(e) the carrying out of flood mitigation works, and

(f) the carrying out of coastal management works, and

(g) any other thing done or omitted to be done in the exercise of a council's functions under this or any other Act.

(4) Without limiting any other circumstances in which a council may have acted in good faith, a council is, unless the contrary is proved, taken to have acted in good faith for the purposes of this section if the advice was furnished, or the thing was done or omitted to be done, substantially in accordance with the principles contained in the relevant manual most recently notified under subsection (5) at that time.

(5) For the purposes of this section, the Minister for Planning may, from time to time, give notification in the Gazette of the publication of:

(a) a manual relating to the management of flood liable land, or

(b) a manual relating to the management of the coastline.

The notification must specify where and when copies of the manual may be inspected.

(6) A copy of the manual must be available for public inspection, free of charge, at the office of the council during ordinary office hours.

(7) This section applies to and in respect of:

(a) the Crown, a statutory body representing the Crown and a public or local authority constituted by or under any Act, and

(b) a councillor or employee of a council or any such body or authority, and

(c) a public servant, and

(d) a person acting under the direction of a council or of the Crown or any such body or authority,

in the same way as it applies to and in respect of a council.

(8) In this section, "coastal zone" has the same meaning as in the *Coastal Protection Act 1979*, and includes land previously in the coastal zone under that Act.

Cuerel Russell

From: Cuerel Russell
Sent: Monday, 15 September 2003 1:49 PM
To: [redacted]
Subject: FW: Letter to Bundaberg

Attachments: 030315 - Letter to Bundaberg CC.dot; InterScan_Disclaimer.txt


030315 - Letter to Bundaberg C...


InterScan_Disclaimer.txt (944 ...

Russell Cuerel
Principal Policy Officer
Water Use
Natural Resources and Mines, Old
phone [redacted]
email

-----Original Message-----
From: Raelene Corner [redacted]
Sent: Wednesday, 16 April 2003 12:15 PM
To: Cuerel Russell
Cc: Gary Lee
Subject: Re: Letter to Bundaberg

Hi Russell,

Thank you for your information. Gary and I have considered the information you provided and what's in the draft SPP and Guideline and prepared a response to Bundaberg City Council.

Please take a look and forward any comments,

Thanks

Raelene.

>>> Cuerel Russell 04/15/03 03:15pm >>>
Raelene,

First draft of response to Bundy.

Has basis I want I think we need to see (and an "excuse" para which you can keep or not).

Please discuss before sending.

<<Letter to Bundaberg.doc>>
Talk to you (and Gary) tomorrow.

cheers

quickly as possible and delete this message and any copies of this message from your computer and/or your computer system network.
****

Raelene Corner
Ph: [redacted]
Our Ref: CDS 5182

Counter Disaster
and Rescue Services

Department of
Emergency Services

16 April 2003

Mr Peter Byrne
Chief Executive Officer
Bundaberg City Council
PO Box 538
BUNDABERG QLD 4670

Attention: Mr A Fulton, Manager of Planning and Development

Dear Mr Byrne

Thank you for your letters of 4 December 2002 and 2 April 2002 regarding the State Government's position on the Defined Flood Event (DFE) selected for Bundaberg City Council's Draft Planning Scheme.

The draft State Planning Policy for Natural Disaster Mitigation (SPP) outlines the State Government's position on selecting a DFE as follows: "The Queensland Government's position is that, generally, the appropriate flood event for determining a natural hazard management area (flood) is the 1:100 year aver average recurrence interval (ARI) flood. However, it may be appropriate to adopt a different DFE depending on the circumstances of individual localities...Local governments proposing to adopt a lower DFE in their planning scheme to determine a natural hazard management area (flood) for a particular locality will be expected to demonstrate that the proposed DFE is appropriate to the circumstances of the locality.

Therefore, while the selection of the DFE is a matter for the local government, the State Government wants to ensure that the decision is soundly based on assessment of all relevant factors. The draft SPP Guideline (see Appendix 2, A2.36) sets out the key issues to be considered by Council when determining an appropriate DFE including:

- potential economic and social impacts of a range of flood events;
- community desires and expectations;
- environmental values of and objectives for the floodplain;
- consistency with adopted DFEs in adjoining localities (whether or not within the same local government area);
- emergency response requirements (e.g. warning times, refuges, evacuation routes, recovery measures); and
- management and mitigation measures.

Emergency Services Complex
Cnr Kedron Park Road & Park Road
Kedron Qld 4031

GPO Box 1425 Brisbane
Queensland 4001 Australia

Telephone +61 7 3247 8511
Facsimile +61 7 3247 8505
Website www.emergency.qld.gov.au

ABN 92 265 149 823

The information provided in your letter in relation to flood warning times and community expectations addresses some of these issues, and suggest that a lesser DFE may be appropriate for Burnett River flood events in Bundaberg City.

However, to enable Department of Emergency Services, in consultation with Department of Natural Resources and Mines, to confirm this, it would be appreciated if the following additional information could be provided:

- results of the flood studies and process used by Council to select the DFE (including information on the 1:100 ARI flood event for comparison purposes); and
- details and outcomes of the community consultation undertaken by Council in arriving at the decision.

The Department of Emergency Services appreciates the efforts that Council is making to ensure that flood hazard is properly addressed in the proposed new IPA scheme. If you have any further enquiries, please contact Raelene Corner on [redacted]

Yours sincerely

Trevor Leverington
A/Director
Disaster Mitigation Unit

Cuerel Russell

From: Cuerel Russell
Sent: Monday, 15 September 2003 1:49 PM
To: [redacted]
Subject: FW: Letter to Bundaberg

Attachments: InterScan_Disclaimer.txt

InterScan_Disclaime
r.txt (944 ...

Russell Cuerel
Principal Policy Officer
Water Use
Natural Resources and Mines, Qld
phone
email [redacted]

)
-----Original Message-----
From: Raelene Corner [redacted]
Sent: Wednesday, 16 April 2003 2:37 PM
To: Cuerel Russell
Subject: RE: Letter to Bundaberg

Thanks Russell,
Yes we understand you concerns with the original response and I will keep them for future reference.

Thanks

Raelene.

>>> Cuerel Russell 04/16/03 12:28pm >>>
Raelene,

Looks good.

I assume Gary and Ken understood my concerns with the original proposed response?

cheers

Russell Cuerel
Principal Policy Officer
Water Use
Natural Resources and Mines, Qld
phone
email [redacted]

-----Original Message-----
From: Raelene Corner [redacted]
Sent: Wednesday, 16 April 2003 12:15 PM
To: Cuerel Russell
Cc: Gary Lee
Subject: Re: Letter to Bundaberg

Hi Russell,

Thank you for your information. Gary and I have considered the information you provided and what's in the draft SPP and Guideline and prepared a response to Bundaberg City Council.

Please take a look and forward any comments,

Thanks

Raelene.

>>> Cuerel Russell 04/15/03 03:15pm >>>
Raelene,

First draft of response to Bundy.

Has basis I want I think we need to see (and an "excuse" para which you can keep or not).

Please discuss before sending.

<<Letter to Bundaberg.doc>>
Talk to you (and Gary) tomorrow.

cheers

****
The information in this e-mail together with any attachments is intended only for the person or entity to which it is addressed and may contain confidential and/or privileged material.

Any form of review, disclosure, modification, distribution and/or publication of this e-mail message is prohibited.

If you have received this message in error, you are asked to inform the sender as quickly as possible and delete this message and any copies of this message from your computer and/or your computer system network.
****

Dear Judy Randall

Re Draft Bundaberg Planning Scheme – Adoption of Flood Map

I refer to your letters of 4 December 2002 and 2 April 2003 regards the State Government's position on the Defined Flood Events (DFEs) selected for Bundaberg City Council's Draft Planning Scheme.

As you note, the State Government has adopted the 1% AEP (or 1 in 100 yr ARI) as the desirable Defined Flood Event for the purposes of implementing the SPP. The State Government also recognises that this may not be appropriate in all localities and that some local governments may be justified in selecting a lesser event. However, the State Government needs to be satisfied that the process of selecting a lesser DFE is acceptable, i.e. the local government will have considered issues including:

- at least attempting to identify the consequences of events larger than the DFE (particularly where modelling for the lesser event has been already undertaken and it should therefore be a relatively simple matter to model larger events);
- ensuring that the community is aware that a DFE less severe than the 1% AEP has been adopted; and
- introducing complementary planning measures (such as freeboard) that result in effective immunity for residential dwellings approaching as best as possible the 1% AEP level.

Bundaberg may be a case for a DFE less severe than the 1%AEP, however the State Government's expectation is that, in determining that a DFE less severe than the 1%AEP is appropriate, Council will have made as complete a consideration as possible of all the issues be able to demonstrate this by supplying:

- details of the DFE and any complementary measures it proposes to adopt
- the outcomes of whatever studies or reports into flooding and its impacts Council has based its DFE selection on; and
- details and results of any community consultation undertaken by Council in arriving at the decision.

I note that the details of the DFE and planning scheme have already been provided to DES along with advice of "considerable public resistance" to the proposed DFE. However there remains the issues of investigations into flooding and its impacts, particularly for more severe events, and the details and results of any community consultation.

I apologise for the delay in responding to your original letter, however as you would appreciate, the relevant officers of DES and NR&M have been somewhat unavailable due to absences over the Christmas break and the heavy workload involved in amending and finalising the State Planning Policy following the closing of the public consultation period on 13 December 2002.

I trust the above information is of assistance. If you have any further enquiries, please contact???????????

Cuerel Russell

From: Cuerel Russell
Sent: Thursday, 20 November 2003 9:57 AM
To: 'David Heyden'
Cc: Jayasinghe Upali
Subject: RE: Bundaberg Flood mapping

David,

I have had a read of your email and have the following comments:
- Council should demonstrate that the 1% AEP flood was assessed and that the choice of the 2% AEP was made in the knowledge of the consequences of the larger event - eg what happens to evacuation routes and refuges at the 1% AEP?.
- This information should have been made available to at least the elected reps (Councillors) and to council organs like the local disaster management committee.
- In summary, I don't think we can knock back their choice, but we can ask that they know the consequences.
- As far as the flood maps go, sounds OK to me, but I think it is more an IPA admin.(DLGP) issue in terms of what constitutes the "Planning Scheme" and therefore what satisfies the SPP in terms of identifying a "NHMA-Flood".

Also, until the MoU is sorted, I'm not sure that our approvals through the "demonstrating to the satisfaction of DES and NR&M" bits of the SPP will be on a really solid base, i.e. at this stage we have no written policy/guidelines for what constitutes "satisfactory demonstration".

regards

Russell Cuerel
Principal Policy Officer
Water Use
Natural Resources and Mines, Qld
phone [redacted]
email

-----Original Message-----
From: David Heyden [redacted]
Sent: Wednesday, 12 November 2003 9:40 AM
To: Cuerel Russell
Cc: Trevor Leverington
Subject: Bundaberg Flood mapping

About a month or two ago I spoke to you about the Bundaberg City Council's adopted Burnett River Flood level of 2% (Q50). DES provided comments on this issue to Council, which has resulted in the following comments from Bundaberg City Council. Russell, could you determine whether the information Council has provided in regards to adequately determining whether a 2% flood level for the Burnett River is appropriate to your specifications. This is crucial as Bundaberg will be wanting approval from DES to sign off on their Scheme that states SPP 1/03 has been appropriately reflected.

DES comments:

To ensure that SPP 1/03 applies for development assessment purposes, the Flood Management Overlay - Map 3.11 must meet the criteria for a NHMA for flood. This can be achieved by:

* identifying the flood level or levels of the DFE, as was indicated as Australian Height Datum levels on Map FM1 in the draft Bundaberg City Plan. This will ensure Council can pinpoint an appropriate freeboard height above the DFE, for, e.g. residential developments; and

* providing the DES with the additional information that is required to identify, through consultation with the Department of Natural Resources and Mines, if the current Burnett River flood level is appropriate.

Bundaberg City Council Comments:

As you are aware Council has had considerable discussions with respect to this matter and it has been determined that the purpose of the map in the Planning Scheme is to trigger assessment against the flood management code. The actual flood mapping is of extensive detail and will occupy numerous maps which it is felt are best outside of the scheme to allow for easy amendment, eg. The flood mapping will map every individual allotment and the associated house floor level. This work is currently being undertaken and is not yet complete. When complete it will be adopted by Council for purposes of the Standard Building Regulation.

Bundaberg City Council has proposed a 2% AEP flood immunity level associated with flooding at the Burnett River and a 1% AEP flood for localized flooding

* The Council has adopted the 2% AEP level because:

* An extensive flood warning system is in place on the Burnett River;

* There is historical acceptance of the 1942 flood level as being an acceptable level for flood plain management.The 1942 current flood level is in most cases slightly below the 2% AEP flood proposed in the Planning Scheme. The communities acceptance of the 1942 flood level is reflected in the strong public reaction against increases in flood levels above the 1942 flood level by the proposed 2% AEP.

* The Burnett Basin Flood Hydrograph at Bundaberg is relatively flat as shown on the attached hydrograph. The approach of a flood is thus not rapid and unexpected

There is a considerable lead time, triggered by upstream flood warning stations, associated with a flood reaching Bundaberg eg. the flood peak measured at Gayndah is approximately 36 hours prior to the flood peak at Bundaberg. A point halfway up the flood rise on the Mundubbera hydrograph is some 60 hours before the flood peak in Bundaberg . The nature of the flood hydrograph in Bundaberg, the flat local topography and nature of escape routes,together, result in a significant amount of time being available for the movement of persons and chattels to safety, if necessary. The majority of affected urban land in Bundaberg is affected only in major flood events.

In regards to Council not providing all flood data on their overlay map, it has been raised that Council may include this information as Planning Scheme Policy to support the overlay map in the Scheme. This would make the amendment process easier.

Thanks

Give me a call if you wish to discuss any issue or need clarification.

P.S I understand that a meeting has been set up with NRM on the 26th Nov to discuss the on-the-ground implementation of the MoU between DES and NRM. I assume you will be involved in this meeting.

David Heyden
Assistant Project Officer
Strategic Management and Policy Unit
Strategic and Executive Services Division Department of Emergency Services Level 3 Block F, Healy Wing Cnr Kedron Park & Park Rds, Kedron Q 4031 GPO Box 1425 Brisbane Q 4001
Telephone: [redacted] email: [redacted]