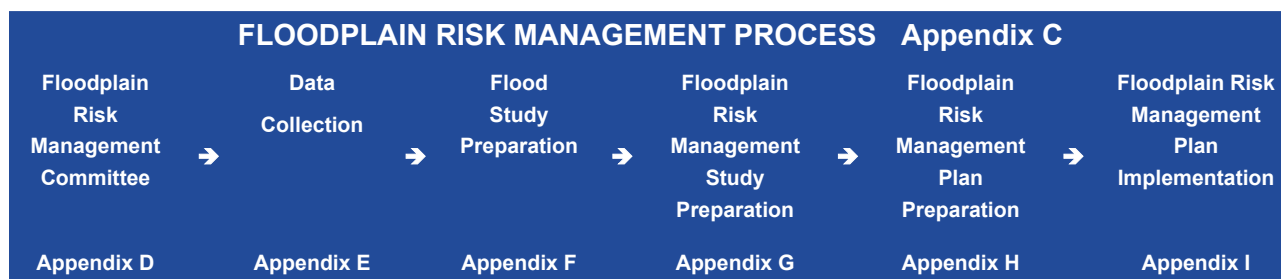


APPENDIX C FLOODPLAIN RISK MANAGEMENT PROCESS



TECHNICAL SUPPORT APPENDICES (Those directly supporting this Appendix are highlighted)								
Floodplain Risk Management Measures		Flood Planning Levels		Hydraulic & Hazard Categorisation		Flood Damages		Emergency Response Planning for Floods
Appendix J		Appendix K		Appendix L		Appendix M		Appendix N

C1 Introduction

This appendix outlines the application of the floodplain risk management process (see Figure 2.1). The process aims to meet the objectives of the NSW Government’s Flood Prone Land Policy (outlined in Section 1.1) through the preparation of floodplain risk management plans.

C2 Where Does the Process Apply

The manual applies to urban and rural floodplains across NSW and is used to manage both mainstream (riverine) and local overland flooding. As the 1986 manual was traditionally applied to mainstream flooding in urban areas Sections C5 and C6 provide more details on the respective application to both rural and local overland flooding issues. It also applies to coastal flooding, discussed in Section C7, but does not cover tsunamis, as discussed in Section C8.

C3 Management Process Objectives

The objectives of the floodplain risk management process are to:

- ❑ reduce the danger to safety and flood damage (and associated losses) to property and infrastructure in the existing community;
- ❑ manage the risk to critical infrastructure, during and after a flood event to ensure

it is available in a suitable form as and when required;

- ❑ ensure future development is controlled in a manner compatible with the flood risk and associated danger to personal safety;
- ❑ manage the flood risk to future infrastructure to reduce potential damages;
- ❑ protect and where possible enhance the river and floodplain environment and be consistent with the objectives of relevant State Government policies;
- ❑ satisfy the objectives and requirements of the EP&A Act;
- ❑ ensure the management plan is fully integrated with the local flood plan, catchment management planning, and council’s existing corporate, business and strategic plans and existing and proposed EPIs. It also needs to meet council’s obligations under the LG Act;
- ❑ ensure that the management plan has the support of the local community;
- ❑ ensure actions arising out of the management plan meet with ESD principles, are socially sustainable, economic, and maximise positive and minimise negative impacts;
- ❑ establish a program for implementing the management plan that should include a funding mechanism, priorities, staging, responsibilities, constraints and monitoring;

- ❑ write or update a local flood risk management policy for the study area through the various stages of the process to control development during preparation of the management plan and associated background studies (discussed in Section C9); and
- ❑ consider how best to incorporate management plan findings into council's EPIs, development control plans and policies.

The management plan preparation process, described below and in subsequent appendices aims to achieve these objectives.

C4 Floodplain Risk Management Plan Preparation Process

The preparation of the management plan involves a number of stages:

- ❑ the floodplain risk management committee (discussed in Section 2.2 and Appendix D) is responsible for overseeing the process;
- ❑ data collection (see Section 2.3 and Appendix E) determines the historical and background data available to be collected and used in studies;
- ❑ the flood study (discussed in Section 2.4 and Appendix F) determines flood behaviour in the study area;
- ❑ the floodplain risk management study (see Section 2.5 and Appendix G) is the major multi-disciplinary task. It involves assessment of all management options and provides all the major inputs to the management plan. It includes:
 - floodplain risk management options (see Appendix J);
 - hydraulic and hazard categorisation (see Appendix L);
 - flood damages assessment (see Appendix M);
 - consideration of limits on, and conditions for, future development (see Sections G6 and J2)
 - FPLs, including flood events and freeboard to base these on (see Appendix K);
 - information provision on planning certificates under Section 149 of the EP&A Act (see Appendix I);

- ❑ the floodplain risk management plan. This is the decision making part and formulation of the process (Section 2.6 and Appendix H); and
- ❑ implementation of the management plan as discussed in Section 2.8 and Appendix I. This includes the local flood risk management policy, approvals for recommended works, incorporation of planning controls into EPIs and development control plans and policies.

C5 Rural Flooding

This manual and its predecessors deal with floods causing danger to life and damage to property as a result of occupation of the floodplain. In the 1986 manual, application and usage tended to focus on urban floodplain areas where a higher proportion of the population lives, where development pressures are greatest, and where local councils control development.

Since 2001 the manual has also been applicable to rural areas where, although councils are also responsible for land use planning and management, additional mechanisms are often needed for floodplain risk management. For example, in areas designated under Part VIII of the Water Act or under the regulations of the Water Management Act approval from DIPNR may be required for certain works. The roles of councils and DIPNR in this regard are discussed in Sections 3.1 and 3.2.

The essential difference between urban and rural areas is the final use of the management plan. Management plans prepared by councils for urban or local areas provide a basis for consideration of development constraints in relation to flooding into their EPIs.

However, DIPNR prepare and use management plans for rural areas designated under Part VIII of the Water Act or under the regulations of the Water Management Act to ensure development of the floodplain provides for flow of floodwaters within paths identified in the plan. Therefore the management plan is used to control development which is likely to affect flood flowpaths in the area covered by the plan.

As with flooding in urban areas, there is a suite of available management, planning and mitigation options that can be selected to address flood problems in rural areas. Apart from typical residential issues, such as the

chance of damage to farmhouses and buildings and rural residential development, the whole question of impact of flooding on agricultural activity needs to be considered. This often involves special problems associated with scale, for example:

- the area of land under investigation;
- the complexity of flood behaviour;
- impacts of protection works for valuable crops on flood behaviour;
- the period of inundation;
- the uncertainties associated with flood related data; and
- the environmental values associated with flood dependant ecosystems on rural floodplains.

This indicates the need for a different emphasis and possibly different risk management measures in rural areas, rather than the need for a separate management process.

C6 Local Overland Flooding

Local overland flooding problems were included in the policy and manual in 2001 as the distinction between mainstream and local overland flooding was found to be artificial for several reasons:

- it matters little to flooded residents whether the floodwaters flowing through their property originate from a local catchment or from a river overflowing its banks;
- whilst the magnitude of local overland flood damage in New South Wales is less than that of mainstream flood damage, it is still substantial. The average annual mainstream flood damage in urban areas of New South Wales is \$84 million per annum, whilst the corresponding figure for local overland flood damage is \$16 million per year. In deriving these figures, it was acknowledged that local overland flood damages could be substantially under-estimated (AWRC, 1992);
- mainstream and local overland flooding behaviour interact, with flooded mainstream channels often impeding local overland drainage and so contributing to local overland flooding; and

- it is often impossible to define a meaningful boundary between local overland and mainstream flooding.

Therefore, this manual treats local overland flooding as a significant problem that needs to be considered along with mainstream flooding.

Local overland flows can be generated from a variety of sources. At the lower end of the scale these would typically include direct surface runoff, surcharges and overflows from low points in kerbs, or overflows from smaller pipes. These can be categorised as local drainage as discussed in Section C6.2. At the upper end of the scale overland flows involve the floodplains of original watercourses whether still natural or altered (piped, channelised, diverted or restricted due by urban development) and/or may be associated with overflows from trunk drainage systems. These can be categorised as major drainage as discussed in Section C6.1.

The definition in the manual of major and local drainage problems relate to the scale of problems occurring throughout urban areas. It is not to be interpreted as the classifications of major and minor drainage system design under Australian Rainfall and Runoff, which is restricted to new urban areas developed over the last two decades. The principles in the manual apply to all overland flow associated with major drainage.

Whilst the manual does not specifically deal with local drainage, councils should consider the principles in the manual when addressing these problems.

C6.1 Major Drainage

Councils have discretion in determining whether urban drainage problems are associated with major or local drainage. However, in terms of this manual, major drainage problems will typically involve:

- the floodplains of original watercourses or trunk drainage systems (which may now be piped or channelised or diverted), or sloping areas where overland flows occur along alternative paths once system capacity is exceeded; and/or
- water depths generally in excess of 0.3m (in the storm event used to derive FPLs). These conditions may result in danger to

personal safety and damage to property (both premises and vehicles); and/or

- major overland flowpaths through developed areas outside of defined drainage reserves; and/or
- the potential to flood a number of buildings along the major flow path.

Good building practice can reduce flood frequency and damages. However, due to the relative depth of flooding, general building controls cannot control all problems.

Problems can be minimised in new development areas by good subdivision design practice. Good practice considers the potential for overflows, due to system capacity exceedance and blockage, and determines how to pass these excessive flows through the subdivision via drainage reserves and public pathways rather than having them enter private property and buildings.

Strategies to address problems will normally be similar to mainstream flooding. Evaluation of local scale changes (increased capacity, altered flowpaths etc) should be considered in the context of the impacts on the entire system so as to identify and evaluate potential adverse impacts.

Particular consideration needs to be given to the impacts of upstream urbanisation on downstream flooding and to any developments which block flow paths. The costs of mitigation works can, in certain cases, be offset by the associated economic and social benefits.

Overland flow paths associated with major drainage problems should be subject to information on Planning Certificates under Section 149 of the EP&A Act as discussed in Section 17 along with the suggestion of an initial subjective assessment for a preliminary determination of affected properties.

C6.2 Local Drainage

Local drainage problems occur randomly throughout urban areas and fall outside the definition of major drainage (Section C6.1).

While outside the scope of the manual, it is important that councils give due recognition to these problems. However, as these problems are not amenable to rigorous analysis, councils are not obliged to convey information on local

drainage problems on Planning Certificates under Section 149 of the EP&A Act.

Local drainage problems invariably involve shallow depths (less than 0.3m) with generally little danger to personal safety. These problems generally result from building practice where floor levels are at or near finished ground levels adjacent to the house.

Local drainage problems can generally be minimised by adoption of general urban building controls requiring a minimum difference between finished floor and finished ground levels (to cope with shallow water depths) and adequate site drainage. Areas without these controls may have damage potential but the level of damages is generally relatively small. Therefore, councils cannot justify the cost of remedial measures for these problems in relation to the benefits in economic cost alone.

Whilst not amenable to rigorous evaluation, it is important that local drainage problems are recognised and that councils consider:

- the impact of upstream catchment change on downstream areas;
- the need to ensure that any upgrading works consider: the consequence of translating the problem from one location to another; the potential to alter flowpaths; and the consequences for downstream properties; and
- setting standards for development that address local drainage issues.

Public education is of necessity limited to generalised media warnings of impending storms and possible localised flooding.

C7 Coastal Influences

On inland streams and in the non-tidal reaches of coastal rivers, the size and frequency of a flood at any point depends on the volume and timing of runoff from the catchment. However, in the lower estuarine areas of rivers, flooding is far more complex as it depends not only on rainfall, but also on tides, storm induced increases in the ocean water level or a combination of both. Therefore it is important to consider coastal influences in determining and managing flooding under the floodplain risk management process.

Tailwater induced ocean affects occur when normal tidal behaviour is combined with one

or more of the following to increase the ocean water level:

- a rise in water level due to a drop in barometric pressure (barometric effect);
- strong onshore winds (wind stress);
- wave set-up;
- wave run up;
- longitudinal shelf waves; and
- temperature and salinity variations (steric effects).

Elevated ocean levels can increase flood levels in the lower reaches of rivers, by either preventing floodwaters from discharging into the ocean or by filling up low lying land and estuarine flood storage areas before the river flooding arrives.

Flooding can occur around coastal lakes and lagoons from a possible combination of: elevated ocean levels (as discussed above); entrance constriction by fluvial sedimentation or closure due to normal coastal processes; floodwaters from rivers and streams discharging into the lake or lagoon; and wind generated waves in the lake itself.

The effects of tides on flooding in the estuarine reaches of rivers on flooding in coastal lagoons is discussed in some detail in the NSW Estuary Management Manual 1992.

C8 Tsunamis

Tsunamis occur regularly around the Australian coastline. The 1960 Chile Tsunami, which would appear from studies to be the largest affecting NSW since 1867, resulted in water levels oscillating through the range of 0.84m at Fort Denison and induced strong currents in Sydney Harbour and nearby ports and bays causing some damage to boats and the shoreline.

The management process and measures established in this manual are designed to consider flood risk caused by a combination of storm surge and hydrological and hydraulic processes. They do not extend to the management of tsunamis.

C9 Controlling Development During the Management Process

The most effective way of managing flood risk to future development areas is through

incorporation of management plans outcomes into zonings and development controls in EPIs and development control policies and plans in combination with an effective local flood plan for emergency response.

However, it is important for councils to control development during the preparation of management plans and associated background studies. In this regard councils need to:

- undertake development control based upon current knowledge of the flood behaviour and hazard;
- improve knowledge of flood behaviour and hazard through the management process; and
- manage flood risk to future land use strategically considering the full range of flood risk, as this information becomes available.

During the management process, a local flood risk management policy consistent with the principles of the manual (Section 1.6) can help councils to control development whilst the management plan is completed.

The content of the policy is likely to vary with the available information. The policy can be updated during the process to reflect the improved knowledge and the higher degree of information available, and incorporate any management decisions made by council during this period.

Advice on the controls that could be considered with different levels of information is provided below. Changes following the completion of the management plan and associated requirements are discussed in Appendix I.

C9.1 Controls Based on Historical Flood Information

Historical flood information gives an incomplete picture of flood risk. The scant information often available does not provide an understanding of the range of potential flood risk, their likely frequency, nor a good understanding of the variation in hazard across the floodplain. Hence exposure to hazard and the cumulative impacts of development decisions would not be fully understood.

Therefore, until a flood study is completed (providing a better understanding of flood

behaviour and hazard) it is important that consideration and implementation of appropriate limits and controls for different scales of development are set. These could include:

- small scale and infill development outside known significant flow areas.

These may require minimum fill and floor levels based upon known historical flood levels and a freeboard allowance, typically 0.5m for residential development though a higher freeboard may be considered appropriate due to the degree of uncertainty. For infill development minimum fill levels may not be feasible and it may be more appropriate to require minimum floor level and structural certification of below floor components;

- larger scale developments or developments in areas known or expected to have significant flood flows.

The proponent may be required to submit a flood assessment to determine potential impacts on flood behaviour, set appropriate minimum floor and fill levels. No significant impacts on flood behaviour on other properties should be acceptable. Emergency management should be considered in relation to the local flood plan, with self-sufficient evacuation a requirement; and

- additions and extensions to existing development should be considered in light of the philosophy of merit based decision making and the information available on flood risk.

C9.2 Controls Based on a Flood Study

A flood study generally provides flood levels, indicative flood extents and some information on flow velocities, for a range of flood events.

It provides a more detailed understanding of flood behaviour but does not necessarily detail the variation in hazard across the floodplain, nor consider cumulative impacts. Therefore until the management study is completed appropriate development controls could include:

- small scale and infill development outside known significant flow areas.

These may require minimum fill and floor levels for all new development. This requires selection of an appropriate design standard and freeboard (typically 1% AEP or key historical flood plus 0.5m) for residential development. For infill development minimum fill levels may not be feasible and it may be more appropriate to require minimum floor level and structural certification of below floor components;

- larger scale developments or developments in areas known for or expected to have significant flood flows.

It may be appropriate to require the proponent to submit a flood study determining the potential impacts on flood behaviour. No significant impacts upon flood behaviour on other properties should be acceptable. Emergency management should be considered in relation to the local flood plan, with self-sufficient evacuation a requirement; and

- additions and extensions to existing development should be considered in light of the philosophy of merit based decision making and the information available on flood risk.

C9.3 Controls Based on a Floodplain Risk Management Study

A management study should include categorisation of both true hazard (discussed in Appendix L) and an assessment of the cumulative impacts of future development options (discussed in Sections G6 and G9.1).

It provides a basis for recommendations on appropriate land use limits, types and associated controls (discussed in Section G6) considering flood risk. These recommendations would generally be translated into the management plan.

Controls based upon the outcomes of the management study and plan are likely to be the most comprehensive form of flood related development control. Therefore these recommendations should be implemented as soon as possible to ensure that future development is compatible with the variation in flood hazard across the floodplain.