Australian Disaster Resilience Handbook Collection

GUIDELINE 7-1

Using the National Generic Brief for Flood Investigations to Develop Project Specific Specifications

Australian Institute for Disaster Resilience

AUSTRALIAN DISASTER RESILIENCE HANDBOOK COLLECTION

Using the National Generic Brief for Flood Investigations to Develop Project Specific Specifications

Guideline 7-1

This guideline is for use with Australian Disaster Resilience Template 7-4 Technical Project Brief Template

Supporting document for the implementation of *Australian Disaster Resilience Handbook 7 Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia* (AIDR 2017)

Australian Government
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Handbook 7 Collection

Handbook 7

Managing the Floodplain: a Guide to Best Practice in Flood Risk Management in Australia

Guideline 7-1

Using the National Generic Brief for Flood Investigations to Develop Project Specific Specifications

For use with Template 7-4

Guideline 7-2

Flood Emergency Response Classification of the Floodplain

Guideline 7-3

Flood Hazard

Template 7-4

Technical Project Brief Template

For use with Guideline 7-1

Guideline 7-5

Flood Information to Support Land-use Planning

For use with Practice Note 7-7

Guideline 7-6

Assessing Options and Service Levels for Treating Existing Risk

Practice Note 7-7

Considering Flooding in Land-use Planning Activities

For use with Guideline 7-5

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Preface

As outlined in *Australian Disaster Resilience Handbook 7 Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia* (ADR Handbook 7) (AIDR 2017), flooding is a natural phenomenon that occurs when water covers land that is usually dry. Floods can create hazardous conditions when communities are exposed to these conditions, creating a risk.

Effective flood risk management can enable a community to become as resilient as practicable to floods. This is achieved through planning and preparing for, responding to and recovering from flooding. This requires a coordinated, multidisciplinary approach across all levels of government and between agencies with different responsibilities. It also requires the support of a range of non-government organisations and industry professionals in a wide range of activities and fields, as well as the active engagement of the community. A key step in flood risk management is the completion of studies that improve our knowledge of flood risk, and provide a basis for assessing and making decisions on options to treat flood risk.

When used together, this guideline and the *Australian Disaster Resilience Template 7-4 Technical Project Brief Template* (AIDR 2017) provide a consistent basis for the development of specifications for flood investigations, in consideration with the best practice principles from ADR Handbook 7. They provide advice on specifying projects to manage flooding within the floodplains and catchments of waterways, due to:

- catchment flooding from prolonged or intense rainfall
- coastal flooding due to tidal- or storm-driven coastal events, including storm surge, in lower coastal waterways
- combinations of these sources in the lower portions of coastal waterways, where both can be produced by the same storm or a series of storms.

This document was reviewed for consistency and republished in 2017 following development of the following supporting documents to ADR Handbook 7:

Guideline 7-5 Flood Information to Support Land-use Planning (AIDR 2017)

Guideline 7-6 Assessing Options and Service Levels for Treating Existing Risk (AIDR 2017)

Practice Note 7-7 Considering Flooding in Land-use Planning Activities (AIDR 2017)

1 Introduction

The National Flood Risk Advisory Group (NFRAG) led the development of practical technical specifications for completing flood investigations, in consideration of *Australian Disaster Resilience Handbook 7 Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia* (AIDR 2017). This approach involves:

- A generic technical brief covering the development of floodplain management plans and the linkage of these into floodplain management entity (FME) information systems and decision-making processes, as identified in the Flood Risk Management Framework (see Figure G1). The generic brief aims to provide flexibility in study objectives and deliverables, the scope of investigations and methodology considering the needs of end users, the type and scale of the flood problem, and the available data. It does not cover general tendering or contractual matters.
- A guidance document that assists FMEs to develop project-specific technical briefs from the generic brief. This aims to deliver the outcomes needed for the end users of the project. The guidance document includes key issues in contractual and tendering matters that can be neglected. These include:
  - intellectual property
  - handover of models and deliverables
  - clear statements from the tenderer on any limitations of proposals to meet the full requirements of the brief.
- Several sample project briefs.

The generic brief and this guidance document are a package and should be read together.

The brief can be applied or adapted to the management of floods in urban and rural areas, including water flowing overland through urban areas to waterways. Its use with different flood problems should consider the different issues that need to be addressed, such as the following:

- Local overland flood catchments respond quickly to rainfall and often have ill-defined flow paths that may follow roads, go through private property, or be inhibited by buildings and fences. These may need specific requirements in the brief.
- In rural floodplains, the scale of flood-dependent ecosystems and agricultural activity means that environmental issues, flood duration (resulting in crop losses) and maintenance of flow to these areas are important issues that may need specific requirements within the brief.

This guide was developed after considering a range of briefs from various jurisdictions. This critical review led to the following observations:

- The variable structure of the briefs can impact on their clarity, can obscure information, and may result in duplication and – potentially – contradiction.
- The boundaries between technical specification, tendering requirements and contractual conditions can be blurred.
- The objectives sometimes may be obscured in the project scope or include deliverables.
- The deliverables section can include non-deliverables and deliverables may also be covered in other sections.
- The formats and requirements for the handover of data are often unclear.
- The methodology section communicates how deliverables are expected to be produced. It can range from being very prescriptive, stipulating the exact method to be followed, to giving the tenderer more freedom by inviting them to propose what they believe to be appropriate, based on their experience.
- There is inconsistent language in stipulating what is expected of the study. For example, wording such as 'it is desired that…', '…should be', 'is to be…' conveys varying degrees of necessity.
- The list of available information may exclude year of publication and author.
- Poor formatting of figures showing study area or similar (e.g. low-resolution figures with no legend).
- The generic brief may be adapted by individual jurisdictions to meet their specific needs.
- The generic brief will evolve over time using lessons learnt fed back through NFRAG.

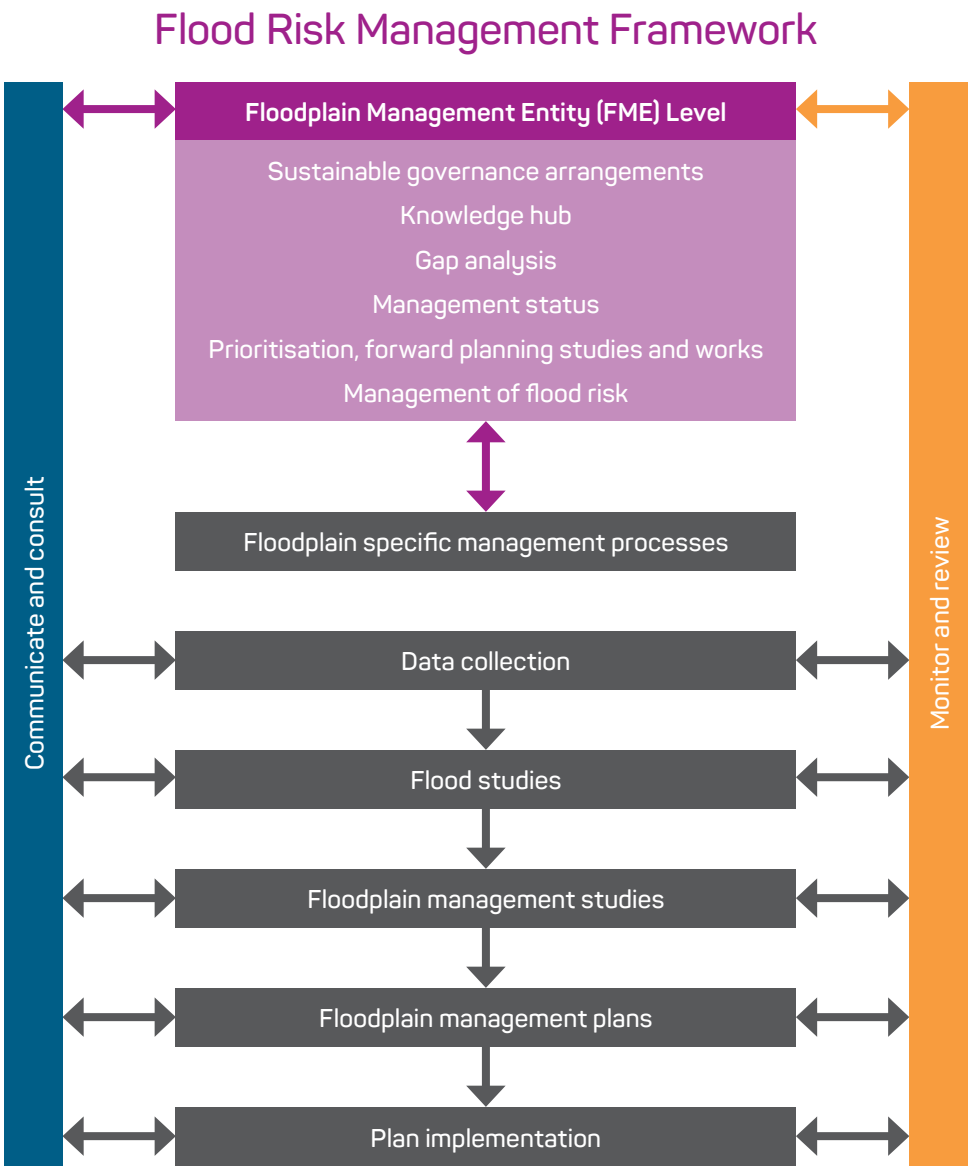


Figure 1: The flood risk management framework

1.1 Document structure

This guideline is broken down into four additional sections:

- Section 2 provides general advice on using the guideline and the generic brief.
- Section 3 outlines decisions to make before writing a brief, and helps to define the objectives and governance through a series of high-level questions.
- Section 4 develops the project scope through a series of scoping tables and questions, and provides a guide to the generic brief.
- Section 5 outlines some key issues to consider that relate more to tendering or contractual conditions.

There are also two appendixes containing checklists, examples of how to organise files for handover, and some examples of forms for tendering information.

2 General advice on using the guide and the generic brief

The generic brief is intended to be used – either as a template or a guideline – for all types of flood-related studies in Australia. It has been written using the terminology adopted by ADR Handbook 7 to make it compatible with that document and fit-for-use nationwide. The terminology is aimed at covering the variations between different states and jurisdictions, and hence sometimes uses generic terms that cover all local variations. An outline of additional key terms is given in Section 2.1.

It has been written in a standard functional structure to provide linear progression with clear separation of the purpose of individual sections, as outlined in Section 2.2.

As the generic brief encompasses a very wide range of users, flood situations and study types, it has been written in a modular format, where content can be removed to tailor the brief to a particular study. The modular format is intended to accommodate the input of the FME that is preparing the brief, while preserving a standard functional structure and contents.

The variable content of the brief is generally a function of the study's:

- jurisdiction (discussed in Section 4.1)
- its complexity (in terms of flooding behaviour and scope, discussed in Section 2.3)
- flood source (whether from a waterway or flowing overland to a waterway, discussed in Section 2.4)
- scope that is necessary to achieve the objectives (discussed in sections 2.4 and 2.5).

It is acknowledged that this is a broad categorisation of study types, and that a study will frequently not neatly fit into prescribed categories. For these studies, the standard functional structure of the generic brief should act as a guide in preparing the brief.

2.1 Terminology

The glossary in ADR Handbook 7 provides definitions of the majority of key terms in this guideline. The following key terms are also used:

- **Principal** is the authority or agency with the primary responsibility of overseeing the study. Often, the principal is the FME who is responsible for directly managing flood risk at a local level. The principal in this brief could also represent a number of agencies working in partnership to manage flood risk across a floodplain.
- **Data collection study** may be the collection of flood data and intelligence following an event, or be the precursor to a more comprehensive flood study or floodplain management study. A data collection study can also assist in scoping a more detailed study, because it identifies what information already exists.
- **Digital elevation model (DEM)** represents the topography of an area as a grid of cells. This is derived from survey data, including light detection and ranging (LiDAR) data.
- **Defined flood event (DFE)** is the flood event for which flood hazard management for new developments is based upon.
- **Flood function** refers to the flood-related functions of flow conveyance and storage of flood flows within flood dependent ecosystems and, more broadly, within the floodplain.
- **FME** is the body or organisation – often government – that has primary responsibility for managing flood risk and floodplains in a local area.
- **LiDAR** is a survey method that collects topographic data across a large area using airborne or vehicle-mounted equipment, and generates high-speed laser pulses. It is often used as one of the inputs to creation of a DEM of the area.

2.2 Structure

The generic brief has been carefully prepared to contain discrete sections that complement each other and provide a linear sequence of activities. When adapting the generic brief to specific circumstances, the structure should be as follows:

1. **Introduction.** Provides an overview of the project, including the principal, funding partners, associated framework, and outlines high-level aims.
2. **Objectives of this study.** Describes why the study is being undertaken and what it will achieve. It frames the project in the context of the FME's broader agenda and gives the tenderer an initial idea of what is being asked for.
3. **Background and study area.** Provides essential background information such as the study area, its political context and key features.
4. **Available information.** Lists available references, data and sources of further information relevant to the study.
5. **Current guidelines and references.** Lists documents that should be considered or adhered to as part of the study.

6. **Scope of work.** Outlines how the objectives will be achieved and deliverables will be produced including type and number of meetings and timing requirements (milestone, hold points, duration).
7. **Deliverables.** Outlines what needs to be delivered, in what format, how, where to and when.

2.3 The complexity of a study

The scope of a study is dependent upon financial constraints, the flood risk in an area (areas with minimal risk warrant a less-detailed investigation) and the type of flooding (ocean inundation alone requires a less-complex model than an area with riverine and overland flooding, or a combination of these flood sources). Each of these factors is considered when commissioning a study and a decision is made as to the study's objectives, deliverables and methodology. The generic brief guides and, where possible, standardises this decision-making process by grouping studies as either 'simple' or 'complex'.

Generally speaking, a simple study uses a relatively unsophisticated model type to determine flood behaviour for a small number of design flood events. The model outputs give a representation of flood risk in the area, typically for general land use and emergency management planning purposes.

In contrast, a complex study uses a full two-dimensional hydraulic model to produce information on the full range of design flood events in an area. It gives detailed information on flood risk to facilitate more sophisticated land use and emergency management planning, and is likely to be used by a wider range of end users. It should be noted that a study will rarely completely align with the definitions of simple or complex – in this case, a compromise between the two should be made.

2.4 Riverine or overland flooding

A flood study in an area where the primary flood influence is riverine (i.e. water escaping from waterways) can be significantly different from a study where the primary influence is due to water flowing overland towards waterways. The associated flood investigations often need a different methodology and different deliverables.

Riverine studies are typically focused on towns or communities affected by flooding from a major waterway. Overland flood studies tend to focus on smaller parts of larger riverine catchments. They have smaller catchments and greater emphasis on confined flow paths, and may include overland flow and drainage infrastructure. As with study complexity (Section 2.3), these categories are very broad, and some overland studies will exhibit characteristics of a riverine study and vice versa.

The main differences between riverine and overland studies include the following:

- Overland catchments tend not to have reliable information on historical floods for the purposes of calibration and validation. If they do, it is not of great significance, because urbanisation has often occurred in the interim and resulted in changes to the flood behaviour. In these studies, historical information tends to be used to identify areas with flooding issues rather than for calibrating model behaviour.
- Overland flow studies generally require a greater level of detail and resolution.
- Simple riverine flood studies often produce flood profiles along a watercourse. However, due to the complexity of flood behaviour in overland flow paths, flood profiles are often not used in these situations.
- Velocities are of more interest in an overland area, where there can be large variation in the velocities between different flow paths, compared with the more uniform velocity of a river or waterway.
- Riverine flood information describing inundation of different roads, properties and critical structures in the study area is often able to be related to a nearby river water level gauge. However, stream gauges are less likely to be located in an overland flow path and, if they are, the limited available warning time means that a coordinated emergency response is unlikely.

2.5 Miscellaneous optional content

Some sections of the generic brief contain optional content, which can be included based on whether or not the FME preparing the brief feels it is necessary to meet the needs of the end users of the project. This optional content is not a function of the study's jurisdiction, nor the complexity of the flood situation or the location, and so could not be grouped with the optional content for those categories. Examples of miscellaneous optional content that would affect the scope of work and the deliverables are:

- a flood damages assessment and associated survey
- level of community consultation to be carried out
- whether or not to consider climate change
- various scope options that provide end user deliverables, such as flood hazard, emergency management aspects, impact assessment and land-use planning advice considering flooding
- a template for the report's structure
- options to amend the 'Data collection' subsection in the 'Scope of work' section with different content in the case that a data collection study or topographic data collection has already been carried out
- a preference for the type of hydrological analysis (including flood frequency analysis) and, similarly, for hydraulic modelling
- option to include additional review components, such as an independent peer review.

3 Define governance arrangements and study objectives

This section provides a number of high-level guidance questions that should assist in the initial stages of brief scoping and preparation. After answering these questions, you should have an understanding of who your end users are and their requirements, as well as how far through the floodplain management process you will need to progress. Appendix A provides Checklist A that can be used, if desired, to document key information derived from this section for future reference.

3.1 Why are you considering scoping a study?

There are a range of reasons why a principal or FME has decided that there needs to be some definition of flood risk or assessment of management options within their catchment or area. They tend to fall into the following categories:

- A recent flood event has identified that a flood problem exists in your area, and the full risks need to be determined and/or managed.
- A statutory requirement has meant that you need to undertake flood mapping to establish land-use planning controls (including setting minimum floor levels) for a new development across an area.
- There is an existing study that is not meeting your information needs.
- You believe there is a flood problem, and want to pre-emptively define and manage flooding in your area.
- You have defined the flood problem, but want to examine management or treatment options.
- Other external factors or pressures, such as the community, strategic planning or insurance requirements, mean that the flood risk in your area needs to be defined.

3.2 Where to start?

To prepare a suitably targeted brief that will allow tenderers to understand the principal's needs and therefore tender appropriately, a range of items need to be considered initially. If you are not in a position to answer the questions in this section, guidance can be sought from a range of sources including:

- others in your organisation
- relevant jurisdictional government agencies
- others in a similar position at nearby FMEs
- Engineers Australia
- Floodplain Management Australia
- tenderers with experience in the scoping or preparation of flood investigations, ideally in your jurisdiction.

3.3 What resources do you require?

There are a range of documents and data available that provide background and guidance information to assist in understanding the Flood Risk Management Framework (Figure 1) and guide decisions on what outputs you need. The following documents should be reviewed:

- *Australian Disaster Resilience Handbook 7 Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia* (AIDR 2017).
- *Development of practical specifications for mapping and modelling outcomes and outputs. Stage 1 – comparing model capability and end user needs* (WMAwater 2013).

In addition, the following resources and information should be consulted:

- relevant state or territory guidance, because jurisdictions may have specific requirements and guidance to consider in scoping projects; for example, they might have specific data sharing and licensing requirements and standards for spatial data to enable this to be used more broadly across government
- previous studies in the area
- data collected following flood events, including community feedback.

3.4 What assistance is available?

Depending upon the jurisdiction, specific financial and technical assistance, and policies and guidance may be available for an FME to investigate flood risk; for instance:

- Financial assistance, where it exists, would generally be in the form of subsidies. It is generally made available through competitive funding programs. Funding for these programs may be sourced from the jurisdiction, or be a partnership between the jurisdiction and the Australian Government.
- Technical assistance or advice, where it exists, may be able to be provided by relevant jurisdictional agencies.
- Jurisdictional policies and guidance documents may have specific standards or approaches, and information needs that must be considered. Advice on relevant policies and guidance may be able to be provided by relevant jurisdictional agencies.

3.5 Who are your end users?

A critical aspect of scoping a project that provides useful information for a range of end users is to determine the possible end users and their outcome needs at the outset of the project. WMAwater (2013) provides guidance on possible end users and their likely requirements. By considering the range of end user needs appropriate to the flood situation being investigated at the start of the project, the best study approach can be specified. This is crucial for prospective tenderers to be able to make recommendations regarding approach and methodology to satisfy the range of needs in the most cost-effective and efficient manner. This process also allows an understanding of the trade-offs when considering other external factors, such as available budgets and timing.

It is important to identify and confirm the requirements of external stakeholders before scoping the brief, because this will influence the type of study, the level of detail and the optional items required. End users may be at different levels of government or be in the non-government sector. They typically fall into the following groups:

- high-level strategic decision makers
- community
- flood risk management professionals
- engineers involved in designing, constructing, maintaining and operating mitigation works
- emergency management planners and responders
- land-use planners (setting strategic planning direction and planning controls)
- hydrologists and meteorologists involved in flood prediction and forecasting
- insurers
- others.

Table 1 identifies end user groups and their likely deliverable requirements. Derived from Comparing Model Capability and End User Needs (WMAwater 2013), the table also includes a guide to which section of the generic brief is likely to deliver the end user requirement. Comparing Model Capability and End User Needs includes a separate table for emergency management; these have been combined into one column as part of Table 1, for simplicity. The original publication ranked end user needs according to relevance to the function of the end user:

- 1 = of passing (limited) interest
- 2 = useful but not important (nice to have)
- 3 = important
- 4 = critical to function.

Different jurisdictional agencies may have different end user requirements that should be considered in developing briefs. Contact with these government agencies may provide associated guidance that can be referenced in the brief.

Table 1: End user needs

Model type	Outputs	End user group and ranking[a]		
		Strategic land-use planning	Development controls	High-level decision makers
Basic	Flood information at a point location (e.g. flood level or depth)[c]	2	3	3
	Flood levels[c]	3	3	3
	Flood profiles (e.g. flood levels along a river)[c]	1	1	3
	Flood depths	3	3	3
	Flood velocities	3	3	2
	Spatial flood extent	4	4	4
	Historical flood information (e.g. recorded flood levels)[c]	4	3	3
Complex	Gauge height/elevations at which structures are overtopped[c]	1	2	3
	Link between gauge height and areas inundated[c]	3	3	2
	Timing of structures overtopped, including levees and bridges[c]	2	2	3
	Gauge information (related timing)[c]	2	2	3
	Inundation timing of properties/access roads[c]	2	2	3
	Mapping depicting percent chance of flooding on an annualised basis	3	3	2
	Spatial flood information for a range of events	4	3	3
	Flood information for future conditions (climate change/land use changes) in the catchment	3	3	3
	Levels/AEP at which critical access roads are affected[c]	4	3	4
	Levels/AEP at which properties are affected	4	2	3
	Levels/AEP at which critical municipal structures, (including pump stations, power substations, water and wastewater treatment facilities, hospitals, schools, airports, and fire and police stations) are affected[c]	4	4	3
	Assessment of change in flood behaviour or levels as a result of mitigation works	4	3	3
	Flood hazard[c]	3	3	2
	Flood function	4	3	2
	Assessment of impacts of changes in the floodplain due to development, filling, or infrastructure crossing the floodplain on flood behaviour	3	4	3
	Assessment of worst case flood outcomes such as levee failure[(1)]	3	3	3
	Flood planning levels	4	4	3

Notes: a. Ranking: 1 = of passing (limited) interest 2 = useful but not important (nice to have) 3 = important 4 = critical to function.
b. Insurers price insurance based on current conditions and require mapping of current risks, excluding any future factors such as climate change.
c. From an emergency management perspective, these types of outputs are normally considered to fall under the flood intelligence category.

Insurers[b]	Community	Flood risk manager	Flood prediction	Emergency management	Section to derive deliverable
3	3	4	4	3	Hydraulics
4	3	4	4	4	
3	3	4	3	3–4	
4	3	4	3	3–4	
3	1	4	3	2–3	
4	4	4	3	4	Hydraulics – alt 3 (course 2d), alt 4 (dynamic 2d rural, alt 5 (dynamic 1d/2d riverine), alt 6 (dynamic 1d/2d overland)
4	4	4	4	3–4	Data collection, community consultation, hydraulics
3	2	4	3	4	Hydraulics
2	3	3	4	2–4	
2	3	4	3	3–4	Hydraulics – alt 3 (dynamic 1d or course 2d), alt 4 (dynamic 2d rural, alt 5 (dynamic 1d/2d riverine), alt 6 (dynamic 1d/2d overland)
2	3	4	4	3–4	
2	3	4	4	3–4	
4	1	4	4	3–4	Hydraulics – alt 3 (course 2d), alt 4 (dynamic 2d rural, alt 5 (dynamic 1d/2d riverine), alt 6 (dynamic 1d/2d overland)
4	3	4	3	3	Hydraulics – alt 3 (course 2d), alt 4 (dynamic 2d rural, alt 5 (dynamic 1d/2d riverine), alt 6 (dynamic 1d/2d overland) Modelling events
2	3	4	3	2–3	Hydraulics, modelling events
2	3	4	4	3–4	
3	2	3	4	3–4	Hydraulics, modelling events, flood damages assessment
2	3	4	1	3–4	
4	3	4	3	3–4	Hydraulics, assessment of management options
3	3	4	2	4	Flood hazard assessment
2	3	4	3	3–4	Flood function assessment
4	3	4	4	2–3	Cumulative impact assessment Impact of floodplain works assessment
3	3	4	4	3–4	Levee assessment, dam break assessment, impact of floodplain works assessment
3	3	4	1	2–3	Advice on land-use planning considering flooding

3.6 Who should oversee the study?

Before developing the brief, it is important to understand who will have oversight of the study. This will generally be an FME, but there are circumstances where this is not the case. For example, the FME might be a catchment management authority who is reliant on local government to provide funding. In some jurisdictions, including Queensland and New South Wales, the FME will normally be the local government, or it may be a joint state–local government partnership.

Where there are multiple end users of the information or outcomes of the project (see Section 3.5), it is usually appropriate to establish a flood risk management committee, including a range of relevant government stakeholders to oversee the project before it commences. Further guidance is provided in ADR Handbook 7 Section 3.2 (AIDR 2017). The project steering committee needs a direct link to the FME for reporting purposes. A key consideration in relation to the project brief will be the tenderer's reporting arrangements, in particular:

- the number and location of meetings
- expectations of the meetings
- whether the meetings satisfy stakeholder consultation requirements or additional effort is required.

These aspects are covered further in sections 4.6.3 and 4.9.

3.7 What issues should be considered when defining the study area?

Defining the study area is important to ensure that information is gathered where needed, and that opportunities for understanding flooding and the value of the study are maximised while managing costs. Consideration needs to be given to the purpose of the study, who the end users of the information are likely to be and how sophisticated the modelling is likely to be. The study may focus on a relatively small area (e.g. development proposal, overland flooding catchment, a single town or a single town including surrounding rural areas), or it may focus on an FME service area or a floodplain that crosses a range of FME service areas.

The study area should not define the extent of the modelling, but rather the extent of the area for which reliable information on flood behaviour is required for management of flood risk. Both hydrological and hydraulic models will need to go beyond the boundaries of the study area to provide reliable information within the bounds of the study area. The brief will need to make it clear that the study area specifies where reliable modelling deliverables are required, not the extent of the models or the data used for their development.

3.8 What do end users want out of the study?

Determining what end users want from the study is a high-level objective of your study that based upon an understanding of the flood situation and considering the various reference documents. Studies generally fall into three categories:

- An inexpensive, simple, interim and/or rapid assessment of the existing flood situation. This type of assessment is likely to use simple approaches, have the principal as the sole or primary end user, and provide limited outputs such as flood extents for a single probability. This assessment would allow a general understanding of the existing flood risk, but may not, for example, provide an understanding of how the risk changes with event probability or over time during an event.
- A study to gain a more detailed understanding of the existing flood risk. This study would allow an assessment of the flood risk to be made under a range of flood probabilities and historic events, and consider different scenarios such as levee failure. This type of study would involve more complex approaches and set you up well for assessments associated with the management of flood risk in the future. It would also provide a range of outputs to inform a number of different end users.
- A study to assess and determine a range of measures to manage flood risk considering the needs of a range of end users. This study would provide a range of outputs with a focus on the management of existing and residual flood risk, and would be suitable for a broad range of end users.

3.9 Is a simple or complex approach needed?

Determining if you require a simple or complex study will provide a good starting point for scoping the study brief. A number of questions relating to what is already known can assist in guiding this decision, including:

- What are your current and potential future required outputs? This will be guided by the project end users and will guide the approach required to achieve the outputs.

- Has there been a recent event that has indicated a flooding problem and raised community concern about flooding? This may indicate there is a significant flooding problem, which may require complex approaches, or it may indicate the need for comprehensive community consultation.
- How many people or properties are likely to be at-risk of flooding? This may indicate the scale of the flood problem, and guide the need for comprehensive or simple community consultation, or the need for the assessment of flood risk management measures.
- Has a previous study been undertaken and, if so, what type of information did this provide? This can inform the approaches or outcomes required from the current study, or its starting point.

3.9.1 What type of flood situation exists?

The type of flood situation in your study area will influence the modelling approach adopted, the range of end users, their information requirements and the outcomes required from the study. The flood situation can generally be classified into one of the following categories:

- **Rural (riverine) catchment with scattered development.** Here, there is often a long warning time and, generally, a limited population is at-risk.
- **Large rural (riverine) catchment with township, plenty of warning.** In this category, there is often a long warning time and a more significant population at-risk.
- **Small rural (riverine) catchment with township, little warning.** In this flood situation, flood waters often rise rapidly, but there could be limited population at-risk.
- **Large urban (riverine) catchments.** Here, there may be a moderate warning time and a large population at-risk.
- **Small urban catchments (overland flow).** Here, flood waters often rise rapidly, but at generally shallow depths; however, there is a significant population at-risk.

It should be noted that any of these categories may involve a coastal flooding mechanism in the catchment – for example, an ocean boundary or a coastal lake. This does not normally affect the classification of the area into one of the five categories.

3.10 Where are you in the management framework?

ADR Handbook 7 promotes a risk management approach that facilitates the effective understanding and management of flood risk. The Flood Risk Management Framework (see Figure 1) encourages the collection, improvement and dissemination of the best available information on flood behaviour and associated risks, while providing flexibility for the requirements of different FMEs. The framework provides a staged process for floodplain-specific investigations, which generally involves the following stages:

- data collection, to collect background data for a study
- flood study, to provide an understanding of flood behaviour
- floodplain management study, to assess and recommend management options
- floodplain management plan, to decide on management measures
- implementation, to implement management measures in the plan.

Based on the requirements determined in this section and an understanding of any work undertaken to date in the catchment, a decision can be made on the starting point for the study and what stages of the floodplain-specific processes of the framework are required.

For instance, comprehensive fit-for-purpose data collection and a complete flood study may have been done, and the assessment of management options is required via the completion of a floodplain management study. Alternatively, your area may have a relatively minor flood problem and its extent needs to be defined – this may be achieved via a flood study.

4 Guide to the generic brief

The generic brief is aimed at meeting a wide range of study types and will need to be tailored to suit the document to the scope of a particular study. The generic brief has been designed to make changes as required, including additions. When changes have been made, it will be necessary to review the document to avoid issues such as inconsistent points of reference, duplicated or inconsistent information, or incorrect cross-references.

The general method for editing and completing the different sections of the generic brief is as follows.

- Replace text in square brackets with preferred content. For example, replace 'The model shall produce results for [list of design events]' with 'The model shall produce results for events of 1% and 10% AEP' (annual exceedance probability).
- For sections marked as 'Alternative text' (**shaded in green**), in most cases, only include the alternative section of text that applies to the specific study.
- For sections marked as 'Optional text' (**shaded in orange**), choose between keeping the text if it is necessary for the brief, or deleting it if it is not necessary.
- For tables, additional rows can be added to tables as necessary. However, tables should not be removed from the generic brief. In the case where there is no information, 'nil', 'none' or 'not applicable' should be added to the table.

Appendix A of this guideline (which includes checklists A–C) can help to document decisions while preparing the brief for future reference. Checklist B includes a range of questions that will assist in developing a starting point for brief preparation. It is recommended that the user completes this table in conjunction with reading the relevant sections of the guide. Answering all questions in Checklist B will provide information for all standard and optional sections of the generic brief. This information will assist in developing a study brief from the generic brief.

Checklist C provides an overview of each scope section of the generic brief, what deliverable can be derived from inclusion of that section and related sections that may need to be included. For example, for a flood damages assessment, a survey may be required, and this has been identified in Checklist C.

The remainder of the sections explain how to address each chapter or section of the generic brief.

4.1 Introduction

The introduction provides the overall outline for the project, including naming those involved and a description of the study's governance.

The introduction, section 1 of the generic brief should provide some background to the project, name the principal and funding partners, and outline associated process and high-level aims. It should set the high-level context for the project, which should be in accordance with ADR Handbook 7. The generic brief has included introductory text based on ADR Handbook 7. Some jurisdictions have an existing guideline and a management process that is consistent with ADR Handbook 7. In this case, alternative introductory text examples are shown.

Section 1 of the generic brief should also include details on the governance of the study and guide the tenderer in understanding how they will interact with the principal. For example, the principal may have a committee that is responsible for steering the study, and may comprise representatives from the principal's organisation, other stakeholders and end user groups, and jurisdictional government. There may also be a subcommittee that guides the technical aspects of the study. It may include representatives from the principal's organisation and jurisdictional government.

The following are examples of alternative text that could be used in the introduction.

Alternative text: |New South Wales|

[The principal] in partnership with [partner councils/authorities] has received [financial support from government program(s)] managed by [agencies] to undertake a flood investigation of the [location and/or catchment name].

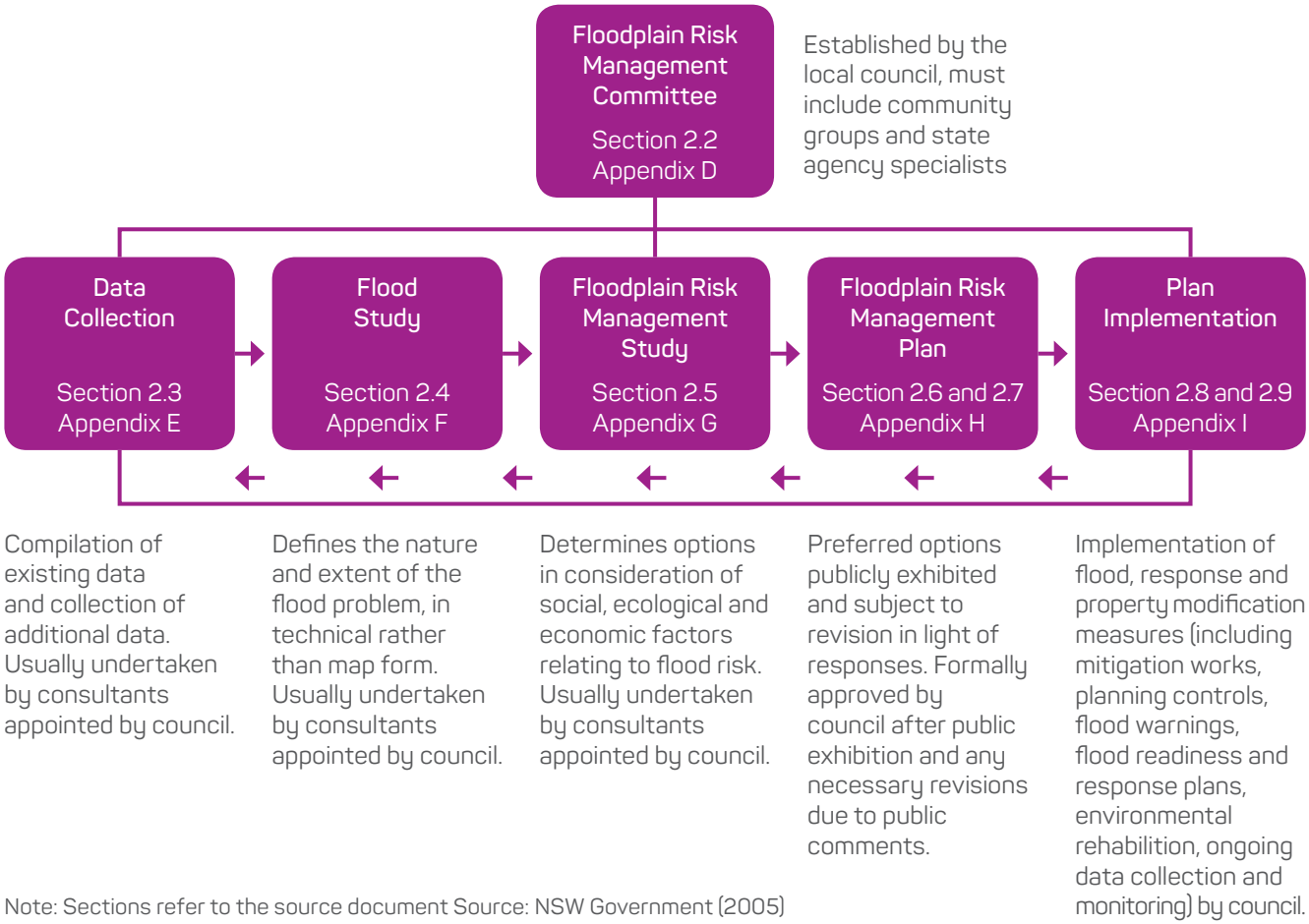
The primary objective of the New South Wales (NSW) Government's Flood Prone Land Policy is to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods, utilising ecologically positive methods wherever possible.

Through the NSW Office of Environment and Heritage (OEH), NSW Department of Planning and Environment (DPE) and the NSW State Emergency Service (SES), the NSW Government provides specialist technical assistance to local government on all flooding, flood risk management, flood emergency management and land-use planning matters.

The *Floodplain Development Manual* (NSW Government 2005) is provided to assist councils to meet their obligations through the preparation and implementation of floodplain risk management plans, through a staged process. The following diagram, taken from this manual, documents the process for plan preparation, implementation and review.

The *Floodplain Development Manual* is consistent with *Australian Disaster Resilience Handbook 7 Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia* (AIDR 2017).

Figure 2 (on the next page), taken from the *Floodplain Development Manual*, provides an overview of the floodplain risk management process in NSW.



Note: Sections refer to the source document Source: NSW Government (2005)

Figure G2: The floodplain risk management process in New South Wales

Alternative text: |Victoria|

[Area] Catchment Management Authority in partnership with [council #1], [council #2] and [water authority] has received [state/jurisdiction and federal financial support] to undertake a flood investigation of the [catchment name].

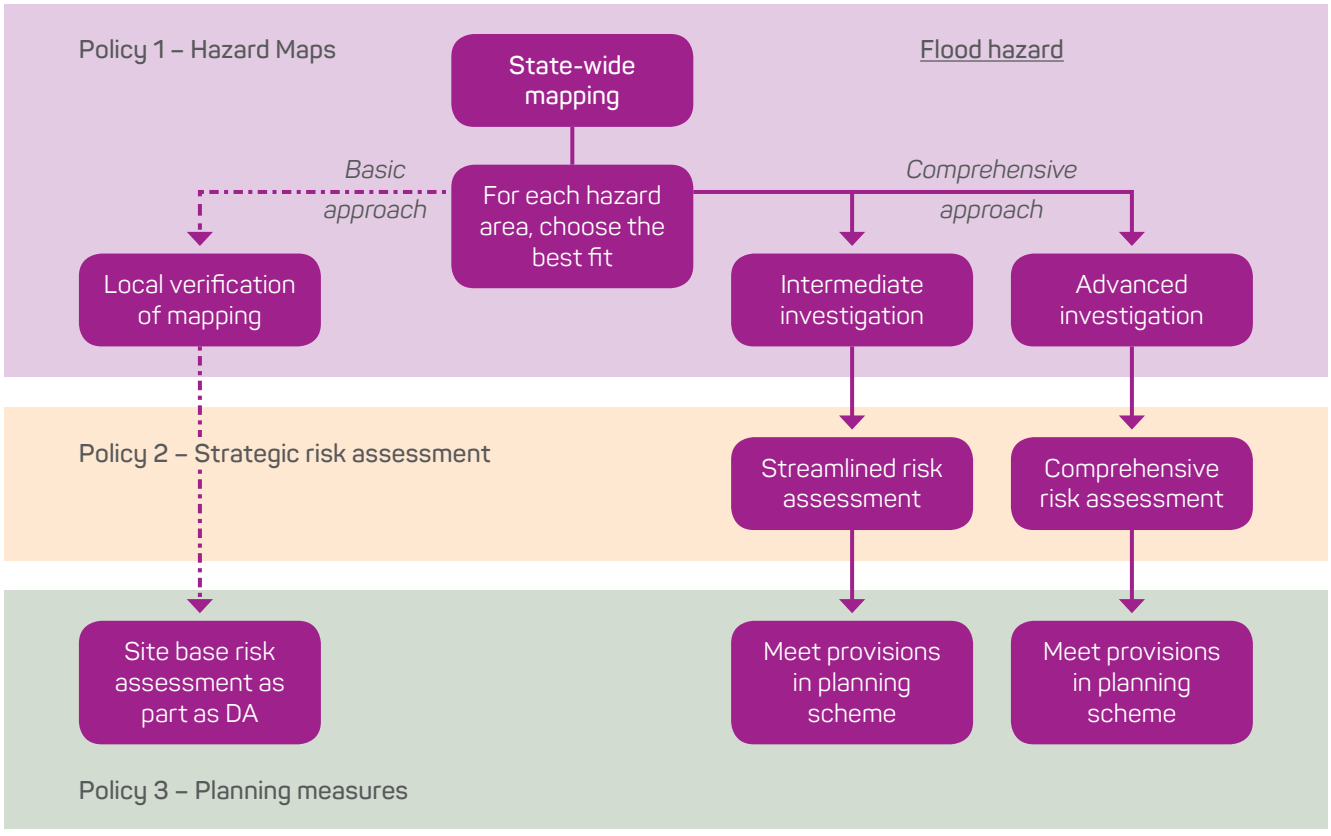
A flood investigation provides a solid foundation for effective floodplain management by incorporating several key factors, including consultation with communities, and involvement from local councils and other relevant agencies. Investigation of hydraulic and hydrologic information allows for a comprehensive understanding of the [catchment name] and its reaction to flooding events of varying magnitudes. A flood investigation also identifies aspects of flood behaviour specific to a particular location and allows for the potential implementation of better management measures in the council's flood action plan specific to that area.

Alternative text: |Queensland|

The Department of State Development, Infrastructure and Planning is responsible for the state's interest in planning in flood-prone areas, and is contained in the State Planning Policy (SPP) for natural hazards. The SPP is applied across the state as councils develop and implement their planning schemes. The SPP state interest for natural hazards is that the risks associated with natural hazards are avoided or mitigated to protect people and property, and increase the community's resilience to natural hazards. The *State Planning Policy – State Interest Guideline: natural hazards, risk and resilience* (Qld Government 2014) supports the implementation of the SPP and must be read in conjunction with the SPP. The use of the guidance material by local government is optional – it does not form a statutory component of the SPP. The State Planning Policy – State Interest Guideline: natural hazards, risk and resilience Technical Manual (DSDIP 2014) is consistent with ADR Handbook 7.

The Department of Natural Resources and Mines (DNRM), in partnership with the Department of Science, Information Technology, Innovation and the Arts (DSITIA), undertakes flood mapping and analysis across a number of at-risk towns under the Queensland Flood Mapping Program. This mapping is made available to local government councils, and forms the basis for hazard identification and assessment (Figure 3).

Each council is required to undertake fit-for-purpose flood investigations in an evidence-based risk management approach, using the best information available to underpin decisions made in their planning schemes or at the time a development application is lodged. A comprehensive approach is recommended that seeks to achieve an acceptable or tolerable level of risk, where the spatial extent of the flood hazard overlaps significantly with areas of planned development.



Source: Figure 1, DSDIP (2014)

Figure 3: Flood hazard investigations and land-use planning and development under the State Planning Policy – Technical Manual fit-for-purpose approach to natural hazard studies and risk assessments

4.2 Objectives of this study

At the end of this section of the generic brief, the aims and high-level objectives of the project should be clear.

Section 2 of the generic brief states what the project will achieve in relation to flood risk management within the study area and how it more broadly fits within flood risk management in the principal's domain. It gives the tenderer context for the deliverables and methodology and allows them to tailor their proposal to suit. This section answers the question 'What type of study is this?' A data collection, flood study, floodplain management study, floodplain management plan or some combination?

This section should provide high-level objectives in the context of the Flood Risk Management Framework (refer to Figure 1) and should not be used to list outputs or deliverables. This section answers the question 'What will this study achieve?', not 'How will it be achieved?' (scope of work) or 'What outputs should be delivered' (deliverables).

This section also allows the project end users to be identified and any key considerations regarding those end users (see ADR Template 7-4 Table 1).

The generic brief provides options for some of the paragraphs that are intended to cover the different circumstances. For example, Alternative text 1 describes the components of a flood study, whereas Alternative text 2a and 3a, describe the components of a floodplain management study and plan or review and Alternative text 4a provides for a review of a completed floodplain risk management study.

Refer back to Figure 1 to see the relationship between the different elements.

[Alternative text 1: Flood study/combined (e.g. a flood study combined with a floodplain management study)

This project involves conducting a flood study, which is a comprehensive technical investigation of flood behaviour that provides the main technical foundation for the development of a robust floodplain management plan. It aims to provide a better understanding of the full range of flood behaviour and consequences in the study area. It involves consideration of the local flood history, available collected flood data, and the development of hydrologic and hydraulic models that are calibrated and verified, where possible, against historic flood events and extended, where appropriate, to determine the full range of flood behaviour.]

And/or

[Alternative text 2a: Floodplain management study and plan/combined (e.g. a flood study combined with a floodplain management study)

The project extends the flood study to a floodplain management study and plan, allowing an increased understanding of the impacts of floods on the existing and future community. It also allows testing and investigating practical, feasible and economic management measures to treat existing, future and residual risk. The floodplain management study will provide a basis for informing the development of a management plan.]

And/or

[Alternative text 3a: Floodplain management plan/combined (e.g. a floodplain management study combined with a floodplain management plan)

The floodplain management plan will document and convey the decisions on the management of flood risk into the future. Drawing on the investigations undertaken as part of the floodplain management study, the plan will outline a range of measures to manage existing, future and residual flood risk effectively and efficiently. This will include a prioritised implementation strategy, what measures are proposed and how they will be implemented.]

And/or

[Alternative text 4a: Floodplain management study and plan review

The project will review the existing floodplain management study and plan, to enable an understanding of the impacts and changes in flood behaviour due to physical alteration of catchment characteristics such as construction of flood mitigation works or extensive new development in the catchment or to re-examine flood behaviour in light of new information, such as from a flood event. It also involves reviewing existing recommended management measures as well as testing and investigating practical, feasible and economic management measures to treat existing, future and residual risk. The revised floodplain management study will provide a basis for informing the development of a new floodplain management plan.]

And (with 2a), to be added to the bullet points in the same section

[Alternative text 2b: Floodplain management study/combined

- selection of practical, feasible and economic measures for treatment of risk,
- development of a floodplain management plan.]

And (with 3a), to be added to the bullet points in the same section

[Alternative text 3b: Floodplain management plan/combined

- development of a prioritised implementation strategy.]

4.3 Background and study area

When completed, this section of the generic brief will include eight to nine paragraphs and a comprehensive figure of the study area, which will provide key background and study area context.

Section 3 of the generic brief provides essential background to the tenderer, key figures and statistics on the area, and a definition of study area. Key paragraphs to be included are:

- **Paragraph 0: Summary of key drivers for undertaking the study.** For example, flood event, changes in floodplain, new mitigation works, significant changes in catchment e.g. development, changes in hydraulics / hydrological methods, other factors that may result in need to undertake a study or revision of a study which can be many and varied.
- **Paragraph 1: Study area overview.** Summary of the town/area of interest, study area location in the catchment, major hydrological features, flood history and so on. This section may refer to past studies, but a comprehensive list of references should be provided in Table 2 of the generic brief.
- **Paragraph 2: Catchment description.** Catchment size, waterways, geographic features such as topography (e.g. steep upper sections, flat floodplain), soils and any flood-dependent ecosystems (e.g. wetlands). What features influence flooding in the catchment? Is development sparse or dense? Is there development pressure and is this significant?
- **Paragraph 3: Study area political context.** Public administration context description (local government, catchment management authority), population, towns, land uses and development. Is the study focus local government area wide, catchment wide or a single town? Note that decisions made in Section G3.6 will assist with developing this paragraph.
- **Paragraph 4: Description of flood behaviour.** A broad description of the flood behaviour in the study area. Flood situation and what is known about flooding in the area, such as:
  - Is it overland, riverine and/or influenced by oceanic inundation?
  - Is there a lot of warning time, and does the catchment respond rapidly?
  - What is the flooding duration (hours, days, months)?
  - Are there flooding hot spots in the study area?
  - Are there areas subject to groundwater flooding, where the water table can rise above the surface of the ground and pond for periods of time?

This paragraph should also identify frequently inundated areas and exacerbating factors (e.g. blockage, high tides, antecedent conditions, and natural or constructed hydraulic controls, including dams and bridges), as well as coincident tributary flooding.

- **Paragraph 5: Description of flood history.** An overview of the area's flood history, including:
  - a description of the most recent events and the largest recorded events (in terms of their peak height or flow)
  - areas of inundation
  - impacts on the community (e.g. damage to property and community facilities, loss of life, areas cut off, disruption to community function, photos/video availability)
  - any notable occurrences (e.g. levee was overtopped, dam was full, bridge was blocked and/or overtopped).

A succinct overview of relevant findings from previous studies (to be listed in Table 2 of the generic brief) should also be included where relevant.

- **Paragraph 6: Description of emergency management situation** should answer questions such as:
  - Does the type of flooding limit the response to, preparation and clean-up rather than response/evacuation?
  - Is the planning time constrained, by either a flash flood or where warning is hours rather than days, and is a coordinated response by emergency services infeasible or unlikely?

- Is there a significant amount of warning time available, and is coordinated evacuation a possibility?

The need for logistical information in relation to timing for emergency management can have a significant impact upon the sophistication of modelling and the scope of work required.

- **Optional paragraph 7: [Preferred Modelling Software]** If you are proposing to use particular modelling software, either because it was used in earlier modelling or it is required to be compatible with systems used by the end users, please insert a statement as why there is a preference for it. The full details of output software requirements should be included in Table 14 in Section 7 of the generic brief, which should be referred to in this paragraph.

- **Paragraph 8: How are the outcomes going to be used?** This paragraph can assist the tenderer to understand how the outcomes of the study are going to be used so that this can be considered when determining the methodology and recommending the outputs needed from the study. This paragraph should refer to Section 2 of the generic brief and refer to the range of end users.
- **Figure 1:** It is important to include a clear figure of adequate resolution to describe the study area and key features, such as waterways, towns, roads, bridges and key infrastructure (e.g. weirs, levees, reservoirs, dams). It should include an overlay aerial image or cadastral information. The figure should include a legend of all items shown on the figure. A4 size should be the minimum.

4.4 Available information

This section of the brief outlines the information available on previous studies, local policies and plans, available data, and third parties who may also hold data. It enables you to complete Tables 2 to 5 in section 4 of the generic brief.

Reference documents and data available for use in the study should be listed in Section 4 of the brief. The principal is encouraged to compile relevant data before tendering, so this information can be considered in writing the specification, and be available as a reference to inform both the tendering process and the study itself. Having the information available electronically on request is recommended. Access to detailed information:

- allows the tenderer to better scope the project and to build upon rather than replicate existing work
- reduces the potential for rework or variations that could have otherwise been avoided if key information comes to light during the project
- can inform the tenderer's recommended methodology for the project and modelling software choice.

Using tables in this section of the generic brief provides the clarity needed for such a detailed listing. To assist the tenderers, any documents referenced should include title, author and year of publication.

In Table 2 of the generic brief, there is an opportunity to describe previous studies that have been undertaken. These could be:

- studies to collect data
- earlier flood studies or other investigations
- Floodplain management studies, or other studies into mitigation works and other relevant structures on the floodplain
- any other relevant studies including studies into coastal inundation and erosion, estuary management and stormwater systems.

The tenderer will need to be aware of these studies, if it is possible that they could impact on the scope of work of the project.

Where other relevant third-party studies are known to exist (e.g. flood study for upgrade of a main road in the study area), the principal should try to make these available for tendering. Where this is not possible, the principal should add thirty-party and document details to Table 5 of the generic brief.

Table 3 in the generic brief should be completed to ensure that the tenderer is familiar with some of the end uses of the project outcomes or outputs. Types of documents to be included are:

- Land-use policies. These can usually be sourced from the relevant state/territory or local government. They can include statutory planning instruments, regional and local planning strategies, local flood-related policies that outline strategic planning directions, and specific flood-related development controls for land.
- Emergency management plans. These can usually be sourced from the emergency service provider or local council. They help determine how emergency management agencies respond to a flood event.
- Local design standards. These may include relevant information on design standards infrastructure. Where available, they may be able to be sourced from the relevant local council.
- Other relevant policies and plans. These may include for example management plans for entrances of waterways from the ocean.

Table 4 in the generic brief should include a listing and description of known (and compiled) existing data. The identification of existing data allows tenderers to make informed decisions about approach and methodology, and allows reasonable estimates of time for additional data collection or amalgamation of existing datasets. Table 4 in the brief may include the following types of data:

- Any information the principal or any other organisation has on historical floods – for example, flood photography or videos, flood height marks, flood extents, anecdotal evidence and damage reports. This should include access to any information made available to the community on flooding.
- Hydrologic data the principal or any other organisation is in possession of, such as stream flow records, rating curves, rainfall records, ocean and water level data, and rainfall gauges.
- Any survey data the principal or any other organisation has available for use in the study – for example, DEMs or LiDAR data, creek/river cross-sections or hydrosurveys, location and dimensions of drainage assets, and floor levels.
- Any survey data the principal or any other organisation has that describes current or previously existing structures (e.g. bridges, culverts, weirs, levees, irrigation channels, dams, developed areas). Asset management information systems may assist.
- Geographic information system (GIS) layers the principal or any other organisation has, including cadastral layers, waterways, natural environment areas, street names, roads and land-use planning areas.
- Existing hydrologic and hydraulic models, and associated files. It is important to provide advice on which previous studies (Table 2 of the generic brief) these models supported.

Table 5 in the generic brief provides an opportunity to list the range of other organisations (both government and private) that may hold data relevant to the study and who should be contacted as part of the study.

4.5 Current guidelines and references

This section of the generic brief provides guidance on completing Table 6 in Section 5 of the generic brief, which provides a list of key guidance and reference documents for the study.

A range of documents and guidelines exist across Australia that guide best practice in this field. They may apply nationally, such as ADR Handbook 7 and the current version of Australian Rainfall & Runoff (ARR), or be limited to a jurisdiction, local government or an FME.

Table 6 of the generic brief lists key documents that need to be considered or adhered to in completing this study. Examples are provided, and this section can be tailored for the appropriate jurisdiction or study. For example, in New South Wales, the Floodplain Development Manual (NSW Government 2005) is consistent with ADR Handbook 7 (AIDR 2017) and both documents should be listed.

Some guidelines may be specific to the study type. For example, jurisdictions may have specifications for the acquisition of LiDAR data like the Standard LiDAR product specifications (LPMA 2010). In addition, organisations may want to submit outputs to the National Flood Risk Information Project (NFRIP) and, therefore, GIS data should be consistent with the NFRIP guide (in this case, the relevant guideline should be included in Table 6 in the generic brief). These specifications should be referenced and followed to avoid unnecessary rework.

4.6 Scope of work

This section (section 6) of the generic brief, when completed, will detail the scope of work for the study. It will be made up of a range of standard and optional sections depending on the study needs.

The scope of work (generic brief Section 6) generally outlines how the objectives will be achieved and any specific methodology that should be adopted. It is preferable to allow tenderers to propose a fit-for-purpose methodology that will achieve the requirements of the study, and will use their experience and expertise within the bounds of current best practice. Restrictions can be placed on the proposed approach; however, this may exclude some tenderers, result in misapplied methodologies and can be more costly for the principal.

The scope of work section of the generic brief follows an almost-linear progression through the project and can be customised for a range of different study types. Deliverables should not be listed in this section, but rather outlined in Section 7 of the generic brief.

Based on the scope of work selections made, a typical list of deliverables needs to be developed and inserted into Table 14 of Section 7 and the cost schedule line items and reporting items updated.

The following sections describe the content and content options and alternatives for the scope of work section.

4.6.1 Data collection and review

This section should generally be included in all study types; the scale of the data collection exercise will depend on what has previously been undertaken. Completing the tables in Section 4 of the generic brief will help the tenderers to determine the scale of the data collection exercise that will be required.

An optional inclusion is a statement about an existing data collection study completed specifically for the current study. It should be noted that at least a review of these data should be done as part of the current study.

The section may also be used to describe the scope of a data collection study – a stand-alone study that precedes a flood study being undertaken. If it is to be used for this, most of the remaining contents of the scope section in the generic brief should be removed.

Specifically, any reference to hydrologic analysis, hydraulic analysis, modelling events, model calibration and validation, and model parameter sensitivity should be removed, and information on the site visit and consultation should remain.

|Optional text – Data collection study already completed and is listed in Table 2|

[Name of data collection study, author] was completed in [month year] and collected data necessary for the current study.

The data collection report, as well as the data collected, [is available for review during the tendering process and] will be supplied at the start of the study.

This section also includes general clauses regarding approval for additional work items.

Topographic survey

A topographic survey may be required for a range of study types for use in developing a DEM or hydraulic model, or to estimate flood damages. The cost of a survey can be a reasonable portion of the study cost and, therefore, it is important to understand what data are available that could assist the study. If existing relevant topographic data are available, these should be listed in Table 4 of the generic brief.

Where topographic survey is known to be required or is likely to be required, an optional clause can be included to cover this as part of the project scope. This will guide the principal in setting an overall project budget. In the case that they exist, the inclusion of this section may generate a deliverable about historical flood levels or information. If this is the case, an item should be included in Table 14 of the generic brief.

|Optional text – Study requires topographic survey collection|

A topographic survey of watercourses and the adjoining floodplain (if necessary) is required, for the purposes of hydraulic modelling. Additional survey of structures such as bridges, culverts and road levels is required if they are likely to control or significantly influence flood behaviour and up-to-date, detailed information for these structures does not exist. If applicable, relevant stream water level gauges should be identified and surveyed. Watercourses to be specifically modelled are shown in [Figure 1].

Following engagement and a detailed inspection of the study area, the successful consultant shall submit to the principal a brief outlining details of the survey required, as well as an upper limit fee to undertake this portion of the work.

Following receipt of written approval from the principal, the consultant shall arrange for the survey to be undertaken. The consultant shall be responsible for the engagement and supervision of the approved sub-consultant to complete the work. The consultant is also responsible for ensuring any data used is fit for purpose.

And

|Optional text – LiDAR acquisition|

LiDAR survey data are to be obtained as part of the study. The LiDAR will be the primary source in defining the catchment's topography. It is to be of appropriate resolution for use in defining the hydraulic features of the catchment and is to be captured in accordance with the relevant guideline listed in Table 6. The cost of the LiDAR survey is to be included as an additional, separate item on the proposed cost schedule.

Other general clauses are included in the generic brief regarding costing, alternative methods, aerial collection specification and datum.

Digital elevation model development

The acquisition of large-scale LiDAR survey data is becoming far cheaper – making it more common to use in many flood-related studies. The development of a DEM from these data and other more traditional field survey data can be an extensive exercise that has traditionally been lumped as part of hydraulic model development costing item. Specific software is often required to combine these data to build a DEM and it is becoming more common to engage a specialist to undertake this task. When this is the case, it can make comparison of tender pricing difficult. The generic brief has allowed for this item to be optionally separated out, making price comparison simpler and allowing tenderers to either undertake the task in-house or use an external specialist. Inclusion of this item will also require the inclusion of a cost schedule line item and associated deliverable.

|Optional text – digital elevation model (DEM) development|

The methodology proposed to develop the digital elevation model (DEM) should be identified. The tenderer should identify realistic costs for undertaking this task either in-house or by a specialist sub consultant. This does not include data acquisition.

Survey for flood damages assessment

Where the scope of work in sections 4.6.10 and 4.7 includes an estimation of flood damages, a survey of floor levels may also be required. These can be obtained by a variety of methods, each with different accuracy that may inhibit their use for other purposes. For example, an estimated floor level (derived via a drive-by method or average above-ground method) may be of a suitable accuracy for a study area wide flood damages assessment. However, it would not be suitable for use at an individual property level.

It is important to consider the identified end users and the potential future use of these data (e.g. provision to the individual as part of community education or a service provided by the principal, or provision to insurers) so that the proposed methodology can reflect this.

Where survey is required for flood damage assessment, an optional clause needs to be added to the brief. Two alternative options are provided to cover different capture methods of different levels of accuracy.

Where survey for flood damages is included, it is important to include flood damages assessment in the scope of work as outlined in Section 4.6.10.

|Optional text – Study requires floor level survey|

To assess the cost of flooding on the community, a realistic estimate of the associated survey requirements and costs must also be provided. The consultant should consider the proposed end use of this information, and outline the proposed methodology and any limitations on the accuracy of this methodology relative to these uses. These limitations also need to be incorporated into the final report.

And

|Alternative text 1 – Detailed floor level survey|

The end users identified for this study require a detailed and accurate estimate of floor levels. Typical data to be collected include both survey information (lowest habitable floor level, ground level at dwelling, ground level at kerb near entry) and other property-specific information (type of house construction, number of floors, relative size, etc.). This information should be collected by a registered surveyor. Deliverables should meet the requirements (including relevant coordinate system) and be consistent with the format specified in Table 14.

Or

|Alternative text 2 – Estimated floor level survey|

A floor level survey done as part of this study will be used to assess the relative cost of different events and flood situations. The data are not required by any other identified end users. Typical data to be collected include both survey information (lowest habitable floor level, ground level at dwelling, ground level at kerb near entry) and other property-specific information (type of house construction, number of floors, relative size, etc.). This information may be collected by estimate methods. Deliverables should meet the requirements (including relevant coordinate system) and be consistent with the format specified in Table 14.

4.6.2 Site visit

A site visit should be undertaken as part of all studies. This gives an opportunity for the principal and the tenderer to inspect the study area, identify any potential issues and highlight areas of interest. The tenderer may end up undertaking a study that lacks context if a site visit is excluded.

4.6.3 Consultation

Consultation requirements vary significantly between studies depending upon their scope, likely community concerns relating to the study outcomes and any associated management options, and the principal's general community consultation processes. These are all factors used to decide how to engage the community, noting that the potential needs of community consultation may change during the study. The principal should provide an outline of the way in which they expect consultation to be undertaken, so that this can be considered in tendering for the project. However, it is important to be flexible as the study progresses to allow for changing needs.

In some cases, it may be prudent to cost several alternatives as part of tendering. Alternatives may not be part of the upper limit fee, but used to provide a reference for variations if needed. All items that require costing (included or excluded from the upper limit fee) should be included as line items within the cost schedule. Cost schedule line items, scope description and deliverable (including reporting) should be added based on selections made from the community consultation options.

Community consultation

Community consultation has an important role in all flood-related studies. The aims of the community consultation program are:

- to inform the community about the study
- to allow the consultant to identify community concerns, by enabling the community to provide input and comment on the modelling results, and identification of flood issues and potential management options.
- to gather information and data from the community by participation, to provide input data to the calibration/validation process and comment on the modelling results
- to develop and maintain community confidence and collaboration with the study results, by providing the opportunity to comment on the modelling results, options identified and study outcomes.

These principles are in line with that of the *Australian Disaster Resilience Handbook 6 National Strategy for Disaster Resilience: Community Engagement Framework* (AIDR 2013).

Consultation points and program

Depending on the needs of the study, consultation and collaboration with the community may be required at various stages or points throughout the study. Although a complex study may involve consultation at several points throughout the study with various tools, a more simplistic study may involve only one or two points with the use of more simple tools. Common consultation points may include:

- commencement – collaborate on purpose and need for the study
- early stages – consult to collect flood-related information
- historic and design event modelling – consult to gather feedback on modelled flood behaviour compared with observed flood behaviour,
- identification of flood risks – consult on the flood risk identified by the study to support community understanding and acceptance of current risks
- management option identification and assessment – collaborate on the identification and assessment of options to support the community to have informed input on flood risk management options, and to consider their benefits and costs
- public exhibition – inform the community on the recommended outcomes of the study to support finalising the study.

Table 7 of the generic brief provides the opportunity for the principal to identify the relevant points of consultation and the tools (see 'Suggested tools') that are considered relevant for that particular consultation point.

The level of any community consultation program also needs to consider the type of flood situation, the community and the scale of issues present. The principal is generally well placed to guide the scale of program required, since they understand:

- who the key strategic decision makers are
- what issues are negotiable with the community
- likely stakeholder and agency interpretation of the issues or concerns
- the preparedness of people to engage
- the likely resources required to undertake the engagement.

Suggested tools

The following is a suggested list of tools that may be used to achieve the outcomes of the community consultation program. The list is quite exhaustive and it is common for only a few of the tools to be used in any one study. The optional text may be included in the generic brief to describe the tools included for different consultation points as outlined in Table 7:

- For a study that is expected to have a range of issues, a very vocal community or a large community, you may wish to engage a community consultation specialist to design and develop a program for the study. For a tailored study program, it is ideal for the principal to understand the issues and requirements before the study starts. A community consultation specialist can be a costly addition to a project, and it is important that their focus meets the principal's and study area's needs.

|Optional text|

A community consultation specialist is required to design and develop a consultation strategy and implementation program for this project.

- A community questionnaire achieves a number of objectives, including informing the community about the study, seeking data and information, and providing a mechanism for feedback on management measures or study outputs. It can be combined with a newsletter.

|Optional text|

A community questionnaire is to be sent to [flood affected/all] landowners and residents in the study area, informing them about the study objectives and requesting any information they may have on historical floods. The survey is to be [sent in the post/ provided as an online questionnaire/both sent in the post and provided as an online questionnaire].

- In the case of posted material, it should be clearly stated if those costs are to be included in the tenderers' price or if it will be borne by the principal.

A community newsletter can inform the community about the study and its outcomes, as well as advertise other methods of consultation such as an online questionnaire or community information session. A newsletter may also be sent to a wider area of the community for information purposes. Other methods that achieve similar outcomes to a newsletter include a media release, an interest article about the study area flood history linking to the current study, letters to key stakeholders or those on a specific consultation list.

|Optional text|

A community newsletter is to be sent to [flood affected/all] [landowners and residents/landholders/ residents] in the study area, informing them about the study objectives or outcomes. The newsletter is to be [sent in the post/available for download/available from the principal's information centre].

- A project-specific website achieves a number of consultation objectives, including informing, and seeking input and comments. It can provide regular updates on the project without the need for wide-scale media/mail blasts. A website also provides a portal to download relevant study documents and can be linked to online questionnaires.

|Optional text|

A project website should be established by the consultant and hosted [on their own server/on the principal's server]. It should contain functionality for regular updates, document download and comment. The consultant is to regularly update the website throughout the project.

- A media release providing information on the study informs the general community and provides a public record. The media release may be at one or multiple points in the study – for example, at the study start, at the same time as a newsletter or questionnaire, before any public meetings or information sessions, when the study is placed on public exhibition, or when the study is finished.

|Optional text|

The consultant is to prepare a media release with key facts about the study to be sent out [at the commencement of the study/in unison with any newsletter/questionnaire mail outs/ when the study is placed on public exhibition/ when the study is finished].

- Information about the flood study disseminated on social media can access parts of the community not exposed to traditional media outlets. Information, which will generally resemble that presented in a traditional media release, can use existing social media channels managed by the principal. Commonly used social media includes Twitter and Facebook.

|Optional text|

The consultant is to provide information on the study via social media on the study at key stages in the study, such as at the start of the study or in unison with other community consultation. Information will be provided to the principal, who will then manage its distribution via its preferred social media platforms.

- Smaller, targeted meetings provide a mechanism to consider the individual concerns of key individuals or groups. These may be identified landholders, key interest groups, or other stakeholders. Smaller, targeted meetings are a very effective tool for including those with difficult issues.

|Optional text|

The consultant is to hold [number] of smaller, targeted meetings with key project stakeholders.

- Public information sessions provide a forum to inform the community about the study and its outcomes, as well as gather data and information. They can be held at various stages throughout the project.

|Optional text|

[Number of information community sessions] information sessions held at key stages in the study, aimed at informing residents about the study progress and gathering information on historical flood events.

- A study may have a jurisdictional requirement to be placed on public exhibition for viewing. This and other associated tools may be required as part of a consultation program.

|Optional text|

As part of the consultation program, the study report should be placed on public exhibition and be available for viewing for a period [that is equal to or exceeds the jurisdictional minimum requirements].

- During a public exhibition period, the principal may require a public presentation or display of the project outcomes. This is an effective tool for delivering the key summary outcomes of the project.

|Optional text|

The consultant is to hold [number] of public presentations during the public exhibition period.

|Optional text|

The consultant is to prepare public display material for presentation at a location of the principal's choice during the public exhibition period.

- If there is a preference to use a tool that is not included in this list, it may be added when preparing the brief. Less common methods of communication are not discouraged; however, their purpose and method should be clearly described.

|Optional text|

[Other consultation tool].

Other key stakeholders

Consultation with other key stakeholders is an important aspect of the consultation process. These stakeholders may overlap with identified end users, but may also be an active group related to the community and government that support flood risk management in the jurisdiction. The following is a list of possible key stakeholders:

- key community groups
- other technical officers at the principal
- principals from relevant neighbouring areas within the catchment
- jurisdictional government representatives from relevant agencies.

Table 8 of the generic brief should include a list of key stakeholders for consultation.

4.6.4 Hydrologic analysis

This section guides the scope of work required as part of the hydrologic analysis. The scope will depend upon the availability and adequacy of existing data, which should be listed in Table 4 of the generic brief. For example:

- stream water level gauge information that is available in the catchment
- hydrologic models that are available from previous studies.

There are a number of options for a hydrologic analysis, depending on previous work and available data, and their adequacy for the intended purpose. For example:

- the adequacy of an existing hydrological model for use in this study
- the availability of adequate stream flow gauging records in the catchment, which may make flood frequency analysis a viable hydrologic method.

The choice of hydrologic model and its schematisation may be affected by distinct hydrologic features in the catchment that the principal is aware of. Table 9 of the generic brief should incorporate these features. Examples may include a stream gauge that has been shut down, moved or started; notable changes to the land use or vegetation in the catchment between historical events and the current time; or the construction of a dam or reservoir in or upstream of the catchment.

More information on each of the methods is available in Section 11.3 of ADR Handbook 7. The tenderer should demonstrate that their proposed software is an industry standard package. This will assist future use of the model by the principal or future consultant.

The generic brief allows for a number of situations in relation to a previous hydrologic analysis, whether the analysis should be adopted as is following a fit for purpose review or whether update or extension is required.

|Optional text – Previous hydrologic analysis exists and should be adopted|

[Report/reference] listed in Table 2 of the brief undertook a hydrologic analysis of the study area and is proposed to be used for this study. A review of the analysis and model, and their appropriateness for use should be undertaken in the initial stages of the study

The hydrologic model is available for use during this study if considered fit for purpose by the consultant.]

And

|Optional text 1a – Previous hydrologic analysis will require update|

[The project scope assumes the model will require an update and extension to meet the needs of the study. This should be incorporated in the base cost estimate of the proposal.]

And

|Optional text 1b – Included for any case where an existing hydrologic analysis exists|

[Following review of the documents available as part of the tendering process, should the consultant identify that it is likely that the model would not be considered fit for purpose, the consultant's proposal is to incorporate the indicative additional costs associated with the development and calibration/validation of a new hydrologic model. Reasoning should be given why the model is not considered fit for purpose and how the proposed model would meet the objectives of the study. These indicative costs should be included in the cost schedule.]

In 2016 the Bureau of Meteorology released in conjunction with the update to ARR 2016 new intensity frequency duration (IFD) data across the whole country. During the early implementation of the IFD data, it may be necessary in some catchments to compare the new IFD data to at site gauge data in order to understand if any significant bias exists. This is particularly relevant for coastal catchments where there are known rainfall extremes or concerns with the new IFD. This can be included in the scope of work by including the following paragraphs.

|Optional text – Comparison of 2016 IFD data to at site gauge data|

[To determine if there is any significant bias between "at site" gauge data and BOM 2016 IFD it is necessary to compare the two. For the IFD duration nearest to the catchment response duration and 5 durations either side compare the 2016 IFD and the annual maximum series extracted from each gauge for each duration. The "at site" data should be plotted using standard flood frequency plotting position formula and compared to the 2016 IFD. If the record is short the partial duration series can be used instead of the annual duration series after appropriate conversion to AEP.

It is not unexpected that individual gauges will show some bias as the approach used to pool data for 2016 IFD estimates will generally be more correct than an individual gauge. However, where a significant bias is found between multiple gauges and the 2016 IFD the consultant should recommend an approach to consider this issue. In general, where 2016 IFDs are higher or similar to "at site" data the 2016 IFDs would generally be used. However, where "at site" data of multiple gauges are significantly higher than the 2016 IFDs, consideration should be given as the whether the application of a local correction factor or the use of "at site" data may be appropriate in the study. The consultant is to report on the comparison and any associated recommendations.]

The generic brief includes text for alternative hydrologic analysis methods including:

- existing hydrologic model/information
- rainfall-runoff routing
- regional methods
- flood frequency analysis
- direct rainfall.

More information on each of the methods is available in Section 11.3 of ADR Handbook 7 and ARR 2016.

ARR 2016 recommends that the design estimates be compared to an alternative method and therefor two of the above methods should be selected.

In the case that an existing hydrologic analysis exists these paragraphs can be used to describe the method previously used, this will assist the tenderer in preparing their response.

Either

|Alternative text 1 – Rainfall-runoff routing|

Given the scope of the study and the likely hydraulic modelling and outputs required, an appropriate computer based rainfall-runoff routing model is suitable for this study. The chosen modelling software should be detailed, including a description of its capability to represent all significant features of the catchment. The extent of the rainfall-runoff routing model shall be sufficient to establish reliable boundary conditions for input to the hydraulic model covering the study area.

And/Or

|Alternative text 2 – Regional methods|

Given the available data, scope of the study and outputs required, a regional method, or a regional method with a small amount of local data, is suitable for this study. Regional methods should not be used for the calibration of other models. Examples of this are using the ARR Project 5: Regional Flood Frequency Estimation or using the ARR Project 5: Regional Flood Frequency Estimation method with a short record (e.g. five years) and a Bayesian maximum likelihood approach (e.g. TUFLOW FLIKE).

And/Or

|Alternative text 3 – Explanatory text to be included if principal believes a flood frequency analysis is viable|

The length of recorded gauged flow in the catchment makes it suitable for a flood frequency analysis. Historical records of gauged flow are available at the stream water level gauges detailed in Table 4 of the brief. A flood frequency analysis will draw on the extensive hydrologic record of the area and provide a reliable estimate of peak flow for design events at the gauge location(s). The flood frequency analysis should be undertaken in accordance with the procedures outlined in ARR.

Details of the rating curves available and used in the analysis should be documented.

And/Or

|Alternative text 4 – Direct rainfall method|

Given the flood behaviour, scope of the study and outputs required, the direct rainfall method is suitable for the study. The method, which applies rainfall directly to grid cells in the hydraulic model, is applicable across various catchment types. It is often used when the catchment terrain is flat, when there are cross-catchment flows or when the study is on a detailed urban area. The chosen modelling software should be detailed, and consideration should be given to the limitations of the approach and the appropriate checks required.

For broad brush assessments direct rainfall should only be run with a single temporal pattern. In most cases an ensemble should be run with the direct rainfall method. The design results should be determined by selecting the mean water level from the ensemble results. Given the extreme differences between direct rainfall models and rainfall runoff routing models, a representative temporal pattern cannot be determined using a rainfall runoff routing model and then be applied to a direct rainfall model.

Guidelines on the use of direct rainfall models are given in ARR and associated project report Project 15: Two dimensional simulations in rural and urban floodplains. In all cases a number of checks should be carried out including comparing the model response for large and small design floods to rainfall runoff routing models over small sub-areas, major subareas and the whole catchment. The outcomes should be documented, including for the same design inputs the comparison should compare peak flow, response time, runoff volume and hydrograph shape.

Further optional text is provided for optimising the above alternatives, including:

- combination of regional method and rainfall-runoff routing
- combination of flood frequency analysis with rainfall-runoff routing.

|Optional text 1a – Combined regional method and runoff routing|

One or more gauges in the catchment have a very short length of record or are not considered reliable for the selection of appropriate model parameters. It is likely that other gauges in the region are more representative and provide a more reliable basis for guiding the selection of model parameters. Regional parameters developed via regional methods should be adopted for use in rainfall-runoff modelling.

Or

|Optional text 1b – Combined flood frequency analysis and runoff routing|

Design flood estimates are to be adopted based on the results of the flood frequency analysis and rainfall-runoff modelling. Rainfall-runoff model parameters should be adjusted to fit the adopted design flood estimates.

The generic brief allows for the methods described as part of ARR 2016 to be included as part of the scope. There are three basic approaches to hydrologic modelling that can be used, they are referred to within the generic brief as simple, ensemble and complex. For most studies the ensemble approach represents the best balance between complexity and reliability. The simple approach is only recommended for quick broad brush assessments and is generally not appropriate for setting building controls. Advanced approaches represent the next step in flood estimation, Monte Carlo approaches will generally only be used for complex high risk studies.

Either

|Alternative text 1 – Simple hydrologic approaches|

[The hydrologic analysis is to use the simple hydrologic modelling approach outlined in Australian Rainfall and Runoff 2016. This approach relies on selecting a single representative temporal pattern for each event duration. The single representative temporal pattern should be the median from the Australian Rainfall and Runoff 2016 design inputs from the Australian Rainfall and Runoff data hub. The method for selecting the representative pattern will need to be documented.]

Or

|Alternative text 2 – Ensemble hydrologic approaches – best balance for most studies|

[The hydrologic analysis is to use the ensemble hydrologic modelling approach outlined in Australian Rainfall and Runoff 2016. This approach relies on selecting an ensemble of 10 and in some cases 20 temporal patterns for each event duration. The design flow at key locations should be calculated by the averaging the flow from the ensemble for each duration. These key locations should be areas within the catchment where the hydraulic model is to be set up including inflow locations to the hydraulic model and those locations further downstream within the hydraulic model where tributaries combine]

Or

|Alternative text 3 – Complex hydrologic approaches – used in limited circumstances where advanced techniques are required|

[For complex and important studies a Monte Carlo approach should be applied. The proposed Monte Carlo approach must be designed to capture the variability of the inputs that have been determined to have significant causal or interactive affects. The exact Monte Carlo approach adopted will depend on the circumstances and examples are given in a range of references listed in Table 6.]

4.6.5 Hydraulic analysis

This section guides the scope of work required as part of the hydraulic analysis. There are a number of options available depending on what work has been undertaken in the past, and what data and information are available in the catchment. The complexity of the required hydraulic analysis and end user needs should guide the selection of alternative text in this section.

As with the hydrologic analysis, the choice of model and its schematisation may be affected by features in the catchment that the principal is aware of. Table 10 in the brief should include a list of these features, and usually involve some kind of structure over the watercourse or floodplain – for example, bridges, culverts, levees, weirs, detention basins, reservoirs or dams.

The tenderer should demonstrate that their proposed software is an industry standard package. This will assist future use of the model by the principal or a future consultant.

The generic brief allows for a number of situations in relation to a previous hydraulic analysis, whether the analysis should be adopted as is following a fit for purpose review or whether update or extension is required.

|Optional text – Previous hydraulic analysis exists and should be adopted|

[Report/reference] listed in Table 2 undertook a hydraulic analysis of the study area and is proposed for use in this study. A review of the model and outputs appropriateness for use should be undertaken in the initial stages of the study in light of the project scope. The model is available for use during this study if considered fit for purpose by the consultant.

And

|Optional text – Previous hydraulic analysis will require update|

[The project scope assumes the model will require an update and extension to meet the needs of the study. This should be incorporated in the base cost estimate of the proposal.]

And

|Optional text – Included for any case where an existing hydraulic analysis exists|

[Following review of the documents available as part of the tendering process, should the consultant identify that it is likely that the model would not be considered fit for purpose, the consultant's proposal is to incorporate the indicative additional costs associated with the development and calibration/validation of a new hydraulic model. Reasoning should be given why the model is not considered fit for purpose and how the proposed model would meet the objectives of the study. These indicative costs should be included in the cost schedule.]

The generic brief includes text for alternative hydraulic analysis methods including:

- historical information
- 1D steady state
- dynamic 1D or coarse 2D
- dynamic 2D rural
- dynamic 1D/2D riverine
- dynamic 1D/2D overland.

The dynamic 1D/2D overland alternative includes a number of sub-options to define the complexity of the pipe network modelling. This would also be governed by the flood behaviour in the area.

More information on each of the methods is available in ADR Handbook 7 and ARR 2016.

In the case that an existing hydraulic analysis exists these paragraphs can be used to describe the method previously used, this will assist the tenderer in preparing their response.

Either

|Alternative text 1 – Historical information|

A range of detailed historical information exits for the study area. The scope and required outputs of the study mean that this information should be used to define flood behaviour. This method includes a combination of [historical flood extents/flood frequency analysis/ DEM/others] to define the [flood extent, levels and depths in the area]. A review of the available information and outputs appropriateness for use should be undertaken in the initial stages of the study.

Or

|Alternative text 2 – 1D steady state|

Given the scope of the study and outputs required, the size of the study area, and the nature of the waterways and their flood behaviour and flood risk, a 1D steady state model is suitable for this study.

The model type will represent the simple nature of flooding in this study area and provide key outputs such as flood levels, depths and velocities at key locations, in addition to flood profiles. This model type can also provide information inputs for a broad assessment of flood hazard and function for land-use planning purposes.

Or

|Alternative text 3 – Dynamic 1D or course 2D|

Given the scope of the study and outputs required, the size of the study area, and the nature of the waterways and their flood behaviour, a 1D (or coarse 2D) hydraulic model is suitable for this study, with dynamic time-varying inputs. This model type will represent the floodplain in sufficient detail to accurately simulate flow behaviour. Furthermore, a 1D (or coarse 2D) hydraulic model will produce spatial and temporal outputs to a level of detail that is appropriate given the range of end users and their varying needs.

In the case of 2D modelling, the proposed grid cell resolution should be sufficient to appropriately represent the features within the catchment, including the main channel. Guidance on this is provided in ARR Project 15: Two dimensional simulations in rural and urban floodplains.

Or

|Alternative text 4 – Dynamic 2D rural|

Given the scope of the study and outputs required, the size of the study area, and the nature of the waterways and their flood behaviour, a 2D hydraulic model is suitable for this study. This model type will represent the floodplain in sufficient detail to accurately simulate flow behaviour. Furthermore, a 2D hydraulic model will produce spatial and temporal outputs to a level of detail that is appropriate given the range of end users and their varying needs.

Or

|Alternative text 5 – Dynamic 1D/2D riverine|

Given the scope of the study and outputs required, the size of the study area, and the nature of the waterways and their flood behaviour, a 1D/2D hydraulic model is suitable for this study. This model type will represent the floodplain and flow paths in sufficient detail to accurately simulate flow behaviour in the hydraulic model. Furthermore, a 2D hydraulic model will produce spatial and temporal outputs to a level of detail that is appropriate given the range of end users and their varying needs.

The proposed grid cell resolution should be sufficient to appropriately represent the features within the catchment. Guidance on this is provided in ARR Project 15: Two dimensional simulations in rural and urban floodplains.

Or

|Alternative text 6 – Dynamic 1D/2D overland|

Given the scope of the study and outputs required, the size of the study area and the nature of the overland flood behaviour, a 1D/2D hydraulic model is suitable for this study. This model type will represent the floodplain and flow paths in sufficient detail to accurately simulate flow behaviour. The grid cell size selection should be suitable to define the overland flow in a relatively built-up environment. This may be limited by the accuracy of the topographic data, the stormwater drainage network and other hydraulic structures (and blockage of these), land use, and buildings. The consultant should consider these items when setting out their proposed methodology.

The proposed grid cell resolution should be sufficient to appropriately represent the features within the catchment. Guidance on this is provided in ARR and associated project report Project 15: Two dimensional simulations in rural and urban floodplains. Furthermore, a 2D hydraulic model will produce spatial and temporal outputs to a level of detail that is appropriate given the range of end users and their varying needs.

And, one of

|Alternative text 6a – All pipes in|

The drainage system is an important aspect of the management of flooding in significant events. The hydraulic model should include all drainage pipes. The consultant should test the sensitivity of the flood level when including all drainage pipes.

Or

|Alternative text 6b – Greater than minimum size pipes in|

The drainage system is an important aspect of the management of flooding in significant events. The hydraulic model should include all drainage pipes greater than [xx m]. The consultant should test the sensitivity of the flood level when adjusting the minimum size.

Or

|Alternative text 6c – No pipes in|

The pipe drainage network has a relatively minor capacity for the management of flooding. The hydraulic model does not need to include drainage pipes. The consultant is to advise if any drainage structures may significantly influence model results, which would therefore warrant their inclusion in the model. The consultant should test the sensitivity of the flood level if these drainage structures are to be included.

The generic brief allows for the methods described as part of ARR 2016 to be included as part of the scope. There are three basic approaches to hydraulic modelling that can be used, they are referred to within the generic brief as simple, ensemble and complex. For most studies the simple hydraulic approach coupled with an ensemble hydrologic approach represents the best balance between complexity and reliability.

An optional paragraph is provided associated with the simple hydraulic assessment that allows the sensitivity of the design flood estimates to temporal patterns to be determined.

Either

|Alternative text 1 – Simple hydraulic approach – best balance for most studies|

[For each duration a representative temporal pattern that produces flows similar to the mean should be selected for hydraulic modelling, this is generally the hydrological event just above the mean at locations where tributaries have combined. The selected event should be compared to the other ensemble event hydrographs and another pattern should be selected if the hydrograph is very different to the rest of the ensemble. Where none of the ensemble events are near the mean it is permissible to slightly scale the rainfall to match the mean]

And

|Optional text 1a – sensitivity of design flood estimate to temporal patterns|

[In addition the largest and smallest events are to be run though the hydraulic model to understand the sensitivity of design estimates to temporal patterns. This needs to only be done for the critical durations determined from the hydraulic.]

And

Optional text 1b – To be added for Direct Rainfall methods|

For direct rainfall methods the design results should be determined by selecting the mean water level from the ensemble results. Given the extreme differences between direct rainfall models and rainfall runoff routing models, a representative temporal pattern cannot be determined using a rainfall runoff routing model and then be applied to a direct rainfall model.

Or

|Alternative text 2 – Ensemble hydraulic approaches|

[Information is needed on the variability of variables other than the peak flow or depth, such as rate of rise. For this case the design flood levels should be determined from the ensemble. A representative design flood that is close to the mean should also be determined. The method for selecting the representative design flood will need to be documented.]

And

Optional text 2a – To be added for Direct Rainfall methods|

For direct rainfall methods the design results should be determined by selecting the mean water level from the ensemble results. Given the extreme differences between direct rainfall models and rainfall runoff routing models, a representative temporal pattern cannot be determined using a rainfall runoff routing model and then be applied to a direct rainfall model.

Or

|Alternative text 3 – Complex hydraulic approaches|

[For each duration a representative event that produces flows similar to the design flow calculated in the Monte Carlo analysis should be selected, the event should be driven by design rainfall with an AEP similar to the AEP of interest at locations where tributaries have combined. The selected event should be compared to the other event hydrographs and another pattern should be selected if the hydrograph is very different to the rest of the ensemble. Where none of the ensemble events are near the mean it is permissible to slightly scale the rainfall to match the mean.]

4.6.6 Model calibration and validation

Model calibration and validation is an important aspect of defining flood behaviour as it can increase confidence in the results that the models are producing. This is an important component both for a flood study, where model establishment often occurs, and a flood management study, where model modifications may be required. Data availability can limit the scale of calibration that may be undertaken. Completing the tables in Section 4 of the generic brief can help identify what data are available, which may improve the outcomes of the calibration and validation process.

Options are provided for a range of calibration methods as well as ground truthing of the model results. The generic text in the generic brief provides the tenderer the opportunity to review the available information, and determine if there are suitable events for undertaking model calibration and validation. The generic brief has provided three optional inclusions for where calibration or validation is unlikely, where the principal is aware of specific events where there is sufficient data for calibration and validation, or when the Principal wishes to explicitly quantify the desired calibration fit. There is also a fourth option for when a floodplain management study is being undertaken and a calibrated model already exists, in which case the brief can state that no calibration is necessary.

Either

|Alternative text 1– No calibration data|

A comprehensive calibration and validation of the hydrologic and hydraulic model is unlikely to be possible, due to a lack of calibration data for the catchment. However, tenderers should outline how selection of model parameters in the hydraulic model will achieve reasonable accuracy in model results.

Or

|Alternative text 2 – Calibration data (either hydrologic or hydraulic) |

Suitable hydrologic and hydraulic models to simulate flood behaviour in the study area are to be developed by calibration and subsequent validation of flood behaviour against available data from historical flood events. Historic events to be used have been listed in Table 11 or should be identified by the successful tenderer in consultation with the principal.

To achieve a fit to calibration events, consideration should be given to how conditions on the floodplain have changed and what historical topographic features or structures are not represented in the current survey data. Following calibration, the model is to be validated against the historical events detailed in Table 11.

During the calibration and validation process, features of the catchment that have a distinct influence on flood behaviour should be considered. The calibration/validation process should guide the final model configuration and selection of hydraulic model grid cell resolution if undertaking 2D modelling. The significant features present in this catchment are listed in Section 6, 'Hydrologic analysis and hydraulic model'.

[Sentence describing any specific features of the calibration process distinct in the study area (e.g. profile through a bridge, or blockage of culverts and structures)].

And

|Optional text extension 2a – Explicitly quantified calibration|

The calibrated model is to achieve a satisfactory fit to the historical data. [Sentence describing preferred calibration benchmark (e.g. The calibrated model is to be able to reproduce the flood level recorded at the gauge within 0.[X] m, for each calibration event.)]

Or

|Alternative text 3 – Model has already been calibrated|

The model established as part of the flood study (listed in Table 2) was calibrated as part of that study. Its calibration is satisfactory for the model to be used in this study and therefore no model calibration is required.

Ground truthing allows the modelling results and assumptions made to be validated to ensure that potential flowpaths and obstructions are accurately represented within the model. This can be done as a desktop assessment or in the field.

Either

|Optional text – Ground truthing – desktop review|

The consultant is to validate model results and assumptions made to ensure potential flow paths and obstructions are accurately represented within the model and model produced behaviour. This ground truthing exercise is to be undertaken as a desktop review.

Or

|Optional text – Ground truthing – field|

The consultant is to validate model results and assumptions made to ensure potential flow paths and obstructions are accurately represented within the model and model produced behaviour. This ground truthing exercise is to include field inspections of key.

The established hydraulic model can be used to validate an existing rating curve; this is particularly useful through the high flow zone where validation points are often limited. The review should include liaison and provision of the outcome of the review to the gauge owner.

|Optional text – rating curve review|

Where a hydraulic model has been established, the existing rating curve should be validated against the results of the hydraulic model, particularly in the high-flow zone above the highest ratings. In conducting the review, liaison should be undertaken with the gauge owner and the results of the review provided for their consideration.

4.6.7 Model parameter sensitivity

Model sensitivity analysis is an important aspect of model establishment. It is particularly important if model calibration or validation is unlikely. Sensitivity analyses assess the degree of influence different model parameter values have on the results of the calibration and validation. Sensitivity analyses can provide an indication of the relative uncertainty associated with design model results. Principal parameters to be tested include:

- hydrologic – spatial and temporal variation, rainfall losses, lag, catchment storage and so on
- hydraulic – roughness/friction, energy losses, bridge coefficients, boundary conditions and so on.

As with model calibration, it may be that the brief is being used for a floodplain management study where a model has already been established, including calibration and sensitivity analysis. If this is the case, the following optional text may be added to explain that no sensitivity analysis is required.

|Optional text – Model sensitivity has already been assessed|

The model established as part of the flood study (listed in Table 2) included a model parameter sensitivity analysis. This analysis is satisfactory and no further sensitivity analysis is required.

In 2016 an updated ARR was released. ARR 2016 included a range of new design inputs for the estimation of design flood behaviour. During the early implementation stages an understanding of the influences of these design inputs on flood behaviour in the study area may be desirable. This may be achieved through either a comparison to previous estimates or undertaking a sensitivity run using ARR 1987 techniques.

Either

|Optional text 1 – Model sensitivity ARR 2016 – test by comparison to previous estimates developed using ARR 1987 techniques|

Previous flood estimates developed using ARR 1987 techniques should be compared to those derived in the study using Australian Rainfall and Runoff 2016 techniques. The cause of any significant differences from the estimates derived from this study using the methods outlined in Australian Rainfall and Runoff 2016 should be determined and reported.

Or

|Optional text 2 – Model sensitivity ARR 2016 – test by limited modelling using ARR 1987 parameters|

For comparison purposes the 1% and 5% AEP events should also be developed using the procedures and design inputs including IFD outlined in Australian Rainfall and Runoff 1987. The cause of any significant differences from the estimates derived from this study using the methods outlined in Australian Rainfall and Runoff 2016 should be determined and reported.

4.6.8 Modelling events

This section informs the development of Table 11 of the generic brief, which summarises the flood events and floodplain conditions to be assessed. The intent is to define the events and scenarios to be modelled or considered as part of the study in one place to avoid duplication and possible contradiction throughout the document.

This section also lays out possible enveloping combinations that may be required, for example in a catchment subject to catchment runoff as well as coastal influences or where blockage of structures is a significant factor for parts of the study area.

|Optional text – Catchment flooding and coastal inundation|

The study area is in an area where catchment flooding is influenced by coastal inundation or by the waterway entrance into the ocean. The coincidence of catchment flooding and coastal inundation is to be considered in deriving design events.

And, Either

|Optional text – Alternate 1– Blockage- ARR|

The blockage of structures can be an important factor in this catchment. Different combinations for degrees of blocked and unblocked scenarios can result in peak flood conditions in different areas. Design events may need to be derived using an envelope of different blocked and unblocked scenarios at different points in the catchment.

Or

|Optional text –Alternate 2– Blockage- Alternate|

The blockage of structures can be an important factor in this catchment. [Describe method of blockage assessment to be applied to design event modelling].

And

|Optional text – Waterway timing coincidence|

The study area includes the junction of two major waterways. The coincidence of flooding in the vicinity needs to consider relevant guidance in Australian Rainfall and Runoff.

When completing Table 11 of the generic brief, it is important to consider assessing the full range of potential flood risk up to and including the probable maximum flood (PMF, see ADR Handbook 7, AIDR 2017 for explanation), as this informs a range of risk management decisions. Other sections should refer back to Table 11. All rows of Table 11 are optional; however, most study types would include 'Design flood events – existing conditions' (i.e. row 2) as a default. Based on the selections made this table is also developed based on those rows likely to be required. The rows can be added and removed as appropriate to the study type and scale of complexity. Each row and its purpose and guidance is described below.

Row 1 – historical events

Historical events provide a basis for calibration and validation of the hydrologic and hydraulic model behaviour against recorded or observed information. These scenarios need to consider the historical floodplain and catchment conditions. Key events with a reasonable amount of available information should be included so that the tenderer can determine if they are suitable for use in calibration and validation. There should be a preference for listing historical events of a range of sizes, as this will enable the ability of the model to predict flood behaviour for different-sized events. For example, using only small in-bank events for calibration may mean the model is not suitable to predict the 1% AEP event. Identifying calibration events provides an opportunity for the principal to list well-known flood events that may not necessarily be used for calibration (due to lack of data), but are of general interest and should be researched as part of the study.

The principal may identify historical events to be used for calibration that, when investigated in more detail as part of the study, have insufficient recorded data to be used in model calibration. In this case, the events listed in row 1 will change as the study progresses. It may also be that no calibration events are known of, and then calibration data is discovered as part of the study. In this case, the events in row 1 will also change.

Row 2 – design flood events under existing conditions

Design flood events provide an understanding of the range of potential flood behaviour under existing floodplain and catchment conditions. It is recommended to include the defined flood event (DFE), up to three or more events below the DFE, at least one AEP event above the DFE, as well as the PMF. Depending on the catchment type and flood situation, this row may include catchment- or tidal-generated flooding; these should be specified. The selected events may be governed by the project end users – for example, the 0.2% AEP, 1 in 2000 average recurrence interval (ARI) and 1 in 10,000 ARI are used by the insurance industry, in bridge design and for dam-break assessments, respectively.

Row 3 – design flood events considering catchment development

Design flood events considering full development of the catchment within permissible land uses provides an assessment of the cumulative impacts of development on flood behaviour and function. This information can assist in the management of development to maintain flood conveyance areas and reduce the potential for significant impacts on flood behaviour. It is recommended that this assessment be undertaken for the DFE, one additional frequent event below the DFE and the PMF.

Row 4 – flood behaviour sensitivity

This includes flood behaviour sensitivity to the impacts of climate change, sea level rise, rainfall intensity increases and/or other climate change variations. It is recommended that the sensitivity is assessed against the DFE. It should be noted that the difference between the 1% AEP and 0.5% AEP events (from row 2) can give an understanding of how sensitive the system is to increases in rainfall. The various guidelines detailed in Section 5 of the generic brief may also provide guidance on the assessment of sensitivity to climate change.

Row 5 – levees

Levee assessments allow for the review of both the benefit of an existing levee and the worst-case scenario for potential levee failure for key design events. It is recommended to include the DFE, an event near the levee design height, and an event that results in levels above the levee design height and the PMF.

Row 6 – proposed works

The assessment of proposed works, such as infrastructure on the floodplain, allows the effect of these works to be assessed. It is recommended to assess the effect of the proposed works against the DFE as a minimum, plus one event below the DFE and one event above the DFE.

Row 7 – model parameter sensitivity

A model parameter sensitivity analysis assesses the degree of influence that different model parameter values have on the results of the calibration and validation. It is recommended to assess the DFE as a minimum.

Row 8 – flood hazard

Flood hazard assessment can inform a range of end users, including the principal, of the flood risk management for existing communities and strategic planning, and emergency management. Provisional flood hazard can be determined using hydraulic considerations such as depth and velocity. It is recommended to assess the hazard of the DFE as a minimum, plus one event below and one above the DFE.

Row 9 – flood function

Assessment of flood function identifies areas on the floodplain of flow conveyance and storage. This assessment is key to identifying the areas of the floodplain that are particularly sensitive to changes in flood behaviour and should be avoided for development. It is recommended to assess the flood function of the DFE as a minimum, plus one event below and one above the DFE.

Row 10 – floodplain management

The effects of floodplain management measures should be assessed. It is recommended to assess the effect of measures against the DFE as a minimum, plus one event below and one event above the DFE.

Row 11 – emergency management

Assessment of design events to provide information to support emergency management and flood warning.

Row 12 – information to support land-use planning

Assessment of design events to provide information to support land-use planning.

Table 2 provides an overview of the various options for each row.

Table 2: Possible modelling events

Model	Description/information										
Historical calibration/ validation flood events – historic conditions	(month, year)	(month, year)	(month, year)								
Design flood events – existing conditions	0.5 EY	0.2 EY	10% AEP	5% AEP	2% AEP	1% AEP	0.5% AEP	0.2% AEP	1 in 2,000 year ARI	1 in 10,000 year ARI	PMF
Design flood events – fully developed for permissible land uses	5% AEP	1% AEP	0.2% AEP	PMF							
Design flood event to test climate change sensitivity	1% AEP with Xm SLR	1% AEP with Ym SLR									
Design events for levee assessment	DFE	Several events up to levee design flood	Levee design flood	Events just above the levee design flood							
Design events for assessment of proposed works in the floodplain	0.5 EY	20% AEP	10% AEP	5% AEP	2% AEP	1% AEP	0.5% AEP	0.2% AEP	PMF		
Design events for model parameter sensitivity analysis	5% AEP	1% AEP									
Design events for assessment of flood hazard	5% AEP	1% AEP	PMF								
Design events for assessment of flood function	5% AEP	1% AEP	PMF								
Design events for assessment of floodplain management measures	5% AEP	1% AEP	PMF								
Design events for assessment of flood warning and emergency management	5% AEP	1% AEP	0.2% AEP	PMF							
Design events for developing information to support land-use planning activities	1% AEP	0.2% AEP	PMF								

AEP = annual exceedance probability; ARI = annual recurrence interval; EY = equivalent years; PMF = probable maximum flood; SLR = sea level rise; Xm = assessment allowing for X metres SLR; Ym = Assessment allowing for Ymetres SLR

Note: Extreme events may be used in some cases as an alternative to a PMF

4.6.9 Optional sections

The generic brief provides for a range of options that are either tied to end user requirements, extend the detail or complexity of the study, or include components as part of a floodplain management study. The options are grouped by type and are described in the following sections and include:

- consequences of flooding on the community
- flood damages assessment
- levee failure and overtopping analysis
- impacts of dams on flood behaviour
- assessment of the impacts of climate change on flood behaviour
- flood hazard assessment
- flood function assessment
- flood emergency response classification of communities
- derivation of areas where the majority of flood related land-use planning controls will apply, sometimes called the flood planning area
- information to support emergency management activities
- advice on land-use planning considering flooding
- assessment of cumulative impacts of development

4.6.10 Consequences of Flooding to the Community

Consequences of flooding on the community

A consequences of flooding on the community assessment identifies the impacts of flooding on the community, in areas such as people, economy, environment, public administration and social setting. This may include information on fatalities, major road closures, services disrupted, areas flooded and numbers of properties affected. A preliminary assessment may be based on historical flood events; however, an assessment based on a number of design events can identify a greater range of flood impacts to the community. Combining this assessment with a flood damages assessment allows these impacts to be assigned a financial cost. If emergency managers have been identified as study end users, this assessment may also provide preliminary information for emergency management purposes.

Note: Including these optional items will generate an additional reporting item and associated mapping, which should be indicated in Section 7 of the generic brief.

|Optional text – Consequences of flooding on the community|

A key objective of the study is to better inform management of flood risk in the study area. An assessment of the consequences of flooding on people, economy environment, public administration and social setting is to be included as part of the study. An assessment of risk should be based upon relevant guidance as shown in Table 6. This assessment shall consider based on historical and anecdotal information, in addition to model results and relevant mapping for key design events.

The assessment should outline consequences that may include any fatalities, major roads cut, services that may have been disrupted, areas flooded and number of houses affected.

Flood damages assessment

A flood damages assessment provides an indication of the cost of flooding across a range of flood events. It is often used as a measure to determine the cost benefit from flood management measures and to compare the benefit between measures. Typically, it is undertaken as part of a floodplain management study, but a preliminary estimate of the existing cost of flooding or property affectation may be useful during a flood study. This section is tied to the optional survey of flood level item. The accuracy or detail of the underlying floor level data will influence the accuracy of the flood damages assessment and may limit the future use of the underlying data. For example, survey collected via estimated methods is unlikely to be suitable for use by emergency planners or insurers at a property scale. Flood damages assessment should be in accordance with the relevant guidelines listed in Section 5 of the generic brief – for example, *Australian Disaster Resilience Handbook Collection - Manual 27 Disaster Loss Assessment Guidelines* (AIDR 2002) and *Manual 28 Economic and Financial Aspects of Disaster Recovery* (AIDR 2002).

The costing table should list items for the estimated number of properties to be included in the flood damages assessment. This will allow comparison to be made between different tender submissions. The text below should be included if a flood damages assessment is to be included in the project scope.

Note: The inclusion of these optional items will generate an additional reporting item and associated mapping, which should be indicated in Section 7 of the generic brief.

|Optional text – Flood damages assessment|

After the full extent of the floodplain has been determined, the study will incorporate an estimate of flood damages to assist in determining the impacts upon the community across the range of flood events. The flood damages are to be estimated in accordance with the relevant guidelines listed in Section 6.

The flood damages assessment shall produce, for each flood event, information on the number of properties affected and their category (residential, commercial, etc.), the tangible damages, and the average annual damage. For the purposes of tendering, it shall be assumed that the damages for the number of developed properties of all types, as detailed in Table 14, are to be assessed.

Depending on the method of floor level collection for flood damage assessment, it is essential that the accuracy and any limitations of the data should be outlined as part of the documentation associated with the flood damages assessment.

Levee failure and overtopping analysis

In a situation where a portion of or a whole a community is protected by a levee, a range of factors associated with the levee may need to be considered. These include what level of protection is currently provided, how much of the community is currently protected or what the consequences are of levee failure. The generic brief has provided for two options for varying level of complexity for the assessment. Events to model are to be outlined in Table 11 of the generic brief. The optional text is included below.

Note: The inclusion of this optional item will generate a set of end user deliverables from Table G1 (assessment of worst-case flood outcomes), timing of structures overtopped, which should be added to Table 14 of the generic brief.

|Optional text – Levee failure and overtopping analysis|

A portion of the community is protected from some inundation by the [levee name] levee. To have a better understanding of the flood risks associated with either the levee overtopping or catastrophic failure, the following scenarios should be modelled.

And either

|Alternative text 1 – Simple Scenario|

For the events listed in Table 11 of the brief, the levee should be removed from the model terrain. This will identify the areas protected by the levee, and provide an indication of the consequences of failure, including damages, and thus the social and economic benefits of the levee to the community.

Or

|Alternative text 2 – Complex Scenarios|

For the events listed in Table 11, the levee should be:

- removed from the terrain
- breached at an appropriate location and level.

These scenarios will identify a range of risks associated with the levee, including identification of the areas protected by the levee, the potential rate of rise within the levee under an overtopping, and a likely breaching scenario. It should also identify the social and economic benefits provided by the levee.

Impacts of dams on flood behaviour

An assessment of the impacts of a dam on flood behaviour for catchments where a significant dam exists and its failure represents a risk to life may be desired to meet other end user's needs. The assessment should be undertaken in accordance with the relevant Australian National Committee on Large Dams guideline, which should be identified in Table 6 of the generic brief This is an optional item and the text is included below.

Note: The inclusion of these optional items will generate an additional reporting item and associated mapping, which should be indicated in Section 7 of the generic brief.

|Optional text – Impacts of dams on flood behaviour|

The [XX Dam] located within the catchment poses a significant risk if failure was to occur. A simple hydrologic and hydraulic assessment should be undertaken to understand the potential consequences of dam failure scenarios in accordance with the relevant guideline, as detailed in Table 6.

Assessment of the impacts of climate change on flood behaviour

Understanding the potential impacts of climate change on flood behaviour and the sensitivity of consequences in the catchment, allows these issues to be understood and considered in planning for the future management of flood risk. The assessment should be undertaken in accordance with the recommendations in ARR.

|Optional text – Assessment of the impacts of climate change on flood behaviour|

Sensitivity analysis of climate change should be undertaken in accordance with events outlined in Table 11 and guidance in Table 6. In coastal areas where flood levels would be influenced by ocean levels or behaviour (including intermittently closed and open lakes and lagoons (ICOLLS), this would involve both consideration of sea level rise and well as impacts of climate change on flood producing rainfall events. These would generally be undertaken independently and in combination. The assessment of flood producing rainfall events should be undertaken in accordance with the recommendations in ARR. The report should outline how sensitive flood behaviour and consequences to the community are in relation to climate change.

4.6.11 Post processing of results

This section includes a range of options for the post processing of hydraulic model outputs. A number of these outputs are required in order to undertake further assessment of optional items.

Flood hazard assessment

Flood hazard can vary with flood severity, as well as across the floodplain for the same flood event. A flood hazard assessment can inform a range of end users, including the principal's flood risk management for existing communities, strategic planning, and emergency management. Flood hazard can be determined using hydraulic considerations such as depth and velocity.

Note: The inclusion of this optional item will generate a set of end user deliverables from Table 1 of this guideline (flood hazard), which should be added to Table 14 of the generic brief. The events for which flood hazard in required should also be listed in Table 11 of the generic brief.

|Optional text – flood hazard assessment|

Flood hazard is to be determined based on hydraulic considerations such as depth and velocity. The assessment will be limited to the depth–velocity product using the velocity at the peak water level, in accordance with guidelines listed in Table 6 of the brief. The events to be considered are detailed in of Table 11.

Flood function assessment

Maintaining the flood function of the floodplain is essential for managing flood risk. Flood behaviour is sensitive to changes in the floodplain, and its effect on flow conveyance and storage. Determining areas of flow conveyance and flood storage in the DFE (as a minimum) is key to identifying the areas of the floodplain where flood behaviour is particularly sensitive to changes in the floodplain and where such changes should be avoided. Identification of these areas can also provide essential information to guide future strategic planning. There are a number of methods available to identify the flood function areas of the floodplain, including:

- the modelling of encroachments
- identification of flow conveyance and storage areas using hydraulic considerations
- percentage flow
- simply applying the extent of different AEP events to identify flow conveyance areas.

Ideally, a number of these methods should be applied for a rigorous assessment and to confirm the conveyance areas.

Note: The inclusion of this optional item will generate a set of end user deliverables from Table 1 of this guideline (flood function), which should be added to Table 14 of the generic brief. The events for which flood function is required should also be listed in Table 11 of the generic brief.

Either

|Optional text 1 – Simple|

To provide an indication of the existing flood function, flood conveyance and storage areas should be determined based on a preliminary assessment of their extents by considering different AEP events or an agreed alternative methodology. The events to be considered are included in Table 11.

Or

|Optional text 2 – Complex|

To provide an indication of the existing flood function, flood conveyance and storage areas should be determined based on a detailed assessment of their extents by modelling encroachments into the floodplain due to potential development or an agreed alternative methodology. The different floodplain areas should be confirmed via an alternative method. The events to be considered are included in Table 11.

Flood emergency response classification of the floodplain

Emergency managers require a range of deliverables that are specific to their needs for planning and response to flood emergencies. This option should be considered when emergency managers have been identified as study end users or an emergency management issue has been identified. The following includes scope for the development of flood emergency response classification mapping which gives an indication of the relative difficulty of the emergency management situation. It is not generally relevant in local overland flood situations and below a precinct scale.

Note: The inclusion of this option will generate a set of end user deliverables from Table 1 (inundation precincts, levels/AEP at which critical access roads/properties/critical municipal structures, inundation timing of properties and access roads, or gauge-related timing), which should be added to Table 14 of the generic brief.

|Optional text – Flood emergency response classification of the floodplain|

The floodplain shall be categorised based upon the flood emergency response classification guideline outlined in Table 6. This classification provides an indication of the relative difficulty of the flood emergency management situation at a community or precinct scale. It may also assist in identifying the type and scale of information needed by the emergency managers to assist with emergency response planning.

4.6.12 Information to support decisions on activities in the floodplain and managing flood risk

These aspects provide information to support decisions in relation to development of the floodplain and the management of flood risk and can be included by adding in the relevant clauses below.

Flood planning area

The flood planning area is the area in which the majority of flood related development controls to residential development generally apply.

|Optional text – Flood planning area|

The study is to map a flood planning area based on the defined flood event and an appropriate freeboard or other agreed methodology.

Information to support emergency management activities

Information to support emergency management activities identifies the impacts of flooding on the community, such as areas flooded, and timing and duration of inundation. The assessment may need to consider events of a short duration with a faster rate of rise. A preliminary assessment may be based on historical flood events; however, an assessment based on a number of design events can identify a greater range of flood impacts to the community.

Note: The inclusion of these optional items will need to be accompanied with a set of end user deliverables from Table 1 of this guideline (inundation precincts, levels/AEP at which critical access roads/properties/critical municipal structures, inundation timing of properties and access roads, or gauge-related timing), which should be added to Table 14 of the generic brief.

|Optional text – Information to support emergency management activities|

Emergency services may require a range of information in relation to the impacts of flooding on the community, community infrastructure and evacuating the community to safety. A key consideration for emergency services is timing of the flood event to reach critical levels such as cutting evacuation routes. This may result from shorter duration events rather than those generating peak design levels. Therefore a range of shorter duration events should be modelled as outlined in Table 11 to determine the critical timing for emergency response. This information would generally be required where time to reach a critical level is an important factor in emergency response planning.

Where required this should include information on the consequences of flooding to key transport and evacuation routes, and key infrastructure for community response and recovery from flooding, should be identified. This should include information on what level/gauge height key transport links may become impassable, what level/gauge height key public infrastructure (e.g. hospitals, water supply, sewerage works, main electrical switchyards) are inundated, timing of structures overtopping (including levees and bridges) and gauge-related timing information. This information can be supplemented with historical or anecdotal evidence, including related timing information.

Advice on land-use planning considering flooding

The effective consideration of flood risk in strategic land-use planning is an important floodplain management measure. When coupled with sensible development decisions, land-use planning limits the growth in residual risk resulting from new development in the floodplain. This option should be considered if land-use planning professionals have specifically been identified as study end users or in a situation where development pressure in the study area is significant. The brief provides for the optional inclusion of advice on land-use planning considering flooding, in addition to two scales of complexity for the assessment. The complex assessment considers a range of additional factors that may contribute to land-use planning decisions.

Note: The inclusion of these optional items will generate a set of end user deliverables from Table 1 (flood planning levels), which should be added to Table 14 of the generic brief. Additional reporting items would also be required.

|Alternative text 1 – Simple: Advice on land-use planning considering flooding

A key objective of the study is to provide basic flood information to support land use-planning activities.

The consultant is to recommend general planning controls to apply within different locations in the floodplain, taking into consideration flood function, flood hazard, relevant local and jurisdictional standards, the impacts of flood on the development, and the impacts of development on flood behaviour.

General planning controls can be developed based upon an assessment of the defined flood event (planning flood) and a definition of the associated flood planning level. It would generally involve mapping of the flood planning area and an extreme event, such as the PMF.

Or

|Alternative text 2 – Complex, typically based upon the information from a flood study|

A key objective of the study is to provide better flood information to support land-use planning activities in the study area. This includes:

- improved information on how flood related constraints may vary across the floodplain as outlined within the relevant guideline referred to in Table 6.
- advice on general planning controls within different flood planning constraint categories considering the varying constraints, any general requirements of government and relevant standards.

This information should be made available to inform land-use planning activities until more detailed assessment is undertaken in a future management study.

This may be provided in the form of flood planning constraint mapping and associated information as outlined in the option below.

More advice to support strategic land-use planning directions and additional advice on development controls would generally come from additional work undertaken in a floodplain management study.

|Alternative text 3 – More complex, typically using products of a floodplain management study|

A key objective of the study is to provide better flood information to support land-use planning activities in the study area. This includes:

- improved information on how flood related constraints may vary across the floodplain as outlined within the relevant guideline referred to in Table 6.
- advice on general planning controls within different flood planning constraint categories considering the varying constraints and the principal's general requirements and relevant standards.

Existing local planning instruments and policies should be reviewed in consideration of flood related planning constraint categories, any jurisdictional policies and directions, and floodplain management objectives.

The consultant is to provide advice in relation to:

- the consistency of current or proposed future strategic planning directions for the community in relation to addressing floodplain management objectives.
- the adequacy of current land-use planning and building controls for specific development areas or developments in relation to addressing floodplain management objectives and managing flood risk to both new development and limiting impacts upon the existing community.
- the suitability of different land uses in different areas of the floodplain considering their use in community response to flooding.
- the suitability of different land uses in different areas of the floodplain, considering the vulnerability of these uses and their users to flooding.
- the residual flood risk, following the instigation of general constraints and in relation to the need for additional constraints, where warranted, in specific areas of the floodplain.
- provide recommendations for changes in land-use planning directions or controls to address any identified shortcomings.

This generally requires a sound knowledge of the local and jurisdictional land-use planning and building controls requirements and relevant standards, and a detailed understanding of flood behaviour and related flood planning constraints.

Advice on land-use planning considering overland flooding

|Optional text – Advice on land-use planning considering overland flooding|

In local overland flooding areas where traditional flood planning area may not be fit for purpose, the consultant is to make recommendations for development controls in consideration of local and jurisdictional directions to reduce the impacts of development on flooding and flood impacts on new development. This may include development controls to ensure maintenance of flow paths and to reduce damage to property in the vicinity of flow paths. The areas are to be identified separately to riverine flooding and mapping provided where different controls are recommended.

Assessment of cumulative impacts of development

An important consideration is the assessment of the cumulative impacts of changes in development on flood behaviour and its impacts. Cumulative impact assessment enables more informed understanding on the broad effects of changing development patterns. The assessment can help define flood function, and set zonings that maintain flood function by limiting development not compatible with these functions.

Cumulative impacts of changes should be considered and are best addressed in broader or strategic (rather than site specific or development-scale) studies.

Note: The inclusion of this optional item will generate a set of end user deliverables from Table 1 (flood information for future conditions), which should be added to Table 14 of the generic brief. The events for which the assessment is required should also be listed in Table 11 of the generic brief.

|Optional text – Assessment of cumulative impact|

The consultant is to assess the cumulative impacts of development on flood behaviour and associated flood risk, and make recommendations on how to manage development to offset impacts affecting existing development. This assessment should be undertaken for the flood events listed in Table 11 and consider full development within existing zonings based on:

- the addition of full permissible development in areas, as outlined by the principal
- limitations on development to maintain flood function and due to flood hazard considerations.

Assessment of the impact of works in the floodplain

An important consideration is the assessment of the impacts of changes to the floodplain on flood behaviour, such as proposed major infrastructure development or other development. The events for assessment are defined in Table 11 of the generic brief.

|Optional text – Impact of floodplain works assessment|

The consultant is to undertake an assessment of the impacts of proposed works within the floodplain, including [xx road/development] on flood behaviour and the associated flood risk. This assessment should be undertaken for the flood events listed in Table 11.

4.6.13 Option Assessment

These sections include scope of work for the identification and assessment of management options across the scale of detail that may be undertaken as part of a flood study through to a floodplain risk management study.

Assessment of management options

The assessment of management options allows a range of potential measures, which may reduce the existing flood risk, to be identified and ranked. The full assessment of management options is typically included in the scope of a floodplain management study; however, depending on the flood situation and other constraints, such as funding, a full or preliminary assessment may be included in a flood study.

It is important to consider a full range of management measures to reduce risks to both existing and future development, and to manage residual risks (see ADR Handbook 7, AIDR 2017). These measures include options that may modify:

- flood behaviour
- the community response to flooding
- the vulnerability of property to flooding.

The assessment of management options should be made against a range of benefit and cost indicators, such as changes in community, social and environmental impacts, and the costs of any changes. The generic brief has included options for the preliminary identification of management options via a simple or complex methodology, and a full assessment of floodplain management options. Management options should be assessed against a range of flood events, which should be listed in Table 11 of the generic brief. A budget item should be added for the number of management options to be assessed as part of the hydraulic modelling.

Note: The inclusion of this optional item will generate a set of end user deliverables from Table 1 (assessment of change in flood behaviour or levels as a result of mitigation), which should be added to Table 14 of the generic brief. A reporting item should also be listed in Section 7 of the generic brief.

|Optional text 1 – Preliminary identification of management options|

A key objective of the study is to better inform management of flood risk in the study area. The identification of areas with significant flood impacts is a key aspect of the management of flood risk.

The consultant is to identify all works, measures and restrictions (including flood, property and response-modifying measures) that have the potential to reduce the social, environmental and economic impacts of flooding, and the losses caused by flooding on development and the community, both existing and future, across the full range of potential flood events (listed in Table 11). The aim is to identify areas of significant flood impact and potential management options to address these impacts for further consideration. A range of measures should be identified, including those that aim to modify flood behaviour and those that do not, such as flood awareness or land-use planning.

And, either

|Alternative text 1a – Simple|

This assessment should consider the flood impacts on the community, including financial, social and environmental impacts, and consider any relevant results of community consultation. An initial review of practicality and feasibility of any flood modification works should be undertaken and any associated issues reported. It shall be based on historical and anecdotal evidence in addition to modelling results.

Or

|Alternative text 1b – Complex|

The practicality and feasibility of any flood modification works should also be assessed and any associated issues incorporated into costings and reporting. This assessment should consider the combined options needed to support the development of a recommended set of management options.

Flood impacts on the community – including financial, social and environmental impacts –should be considered. This assessment shall be based on historical and anecdotal evidence, in addition to modelling results across a range of flood events, and hazard mapping and constraint outputs. Constraint outputs are those that limit development in particular areas in the catchment, such as floodways or flood emergency response classifications of communities. It should also consider any relevant results of community consultation, as well as following the assessment method specified in relevant guidelines and references in Table 6.

|Optional text 2 – Detailed assessment of floodplain management options|

After an initial consideration of all potential measures, the consultant is to provide the principal with a brief report identifying those works, measures and restrictions (including management measures that may modify flood behaviour, property vulnerability or community response to flood events) would warrant further quantitative investigation.

On receipt of written approval from the principal, the consultant is to assess the cost-effectiveness of these identified works, and measures for reducing the effects of flooding on the community and development, both existing and future, taking into account the potential impacts of climate change. The assessment should consider the combined options needed to support development of a recommended set of management options.

Any identified works are to be investigated in sufficient detail to establish their feasibility, cost-effectiveness, effect on flood behaviour (based on the events in Table 11), and social and environmental impacts, to allow the principal and the community to make an informed decision on whether the works should be included in the floodplain management plan. This should include a multi-criteria assessment considering relevant guidance.

The assessment process should also reflect any limitations on the nature/scope of the measure being assessed that may be imposed by legislation. Vegetation management as a potential floodplain management measure is particularly sensitive in this regard.

Costs are to be developed on a life-cycle costing basis and, where appropriate, include all major items that can be identified at a concept/feasibility stage, such as detailed investigation/design, land acquisition, construction, provision for a review of environmental factors (REF) or an environmental impact statement (EIS), project management, contract supervision, and maintenance.

Costs are to be estimated to an accuracy that is consistent with a concept/feasibility stage of project development with sources of information for estimates identified. Identified works shall include concept designs. The consultant is to consider whether the proposed works and measures might produce adverse effects (environmental, social, economic or flooding) in the floodplain and whether they can be minimised. Where possible such impacts are to be quantified.

And

|Optional text 3 – Detailed assessment including a multi criteria assessment|

The assessment of options should consider the method outlined in the Supporting document for the implementation of ADR Handbook 7 and ADR Guideline 7-6 Assessing Options and Service Levels for Treating Existing Risk.

4.6.14 Floodplain management plan

A management plan describes the recommendations from the floodplain management study in an area. It generally recommends a range of measures to manage existing, future and residual risk, which will vary between different locations in the floodplain. The range of measures recommended by the plan will have been assessed as part of a floodplain management study, which itself uses the results of a flood study. Although the plan is primarily a summary of the suitable options for the area, it also requires additional information on each option. This additional information describes how each option will be implemented, and includes:

- the relative priority of the measures; priority should be based on each option's relative benefits and costs, and ease of implementation
- the organisation that is responsible for implementing the option
- the timeframe for delivery
- an estimate of the cost of the option, if applicable.

Studies that include a management plan must also include an assessment of management options (see Section 4.6.13).

|Optional text – Floodplain management plan|

The consultant is to develop a floodplain management plan as part of the project. The plan is to list the recommended measures aimed at managing flood risk in the study area. The plan should summarise what is entailed in each measure, including any associated complementary and compensatory measures. It should also include a brief description of its expected effects, including the area it is to be applied in. for each measure and the overall package of treatment options.

An implementation plan should describe the relative priority, timeframe and estimated cost and benefit of each measure, as well as the organisation with responsibility for its implementation. The content and purpose of the plan should be in accordance with the relevant references and guidelines in Table 6.

The plan is to be developed with the assistance of the principal, and any technical and steering committees, which will have input on the priority and timeframe of the recommended measures. A successful plan requires the commitment of the principal and other agencies that may be requested to undertake or assist with plan implementation.

4.6.15 Peer review

To engender confidence in the results, the study may require independent peer review, in addition to the tenderer's in-house review system. This may be particularly important in studies of regional importance or those that may be addressing sensitive issues.

The generic brief has allowed for three options for a peer review:

- a comprehensive internal review process as part of a quality management system, which would generally be the default
- an independent reviewer or review panel selected and engaged by the principal, and paid for separately from the tender
- an independent reviewer is to be nominated and engaged by the tenderer, with costs included in the tender.

The scale of the issues involved in the study would guide the level of review required. All studies should include an internal review process.

Either

|Alternative text 1|

The consultant is to undertake a comprehensive internal peer review of the study including hydrologic and hydraulic modelling, reporting and outcomes. The peer review is to be documented and considered in finalising the outcomes of the report.

Or

|Alternative text 2|

The principal is to engage an independent technical reviewer or technical review panel that will undertake a peer review of the study including hydrologic and hydraulic reporting outcomes. The consultant is to provide all relevant data to support the peer review and consider the findings of the peer review in finalising the project.

Or

|Alternative text 3|

The consultant is to nominate a suitably qualified professional to undertake a peer review of the study including hydrologic and hydraulic reporting outcomes. The cost, support and consideration of findings of the peer review is to be included in the overall project budget.

4.6.16 Reporting

This section provides for a description of the key aspects that should be covered in the project report. Line items should be added and removed based on the scope of work items included. Table 14 of the generic brief lists the types of reporting required throughout the study, such as progress reports and other milestone reports. Table 14 also describes the number of copies of reports required; however, most reports can be provided electronically to reduce the requirements for printed copies.

Reporting should not just list actual deliverables, but rather describe how they have been derived and any limitations with them. Reporting items should be included for all optional scope items included in the generic brief.

4.6.17 Meetings

This section provides guidance on completing Table 12 of the generic brief (see ADR Template 7-4). When completed, Table 12 will outline the number and type of meetings required as part of the study.

This section allows the location, number and type of meetings required by the study to be defined. The table also outlines what is expected by the consultant, for example is a presentation of a particular project aspect required. Types of meetings to be considered include:

- with the principal's project technical committee
- with the principal's project steering committee
- as part of consultation
- with high-level decision makers.

4.6.18 Timing and hold points

This section provides guidance on completing Table 13 of the generic brief (see ADR Template 7-4). When completed, Table 13 will outline the study duration, key stages and hold points.

This section details the key milestone and hold points throughout the project, and assists in identifying the timing and key hold points in the project. It also provides a reference document during the project, and guidance information for pricing and timing during tendering.

Table 3 lists the typical phases and stages of a flood study. Details for a floodplain management study have been included and should be selected when appropriate.

Table 3: Typical phases and stages of a flood study and floodplain management study

Phase/stage	Description	Hold points
Phase 1	Data collection	
Phase 2	Flood study components	
Stage 2a	Model setup or review, calibration and validation	E.g. 2 weeks
Stage 2b	Design results and mapping	
Stage 2c	Draft flood study report	E.g. 4 weeks
Stage 2d	Final flood study report	
Phase 3	Management study/plan components	
Stage 3a	Model/data review	
Stage 3b	Investigation of existing risk, identification of management options	
Stage 3c	Preliminary assessment of management options	
Stage 3d	Assessment of management options	
Stage 3e	Draft management study report	
Stage 3f	Final management study report	
Stage 3g	Draft management plan report	
Stage 3h	Final management plan report	
Phase 4	Handover of relevant materials	
Phase 5	Completion of contract	

4.7 Deliverables

This section provides guidance on completing Tables 14 of the generic brief. When complete, these will detail the deliverables required to meet the scope of works of the study, as well as the formats of the deliverables.

The deliverables section communicates what is expected from the tenderer, as a reference during the study, and indicates what the principal will have in their possession at the conclusion of the study (as part of the handover).

The primary study outputs will include the final report, model files, results from the models and the associated mapping data. Results files and mapping will be used by a number of end users for a variety of purposes, and will describe the full range of design and historical flood behaviour in detail across the study area. Mapping is generally produced in the relevant datum, typically Australian height datum, for broad use. However, for emergency management planning mapping, it should also be linked to a gauge height, if available, and preferably from a local stream gauge used by the Bureau of Meteorology for flood predictions or warnings in the location. Deliverables will include direct model outputs in addition to processed results derived from the optional section as part of Section 4.6.9.

Where possible, all files should be provided electronically for dissemination to end users through the principal or directly by agreement with the principal.

Communicating the details of the deliverables and their format ensures that the objectives of the study are achieved, and that outputs produced by similar studies are consistent, comparable and able to be effectively and efficiently aggregated where necessary.

Deliverables should also be consistent with any relevant mapping guidelines – for example, as identified in Section 5 of the generic brief. This is the only location in the generic brief that should refer to actual deliverables and outputs. This will avoid duplication and potential contradiction.

Table 14 of the generic brief outlines all deliverables including deliverables derived from optional scope items such as flood damages or LiDAR data. Some items may be too detailed to be included in the report (e.g. collected data on historical flood events) or be solely required to reproduce the study outputs (e.g. model set up files). Table 14 provides space to detail output format and any software preferences. These may be guided by the principal's requirements and relevant guidelines. Typical items to be included in this table are:

- geographic coordinate system
- data
- various software preferences (GIS, word processing, hydrologic model, hydraulic model etc.).

Most industry standard modelling software produces GIS output that is compatible with most GIS software packages. Model results should be provided by the tenderer in their native format to avoid detail being lost in a conversion process or to avoid the costly exercise of regenerating the raw data.

Space in Table 14 has been provided for comment and whether the deliverable needs to be included as a map in the final report. The bulk of the deliverables would be delivered in GIS spatial format and only selected deliverables should be mapped as part of the report. Producing a huge volume of figures can reduce the clarity and functionality of project deliverables. For more simple methodologies, where the outputs may not be spatial, a comment can be provided to indicate, for example, a specific location where results are required.

Identifying end users and referencing Table A from Comparing Model Capability and End User Needs (WMAwater 2013) will assist in identifying all output deliverables. For reference, the outputs identified in Comparing Model Capability and End User Needs (WMAwater 2013), are included in 3.

The line entries in Table 14 should be included based on the scope items included an overview is provided in Table 4, this should be reviewed prior to finalising the project brief. Table 14 can also be used as a handover checklist at the conclusion of the study.

Table 4: End user groups output requirements

Model outputs		Relevant section of guideline
Basic	Flood information at a point location (e.g. flood level or depth)	4.6.5
	Historical flood information (e.g. recorded flood levels)	4.6.1, 4.6.5
	Flood levels	4.6.5
	Flood profiles (e.g. flood levels along a river)	4.6.5
	Flood depths	4.6.5
	Flood velocities	4.6.5
	Spatial flood extent	4.6.5
Complex	Flood planning levels	4.6.9
	Spatial flood information for a range of events	4.6.5
	Flood hazard	4.6.9
	Flood function	4.6.9
	Assessment of impacts of changes in the floodplain due to development, filling or infrastructure crossing the floodplain on flood behaviour	4.6.9
	Flood information for future conditions (climate change/land-use changes) in the catchment	4.6.5, 4.6.9
	Mapping depicting per cent chance of flooding on an annualised basis	4.6.5
	Gauge height/elevations at which structures are overtopped	4.6.5
	Timing of structures overtopped, including levees and bridges	4.6.5,
	Gauge information (related timing)	4.6.5, 4.6.9
	Inundation timing of properties/access roads	4.6.5, 4.6.9
	Levels/AEP at which critical access roads are affected	4.6.5, 4.6.9
	Levels/AEP at which properties are affected	4.6.5, 4.6.9
	Levels/AEP at which critical municipal structures (including pump stations, power substations, water and wastewater treatment facilities, hospitals, schools, airports, and fire and police stations) are affected	4.6.5, 4.6.9
	Assessment of change in flood behaviour or levels as a result of mitigation works	4.6.5, 4.6.9
	Link between gauge height and inundation precinct	4.6.5, 4.6.9
	Assessment of worst-case flood outcomes, such as levee failure	4.6.9

AEP = annual exceedance probability

5 Other aspects to consider

In addition to the study brief, a complete suite of documents for a study should also contain contractual information.

Although most organisations will require the use of standard forms of contract, sections 5.1 and 5.2 provide a general overview of some specific contractual aspects that can influence the utility of study products and therefore may warrant inclusion in contractual documents.

In addition, most organisations will also have standard tendering documentation. Section 5.3 provides some criteria against which tenders for flood investigations can be made.

5.1 Intellectual property of data and models

Suitable intellectual property (IP) clauses should form part of the procurement contract. The clauses should consider how the floodplain management entity (FME) can effectively share and reuse flood information and tools to facilitate the broader understanding and management of flood risk.

Addressing this issue ensures that the FME and any other relevant parties (such as local, state or territory, or Australian government departments) are able to access information under an appropriate licensing arrangement.

The CC license is now in common usage amongst all levels of government in Australia and has been settled as the license that supports open data in all government open data policies. The plain English summary of the CC License can be found at: https://creativecommons.org/licenses/by/4.0/ and the full legal code can be found at https://creativecommons.org/licenses/by/4.0/legalcode. Ideally, the contract should specify that the appropriate copyright notices and markings giving effect to this license are inserted into the materials (predominately the report) by the consulting author as part of the preparation the material.

The best time for the CC License to be applied is when the information is being authored – typically by the contracting author. Consequently, flood information procurement contracts should specify the following:

1. All the outputs are supplied to the FME with the CC License pre-affixed, stating that the FME is the copyright holder.
2. Material owned by the consultant and/or the FME that is incorporated into the outputs (i.e. 'nested' copyright material for example, images, maps, text, or tables in a report), is also licensed under the CC License.
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5.2 Provision of models

The contract should also require copies of the all deliverables of the project (including models and result files) to be provided to the FME and other specified government agencies, where required, or their designated location(s) at the completion of contract. This is to avoid any charge for this at a later date.

An electronic copy of the project deliverables should also be provided, which can, where relevant, be included in jurisdictional and/or national databases, in addition to having advantages for the FME.

5.3 Tender requirements and assessment

It is recommended that the brief include the criteria against which the tenders will be assessed. This will guide the tenderers in their submission and provide the principal with criteria to justify the selection of a successful tenderer. It also gives less-experienced tenderers assistance in what their proposal should contain. An example of things that might be included in the assessment criteria are:

- appreciation of study requirements and specifications
- relevant experience and successful performance with particular reference to nominated team members
- technical skills of the nominated team members
- proposed methodology, including methods to address data constraints and how the available data will be best used, to produce robust flood modelling outputs
- management skills and demonstrated ability to deliver the project on time and within budget
- communication and customer relationship management
- location
- tender price / value of proposed services.

Tenders must also include evidence of a quality management system, and cover for professional indemnity insurance, public liability insurance and statutory workers' compensation insurance.

A brief will normally involve a range of requirements of the tenderer that are not part of the project's scope. Rather, they are conditions that demonstrate the tenderer's appreciation of the task, but are not related to the outputs of the study. For example, curricula vitae of nominated team members are typically required as part of the proposal so as to evaluate the tenderer's experience. Other suggested requirements include:

- A completed cost schedule based on an electronic spreadsheet provided as part of the brief, which reflects the included scope items. This will increase the ease of comparison between relevant bids. An example cost schedule is included in Appendix GB.
- A timeline of how the various scope items will be completed in the specified study duration.
- A section on the limitations and critical assumptions of the proposed methodology to meet the full requirements of the brief, and deliver all deliverables and outcomes.
- Information on referees, conflicts of interest and critical tendering assumptions.

Appendix A Checklists

Checklist A: Governance and objectives (relates to Section 3)

Section of generic brief	Questions	Response
Section 1 – Establishing governance	What assistance is available? Technical? Financial?	
	What are the relevant jurisdictional policies and guidelines?	
	Who are the end users?	
	Who should oversee the study?	
	Should other government agencies be involved?	
	If so which ones and how?	
	How will the project steering committee report to the FME?	
Section 2 – Objectives of this study	What is the study area?	
	What does the study aim to achieve?	
	What are the general needs of end users?	
	Are you expecting to use a simple or more complex approach?	
	Are you dealing with riverine or overland flood problem?	
	What type of study is necessary (e.g. flood study, floodplain management study, or combined flood study and management study)?	

FME = floodplain management entity

Checklist B: Specific scoping questions Part 1

Section	Specific scoping question of generic brief	Brief section	Answer or information to include
Section 4.3 of guideline	**Section 3 – Background and study area**		
	Where is the study area? (see also Section G2.4)	Paragraph 1, Figure 1	
	Describe the catchment?	Paragraph 2	
	What are the location specifics of the study area, town, suburb, LGA?	Paragraph 3	
	What is the flood behaviour?	Paragraph 4	
	Have there been major historical floods? How did they affect the study area?	Paragraph 5	
	What is the warning time and how does it affect emergency management?	Paragraph 6	
	Has a previous study been undertaken using particular software or does your organisation own particular software?	Paragraph 7	
	Who are the study end users? (also see Section G3.5)	Paragraph 8 and Table 1	
Section 4.4 of guideline	**Section 4 – Available information**		
	What previous studies have been undertaken in the study area or surrounding areas of interest?	Table 2	
	What local policies exist that relate to flooding and emergency management?	Table 3	
	What existing data are available for use in this study?	Table 4	
	What other agencies or organisations may hold relevant data or information?	Table 5	
Section 4.5 of guideline	**Section 5 – Current guidelines and references**		
	What national policies should provide guidance for the study? (also see Section G3.3)	Table 6	
	What state/jurisdictional policies should provide guidance for the study? (also see Section G3.3)	Table 6	
Section 4.6.1 of guideline	**Section 6 – Scope of work** **Data collection**		
	Has a data collection or other similar study previously collected data for this study?	Optional text in Section 6.1	
	Will the study need to collect topographic data?	Optional text in Section 6.1	
	Will the study need to collected LiDAR?	Optional text in Section 6.1	
	Will a DEM need to be developed for use in the study?	Optional text in Section 6.1	
Section 4.6.9 of guideline	**Flood damage assessment**		
	Do you require an economic assessment of the cost of flooding via a flood damages assessment? Do other end users require the data?	Optional sub-section ('Flood damages assessment') in Section 6	
	Will floor levels need to be collected?	Optional text in Section 6.1	

Checklist B: Specific scoping questions Part 2

Section	Specific scoping question of generic brief	Brief section	Answer or information to include
Section 4.6.3 of guideline	**Community consultation**		
	Is consultation important?	General question (not a section of the generic brief)	
	At what stages of the project should consultation occur?	Table 7	
	What consultation tools would you like to be used?	Table 7	
	Are there other consultation groups?	Table 8	
Section 4.6.4 /4.6.5 of guideline	**Hydrologic and Hydraulic Assessment**		
	Does the catchment have significant features that affect the flood behaviour?	Tables 9 and 10	
	Are there existing hydrologic and hydraulic analysis that may be utilized as part of this study?	Section 6.4/6.5	
	Do these analysis require update or extension?	Section 6.4/6.5	
	What methods may be required?	Section 6.4/6.5	
Section 4.4.7 of guideline	Is ground truthing of the model results required?	Section 6.8	
	Should the sensitivity of the design flood estimate to temporal patterns be determined?	Section 6.4	
	Should the design flood estimates be compared to methods from ARR87?	Section 6.8	
Section 4.6.8 of guideline	**Events to consider**		
	Are there known historical events?	Table 11, Row 1	
	Are there data available for historical events? (also see G4.6.6)	Optional text in Section 6.6	
	What design events should be considered?	Table 11, Row 2	
	Is there future development that should be assessed?	Table 11, Row 3	
	Should climate change be considered?	Table 11, Row 4, Optional sub-section ('Climate Change') in Section 6	
	Is there a levee that needs to be assessed?	Table 11, Row 5, Optional sub-section ('Levee failure and overtopping analysis') in Section 6	
	Is there other works that should be assessed?	Table 11, Row 6, Optional sub-section ('Impact of works in the floodplain') in Section 6	
	What events should sensitivity testing be undertaken?	Table 11, Row 7	
	What should flood hazard and flood function be determined for?	Table 11, Row 8 and 9, Optional sub-section ('Flood hazard assessment' and 'Flood Function') in Section 6	
	Which design events should management options be assessed for?	Table 11, Row 10, Optional sub-section ('Assessment of management options) in Section 6	
	What events are of interest to emergency managers?	Table 11, Row 11	
	What events are of interest for land-use planning activities?	Table 11, Row 12	

Section	Specific scoping question of generic brief	Brief section	Answer or information to include
Section 4.6.9 of guideline	**Detailed outputs**		
	Does the study need to consider the consequences of flooding on the community?	Optional sub-section ('Consequences of flooding on the community') in Section 6	
	Is there a dam that poses a significant risk that should be assessed?	Optional sub-section ('Dam break assessment') in Section 6	
	Does a flood planning area need to be developed?	Optional sub-section ('Flood planning area') in Section 6	
	Does the study need to consider emergency management aspects?	Optional sub-section ('Emergency management aspects') in Section 6	
	Should the study produce advice on to support into land-use planning?	Optional sub-section ('Advice on land-use planning considering flooding') in Section 6	
	Is there future development that needs to be cumulatively assessed?	Optional sub-section ('Assessment of cumulative impacts') in Section 6	
4.6.14	Is there a reason to increase the confidence in the modelling results by a peer review? (see Section G4.6.10)	Optional sub-section ('Peer Review') in Section 6	
Section 4.6.16 of guideline	**Meetings**		
	What types of meetings are required for the study?	Table 12	
	What is the total number of meetings required for the study?	Table 12	
Section 4.6.17 of guideline	**Timing and hold points**		
	What is the expected project duration?	Table 13	
	What stages and hold points are needed to ensure effective management of this study?	Table 13	
Section 4.7 of guideline	**Deliverables**		
	What formats should the deliverables be in?	Table 14	
	Is detailed mapping required? For what items?	Table 14	
	Are there other data deliverables required?	Table 14	
	What reporting is required?	Table 14	

Checklist C: Generic brief scope and deliverable Part 1

Scope of work item	Guideline section	Standard (S) Optional (O)	Deliverables [a]	Related options that may need to be included	Include in brief
Data collection	4.6.1	S	Report section, flood intelligence data		
Topographic survey	4.6.1	S	Data		
Topographic survey required	4.6.1	O	Data		
Digital elevation model	4.6.1	O	Raw and processed data		
Survey for flood damages assessment	4.6.1	O	Data (surveyed or estimated)	Flood damages assessment	
Site visit	4.6.2	S	Report section and photographs		
Consultation (table 7 and 8 of the brief)	4.6.3	S	Report section including analysis, flood intelligence data		
Consultation tools	4.6.3	O	Input information		
Hydrologic analysis	4.6.4	S	Report section, model		
Hydraulic analysis	4.6.5	S/O	Report section, model, model outputs		
1d steady state			Flood information at a point location, historic flood information, flood levels, flood profiles, flood depths, flood velocities, and gauge height/elevations at which structures are overtopped		
Dynamic 1d			As above, timing of structures overtopped, inundation timing of properties/access roads, gauge information (related timing)		
Course 2d, dynamic (2d) rural, dynamic (2d) riverine, dynamic (1d/2d) overland.			As above, spatial flood extent, spatial flood information for a range of events, mapping depicting per cent chance of flooding on an annualised basis, link between gauge height and inundation precinct	Modelling events flood emergency response classifications of communities	
Modelling events (table 11 of the brief)	4.6.6	S	Flood information for future conditions (climate change/land uses changes) in the catchment, levels/AEP at which properties are affected, levels/AEP at which critical access roads are affected, levels/AEP at which critical municipal structures are affected	Survey for flood damages Flood intelligence	
Model calibration and validation	4.6.7	S	Report section, data		
Model parameter sensitivity	4.6.8	S	Report section, mapping		
Flood hazard assessment	4.6.8	O	Mapping		
Flood function assessment	4.6.8	O	Mapping		

Checklist C: Generic brief scope and deliverable Part 2

Scope of work item	Guideline section	Standard (S) Optional (O)	Deliverables [a]	Related options that may need to be included	Include in brief
Emergency management aspects	4.6.8	O			
Flood emergency response classifications of communities			Link between gauge height and inundation precinct Mapping	Course 2d, dynamic (2d) rural, dynamic (2d) riverine, dynamic (1d/2d) overland	
Additional information needs			Gauge height/elevations at which structures are overtopped, timing of structures overtopped including levees and bridges, gauge information (related timing), inundation timing of properties/ access roads, levels/AEP at which critical access roads, properties and critical municipal structures are affected.		
Impacts of flooding on the community and emergency response	4.6.9		Report section, mapping		
Flood damages assessment	4.6.9	O	Raw data on floor levels, flood damage model input and output files, levels/AEP at which properties and critical infrastructure are affected Data	Modelling events Survey for flood damages	
Assessment of cumulative impacts	4.6.9	O	Assessment of impacts of changes in the floodplain due to development, filling on flood behaviour	Modelling events	
Assessment of management options	4.6.9	O	Assessment of change in flood behaviour or levels as a result of mitigation works Assessment of all impacts of management options including associated modelling. This includes financial (benefit and cost of options), environmental and social impacts, including impacts upon emergency management	Flood damages assessment, modelling events	
Levee assessment	4.6.9	O	Assessment of worst-case flood outcomes, such as levee failure, including financial, environmental and social impacts	Modelling events	
Dam break assessment	4.6.9	O	Assessment of worst-case flood outcomes, such as dam break, including financial, environmental and social impacts	Modelling events	
Impact of floodplain works assessment	4.6.9	O	Assessment of impacts of changes in the floodplain due to infrastructure crossing the floodplain on flood behavior, including financial, environmental and social impacts where relevant	Modelling events	

AEP = annual exceedance probability

a. The report is to address the whole scope of work, including optional portions in sufficient detail to be fit for the intended purpose.

Appendix B
Additional materials

B1 Example file structures for data handover

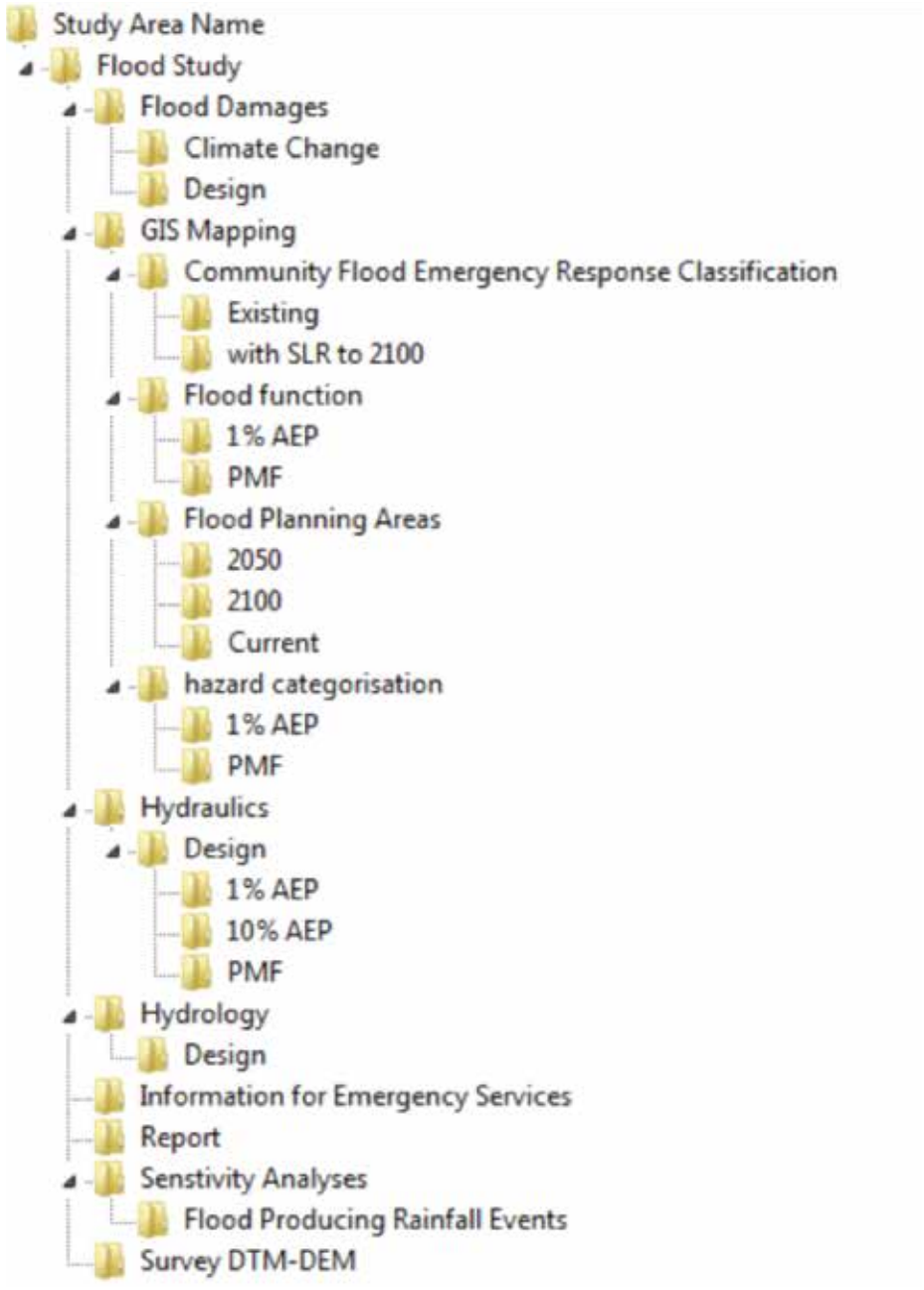

Figure B1: Example file structure for a simple rural or urban project

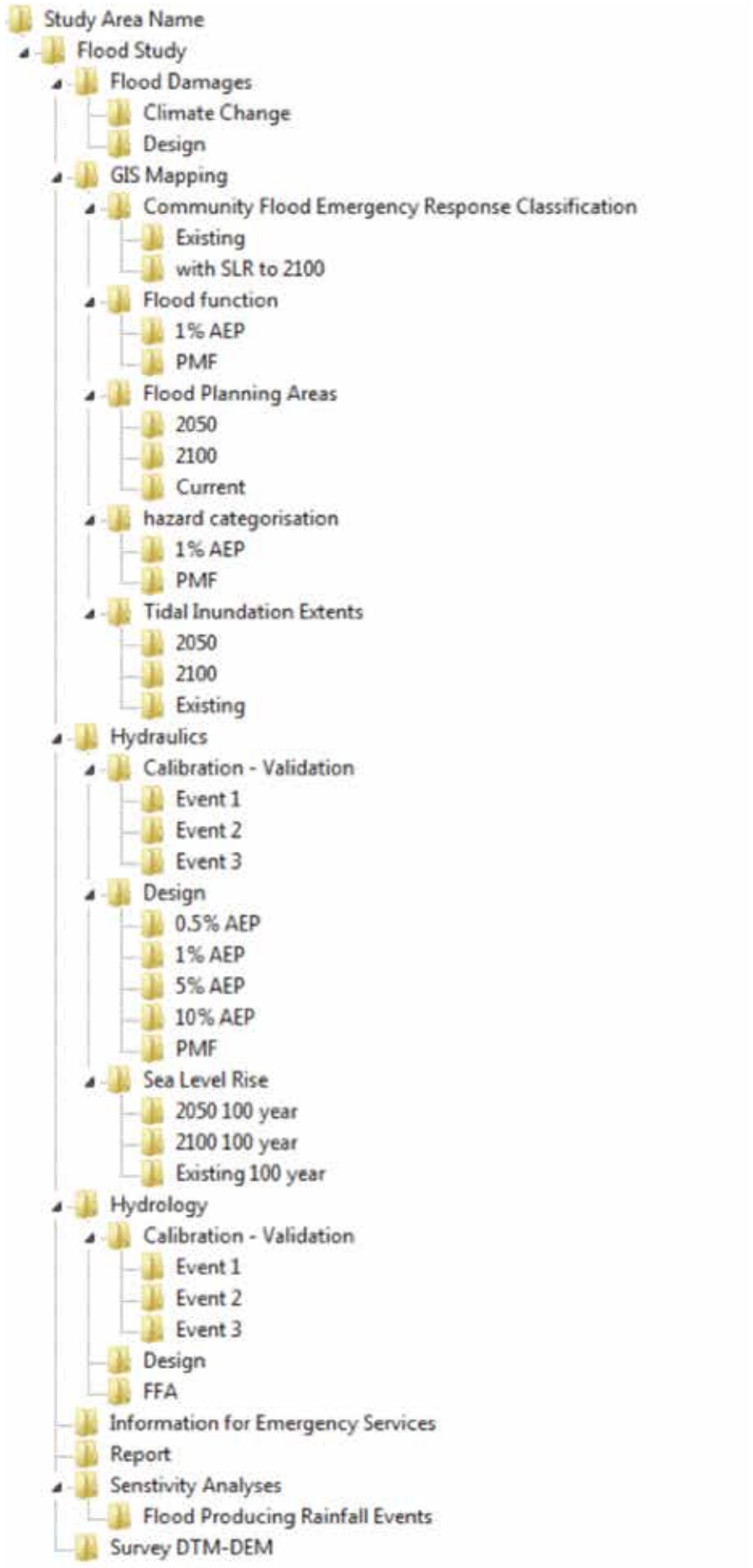

Figure B2: Example file structure for a complex rural or urban project

B2 Sample cost schedule

Including a cost schedule (Table GB1) helps to identify tasks to be completed and tenderers to price in a way that is more easily compared.

Table B1: Sample cost schedule Part 1

Phase 2: Flood study cost schedule	Classification of consultant and consultant's time[a]					Total hours	Total cost
	Project manager Rate $xx/h	Senior engineer Rate $xx/h	Engineer Rate $xx/h	Junior engineer Rate $xx/h	Other staff Rate $xx/h		
Stage 1. Completion of data collection and assessment							
1.1) Data collection and review							$0
1.2) Site inspection							$0
1.3) Survey including cost of preparing and managing survey – brief only							$0
1.4) Community consultation – prepare and distribute brochures, newsletters, questionnaires, etc.							$0
1.5) Community consultation – prepare for and conduct workshops, forums, etc.							$0
1.6) Prepare and present progress report for Stage 1 (including meetings)							$0
SUBTOTAL (hours, excl. GST)	**0**	**0**	**0**	**0**	**0**	**0**	**$ –**
Stage 2. Completion of modelling and mapping report							
2.1) Hydrology							$0
2.1.1) Flood frequency analysis							$0
2.1.2) Establish hydrologic model(s)							$0
2.1.3) Calibrate/validate hydrologic model(s)							$0
2.1.4) Develop design hydrographs							$0
2.2) Hydraulics							$0
2.2.1) Establish hydraulic model(s)							$0
2.2.2) Calibrate/validate hydraulic model(s)							$0
2.3) Prepare and present progress report for Stage 2 (including meetings)							$0
SUBTOTAL (hours, excl. GST)	**0**	**0**	**0**	**0**	**0**	**0**	**$-**

a. Hours; all rates exclude GST.

Table B1: Sample cost schedule Part 2

Phase 2: Flood study cost schedule	Classification of consultant and consultant's time[a]					Total hours	Total cost
	Project manager Rate $xx/h	Senior engineer Rate $xx/h	Engineer Rate $xx/h	Junior engineer Rate $xx/h	Other staff Rate $xx/h		
0.1) Hazard							$0
0.2) Function							$0
0.3) Emergency response							$0
0.4) Land-use planning							$0
0.5) Flood impact assessment (includes flood damages)							$0
0.6) Assessment of cumulative impacts (beyond flood function advice)							$0
0.7) Assessment of management options (including ones that do not impact upon hydrologic and hydraulic modelling)							$0
0.8) Levee assessment							$0
0.9) Dam break assessment							$0
0.10) Peer review							$0
SUBTOTAL (hours, excl. GST)	**0**	**0**	**0**	**0**	**0**	**0**	**$ –**
Stage 3. Draft study report							
3.1) Model design flood events							$0
3.2) Determining and mapping hydraulic and hazard categories							$0
3.3) Determining and mapping current and future residential flood planning areas							$0
3.4) Determining and mapping current and future tidal inundation extents (where relevant)							$0
3.5) Sensitivity analyses including climate change							$0
3.6) Prepare and present progress report for study report (including meetings)							$0
SUBTOTAL (hours, excl. GST)	**0**	**0**	**0**	**0**	**0**	**0**	**$ -**

a. Hours; all rates exclude GST.

Table B1: Sample cost schedule Part 3

Phase 2: Flood study cost schedule	Classification of consultant and consultant's time[a]					Total hours	Total cost
	Project manager Rate $xx/h	Senior engineer Rate $xx/h	Engineer Rate $xx/h	Junior engineer Rate $xx/h	Other staff Rate $xx/h		
Stage 4. Final study report							
4.1) Collate and review all comments/ submissions regarding the draft report							$0
4.2) Prepare final report (including all printing)							$0
SUBTOTAL (hours, excl. GST)	**0**	**0**	**0**	**0**	**0**	**0**	**$0**
Stage 5. Completion of contract							
5.1) Handover of all study materials							$0
SUBTOTAL (hours, excl. GST)	**0**	**0**	**0**	**0**	**0**	**0**	**$0**
Disbursements (to be itemised)							
SUBTOTAL (hours, excl. GST)							**$0**
TOTAL COST OF PROPOSAL (excl. GST)	**0**	**0**	**0**	**0**	**0**	**0**	**0**
GST							**$0**
TOTAL COST OF PROPOSAL (incl. GST)							**$0**
ADDITIONAL COSTS (not included in TOTAL COST)							
A1) Flood damage assessment (optional task)							
A1.1) Cost of assessing flood damages (including any survey)							$0
A1.2) Cost of assessing flood damages (including any survey) to additional properties due to the impact of climate change							$0
A2) Additional meetings (above inception, meeting at end of stages 1–5)							$0
A3) Public presentation and display							$0
A4) Presentation of final report to a meeting							$0
A5) Refamiliarising with suspended project							$0
A6) Itemised cost of work NOT detailed in this brief – estimates only – not included in total cost of proposal							$0

a. Hours; all rates exclude GST.

B3 Sample contractor and tender details (optional content)

Proposal to be lodged at: Insert details

By _____ am/pm on: Insert date

Name of consultant:

(in block letters) _____

ACN (if applicable): _____

Address: _____

_____

Hereby proposes to perform consultancy services in accordance with the brief for: Generic creek flood study

Study fee ..... ($.....)

Alternative study fee (if applicable) ..... ($.....)

In accordance with the attached hourly rates for the study team and cost schedule

And in accordance with the attached outline plan dated: / /
comprising _____ pages

I/we declare that no conflict of interest exists in the performance of the consultancy services at the date of this declaration

Signed for the consultant by: _____

_____

(authorised officer)

In the office bearer capacity of: _____

Name (in block letters): _____

Date

Notes:

This is a fixed lump sum contract.

Fees may not exceed those nominated on this fee proposal form without the prior written approval of the Principal.

Acronyms and abbreviations

ADR Handbook 7	*Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia* (AIDR 2017)
AEP	annual exceedance probability
ARR	Australian Rainfall & Runoff
DEM	digital elevation model
DFE	defined flood event
FME	floodplain management entity
GIS	geographic information system
LiDAR	light detection and ranging
NFRAG	National Flood Risk Advisory Group
PMF	probable maximum flood

References

Australian Disaster Resilience Handbook 7 Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia, AIDR 2017

Australian Disaster Resilience Guideline 7-6 Assessing Options and Service Levels for Treating Existing Risk (AIDR 2017)

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Australian Disaster Resilience Handbook Collection – *Australian Disaster Resilience Manual 28 Economic and Financial Aspects of Disaster Recovery,* AIDR 2002

Australian Disaster Resilience Handbook 6 National Strategy for Disaster Resilience –Community Engagement Framework, AIDR 2013

DSDIP (Queensland Department of State Development, Infrastructure and Planning) 2014, *State Planning Policy – State Interest Guideline: natural hazards, risk and resilience*. Technical manual, DSDIP, Brisbane

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WMAwater 2013, *Development of Practical Specifications for Mapping and Modelling Outcomes and Outputs. Stage 1 – comparing model capability and end user needs to guide model selection,* WMAwater, Sydney

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