

**From:** [NSW Government](#)  
**To:** [Flood Inquiry](#)  
**Subject:** Floods Inquiry  
**Date:** Friday, 20 May 2022 4:51:10 PM  
**Attachments:** [NSW Flood Inquiry Submission\\_rev 2.pdf](#)

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## Submission details

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**I am making this submission as** Other

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**Submission type** I am submitting on behalf of my organisation

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**Organisation making the submission (if applicable)** BMT Commercial Australia Pty Ltd

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**Your position in the organisation (if applicable)** Global Lead for Climate Risk and Resilience

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**Consent to make submission public** I give my consent for this submission to be made public

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## Share your experience or tell your story

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## Terms of Reference (optional)

The Inquiry welcomes submissions that address the particular matters identified in its [Terms of Reference](#)

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<b>1.1 Causes and contributing factors</b>	As outlined in the attached submission
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<b>1.2 Preparation and planning</b>	As outlined in the attached submission
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<b>1.3 Response to floods</b>	As outlined in the attached submission
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<b>1.4 Transition from incident response to recovery</b>	As outlined in the attached submission
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<b>1.5 Recovery from floods</b>	As outlined in the attached submission
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<b>1.6 Any other matters</b>	As outlined in the attached submission
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## Supporting documents or images

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<b>Attach files</b>	<ul style="list-style-type: none"><li>• <a href="#">NSW Flood Inquiry Submission_rev 2.pdf</a></li></ul>
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# NSW Flood Inquiry Submission

## Synopsis

Thank you for the opportunity to contribute to the New South Wales Flood Inquiry.

BMT Commercial Australia Pty Ltd (BMT) is a water and environment consulting firm that specialise in flooding and coastal risk management across Australia. Our submission as set out below is based on our long standing work on flood modelling and mapping and disaster management across NSW as well as work in other State including after the severe flood events in south-east Queensland in early 2011.

In summary, we recommend that the NSW Government:

- Develop a statewide education program to assist local government agencies, households and businesses focused on flood resilience
- Work with the NSW Local Government Association to develop and distribute an online database to identify areas at flood risk
- Work with local government to develop floodplain management plans, and consider annual grants program to implement such plans
- Support local government to collect data and develop suitable and fast-running hydrologic models
- Work with local government and catchment management authorities to develop urban design and nature-based solutions to flood mitigation.
- Through the NSW State Emergency Service, explore and invest in the development of state-wide flood warning systems and improve our capacity to manage natural disasters
- Consider a risk assessment of critical infrastructure and essential services and work with local authorities to review climate risk standards.

We would be pleased to present to any hearings, public or private, of the inquiry.

The principal contacts for this submission are:

- Dr Philip Haines (Managing Director, BMT Environment Australia)
- Greg Fisk (Global Lead Climate Risk and Resilience, BMT)
- Ben Caddis (Principal Flood Engineer, BMT)

## Introduction

This submission has been prepared by BMT Commercial Australia Pty Ltd (BMT), a water and environment consulting firm that specialises in flooding and coastal risk management across Australia. BMT has also developed the world-leading flood modelling tool, TUFLOW, to support our work in this field and to assist the broader flood management industry.

BMT is recognised as being one of the leading flood specialist teams in Australia. BMT was awarded the top Queensland Engineering Excellence Award for work on the Brisbane River Catchment Flood Study, which was undertaken in the aftermath of the 2011 floods in south-east Queensland. Engineers Australia noted that this study “sets a new global benchmark that will direct how flood studies around the world are conducted from now on”. BMT used the outputs from this study to undertake the subsequent flood risk management study, which established the strategic framework for improved management of flooding across land use planning, development assessment and disaster management across the Brisbane River catchment

In New South Wales, BMT undertakes flood modelling and floodplain management studies across the breadth of the State including urban and rural areas in both coastal and inland settings. We primarily work with Councils but also with State government agencies, the urban development industry and Government owned authorities and corporations. Over the past 25 years, BMT has undertaken flood studies and floodplain risk management studies for every major river in the NSW Northern Rivers region, including:

- Tweed River
- Tweed-Byron Coastal Creeks
- Belongil Creek
- Brunswick River
- Richmond / Wilsons Rivers
- Clarence River

For 15 years, we have operated Ballina Shire’s Integrated Flood Model for assessment of all floodplain development and infrastructure in the Ballina Shire. We are also in the latter stages of the Richmond Valley Flood Study for Richmond Valley Council.

BMT have also been directly involved in the February and March 2022 flood events in terms of assisting Council clients with real-time flood prediction and evacuation advice, briefings and involvement in Emergency Operation Committee (EOC) meetings and with State Government agencies in terms of flood events reviews.

## **Understanding Floods**

One of the most critical aspects of flood management is effective education and the capacity of government agencies, residents, businesses and the broader community to plan for and respond to flooding risk before, during and after flood events. This education and awareness will support a greater willingness to plan (both at a land use and household-scale), identifying in advance what needs to be done, as well as where and how it can be achieved.

The core elements of this will be to both understand expected flood behaviour and the risk of flood impacts to life and property, but also to better prepare for emergency situations when they arise. In communicating risk we must continue to explain in practical ways the differences between design standards based on statistically-derived flood conditions versus the actual risk and range of consequences experienced by the community at the personal, neighbourhood and broader societal level (which potentially includes both tangible and intangible loss).

Flood education and capacity building remains a priority that must be funded year on year as part of a commitment to resilience – not just immediately following disasters. This is an action best led by local authorities and local catchment authorities working alongside their local communities – appropriately supported by State and Commonwealth agencies.

**Recommendation** – NSW Government to develop an ‘Understanding Floods’ booklet similar to the one developed by the Queensland Government following the 2011 floods (see [What is a flood? | Office of the Queensland Chief Scientist](#)) and consider perpetual funding for implementation of a State-wide education and capacity building programme to assist local government agencies, households, and businesses focused on flood resilience. With greater flood awareness and resilience, actual tangible and intangible damage and impacts of flooding can be reduced, which would also lower demand on emergency response and post-event relief services.

## **Access to Up-to-Date Flood Information**

Related to the above, flood maps, and property specific flooding information intended for use by the general public, needs to be readily interpretable and should, where necessary, be accompanied by a comprehensible explanatory note. This includes understanding how to read the flood map and understanding the likelihood of occurrence of events.

To achieve this, each Council in New South Wales should have access to current and up to date flood study information in their local government area that covers the full spectrum of possible flood conditions, from frequent nuisance flooding up to very rare and potentially devastating floods.

Councils should make their flood and overland flow maps and models available to applicants for development approvals, and to consultants engaged by applicants to ensure use of an approved evidence-based approach and is to a consistent standard of assessment.

While a number of larger Councils already have existing digital information systems for displaying this information, this may not be the case in smaller local authorities and there is a role for the State Government to assist in this regard.

**Recommendation** – To supplement any existing spatial information systems developed and operated by individual Councils, the NSW Government should work with the NSW Local Government Association and local authorities to scope and invest in developing and distributing an online database which allows the public to search a parcel of land to determine if there is a applicable flood study or flood risk certification (under the EP&A Act) that applies to that land and where to find further information. This should incorporate information relating to the full spectrum of floods that have been determined rather than just floods within a pre-determined threshold, such as the 1% Annual Exceedance Probability (AEP) level used by local authorities for planning purposes.

### **Floodplain Management Planning and Implementation**

Floodplain management across NSW follows the process outlined in the NSW Floodplain Development Manual. This typically involves several stages which are repeated in a cycle:

- Data collection
- Flood Study
- Floodplain Risk Management Study
- Floodplain Risk Management Plan
- Plan implementation

In our experience in NSW and in particular the Northern Rivers, all Councils follow this process, often with funding support from the NSW State Government (NSW Department of Planning and Environment). While the specified review periods are not always observed, Councils do follow the process. In our opinion however, there are two key weaknesses in the process which are:

- Data collection – for example, across most of the Northern Rivers, bathymetric survey used for modelling was collected around 2004/2005. Due to the potential for erosion and scour, a regular program for acquiring new datasets should be established and followed to support flood planning.
- Plan implementation – many of the recommendations from Floodplain Risk Management Plans are not implemented. We expect this is due to availability of funds.

Initial recommendations for improved flood management are starting to emerge for the town of Lismore following recent devastating flooding. This includes planned retreat from certain areas and creating a mix of incentives and regulation to shift future development and unsuited land uses away from flood prone area. This may require the State working with Councils to consider implementing a property buy-back program in areas that are particularly vulnerable to regular flooding, as part of a broader floodplain management strategy.

Ultimately, as actual flood risk vary depending on whether the flooding event is frequent, nuisance, severe or extreme, the response must be equally agile, taking a true risk based approach to planning. This type of approach ensures that the response does not unnecessarily sterilise large areas of land from

appropriate future development, but equally, does not place new vulnerable development in locations that are inappropriate now, or are expected to be in the future due to climate change, therein imposing a risk management burden that must be borne by future generations.

**Recommendation** – NSW Government to continue to invest and support local governments and other local agencies in the development of floodplain management plans, using a risk-based approach to management across the full spectrum of potential floods. Consider how to strengthen the incorporation of floodplain mapping and associated planning and design controls into local planning schemes and instruments and to consolidate Federal, State and local funding toward more strategic floodplain management response such as land buyback and planned retreat in high risk areas.

**Recommendation** – NSW Government to consider additional grants and financial support to local governments for the implementation of approved floodplain management plans noting that this can take the form of an annual grant program (minimum requirement as well as a competitive component). This should be accompanied by reporting from the recipient of grant funding on how the implementation grant has been spent and is contributing toward floodplain resilience (not just disaster relief).

### **Data Collection and Modelling**

Future development, as well as targeted flood mitigation engineering solutions, will need to be guided by detailed and reliable flood modelling. Flood models inform flood hazard mapping and are essential to understanding the consequence of flooding, including the scale and magnitude of damage that could be caused to existing and proposed development and infrastructure.

As identified above, sitting behind a reliable flood model is accurate data. To inform planning and response, we must continue to invest in collection and management of data sets that will enable the accuracy and precision of numerical flood models.

This will involve the collation (and creation where appropriate) of rainfall data, stream flow data, tide levels, floodplain topographic details, river channel bathymetry, floodplain characteristics, dam storage behaviour (if applicable) and the correlation between any of the data sets above.

Increasingly we will also need to manage the uncertainty of future conditions by producing suitable hydrologic models run in a 'Monte Carlo' framework. Using this framework, flood managers can understand the likelihoods of outcomes when considering variability for factors such as: spatial and temporal rainfall patterns; saturation of the catchment; tidal conditions, dam influences (if relevant) and future climate change.

Observational and collected data should also continue to be used to validate hydrologic and hydraulic models such that the precision of modelling is always improving and informing management responses.

Lastly, with increasing influences of climate change, all flood studies for coastal catchments should involve some level of analysis of the joint probability of floods (e.g. compound flooding) including additive impacts from elevated ocean conditions (i.e. storm surge / storm tide).

**Recommendation** – NSW Government to continue to invest and support local governments and other local agencies in the collection of data and development of suitable hydrologic and hydraulic models. This should involve a review of technical modelling guidelines and standards. Modelling studies should increasingly utilise a probabilistic ‘Monte Carlo’ framework for better understanding of the impacts of variability of different factors (including climate change), leading to a more informed probabilistic approach to flood management.

### **Urban Water and Catchment Management**

Appropriate urban design and integrated water management can also reduce the severity of flood impacts. Water sensitive urban design (WSUD), while having marginal effect on larger storm events, has the potential to reduce the volume of local flooding in smaller storm events through the detention, diversion, capture and reuse of water.

Similarly, catchment and waterway revegetation can help to reduce the impact of downstream flooding especially for local flooding in smaller storm events. Many of the management techniques for improving water quality can also have significant potential to help with downstream flood mitigation.

These nature based solutions are increasingly important as the solution can have multiple benefits in terms of flooding, water quality, biodiversity and carbon sequestration.

**Recommendation** – NSW Government with Local Governments and Catchment Authorities should increase funding to deliver programs for WSUD and nature based solutions to flood mitigation in urban areas and at the catchment scale.

### **Use emerging technologies to improve our ability to predict and manage floods**

The accuracy of weather modelling has improved substantially over the past decade. This improvement will continue as more accurate weather and climate models are developed, and as these models are better informed with improving observational data through machine learning algorithms. Real-time radar observation of rainfall and satellite monitoring of inundation will also improve.

These systems can potentially create weather forecasts in near real time and disseminate to key stakeholders via the internet. Near real-time forecasting would allow emergency management agencies and residents with detailed information on rapidly evolving matters such as:

- predicted peak flood levels, rates of rise for their location, and escape routes together with predictions of evacuation time and the provision of staggered ‘get out’ warnings to isolated residents
- traffic network advice that assists with escape route planning to minimise congestion
- the locations and availability of emergency centres and whether space is available.
- having a simulation capability to facilitate greater disaster training and practices.



While these systems have been discussed and piloted at a few locations, there is no standard or Statewide approach to this issue.

**Recommendation** – through the NSW SES, explore and invest in the developing of Statewide flood warning systems and associated software applications that can deliver the benefits as described above.

### **Climate Change**

Climate change will affect floods in several ways. Average rainfalls are projected to increase, while more intense rainfall will increase propensity for flash flooding. Global warming is leading to sea level rise, increasing the risk of flooding near the coast and having a ‘backwater effect’ throughout estuaries and waterways draining to the coast. Weather patterns tend to be cyclic. As we have seen from this summer’s La Nina cycle, this weather pattern can create dangerous conditions for flooding events both individually and cumulatively, with the potential for a series of back to back rainfall and flooding events affecting the same community.

While most flood modelling in NSW now includes consideration of future climate conditions, the approach and standards used are not always consistent and will depend in part on how long ago the flood study was undertaken, the adopted modelling approach and the management measures adopted.

Noting that with climate change we will see a greater propensity of events that are likely to exceed the current design standard of most infrastructure (1% AEP flood event), this should trigger a re-evaluation of flood risk for essential community infrastructure such as major transport infrastructure, water infrastructure, power infrastructure and essential services infrastructure such as hospitals and schools.

**Recommendation** – NSW Government to work with local authorities to revisit all flood studies and modelling across the State to review climate risk standards being used with the view to establishing greater consistency in approach and incorporation of future climate in land use planning and development controls.

**Recommendation** – NSW Government to consider undertaking a Statewide risk assessment of critical infrastructure and essential service infrastructure based on the greater risk of flooding imposed by climate change.

## Summary of Detailed Recommendations – Improving Flood Intelligence and Disaster Preparedness

Based on the above discussion, a summary of more detailed recommendations are included below for consideration by the Inquiry, particularly as part of building resilience and managing flood disasters similar to those experienced in Northern New South Wales:

Recommendation Topic	Explanation/Reasoning
Review and improve telecommunications networks.	Ensure network remains operational during floods. Standby temporary communications to be considered where the risk of network outage remains high.
Review and expand rain and river gauge networks.	Refer to recommendations from Floodplain Risk Management Plans across the region and the Richmond River Flood Warning and Evacuation Management Project (BMT). The review of gauges should include ensuring gauges are able to monitor extreme and rare flood events.
Consider backup telemetry / sensors for key flood gauges.	Across the State, redundancy should be considered for critical gauging sites to ensure reliable and low latency access to data for flood forecasting and flood intelligence.
Develop flood intelligence mapping	Consistent and accurate flood intelligence mapping accessible by Council and the SES will improve flood response by allowing response agencies to quickly identify the likely impacts based on observed and predicted flood levels.
Develop flood intelligence tool	An online flood intelligence tool will ensure all response agencies have access to the most accurate and up to date flood intelligence information. Through the NSW SES, explore and invest in the developing of Statewide flood intelligence system.
Consider risk based forecast mapping	Provision of risk based predictive flood mapping during an event should be considered to communicate the likelihood of flooding. At minimum, this should include identification of areas that will almost certainly flood, areas that will likely flood based on the current rainfall forecasts, and areas that are unlikely to flood, but could if rainfall is under-predicted.
Improvements to Emergency Alerting process to reduce the time taken to issue Emergency Alerts.	Beyond a review of internal processes, use of a flood intelligence tool to identify and publish EA polygons will reduce the back-and-forth EA polygon generation process using email or other communication between the SES and supporting organisations.
Protocol for regular community alerts, during the rise, peak and recession of the flood.	SES and Council to issue updated community messaging on a schedule is essential for the community. The regularity of messaging should reflect the nature of flooding, with 8 hourly messaging a minimum for Richmond River events. Each message should include when the next message will be received. This will assist the community during events where several flood peaks are experienced, particularly in the tidal zone.
Improved messaging to the public	SES and Council community messaging must be clear and accurate, with instructions of what actions they should take. Use of terms such as 'higher ground' or 'low-lying areas' should be avoided unless they can be related to a map or other information so that the community know what actions to take. In addition, terms used to describe local areas

	should be specific and easily recognised by locals (e.g if locals do not use the term “North Ballina” to describe an area, nor should the messaging).
Prioritise flood response measures	Flood response measures, being lower cost and generally having greater benefit than structural measures should be prioritised. All urban and rural residents and business should have access to observed and forecast flood information compatible with the risk at that location. This includes evacuation information for the location.

