

# NATIONAL BEST PRACTICE FLOOD RISK MANAGEMENT GUIDANCE – FITTING THE PIECES TOGETHER

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## **Abstract**

The National Flood Risk Advisory Group (NFRAG) works to improve flood risk management in Australia. Part of this work has involved a substantial and sustained effort on the update and expansion of national best practice guidance since 2009. This paper outlines the culmination of this work and discusses how it can inform practice.

## **Introduction**

The National Flood Risk Advisory Group (NFRAG) is a working group of the Australian New Zealand Emergency Management Committee (ANZEMC). It provides support to ANZEMC and its subcommittees in relation to flood risk management issues. In addition it facilitates processes for effective national exchange of practice, research, information and knowledge management, and mapping and modelling in relation to flood risk management research. It also provides a collegiate pathway for sharing and improving floodplain management practice and making recommendations on best practice in flood risk management that can be implemented in a fit for purpose way within the management frameworks of the different jurisdictions.

NFRAG's ongoing membership comprises representatives from each jurisdiction, local government, Attorney-General's Department, Bureau of Meteorology, Geoscience Australia, the Australian Buildings Code Board, the Insurance Council of Australia, the Australian Fire and Emergency Services Authorities Council State Emergency Services Community Safety Group and the Bushfire and Natural Hazard Cooperative Research Centre.

Since 2009 NFRAG has been working to improve national best practice guidance on flood risk management with the aim of updating best practice guidance consistently with the National Strategy for Disaster Resilience and extending guidance to consider the expanding number of engaged end users who are seeking more specific information to enable them to contribute more effectively in their particular roles in the management of flood risk.

The most recent series of documents, Guidelines 7-5 and 7-6 and Practice Note 7-7, along with a desktop review of approaches for estimating fatalities, as outlined below is complete and will be available shortly.

In addition, the transfer of responsibility for the management of guidance from the Australian Emergency Management Institute to the newly formed Australian Institute of Disaster Resilience (ADR) provided the opportunity for a very minor update of Handbook 7 and companion documents 7-1 to 7-4 as they were rebranded primarily to update referencing and improving consistency with later documents. This has resulted in the ADR Handbook 7 series documents outlined below.

- Australian Disaster Resilience Handbook 7: Managing the floodplain: A guide to best practice in flood risk management in Australia (2017).
- Australian Disaster Resilience Guideline 7-1: Using the national generic brief for flood investigations to develop project specific specifications (2017)
- Australian Disaster Resilience Guideline 7-2: Flood emergency response classification of the floodplain (2017)
- Australian Disaster Resilience Guideline 7-3: Flood hazard (2017)

- Australian Disaster Resilience Template 7-4: Technical project brief template (2017)
- Australian Disaster Resilience Guideline 7-5: Flood information to support land-use planning (2017)
- Australian Disaster Resilience Guideline 7-6: Assessing options and service levels for treating existing risk (2017)
- Australian Disaster Resilience Practice Note 7-7 Considering flood risk in land-use planning activities (2017)

These are available at: <https://www.aidr.org.au/publications/handbook-collection/handbook-7/> and will be available through the ADR knowledge hub: [www.knowledge.aidr.org.au](http://www.knowledge.aidr.org.au) in the near future.

In addition, background documents on flood hazard (WRL 2014) and approaches for estimating flood fatalities relevant to floodplain management (WRL2016) have also been produced as part of this work and will be made available through the ADR knowledge hub in the near future. The development of the handbook 7 series documentation considered and linked to the update of Australian Rainfall and Runoff in 2016, where relevant.

## **Outline of Handbook 7 Series Documentation**

A synopsis of the guidance in the Handbook 7 Series is provided below.

### *Handbook 7 – Best practice handbook*

Handbook 7 provides overall guidance on national best practice in flood risk management.

Occupation of floodplains, whether due to the legacy of former decisions or as a result of future decisions comes with an inherent flood risk. Best practice promotes the consideration and, where necessary, management of flood impacts to existing and future development within the community.

It aims to improve community flood resilience using a broad risk management hierarchy of avoidance, minimisation and mitigation to: reduce the health, social and financial costs of occupying the floodplain; increase the sustainable benefits of using the floodplain; and improve or maintain floodplain ecosystems dependent on flood inundation.

*Handbook 7* outlines that achieving best practice relies upon:

1. Developing clear and sustainable governance arrangements for managing flood risk.
2. Making information on flood risk readily available to inform decisions.
3. Understanding flood behaviour and risk.
4. Understanding and maintaining the natural floodplain functions.
5. Managing risk to improve community resilience to flooding, and manage growth of this risk due to development, and future changes to floodplain topography and climate.

Handbook 7 also provides the flood risk management framework (Figure 1) which links the understanding of flood risk on a floodplain or catchment scale to its management via government floodplain management entities (FMEs). It provides a robust, fit-for-purpose approach that provides flexibility for FMEs with different levels of resources and information, to manage flood risk and work to improve their knowledge and management practices considering the scale and complexity of the flood threat faced by their community.

Guideline 7-1 and Template 7-4 relating to the national generic brief for flood investigations and its use to develop project specific specifications

Embedding the Handbook 7 series guidance in local flood risk management practice is supported by the development of a national template technical specification for flood investigations and its associated guideline on how to use the template to develop project specific technical specifications. These may be used by jurisdictions to develop their own template briefs for use within their jurisdiction or jurisdictions may support use of the guidelines and template directly within their jurisdiction.

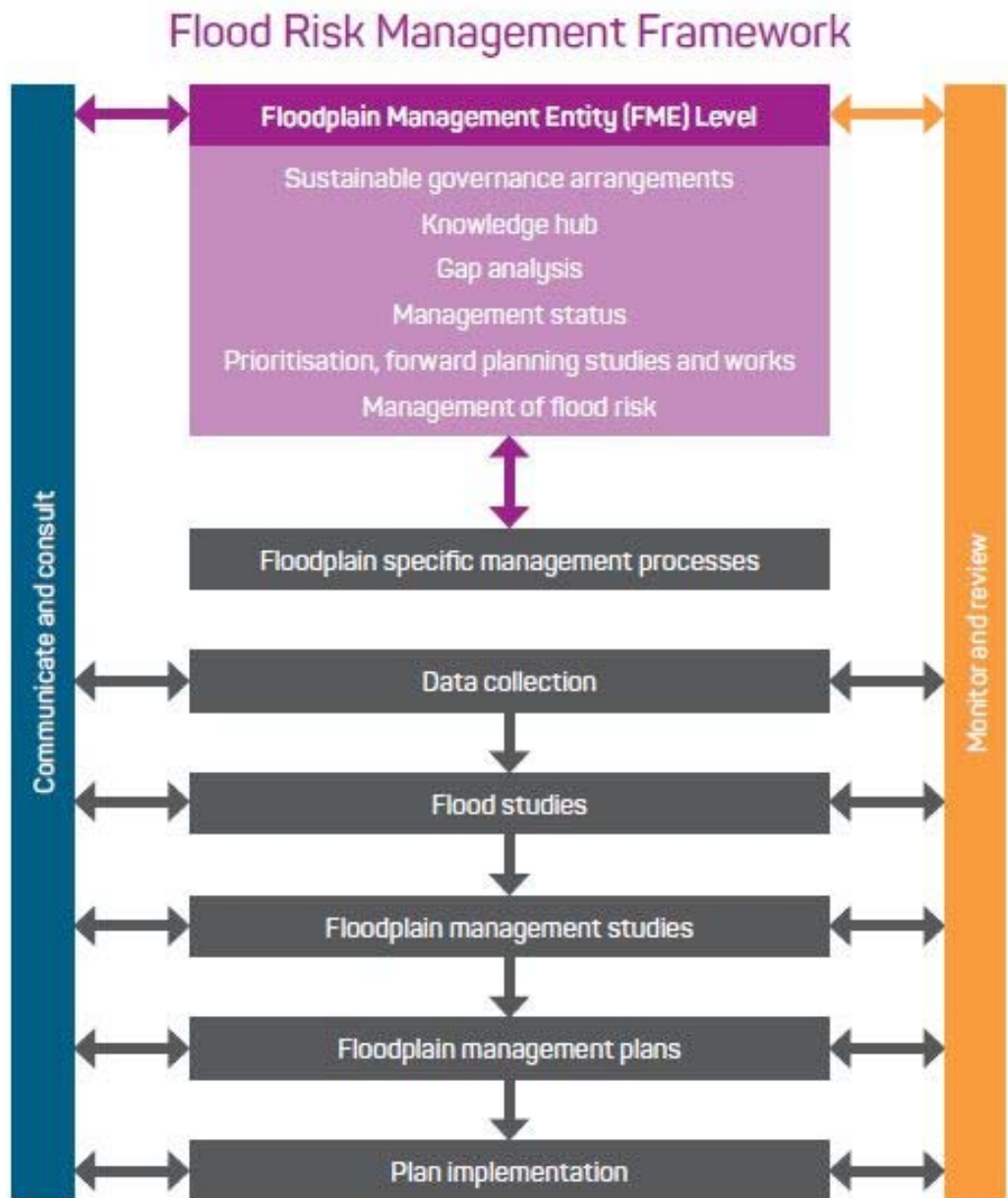


Figure 1: Flood Risk Management Framework (Source Handbook 7 Figure 1.1)

Guideline 7-2 – Flood emergency response classification of the floodplain

Flooding can isolate areas within the landscape and cut-off routes to evacuation centres on flood-free land (above an extreme flood, such as the probable maximum flood or PMF).

Isolation can result in a dangerous situation, because people may see the need to cross floodwaters to access services, employment or family members. Many flood fatalities result from the interaction of people, often in vehicles, with floodwaters. Any situation that increases people’s need to cross floodwaters increases the likelihood of an injury or fatality. Extreme events are generally used to assess isolation as these provide an estimate of the upper limit of the scale of flood behaviour for a location.

This guideline provides advice on using information on flood behaviour over the terrain to assess the varying degrees of isolation of land within the floodplain from safe locations, generally beyond the extent of an extreme flood such as the probable maximum flood (PMF) during floods.

Classification provides the basis for understanding the varying nature, seriousness and scale of isolation problems. Figure 2 shows the process and Figure 3 provides an example of mapping of these classifications for a floodplain).

Classification can be used with information on the full range of flood risk, local topography and evacuation routes, the rate of rise of floodwaters, the effective warning time and the duration of isolation, to support management decisions in emergency management, flood risk management and land use planning.

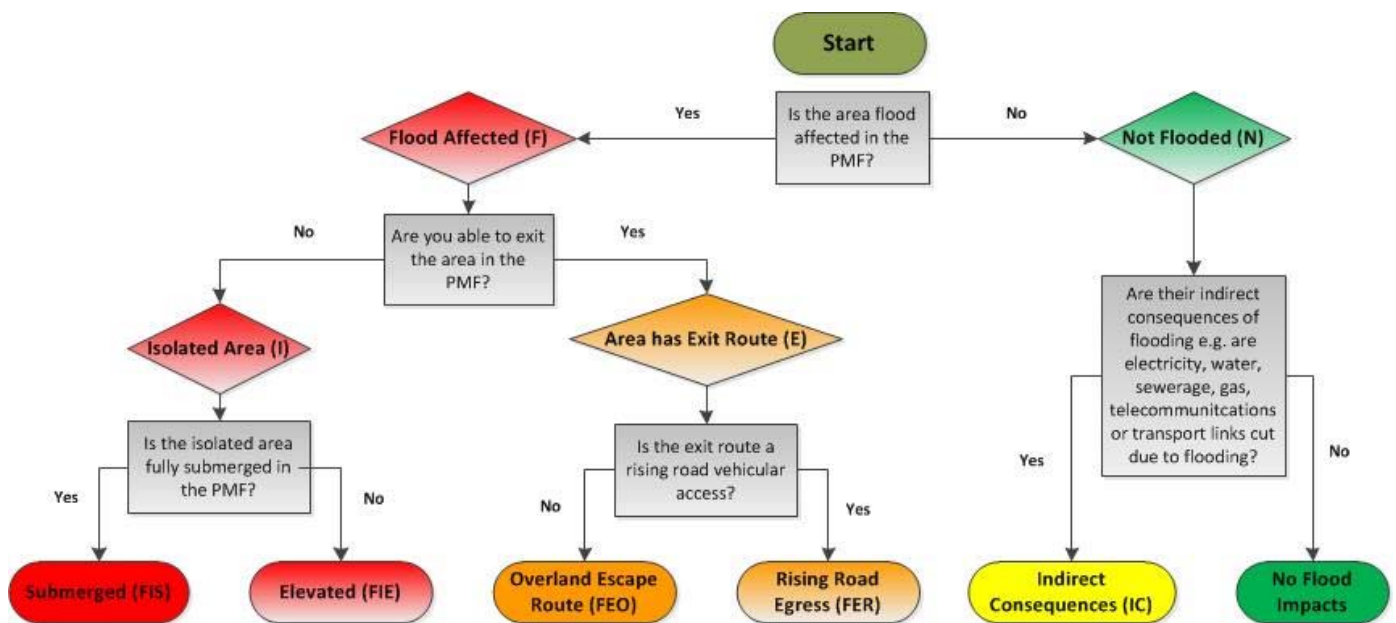


Figure 2: The process of emergency response classification outlined in Guideline 7-2



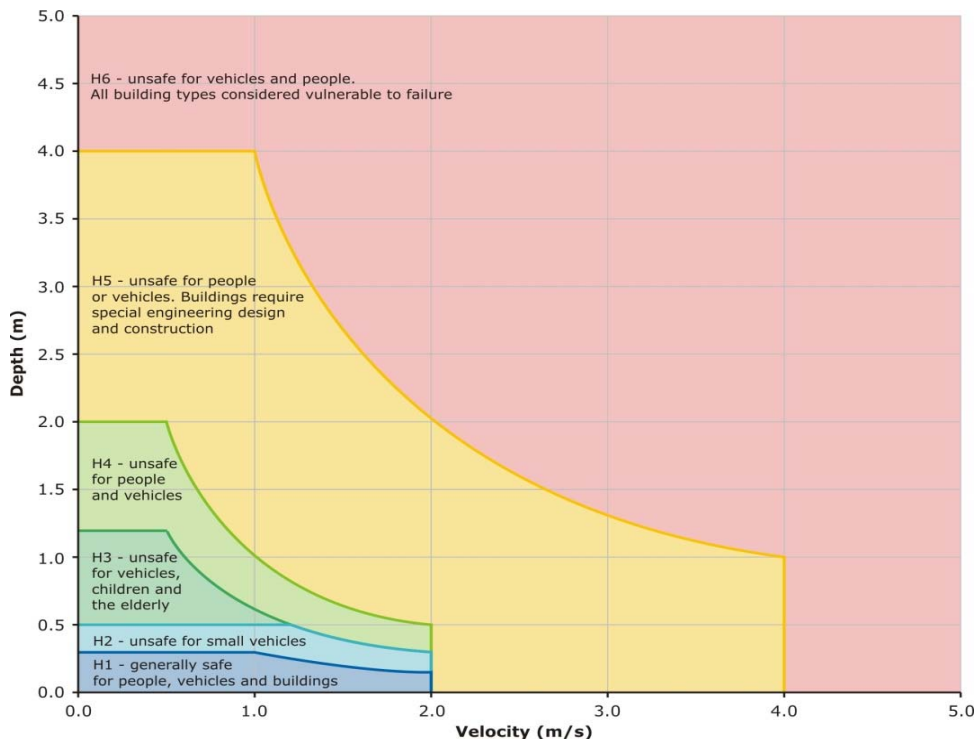
**Figure 3: Example of Flood Emergency Response Classification for a Floodplain**

Guideline 7-3 – Flood hazard

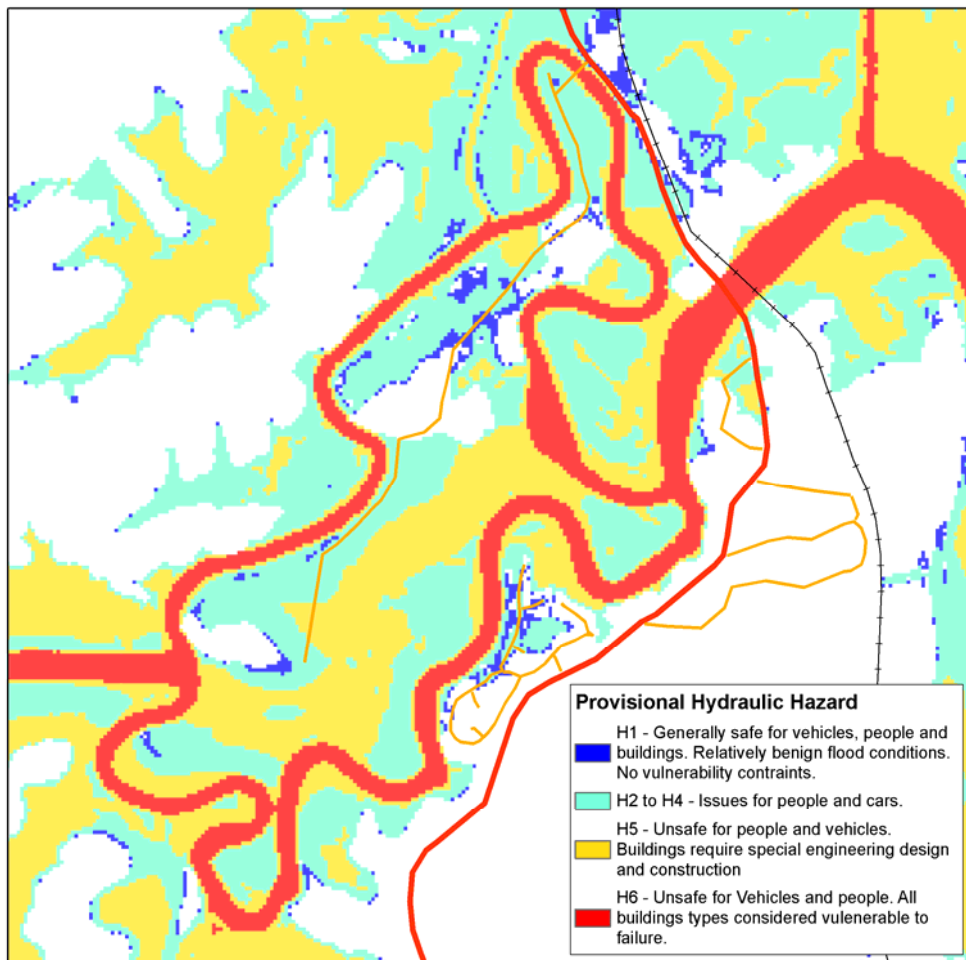
Flood hazard can vary significantly across the floodplain and between and during flood events, particularly with a combination of flood velocity and depth (Vxd). Flood models can provide an understanding of the variation in Vxd during and between events.

Guideline 7-3 provides guidance on assessing the varying degrees of flood hazard that occur across a floodplain and what or who these conditions are hazardous to: i.e. to people, to people in vehicles, and/or to buildings. This helps to inform the breakdown of the floodplain into areas where hazard may require different management responses.

Figure 4 provides an outline of the hazard categories (noting that categories may be combined for practical management purposes and therefore for mapping). Figure 5 provides an example of the use of these classifications on a floodplain. The guideline also provides more specific information on thresholds for hazard to people, vehicles and structures that whilst used in the development of Figure 4, may also be useful, particularly in emergency management. Understanding this variation in hazard can inform flood risk management, emergency risk management and land use planning decisions.



**Figure 4: Flood hazard classification in accordance with Guideline 7-3**



**Figure 5: Example of Flood Hazard Categorisation for a floodplain**  
 Guideline 7-5 and Practice Note 7-7 – relating to flood information to support land use planning activities

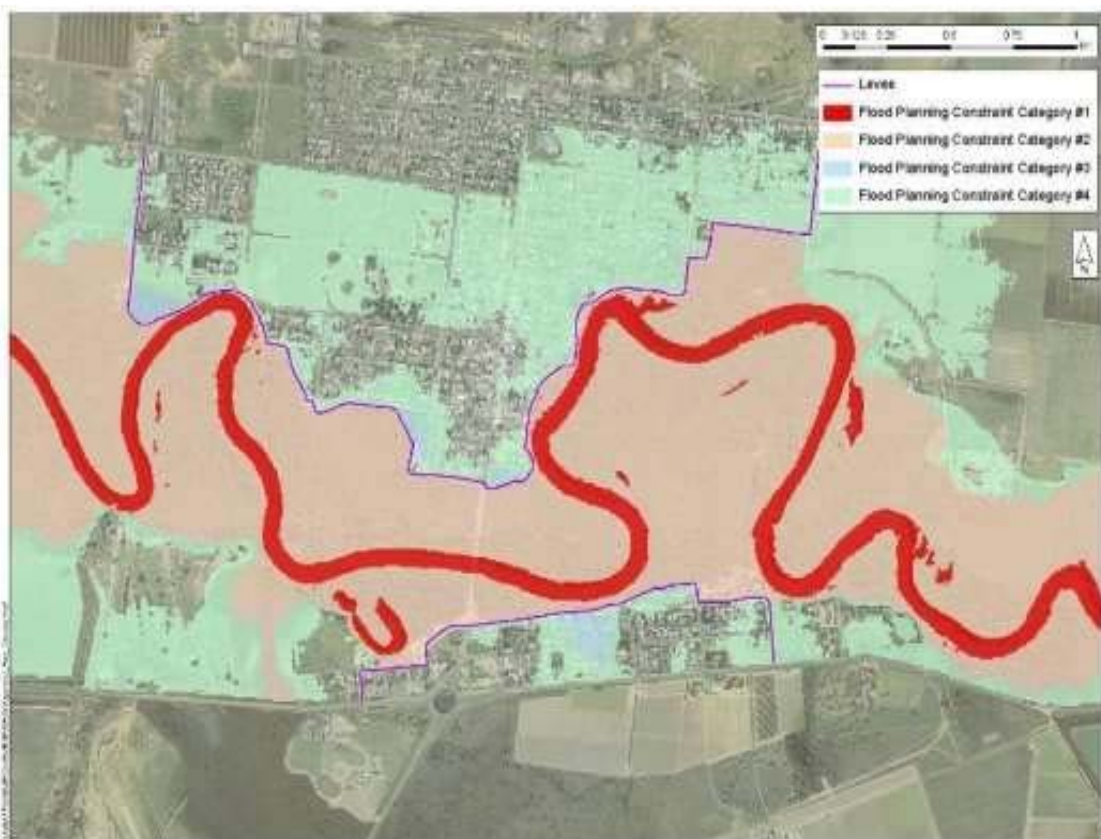
This guideline and practice note discuss the development of better and more concise

flood risk information to support land use planning activities. The process outlined for flood risk managers to develop improved information aims to use the significant amount of information produced in studies on how flood behaviour varies across the floodplain and between events to derive flood planning constraint categorisation (FPCC) mapping. An example provided in Figure 6, with these guidelines the subject of a separate paper at this conference being presented by Mark Babister. The guide aims to support the availability of this information earlier in the floodplain specific management process (see Figure 1), by supporting its development in a flood study, and refinement, where necessary later in a floodplain management study. Availability of this information earlier will enable it to be available to inform land use planning activities undertaken before floodplain management plans are completed. The derivation of FPCCs considers:

- Flood extents for a range of flood events.
- Flood function variation within the floodplain.
- Flood hazard variation within the floodplain. This considers Guideline 7-3.
- The range of flood behaviour and how this influences emergency management of flooding (Guideline 7-2) and flow conveyance and flood hazard (Guideline 7-3).

The guidelines provides:

- An outline of how FPCC mapping can be developed to break the floodplain down into 4 different categories, with FPCC1 the most constrained to FPCC4 the least constrained.
- Advice on how FPCCs may be used to inform different land use planning activities. General advice is provided on the flood related constraints that may typically apply in different FPCCs to address the flood constraints present in this FPCC.



**Figure 6: Example of FPCC mapping for a floodplain using Guideline 7-5**  
Guideline 7-6 supports the assessment of mitigation options and service levels for treating existing risk

Guideline 7-6 builds upon the advice in Handbook 7 and by providing additional advice on assessing options and different service levels of options for treating existing risk

using multi-criteria assessment, with reference also the ADR Handbook 10 National Emergency Risk Assessment Guidelines.

Managing flood risk to the community generally involves a mix of treatment measures, including land-use planning activities, mitigation works and emergency management. Handbook 7 provides information on the options available for treating flood risk, and the associated limitations in managing risk to the community. The selection of different treatment measures and level of service they provide to the community is influenced by:

- the physical characteristics of the location
- economic, social and environmental benefits and costs
- the technical feasibility
- local factors, including community attitudes, support and affordability.

Option assessment and optimisation aim to provide decision makers with robust advice to inform their decisions about treatment options and packages.

This guideline outlines a methodology and criteria to consider when selecting and optimising both treatment options and packages, and the design flood level for a mitigation work (such as a levee) for a local community. The information in this guideline should be considered when developing fit-for-purpose assessment processes.

Figure 7, shows a simple example of how risks to different elements, such as people, property and the environment may vary in an area across the range of flood events. Figure 8 looks at how a levee designed to provide protection for a 1% AEP may alter the risks to these different elements.

The guide discusses a multi-criteria assessment process involving option identification, preliminary assessment or filtering of options, detailed assessment of options including multiple criteria assessment involving a weighted scoring system, and reporting on assessments.

### **Is the development of all the relevant National Guidance finished?**

The short answer is no. The development and refinement of national best practice is an ongoing task. It needs to consider the changing range and needs of end users, changing technologies and standards and the lessons learnt from ongoing practice and from flood events and their impacts upon the community. The completion of this latest set of national best practice guidance is yet another step in this continual improvement process.

Whilst NFRAG is not currently leading any additional funded work on guidance, it will continue to work with the Australian Institute of Disaster Resilience and industry to improve, update and broaden guidance into the future. It expects to lead particular projects where relevant. It will also continue to look for gaps in guidance and examine practical ways in which it may meet this gaps.

NFRAG will also continue its role of providing the basis for cooperative efforts across jurisdictions in developing guidance and to support research that can be, with practical advice on application (an area in which NFRAG operates), be used to improve best practice.



Likelihood of consequence	AEP range (%)	Level of consequence				
		Insignificant	Minor	Moderate	Major	Catastrophic
Likely	>10	Environment	People Public admin Social setting	Economy		
Unlikely	1 to 10	Environment		People Public admin Social setting	Economy	
Rare to very rare	0.01 to 1		Environment	Public admin Social setting	People Economy	
Extremely rare	<0.01		Environment	Public admin Social setting	People Economy	

Risk: ■ Very low ■ Low ■ Medium ■ High ■ Extreme  
AEP – annual exceedance probability

**Figure 7: Example of Flood Risk to an Existing Community plotted on qualitative risks assessment matrix from Guideline 7-6**

Likelihood of consequence	AEP range (%)	Level of consequence				
		Insignificant	Minor	Moderate	Major	Catastrophic
Likely	>10	Environment People Public admin Social setting Economy	People Public admin Social setting	Economy		
Unlikely	1 to 10	Environment	People Public admin Social setting Economy	People Public admin Social setting	Economy	
Rare to very rare	0.01 to 1		Environment Social setting	Public admin Social setting Economy	People Economy	
Extremely rare	<0.01		Environment Social setting	Public admin Social setting	People Economy	

Risk: ■ Very low ■ Low ■ Medium ■ High ■ Extreme  
AEP – annual exceedance probability

**Figure 8: Example of Transformation of Existing community Risk with the Implementation of a 1% AEP Levee plotted on qualitative risks assessment matrix**

This may involve work by one jurisdiction that may assist others. For example, NSW is currently developing guidance to support NSW practice on how to transition from Australian Rainfall and Runoff (ARR) 1987 to ARR 2016, the subject of a separate paper at the FMA conference, Retallick et al. This guidance and the lessons learnt in

its development may provide assistance to other jurisdictions to consider in their transition to ARR 2016.

In addition NFRAG jurisdictional representatives continue to work on activities that relate to the implementation of best practice within their individual jurisdictions. For example NSW has used Guideline 7-1 and Template 7-4 as a framework for updating its technical specifications as discussed in below.

### **How is best practice guidance used?**

Handbook 7 and its companion guides aim to provide a framework for best practice management of flood risk in Australia. These documents should be read and interpreted holistically in a manner consistent with the underlying philosophies outlined in the vision, principles and key objectives (Handbook 7, Chapter 1), and with reference to other relevant guidance.

Best practice guidance does not provide direction to jurisdictions or to floodplain management entities (FMEs) within jurisdictions. Rather it provides advice on best practice in flood risk management that jurisdictions and FMEs can consider in relation to how they manage flood risk their particular context and how this documentation can support their related activities. This context varies both between jurisdictions and within the different FMEs within jurisdictions. For example the following aspects can vary.

- Legislation, regulation and policies.
- Roles and responsibilities for flood risk management, emergency risk management, flood prediction and warning and land use planning.
- History of flooding and the frequency and severity of impacts on the community and the current exposure of the community to flooding.
- Understanding of flood behaviour and impacts.
- Ownership and management and operation of floodplain management measures and an understanding of their relative effectiveness and condition
- Implementation of flood risk management, emergency management and land use planning measures to manage flood risk
- Community understanding of flood risk
- Community expectations on management on flood risk

Therefore best practice guidance does not replace jurisdictional guidance, such as the NSW Floodplain Development Manual. Users of Handbook 7 series documentation should consult the relevant state or territory agencies for advice on the most appropriate material to consider when considering jurisdictional best practice.

This does not mean that jurisdictions cannot or should not use or refer to Handbook 7 or its companion documents when undertaking their flood risk management activities. These documents were written to support their use by jurisdictions in this manner.

This enables jurisdictions to:

- Enable the use of best practice guidance with their own jurisdictions through administrative guidance which supports use of this documentation, or
- Consider best practice guidance in developing or updating their own jurisdictional best practice guidance, and
- Use best practice guidance to support practices within the scope of studies into flood behaviour and its management.

For example, in NSW the recent update of technical briefs for flood investigations refer

to and use relevant Handbook 7 guidance material to support the implementation of best practice flood risk management in NSW. These briefs are based upon Template 7-4 and the guidance to support development is based upon Guideline 7-1. However, they have been developed further in consideration of the NSW context.

In addition, NSW Office of Environment and Heritage (NSW OEH) has taken this a step further with the development of a brief development tool to make the development of a project specific brief consistent with NSW and national best practice easier to develop. This brief development tool is available through NSW OEH but is currently being upgraded to improve the utility of the tool by building the guidance provided in Guideline 7-1 on scoping a project into the brief development tool. Whilst this was developed for NSW, as it was built in a manner consistent with the national best practice framework, Template 7-4 and Guideline 7-1, it can be modified to support practice in other jurisdictions.

Where a jurisdiction wants to embed the Handbook 7 series guidance within its practices rather than developing its own guidance considering best practice guidance it can do this by developing an administrative guideline that enables the use of national best practice guidance within a jurisdiction. This guideline should be kept up to date, be readily available and outline as a minimum:

- Governance arrangements and linkages across prevention, preparedness, response and recovery (PPRR, for typical activities see Figure 9).
- Relevant legislative and policy framework
- Relevant technical guidelines (whether national or jurisdictional) that are to apply
- outline other material that supports best practice
- Alternate terms to those in Handbook 7 where necessary
- Support available to floodplain management entities, the government entities with primary responsibility for managing flooding in an area, to understand and manage their risks.

For example, the NSW Floodplain Development Manual provided advice on administrative arrangements that existed at the time of its publication.

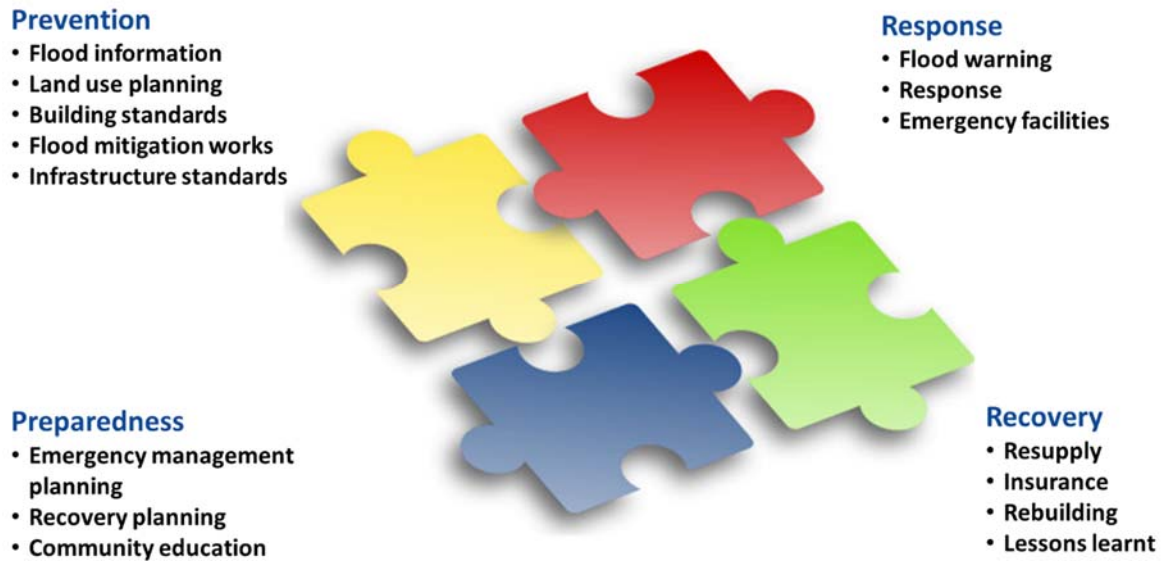
## **Conclusion**

National best practice will continue to evolve as the needs of end users of information from the floodplain risk management framework change, as technology changes, as gaps are identified in best practice, and as lessons are learnt in the implementation of best practice, and from future flood events. NFRAG will continue to work closely with industry in developing and updating guidance where the opportunity arises.

National best practice guidance can and is already being used in practice in a number of ways.

- Firstly, it can be used in the development of jurisdictional best practice advice that considers or utilises national best practice advice. Handbook 7 and the associated guidelines were developed so that they could be utilised rather than replicated by jurisdictions with the support of administrative guidance.
- Secondly through the development of jurisdictional template briefs that incorporate requirements from Handbook 7 and or its companion documents. Guideline 7-1 and Template 7-4 provide a basis for jurisdictions doing this. As outlined above, NSW, for example, has taken the opportunity to update its briefs in consideration of Handbook 7 and the associated guidance.
- Thirdly, project specific briefs may be developed based upon Template 7-4 or jurisdictional equivalents. These briefs can refer to Handbook 7 and/or a number of

its companion documents and require the project scope to deliver advice consistent with these guidelines.



**Figure 9 – Typical activities across PPRR**

## **Acknowledgements**

This paper is based upon the work of NFRAG and its members since 2009. I would like to acknowledge all the NFRAG members and the others who had input into and supported these projects throughout their development.

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