

Report on the Environmental Scan into
A National Approach to Flood Modelling

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Executive Summary

1. Flood modelling is somewhat complex and involves a number of technical, legal, resourcing and financial factors. It is understood that these things need to be considered before Government can fund or recommend a national approach. This environmental scan was undertaken to help identify the scale and scope of activities in this area and determine what needs to be done.

2. Some information received has been detailed, specific and technical while other information is indicative only, and information gaps are apparent. Further work is required to develop a full understanding of flood modelling in Australia.

3. The environmental scan highlighted that:
   a. there are many agencies, organisations and individuals involved in flood modelling
   b. there is coordination in some areas but the effectiveness varies between jurisdictions and in some instances it is often limited or ad hoc
   c. flood modelling is a complex technical task that is reliant on good quality meteorological, hydrological, geomorphologic, digital elevation and land use data
   d. some people are able to access data easily while others either cannot, or are unaware of how to, access it
   e. there are limited mechanisms to discover data and there is duplication of effort looking for it
   f. there are issues around the coordinated collection, cost, licensing and archiving of data
   g. there is both consistency and inconsistency (or the perception of inconsistency) in the accuracy and methodology of flood modelling

4. In summary, there is no consistent or national approach to flood modelling and there are systemic issues that make if difficult or expensive to perform flood modelling. This limits how Australia is able to use information to support a safe, secure and resilient society.

Note: The term 'modelling' is used in this report generally instead of 'mapping'. The former is used as a holistic term to highlight that this is an ongoing process that takes account of many factors. The latter tends to focus on the 'map' output and could give the impression that the activity is complete when a map is produced.

Introduction

5. This past summer, Australia was hit with some of the most testing natural disasters the nation has ever faced. The sequence of floods, cyclones, bushfires and storms was relentless and they impacted on us physically and emotionally as well as financially. In economic terms, the Queensland floods are likely to be the most costly natural disaster in Australia's history.

6. On 13 February 2011, the Council of Australian Governments (COAG) endorsed a National Strategy for Disaster Resilience. The Strategy provides high level guidance to federal, state, territory and local governments, as well as the business community and the not for profit sector, on priority areas for action in building a more disaster resilient Australia.

7. The Strategy emphasises that governments cannot improve resilience alone – the private sector, and in particular the insurance industry, has a vital role to play. The strategy is also about providing all Australians with a better understanding of the disaster risks we face, and the practical steps that we can take to better prepare and protect ourselves. This will help increase individual and

community level empowerment and resilience rather than relying on post disaster recovery efforts and hand outs.

8. It is necessary to minimise our exposure to disaster risks over the short, medium and long term and focus as much on prevention and mitigation as on recovery. In regard to flood events, our ability to predict and monitor floods, and make decisions during a flood event, is critical. The ability to quantify flood risk and price insurance is also critical and will help ensure that people are better able to recover from floods and that costs are spread across communities. Flood modelling for the purpose of identifying this risk is a critical element here and, if done in a strategic manner, is able to serve a number of purposes.

9. To progress work in this area, COAG agreed to task the National Emergency Management Committee (NEMC) to report on a consistent national methodology to assess risk for priority hazards and the manner in which they will be published. In recognition of the severity of the recent flooding in Queensland and other eastern states, the Ministerial Council for Police and Emergency Management – Emergency Management (now the Standing Council on Police and Emergency Management) asked the NEMC to prioritise the development of a program of work to map areas of risk relating to riverine flood, flash floods, storm surge and coastal inundation. The exercise is planned to take into account existing knowledge and initiatives; currency of information and identified information gaps; identification of the full scope of applications of modelling for flood risk identification and the need for consistent and robust methodologies.

10. At the Commonwealth level, this exercise is being led by the Attorney-General's Department (AGD). AGD commenced a high level environmental scan in March 2011 in cooperation with the Risk Assessment Mitigation and Measurement (RAMMS) Sub-Committee of the NEMC. AGD has consulted with key Government and industry stakeholders including the ICA to seek their input and perspectives.

11. This is the first step in the process as it is recognised that research, analysis and stakeholder consultation need to be undertaken before Government could recommend, agree or consider funding for a national approach to flood modelling. A proposal is expected to be completed later in the year.

12. The Government's Natural Disaster Insurance Review (NDIR) Panel are also addressing issues of flood-related issues as part of a broader review of insurance. To date, findings of the NDIR are consistent with this environmental scan. The NDIR will release its final report setting out its recommendations including insurance industry access and usage of flood modelling data to the Assistant Treasurer on 30 September 2011.

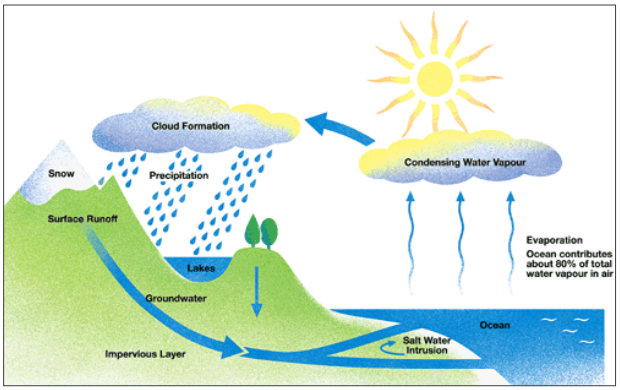
13. The environmental scan process is covered in more detail at Appendix A. Consultation is outlined at Appendix B. A summary of the role or involvement by various areas in flood modelling is provided at Appendix C.

Flood Modelling

14. Flooding results from a series of complex interactions between the natural and built environment. A clear understanding of flooding is critical to understanding what we can do to anticipate, mitigate, monitor and respond to floods.

15. Floods occur where water builds up or flows in places we do not want it or where it is not usually found. The processes that cause flooding are part of the hydrologic cycle that many people are familiar with. A simplified description follows.

16. Rain falls. It varies in intensity, frequency, duration and extent. As rain hits vegetation, a proportion of it is held by leaves. As it hits the ground, it can be absorbed or start to run off to varying degrees depending on the soil or surface type (eg. clay, loam, sand or asphalt). As the soil becomes saturated, water will run off more easily. Water evaporates due to wind and higher temperatures. If it falls as snow or hail, it can remain in place before melting and running off.



17. Water flows to lower areas in relation to topography or the elevation of the land. It naturally runs down valleys and flows into rivers but can also flow as larger sheets or bodies of water. It gets held in dams; and held back or diverted by structures like levees. Water can overflow river banks, dams, levees or block pipes. A dam might break and release a large amount of water that was collected over a period of time.

18. Cyclones regularly affect parts of Australia and often produce large amounts of rain. Tides and storm surges can produce coastal inundation and increase the impact of cyclones. Tsunamis may be rare in Australia but could push water to inland areas.

19. The predicted effects of climate change provide an additional layer of complexity and will amplify climatic conditions. As temperatures rise and there is more latent heat in the system, there will be increased frequency and intensity, and changes in the spatial distribution, of climatic events (including precipitation). As sea levels rise, there will be increased frequency and impact of coastal inundation. By way of example, a mid-range sea-level rise of 0.5 meter in the 21st century will mean that events that now happen every 10 years would happen every 10 days in 2100.

20. Flood modelling enables humans to understand and calculate probabilities of flooding in particular areas. Flood modelling has a range of uses, relies on various kinds of input data and makes use of a number of models and analytical tools. It also results in a number of different outputs. These are covered in more detail in the following paragraphs.

Uses of Flood Modelling

21. Flood modelling is useful to many people because flooding affects many aspects of our lives. Near real-time flood modelling used for emergency management is far more complex and data hungry than the modelling used for non emergency management activities such as environmental analysis and land use planning. Following is a short overview of some of the uses of flood modelling (in various forms) and a description of how it benefits people.

Use	Description
Emergency Management	Emergency managers need to develop evacuation plans, identify safe areas and understand the population that might be affected by flood events. During a flood, they need to be able to anticipate where a flood is likely to be at a given point in time, understand the level of inundations and be able to prioritise activities. Accurate flood information enables them to identify access routes, plan evacuations or movements of people, and support isolated communities.
Environmental Analysis	Environmental analysis involves development of environmental impacts statements, analysing effects on flora and fauna, understanding biodiversity and calculating economic impacts from various influences.

	Floods affect the environment in the short and long term and can greatly affect the natural environment.
Insurance	The pricing of insurance is a function of the risk and the uncertainty associated with estimating that risk. The price of risk depends on the likelihood and magnitude of losses and it is common for pricing to be based on the expected loss experience of a group of like risks. The more uncertainty there is about expected losses, the higher the cost of insurance. Flood modelling provides a way to estimate the frequency and extent of potential floods and therefore the consequent cost of repair or rebuilding. Generally, insurers with better flood information will be able to charge on average lower premiums. Ensuring that people have access to insurance increases resilience generally, and alleviates some of the direct financial impact to the nation.
Land Use Planning	Floods affect the placement and design of roads, bridges, culverts, drainage systems, dams and other infrastructure. They can also influence building codes, land use planning and zoning. Understanding where flooding is likely to occur informs the development and prioritisation of mitigation projects such as placement of levees. Public access to flood information is necessary so that people can make informed decisions and build a resilient society. While it would likely affect communities generally and have an economic impact (eg. real estate prices), it will help mitigate the future costs and impacts of flooding. Flood modelling is an ongoing process because development of new infrastructure shifts or influences water flow, possibly shifting where floods occur.

Case Study: Pricing of Insurance

Insurance companies need to be able to quantify risk in order to determine the price of insurance. This is achieved by understanding the probability of an event occurring and extent of potential floods (amongst other things) and therefore the potential financial impact of a flood to the insurance company. To the extent that data are of poor or unknown accuracy, not up to date and/or low resolution, then actuaries/insurers will increase prices to offset the lack of certainty. Insurance companies carefully monitor their exposure to any one event and buy reinsurance to limit exposure.

There are significant problems for insurers in obtaining the information needed to assess exposure to floods and the detailed data available in other countries are not available in Australia. A sound insurance market needs to be competitive to maintain affordability and equity for the insurance purchaser. It is conceivable that the smaller insurers in Australia will not have the resources to collect and analyse the data needed to allow them to properly price flood risks. Good and regularly updated publicly available flood mapping would give a common framework for consideration of a range of interests, including development and town planning and insurance needs.

Currently, most flood maps in Australia are outdated and refer only to 1 in 100 flood levels, which are defined in different ways. Flood modelling would ideally provide other levels (eg. 1 in 10, 1 in 20, and 1 in 50) and include detailed local topography. Insurers can use this information in conjunction with details about properties (construction type, is the house raised or built on the ground, cost of rebuilding etc.) and pay close attention to building codes in assessing insurance premiums.

The Insurance Council of Australia believes that a first step for them is to be able to access existing data held by LGAs which is not always available to them. Existing data is fine for their purposes now but access to higher quality data would allow more accurate pricing of insurance. Ideally, if flood maps exist, they would be able to access them so that they do not create another version with possible conflicts. There is also some uncertainty about the quality, accuracy and methodology of 'flood maps'.

An interesting point to note is that the Australian share of international expenditure on reinsurance is 2% while recoveries from reinsurance are 6%. This means that reinsurance is relatively cheap and accessible in Australia. There may be less incentive for global reinsurance companies to be involved in the Australian market if there is limited access to information to support the accurate pricing of insurance and reinsurance.

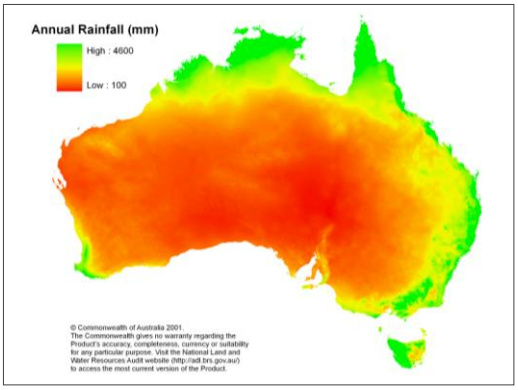
Stakeholders

22. Many people have an interest in flood modelling (and associated aspects of it) including:
    - Residential home owners
    - Industry and business owners
    - Land us planners and property developers
    - Emergency managers and emergency services
    - Government and government agencies (including LGAs)
    - Scientists
    - Environmental groups
    - Engineers
    - Insurance companies and actuaries
    - Data providers

23. In general, flooding is a national issue that affects many people in society.

Data

24. Flood modelling requires a range of different data sets depending on the specific objectives of the modelling activity. Specific data sets may include:
    - Climate data
    - Hydrological data
    - Land cover data
    - Soil or surface type data
    - Elevation data
    - Demographic data
    - Building information
    - Information on flood management structures



25. Taking climate data as an example, this includes information design, rainfall intensity and other rainfall data, as well as information on cyclones, long term climate patterns, seasonal and cyclical variations (eg. el Niño). It also incorporates the predicted effects of climate change (which requires additional input data and models) and covers the frequency, intensity and distribution of climatic phenomena.

26. Models may be enhanced or updated in near real time by new or current input data including:
    - Rain gauge measurements
    - River gauge measurements

27. For any data type, one needs to consider the required resolution, accuracy and coverage of data. This will influence how and where one might be able to access data, or how much it will cost. It therefore feeds into and influences collection planning and collection methods. Higher levels of accuracy and resolution usually come at greater cost.

28. Historical data about past flood events (flood intelligence) can be very useful as a practical basis of understanding flooding and for validation of models. However, it has limited use for longer term predictions as climate patterns change and new infrastructure is built.

Models and Analytical Tools

29. Flood models and analytical tools make use of a range of input data sets to determine the probability, frequency, extent and depth of flooding in particular locations. In simple terms, they tell us how likely, how often, where and how deep flooding might be.

30. The results are often represented on a hardcopy map. This is useful for communication purposes and broad scale or indicative information but it cannot reflect changes in predictions that result from, for example, changes in infrastructure or new climate change predictions. The information becomes dated.

31. More importantly, results are often available in geospatial formats. This means that flood data can be used for a number of purposes (as outlined above). The flood data can be combined with demographic or building data, for example, for further modelling to understand and predict risk and impact on communities and infrastructure.

32. Geographic Information Systems are often used to collate, analyse, manipulate and visualise information. They can also be used to create maps using the latest data. This last point highlights why the data and processes are the key considerations, not the 'map'.

33. Flood predictions are often expressed as, for example, a 1 in 100 year flood. Care is needed in interpretation here since it does not mean that the flood will only occur once in 100 years. Rather, it is a probabilistic expression of the likelihood of a particular flood event occurring at any given time period and could be expressed as a 1% chance of flooding occurring in a year. It is also possible that a 1 in 100 year flood could occur in consecutive years or even twice in the same year.

34. Modelling and analytical tools can also be used during a flood event for a number of purposes (also outlined above). In this situation, the models can be provided with new or current input data such as rain density derived from rain gauges and possibly radar, river gauge heights or observed flood levels. Satellite data can be used to identify moving bodies of water. Models can then be run again to update predicted flood extent and flood levels. These models are dynamic in nature and are often very different from the models that deal with more static information.

35. There are number of models of varying degrees of complexity. Simple bathtub models just increase the level of water and compare it against an elevation model to indicate where flooding will occur if, for example, a river reaches a height of 5m. There are also 2D and 3D models that may use 'smooth particle' analysis and take into account many more factors like obstacles, river levees or water interacting with itself. The choice of model depends on the purpose.

36. Complex models produce more detailed and accurate results but require more detailed and accurate data. They take longer to produce and are likely to come at higher cost.

Modelling and Analytical Activities

37. A number of modelling and analytical activities have been undertaken around the country. These have been done by Local Government Areas, government agencies or by authorities like the Murray-Darling Basin Authority.

38. From a national perspective, activities appear to be somewhat patchy and incomplete in coverage, currency and/or accuracy. Activities also appear to be limited by funding, human resources and possibly technical expertise. However, the environmental scan was not able to gather enough specific and detailed information in the given timeframe and further work remains.

39. A number of flood related projects were previously funded under the Natural Disaster Mitigation Programme but the status or effectiveness of these has not been established yet. The National Flood Risk Advisory Group draws together some key participants in the areas of flood risk modelling and could provide a useful source of knowledge and experience. A number of related forums or workshops are planned to address the topic of flood modelling although they do not appear to be framed within a coordinated national approach.

Case Study: Building Community Resilience

Building community resilience to the impact of flooding events involves a range of measures. These can include physical mitigation of flood waters, such as with levees, off season advice of when and where waters are likely to rise in the event of a flood, and real time warnings and flood level advice as floods are occurring. Flood modelling can be used to assist in planning, design and placement of levees, rainfall stations, and river gauges, and assist with community education with regard to how to prepare for flooding that may still occur.

To build community resilience, flood warning systems and their related public education programs must emphasise the need for flood affected residents to remain proactive during the sometimes long periods between large flood events.

In 1993 and 1998, the Ovens and King River catchments in north-eastern Victoria experienced severe flooding. In September 1999, State and Australian Government funding provided a grant of $408,000 to upgrade the flood warning system for the Ovens River, King River and Fifteen Mile Creek catchments. The primary aim of upgrading flood warning services was to help reduce flood damage through the provision of accurate and timely information to the community.

Features of the improved flood warning system for the Ovens and King River include:

- an increased number of automatic rainfall stations and river gauges to provide clearer information and real time data
- improved 'real time' modelling by the Bureau of Meteorology
- improved flood warning information flow from the Bureau to the Victorian State Emergency Service, local councils, agencies, community groups and individuals
- community education, including the distribution of flood response guidelines to all affected residents, and the development of a register for flood information providers.

40. There is scope for more rigorous cost/benefit analysis of the effects of doing or not doing flood mitigation projects in the future, especially to achieve the best return on investment. This would involve more rigorous modelling to help people understand and quantify the effects of flooding with or without specific mitigation strategies.

Key Points, Issues and Questions

41. As a result of this environmental scan, a number of key points, issues and questions have emerged. Identifying them early will help inform subsequent work in this area.

Data Accessibility and Quality

a) For insurance companies, access to **existing** flood mapping data will meet their immediate need of being able to price flood insurance.
b) Data that is poor or of unknown quality is likely to result in higher prices for premiums.
c) The ICA would like to be able to access better quality data in the future, recognising that mitigation and resilience should be the key drivers behind flood modelling.
d) Some flood mapping data is quite old and there are questions about the quality, accuracy or methodology of available information.
e) Data that does exist is held by different organisations and is not often easy to discover.
f) Government could consider establishment of a national data library with an online catalogue system (even if the data itself resides elsewhere in the country).
g) Some fundamental data should be considered a national resource because it underpins many Government and business activities and enhances effectiveness, efficiency and productivity.
h) There is a question as to whether Government has a role to coordinate or fund such data. (It is often beyond the ability or interest of smaller entities to coordinate or fund such data collection.)
i) There is a question about what type, quality and resolution of data is required for national purposes and what arrangements could be developed to cost share the purchase or creation of data for particular interests.
j) Data is often purchased multiple times with public money because of the way licenses are created. There would be cost benefits in better coordinated collection planning and data acquisition across Government. (Multiplying the base cost of data by about two or two and a half would often allow much greater use of data for a range of purposes.)

Data Discoverability

k) There are many agencies, organisations and individuals involved in flood modelling and people are not always aware of where to source information (data, models and expertise) resulting in wasted time and money, and duplication of effort. Government could consider establishment of a national flood coordination group to provide strategic oversight of flood-related activities.
l) Government could also establish a website that draws together flood-related information on funded projects, research activities, data and mapping products.

National Standards

m) Standards are important to provide assurances about the accuracy, relevance, currency and consistency of (any) information. There do not appear to be any agreed national standards for flood mapping activities, particularly for flood mapping work in LGAs.
n) There have been suggestions that Government funding for flood mitigation projects (for example) could be made conditional upon the recipient making the data available and meeting certain standards.

Risk and Planning

o) Mitigation projects could be appraised in terms of how they modify risk (assuming data and models are available and accessible).
p) There are questions as to whether issues may arise about inappropriate zoning or building approvals if more consistent or accurate flood modelling activities are undertaken and show that houses have been built in flood prone areas.
q) There are questions about what impact this may have on property prices or about liability by land use agencies if this is the case.

42. The environmental scan only touched peripherally on international flood-related activities. While these present possible approaches, they would have to be adapted to the Australian context. A few additional points are:

    a) In the United States, the following occurs:
        i. Data purchased with public money is made available freely to the public for other uses.
        ii. Flood insurance is mandatory but it is underwritten by the Federal Government.
        iii. There are good faith provisions in legislation to stop litigation for best effort flood modelling activities.
        iv. Properties have been bought back in areas of high flood risk.
        v. There is a strong interest by the public and private companies in increasing the resilience of critical infrastructure.
    b) The United Kingdom has undertaken a broad scale, flood risk assessment across the nation. This supports targeted investment in areas of greatest need, strategic flood management planning and understanding how mitigation projects modify risk.

Initial Recommendations

43. It is clear that there is no consistent or national approach to flood modelling and there are systemic issues that make if difficult or expensive to perform flood modelling. This report on the environmental scan is not intended to define the solution but to substantiate and inform further effort in this area.

44. It is recommended that:
    a) All States and Territories take urgent steps to ensure the flood mapping data produced by local governments in their jurisdiction is made available to the insurance industry and other relevant stakeholders, including if necessary by legislation.
    b) AGD and BoM lead a Strategic Coordination Group at the Commonwealth level in collaboration with States and Territories to progress longer term issues
    c) The Strategic Coordination Group develop a proposal for Government on a national approach to flood modelling, with costed options
    d) A workshop be held to identify specific objectives and possible project activities including:
        i. better coordination of flood modelling activities
        ii. addressing impediments to accessing existing data from local, state and Federal agencies (including the use of legislative, policy or other means)
        iii. a coordinated approach to data collection (including factors such as data type, resolution, location, purpose, priority and cost)
        iv. means to discover and access data and other relevant information more effectively
        v. creation of national standards and a framework for developing and agreeing to these standards relevant to flood modelling and mapping (that address general and specific requirements)
45. The next phase of work will involve broad stakeholder engagement with the public and private sectors
46. Consideration be given to how this work will be communicated more broadly, possibly through a dedicated website.

47. A Project Plan will be developed for the next phase of work.

48. A scoping study may need to be undertaken in order to:
    a) define requirements for data, tools and products related to flood modelling
    b) gather specific, detailed information about available data, models and analytical tools, modelling and analytical activities and products
    c) identify gaps and possible solutions to filling those gaps

d) consider the role of Government in regard to flood-related data and other activities
e) explore the public benefits of data being available for free or at a minimal cost; and
f) identify how other countries approach flood modelling and the provision of flood-related information to their communities

49. As a guiding principles, the proposed approach to flood modelling should aim to meet the needs of the majority of stakeholders at least cost.

APPENDIX A

Process

50. It is recognised that research, analysis and stakeholder consultation needed to be undertaken before Government could recommend, agree or consider funding for a national approach to flood modelling.

51. The first step in the process was to gain an understanding of what has been done, what needs to be done and the roles of respective agencies and organisations in this area. Specific information was requested as follows:

Item	Description
Data	Data already collected or available, planned collection or analysis of data requirements; coverage, release or use limitations, general costs (eg license restrictions), funding for data
Models and Analytical Tools	Models you use, are developing or plan to develop; release or use limitations, general costs (eg. license restrictions), funding for models or analytical tools
Modelling and Analysis	Modelling and analysis you have conducted
Outputs	Information about outputs of your work related to flood modelling including reports, databases, maps, analyses
Other Agencies	Other agencies or organisations whom you think we should approach in regards to flood mapping
Contact Officer	A contact officer in your agency responsible for this activity and whom we can contact for clarification or further information

52. A general overview of the process follows:

Date	Activity
01 Mar	AGD sent letters to relevant Commonwealth agencies, the Murray-Darling Basin Authority and ALGA requesting information on flood modelling
07 Mar	AGD sought legal advice about the Water Act to advise the Attorney's Office
22 Mar	RAMMS sent letters to jurisdictions requesting general information on flood modelling
23 Mar	AGD met with Treasury to discuss a national approach to flood modelling
30 Mar	AGD sent an update (submission) to the Attorney on a national approach to flood modelling
27 Apr	AGD met with the Insurance Council of Australia to discuss their requirements for flood risk mapping and activities in this area
27 Apr	AGD met with members of the Natural Disaster Insurance Review (NDIR) Panel to exchange ideas on flood modelling
06 May	Developed initial Project Schedule (current version shown at Appendix C)
13 May	RAMMS sent letters to jurisdictions requesting detailed information on flood modelling
18 May	Started draft Report
01 Jun	Finalised draft Report with initial recommendations
10 Jun	Final version of Report following review and comments

APPENDIX B

Consultation

53. The table below lists (in alphabetical order) agencies, organisations or individuals consulted as part of this environmental scan with an indication of who lead the consultation and whether input was received. This provided a broad perspective on the topic and helped identify common views and issues. It should be noted that not all areas were able to provide a response, or a detailed response, given the time constraints.

54. Consultation was extensive but not in great depth as the initial focus was to define the general scale and scope of flood modelling activities to inform scoping of a general work program and subsequent follow up consultation.

Agency, Organisation or Individual	Lead	Input
Australian Capital Territory	RAMMS	✗
Australian Institute of Actuaries (informal discussions)	AGD	✓
Australian Local Government Authority (ALGA)	AGD	✗
Bureau of Meteorology	AGD	✓
Cooperative Research Centre for Spatial Information (CRCSI)	AGD	✓
CSIRO	AGD	✓
Defence Imagery and Geospatial Organisation	AGD	✓
Defence Science and Technology Organisation	AGD	✓
Department of Climate Change and Energy Efficiency	AGD	✓
Department of Innovation, Industry, Science and Research	AGD	✓
Department of Regional Australia, Regional Development and Local Government	AGD	✓
Department of Sustainability, Environment, Water, Pollution and Communities	AGD	✓
Geoscience Australia	AGD	✓
Insurance Council of Australia (ICA)	AGD	✓
Murray-Darling Basin Authority	AGD	✓
Natural Disaster Insurance Review (NDIR) Panel	AGD	✓
New South Wales	RAMMS	✓
Northern Territory	RAMMS	✗
Queensland	RAMMS	✓
South Australia	RAMMS	✓
David Hocking - Spatial Industries Business Association (SIBA)	AGD	✓
Tasmania	RAMMS	✗
Victoria	RAMMS	✓
Western Australia	RAMMS	✓

RAMMS – The Risk Assessment Mitigation and Measurement Sub-Committee (of the NEMC)
AGD – The Commonwealth Attorney-General's Department

55. Further, two documents were referred to in the preparation of this report:
    a) Reforming flood insurance – Clearing the waters, April 2011 (A Treasury report) and
    b) Understanding flood risk – Our National Flood Risk Assessment (A UK Environment Agency report).

APPENDIX C

Summary of Role and Involvement in Flood Modelling

56. The following table provides a summary of the roles and involvement of various agencies and organisations in flood modelling. It is based on input received. It provides no comment on input provided and should not be taken as necessarily complete.

Agency or Organisation	Role or Involvement
Australian Institute of Actuaries (informal discussions)	1. Actuaries quantify risk on behalf of insurance companies in order to determine the price of insurance. 2. They try to understanding the probability of an event occurring and extent of potential floods (amongst other things) and therefore the potential financial impact of a flood to the insurance company.
Bureau of Meteorology	1. The Bureau is the national flood forecasting and warning agency providing flood warning services in a cooperative arrangement with State, Local and other agencies. 2. The Bureau gathers and stores climate and weather data from a range of sources. 3. It is involved in developing the geofabric - a national data set that identifies the spatial relationships of important hydrological features such as rivers, lakes, reservoirs, dams, canals and catchments. 4. It maintains a range of observation systems including weather stations, river gauges and radar stations as well as satellite observing systems. 5. It performs climate modelling and provides seasonal climate forecast updated monthly. 6. It provides seasonal flow forecasting service and is piloting 7-10 day streamflow forecasting services. 7. It performs hydrologic modelling to make predictions about flood levels at key locations on rivers as part of its flood warning role including a new water availability forecasting services. 8. Issues severe weather warnings including for very heavy rainfall. 9. It makes data available to the public through a website and other electronic forms including through web services.
Cooperative Research Centre for Spatial Information (CRCSI)	1. The CRCSI was involved in creation of the Urban DEM – initially to focus on sea level rise but intended as part of a national elevation data framework (NEDF). 2. The data is available through GA's NEDF-Portal. 3. Future steps intend to focus on new data acquisition, hydrological conditioning, expansion of the portal and enhancing a visualisation tool. 4. Assisted in an audit of elevation data for GA 5. According to DIISR, the CRCSI was also involved with mapping of the 2009 Victorian bushfires, and the 2008 Szechuan earthquake in China
CSIRO	1. CSIRO conducts research using a range of data types and models. Research project relate to flood mapping, monitoring and prediction.

	2. It has developed different methods depending on the requirement. Many of the tools are available only to researchers as they have not yet been operationalised. 3. Research involves use of various satellite data sets. 4. It has conducted a range of research activities and developed different models. 5. It has used hydrodynamic modelling using various specific models of varying complexity. 6. It is involved in research on better measurement of rainfall through the Water Information Research Development Alliance in conjunction with the BOM. 7. It developed a clean SRTM DEM data set with BOM and the Australian National University resulting in a number of derived products.
Defence Imagery and Geospatial Organisation	1. DIGO is considering release of SRTM 2 DEM data across the whole of Australia.
Defence Science and Technology Organisation	DSTO is not involved in flood modelling as it falls outside of their core capability areas.
Department of Climate Change and Energy Efficiency	1. DCCEE is involved in modelling the impacts of climate change. 2. Key focus has been on storm surge and implications o sea levels 3. It has invested in products that support national risk assessment 4. There is likely to be future investment in developing a national wave data set and further analysis of rainfall intensity under changing climatic conditions 5. It commissioned work that starts to identify the extent of coastal erosion. 6. In partnership with the CRCSI and GA, acquired access to high resolution elevation data for key coastal urban areas. Had to negotiate broad access agreements. Looking at further acquisition. 7. It invested in the NEDF-Portal 8. Developed an interactive pilot Visualising Sea level Rise tool. 9. It is looking at how DEM of varying resolutions can be stitched together. 10. It invested in national storm tide modelling with the Antarctic and Climate systems CRC and the UWA. 11. Invested in GA's NEXIS
Department of Innovation, Industry, Science and Research	DIISR mostly identified activities of the CRCSI. 1. CRC is coordinating the involvement of the Queensland Department of Environment and Resource Management (QDERM), Land & Property Management Authority NSW (LPMA), DIISR through the Space Policy Unit, Geoscience Australia, Department of Sustainability & Environment Victoria, and Landgate Western Australia to participate in the ongoing operational trial of a temporary mobile satellite reception and processing facility and its imagery products. The trial hopes to extend its capability to include very high resolution optical imagery from the Rapid Eye and Geo Eye satellites using the same mobile reception and mapping facility.

Department of Regional Australia, Regional Development and Local Government	1. The Department has not commissioned work on flood modelling. 2. It has used flood mapping from GA to identify projects impacted by recent floods 3. It produced a map of flooded areas
Department of Sustainability, Environment, Water, Pollution and Communities	1. Environment acquired a flood inundation data set from Centrelink using data from GA 2. It conducted projects on several areas to assess probable inundation patterns to assess wetland health 3. It has used different data types to support the TRaCK CERF Hub inundation modelling (using some free data). 4. It has other planned activities on land use by determining extent of dams and flood events. 5. There is a proposal to develop models for water use compliance purposes and delivery of processed imagery to State agencies.
Geoscience Australia	1. GA maintains archives of imagery and acquires low cost, public good imagery only. 2. GA has established the Optical Geospatial Radar and Elevation panel to help coordinate acquisition of commercial data. 3. GA coordinates access to radar data through an international charter. 4. It is involved in improving DEMs and making it available through the NEDF Portal. There are still gaps however. 5. It hosts an Australian Flood Studies Database on flood studies completed between1980 and 2004. Further work is proposed to enhance the database and improve capability. 6. Is it involved (providing secretariat support) in the National Flood Risk Advisory Group which has assumed responsibility for the database mentioned above. 7. It has developed the National Exposure Information Systems (NEXIS) for generating national exposure data and can be used to estimate the socio-economic impact of natural disasters (including flood). 8. GA often deploys post disaster teams to collect information on flood damage amongst other things. 9. GA and the ANU developed the ANUGA software. It was originally developed for storm surge modelling and was expanded to handle tsunamis. The tool is being continually developed to make it at least comparable with commercial models and is provided free. 10. GA has developed flood damage curves to estimate economic cost to repair a building under different conditions (with appropriate data). It has also developed other vulnerability models. 11. GA uses satellite data to derive flood extents using automated analysis. 12. GA is working with other agencies to clearly define user requirements for satellite products in emergency response. 13. GA also uses flood hazard modelling tools and is validate ANUGA (already used for tsunami modelling). 14. GA performs flood risk by combining information on flood hazard, exposure and vulnerability.

Insurance Council of Australia (ICA)	1. The ICA has collated flood data (and mapping products) from across LGAs in Australia. 2. Insurance companies can use this for pricing insurance. 3. It has developed a National Flood Insurance Database 4. It has some concerns about data access, quality and standards.
Murray-Darling Basin Authority	1. MDBA conducts flood modelling projects over specific areas. Projects include assessment of floodplain inundation under a range of conditions including consideration of structures like weirs and regulators. Also, they include dam break studies and studies in relation to construction of a rail and highway bypass. 2. It has gathered and uses a wide range of data types including hydrometric and bathymetric data, elevation data (of varying types), climate and imagery. 3. It uses the RiM-FIM. 4. It also uses commercial flood modelling software of varying complexities – MIKE 11, MIKE 21 and MIKEFLOOD. It also uses post-processing tools. 5. MDBA also uses a monthly water balance model (MSM-Bigmod) and a daily flow and salinity routing model (BIGMOD). 6. MDBA has produced various reports over project areas including a Hume Dam Assessment of Hydrologic Risk and Dam break inundation maps.
Natural Disaster Insurance Review (NDIR) Panel	The NDIR is looking at issues surrounding access to flood insurance as part of its review. It is not involved in flood modelling itself.
New South Wales	1. Flood mapping is developed and used through the Floodplain Risk Management Process and recommended to local governments to determine and manage the flood risk in their communities. 2. Floodplain management is achieved through the development and implementation of Floodplain Risk Management Plans by local councils. This plan provides inputs into the council Local Environment Plan and Development Control Plans, to support planning and mitigation activities. 3. The floodplain management process is the responsibility of the relevant local council which may establish a Floodplain Risk Management Committee. Specialist technical assistance, advice and funding are provided to councils through the NSW Office of Environment and Heritage. 4. A Floodplain Risk Management Plan is reviewed as works are implemented, more flood data or advanced modelling techniques become available, and flood events occur. 5. The SES is assigned the responsibility to coordinate the collection, analysis, mapping and distribution of spatial information regarding floods, storms and tsunami as prescribed in the NSW State Disaster Plan. As such the NSW SES maintains the SES Hazards Library, which includes an extensive list of publications, maps and data. 6. The data contained in the Hazards Library is classified 'SES - In Confidence' in accordance with the SES Information

	Classification Policy and should be used under guidance of trained and qualified emergency management personnel. Appropriate extracts may be shared with other Emergency Service Organisations and support agencies for emergency services use with approval.
Queensland	1. QLD has a majority of communities captured through the Protecting Our Coastal Communities project (POCC) (should be finalised this year). 2. Inland flooding data is being collected, subject to council participation. QLD currently has around 25 areas already tendered and more than another 50 or more areas nearly ready to tender in the next few weeks. Data will likely be available late this year or early next year subject to weather. 3. Coastal inundation from storm tide or tsunami is relatively easy to map at a broad scale using the bathtub approach. Some Councils prefer to do proper modelling of these events which would give more accurate results. Different councils will bring different methodologies and obtain different results. These councils would also likely express concern with the 'bathtub' approach being released for their jurisdiction. 4. Inland inundation using the bathtub approach is less accurate. Modelling would therefore need to be a council responsibility. This has the same issue, as different councils may apply different methodologies resulting in inconsistencies. 5. The Digital Elevation data acquired from POCC is available for sale through the Dept. of Environment and Resource Management (DERM).
South Australia	1. Adelaide, the Mt Lofty Ranges and the River Murray are identified as areas that have significant digital elevation data. Other areas such as the South East do have DEMs, but a very high level of resolution is required over large areas given the very flat terrain. Other regions have limited data that may not be sufficient for needs. 2. Floodplain mapping studies are generally undertaken by Local Councils, usually with some funding support from the State Government. The work is therefore not undertaken in a strategic manner (e.g. Zone by Zone, catchment by catchment), and to date SA has not seen it has a responsibility to do so. As a result, there is a patchwork of floodplain studies of various ages across SA, often using different methods. 3. The main impediment to a more strategic approach is the lack of resources across State and Local Governments to have a single uniform mapping program. This has been considered a medium priority in flood hazard management. Higher priorities including risk assessment, monitoring and warning, intelligence, and response capacity are being pursued. 4. Further floodplain mapping projects are currently managed by the Stormwater Management Authority and Local Councils, and there is no plan to alter these arrangements in

	the short term.
David Hocking - Spatial Industries Business Association (SIBA)	1. SIBA represents business interests in the spatial industry. 2. It has an interest in addressing a range of spatial infrastructure issues, including how spatial information supports pricing of insurance.
Victoria	1. Victoria has indicated that its flood mapping data is spread across to agencies, the Department of Suitability and Environment (DSE), and Melbourne Water. 2. DSE has available a series of GIS layers called the Victoria Flood Database (VFD) that captures the extent of known available flood information for Victoria outside the area managed by Melbourne Water. The data applies to riverine flooding. It does not include storm surge, storm water flooding or coastal inundation. 3. Copies of the VFD can be provided free of charge (licensing restrictions apply.) 4. Electronic copies of flood studies which contain flood mapping information and an explanation of how the mapping was obtained are being provided the Australian Flood Studies Database. 5. Older studies often only looked at the 1% AEP standard. More recent studies consider a range of events, including ones rarer than the 1%. 6. Melbourne Water also has available a series of GIS layers within Victoria's GIS that captures the extent of known available flood information for the region. The flood extents for 1% AEP events have been incorporated into Local Government Town Planning Schemes via overlays either Land Subject to Inundation Overlay (riverine flooding) or Special Building Overlay (storm water flooding). The data applies to riverine and storm water flooding. It does not include storm surge or coastal inundation. 7. Copies of this information are provided to companies conducing work for developers. 8. Electronic copies of flood studies which contain flood mapping information and an explanation of how the mapping was obtained are held by Melbourne Water. The older studies often only looked at the 1% AEP standard. More recent studies consider a range of events, including ones rarer than the 1%. 9. In addition some mapping was done in the late 1980s and early 1990s are has been based on recorded flood levels rather than being derived from model studies. There is a process to gradually review this mapping and update using today's standards.
Western Australia	1. Landgate (Western Australia's primary source of land information and geographic data) aims to provide elevation data to government, business and the community on a three tiered solution. a) SRTM 30m hydrologically enforced DEM for the interior of the State b) SPOT 10m for the coastal 100km buffer; and c) LIDAR for targeted areas 2. The Department of Water (DoW) is the State

	Government's lead agency in floodplain mapping and providing floodplain management advice. This advice includes the development of floodplains with the object of promoting the wise use of floodplains while minimising flood risk and damage. DoW holds digital elevation data including LIDAR data sets to meets its needs. The main LIDAR data set collected and processed by DoW is for an area that includes the Swan Coastal plain to Busselton. There are other targeted LIDAR data sets near a number existing river gauging sites. 3. Main Roads WA also holds LIDAR data sets but the extent of their holdings are unknown. The only data set that is known is for an area around the town of Fitzroy Crossing in the Kimberley. Other State agencies and Local Government agencies may also hold data and information sets that would be of use to the insurance industry and other users including the communities at risk.