



# South East Queensland Rainfall and Flooding February to March 2022 Review

## Report 1: 2022–2023

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Contact for enquiries

**Name:** Office of the Inspector-General of Emergency Management  
**Phone:** (07) 3029 8813  
**Email:** [info@igem.qld.gov.au](mailto:info@igem.qld.gov.au)  
**Web:** [www.igem.qld.gov.au](http://www.igem.qld.gov.au)  
**Postal Address:** GPO Box 1425, Mail Cluster 15.7  
Brisbane, Queensland 4001

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IGEM has reviewed all relevant documentation and evidence provided by state agencies and other entities, the community, and sourced from media and other public reports. This review report is based on the information that has been supplied to the Office of the Inspector-General of Emergency Management as at 26 August 2022 and does not consider any other material that has not been provided or sighted by the Office of the Inspector-General of Emergency Management. It is therefore possible that some inconsistencies may be present despite the best efforts of the Office of the Inspector-General of Emergency Management to validate and align the raw data utilised throughout this report.

Cover image credit: An aerial view of the Maryborough floods, image courtesy of Fraser Coast Regional Council

Back cover image credit: The flood marker on the Bond Store in the Maryborough CBD, image courtesy of Fraser Coast Regional Council

## Letter of transmission



**Inspector-General of  
Emergency Management**

31 August 2022

The Honourable Mark Ryan  
Minister for Police and Corrective Services and  
Minister for Fire and Emergency Services  
PO Box 15195  
CITY EAST QLD 4002

Dear Minister

In accordance with your instruction of 15 March 2022, I present the following report into the effectiveness of preparedness activities and the response to the South East Queensland Rainfall and Flooding Event ("the event") that occurred between 22 February and 7 March 2022.

As requested, in conducting the review my Office worked closely with stakeholders and the Queensland community. It also considered previous Office of the Inspector-General of Emergency Management (IGEM) reviews and relevant reviews, including the *Brisbane City Council 2022 Flood Review* completed by the Honourable Paul de Jersey AC CVO QC and the Australian Transport Safety Bureau *CSC Friendship* preliminary review.

The approach to the review was collaborative, with the IGEM review team undertaking extensive engagement with entities responsible for disaster management preparedness and response in Queensland. This included consulting with the Queensland Police Service, Queensland Fire and Emergency Services, the Queensland Reconstruction Authority, local, state and federal agencies, and other relevant entities.

The approach also involved consulting with community members from the 23 affected local government areas and other relevant stakeholders through 13 community forums and through inviting public submissions, of which the Office received 247.

The report, its learnings and its recommendations reflect the *Standard for Disaster Management in Queensland*, identifying both good practice examples and opportunities for enhancement in Queensland's disaster management preparation and response.

Yours sincerely



Alistair Dawson APM

**Inspector-General of Emergency Management**

## **Acknowledgement of Country**

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IGEM would like to acknowledge Aboriginal peoples and Torres Strait Islander peoples as the Traditional Owners and Custodians of this Country. We recognise their connection to land, sea and community. We pay our respects to them, their cultures, and to their Elders, past, present and emerging.

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## **Acknowledgements**

This report would not have been possible without the large number of contributions received through community forums, submissions and conversations with community members impacted by this event. We recognise the strength and courage required by participants to be open and frank in sharing their personal experiences and thank you for both your time and your involvement.

We acknowledge the support, guidance and assistance offered by the Recovery Officers from the Department of Communities, Housing and Digital Economy and staff of the Australian Red Cross and Articulous. Our Community Forums would not have achieved the level of awareness and insight without your professionalism and compassion.

We also wish to thank the numerous local, state, federal and non-government stakeholder representatives for your efforts in providing information quickly and contributing to interviews in a thoughtful and considered manner. Your willingness to provide insights into the disaster management system is an endorsement of your commitment to the continuous improvement of the disaster management arrangements in Queensland.

To the emergency management practitioners and volunteers who responded to the rainfall events of late 2021 and early 2022, we thank you for your tireless efforts.

I would also like to recognise the members of the Office of the Inspector-General of Emergency Management for their professionalism, support, hard work and inquiring minds in undertaking this review.

## Executive summary

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On 15 March 2022, the Premier and Minister for the Olympics announced the Office of the Inspector-General of Emergency Management (the Office) would undertake a review of the South East Queensland Rainfall and Flooding Event in February–March 2022 (the review).

In line with the Terms of Reference ([Appendix A](#)) the review assessed the effectiveness of preparedness activities and the response to the South East Queensland Rainfall and Flooding Event of February–March 2022 by the Queensland Government (including Government Owned Corporations and Statutory Bodies), relevant local government agencies, and other agencies engaged in response operations in the 23 Local Government Areas activated for Disaster Recovery Funding Arrangements (DRFA). The review also addressed the timing and effectiveness of Emergency Alerts that were issued to warn the general community of the flooding event and the effectiveness of cooperation between all agencies engaged in response operations.

In undertaking this review, the Office worked closely with local, state, and federal agencies, impacted communities and other relevant stakeholders to obtain information to assist in the review.

Several climate drivers brought extreme multi-day rainfall, causing significant flooding in South East Queensland from 22 February to 7 March 2022. These included La Niña in the Pacific Ocean, a positive Southern Annular Mode (SAM), and a negative Indian Ocean Dipole, combined with a low-pressure trough in the Coral Sea, a 'blocking' high-pressure system in the Tasman Sea and an unusually cold upper atmosphere weather system across the Great Australian Bight. Highly localised thunderstorms resulted in intense rain and extensive flash flooding along creeks and tributaries of the major rivers.

Multi-day rainfall records were broken across South East Queensland, with several sites recording more than one metre of rainfall in the week ending 1 March 2022. Major flood levels were reached in rivers across the region, including the Brisbane River at the Brisbane City, Mary River at Gympie, as well as the Sunshine Coast, Lockyer Valley and the Bremer, Logan, and Albert River catchments.

Tragically, 13 people lost their lives during this event. More than 9000 homes and businesses were damaged, and over 180,000 customers lost power. The South East Queensland transport network was impacted, and major roads, including the Bruce and Warrego Highways and the Ipswich Motorway, were impacted and closed for several days. Pontoons and other debris washed down rivers affecting the marine environment. The cost to Queensland is estimated at \$7.7 billion.

This event was the third of four rainfall and flooding events that occurred during the 2021–2022 severe weather season. Dealing with multiple rainfall and flooding events concurrent to the COVID-19 novel coronavirus pandemic placed significant strain and fatigue on affected communities, as well as entities engaged in the response to these events under the Queensland disaster management arrangements.

The *Queensland Disaster Management 2016 Strategic Policy Statement* identifies two strategic objectives that underpin disaster management in Queensland:

- 1) Strive to safeguard people, property and the environment from disaster impacts
- 2) Empower and support local communities to manage disaster risks, respond to events and be more resilient.

The *Standard for Disaster Management in Queensland* (the Standard) establishes outcomes for a shared understanding of the risk (outcome 1) and for the community to make informed choices about disaster management, and to act upon them (outcome 6). During the review it became evident that some community members did not understand the flood risks they faced. For example, some community members were not aware that their residential or commercial property was in an area at risk of flooding. This also arose in the Queensland Floods Commission of Enquiry interim (2011) and final (2012) reports.

The Standard also establishes that entities proactively and openly engage with communities (outcome 5) and the shared risk be managed to reduce the impact of disaster on the community (outcome 2). The management of risk is fundamental to making the community safer.

It is acknowledged that steps have been made to identify risks and educate communities; however, further work needs to be done by entities and communities alike to ensure there is a shared understanding of the flood risks in Queensland.

Many warnings were issued throughout this event using multiple channels to deliver warnings, including Emergency Alerts, the Bureau's weather warnings, opt-in systems, social media, radio, and television. This multimodal approach to warn and disseminate information is appropriate to ensure the warnings and information reach the community. The multimodal approach also builds redundancy and resilience as flooding events can impact essential services such as the electricity and telecommunication infrastructure required to deliver some message formats. In this event, the warnings varied in terms of their timeliness, clarity and consistency, with some community members not receiving any warnings. Given recent events and forecasted future events (amalgamation of National Recovery and Resilience Agency and Emergency Management Australia, climate change, advances in technology), there would be benefit with longer term discussions with the Commonwealth and Emergency Management Victoria to determine the next edition of emergency alert.

The indicators for outcomes 5 and 6 of the Standard describe how entities should engage with communities. Entities must do further work regarding the warning and communication systems and processes to ensure the community is aware of their level of susceptibility to disasters so they can make informed decisions to act.

There are valuable learnings this report reflects on through highlighting good practice and opportunities for enhancement. To ensure continuous improvement in Queensland's disaster management arrangements, 19 recommendations have been made.

## Recommendations

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### Recommendation 1

The Inspector-General of Emergency Management recommends that Queensland Fire and Emergency Services review and update the *State Disaster Risk Report*, including re-evaluating the risk of flooding by all types. Queensland Fire and Emergency Services should publish the updated *State Disaster Risk Report* by 1 November 2023.

### Recommendation 2

The Inspector-General of Emergency Management recommends the Queensland Reconstruction Authority and the Bureau of Meteorology investigate options for the consolidation of ownership, renewed capital and maintenance in the flood warning network in consultation with flood warning infrastructure asset owners.

### Recommendation 3

The Inspector-General of Emergency Management recommends Queensland Fire and Emergency Services lead an urgent multi-agency (including but not limited to the Queensland Police Service and Brisbane City Council) review of the workflow, of the current Emergency Alert system, including requesting, composing, authorising and issuing of Emergency Alerts by 1 November 2022.

### Recommendation 4

The Inspector-General of Emergency Management recommends Queensland Fire and Emergency Services, in consultation with the Queensland Police Service, incorporate into the workflow of the current Emergency Alert system a process that ensures the inclusion of an 'urgent approval and distribution without delay' process for Emergency Alert messages by 1 November 2022.

### Recommendation 5

The Inspector-General of Emergency Management recommends Queensland Fire and Emergency Services update and deliver training on the workflow reviewed (as per Recommendation 3) of the current Emergency Alert system to all persons responsible at a local, district and state level by 1 November 2022. Training should address system constraints and system complexities in addition to the process of requesting, composing (including Clear Explicit Translatable Language [CETL]), authorising and issuing Emergency Alerts.

### Recommendation 6

The Inspector-General of Emergency Management recommends Queensland Fire and Emergency Services develop and publish an operationally based quick reference guide that complements the training offered (as per Recommendation 5) by 1 November 2022. The guide will identify key and critical aspects of the Emergency Alert system in relation to the development, composition, request for and authorising of Emergency Alerts and will include a template and an example of 'good' messaging using concise, minimal language and Clear Explicit Translatable Language (CETL).

### **Recommendation 7**

The Inspector-General of Emergency Management recommends that all local governments that currently use pre-formatted messages within the Emergency Alert system review and, where necessary, redraft messages using the principles of Clear Explicit Translatable Language (CETL).

### **Recommendation 8**

The Inspector-General of Emergency Management recommends that all local governments that do not have pre-formatted messages and polygons engage with Queensland Fire and Emergency Services and determine whether their local disaster management group capability could be improved through the development of pre-formatted polygons and messages.

### **Recommendation 9**

The Inspector-General of Emergency Management recommends Queensland Fire and Emergency Services conduct annual exercises with every local disaster management group and district disaster management group to confirm the process for developing, approving and issuing of an Emergency Alert, including the use of pre-formatted polygons and messages. Upon completion of the initial statewide exercise, Queensland Fire and Emergency Services will furnish an exercise evaluation report to the Office of the Inspector-General of Emergency Management by 1 November 2023.

### **Recommendation 10**

The Inspector-General of Emergency Management recommends Queensland Fire and Emergency Services review the *Queensland Emergency Alert Manual – M.1.174* in its entirety by 1 November 2023. The manual should specifically address the authorising environment, legislative obligations and the capability and complexities of the Emergency Alert system.

### **Recommendation 11**

The Inspector-General of Emergency Management recommends Queensland Fire and Emergency Services implement the Australian Warning System for all nationally agreed hazards by 1 November 2023. Implementation should include guidance and training to all local governments and agencies operationally involved in disaster management, with emphasis on those agencies with hazard specific responsibility.

### **Recommendation 12**

The Inspector-General of Emergency Management recommends Queensland Fire and Emergency Services establish a community education program by 1 November 2023 that complements the implementation of the Australian Warning System. An evaluation process should be incorporated into the program to determine effectiveness.

### **Recommendation 13**

The Inspector-General of Emergency Management recommends all local governments that offer an opt-in system develop strategies to increase the number of subscribers who elect to use this service. As part of the annual disaster management plan assessment process for the period 2023–2025, the Office of the Inspector-General of Emergency Management will request information from the relevant local disaster management groups to highlight and share innovative practices that have led to an increase in subscription levels for opt-in services.

### **Recommendation 14**

The Inspector-General of Emergency Management recommends Queensland Fire and Emergency Services lead an inter-agency IT system assessment with Queensland Police Service and local governments to identify disaster management systems currently in use and develop options to enhance connectivity and interoperability between systems. Outputs to be considered include, but are not limited to, consideration of requests for assistance (RFA) and the production of situation reports.

### **Recommendation 15**

The Inspector-General of Emergency Management recommends Queensland Fire and Emergency Services review and implement State Emergency Service (SES) protocol by 1 November 2023 outlining procedures to be undertaken to ensure persons uplifted from places of immediate danger or risk are transferred to a place of safety.

### **Recommendation 16**

The Inspector-General of Emergency Management recommends Queensland Fire and Emergency Services review the tasking protocols used to manage State Emergency Service (SES) tasks undertaken in the response phase of a disaster to enable more complete recording of details for all 'jobs of opportunity' (including the personal details of those assisted and/or rescued) to enable better coordination of tasks and reflect outcomes of activities by 1 November 2023.

### **Recommendation 17**

The Inspector-General of Emergency Management recommends Queensland Fire and Emergency Services adopt measures to achieve a common operating picture between deployed Queensland Fire and Emergency Services assets in disaster management operations by 1 November 2023.

### **Recommendation 18**

The Inspector-General of Emergency Management recommends the Dam Safety Regulator review the Emergency Action Plan for Referable Dam Guideline with particular regard to the distinction between the process required by a flood event as compared to a dam failure event by 1 November 2023. The Emergency Action Plan for Referable Dam Guideline review will be informed by a discussion, facilitated by the Dam Safety Regulator, between dam owner Seqwater, the Brisbane City Council Flood Information Centre, the Brisbane Local Disaster Management Group and the Brisbane District Disaster Management Group. The purpose of the facilitation is to achieve inter-agency understanding of warning and notification responsibilities.

The reviewed Emergency Action Plan for Referable Dam Guideline should be published, promoted and shared via a stakeholder engagement exercise with Queensland's referable dam owners, disaster management stakeholders including local disaster management groups and district disaster management group.

### **Recommendation 19**

The Inspector-General of Emergency Management recommends this report be returned to the Office of the Inspector-General of Emergency Management to monitor, evaluate, and report on progress and implementation of the recommendations that are accepted in whole or in part by government.

## About the review

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### Authorising environment

On 15 March 2022, the Minister for Police and Corrective Services and the Minister for Fire and Emergency Services tasked the Office of the Inspector-General of Emergency Management (IGEM) to undertake the South East Queensland Rainfall and Flooding February to March 2022 Review (the review).

The legislated functions of IGEM are outlined in s 16 of the *Disaster Management Act 2003* (DM Act). The review was conducted in accordance with those functions.

### Purpose

The purpose of this review was to assess the effectiveness of preparedness activities and the response to the rainfall and flooding that occurred in South East Queensland from 22 February to 7 March 2022.

### Scope

The Terms of Reference ([Appendix A](#)) directed the review focus on the:

- effectiveness of preparedness activities undertaken by Queensland Government (including Government Owned Corporations and Statutory Bodies), relevant local government agencies, and other agencies engaged in response operations in all of the Local Government Areas (LGAs) activated for disaster recovery funding arrangements
- timing and effectiveness of Emergency Alerts and other communication that were issued to the community
- timing and effectiveness of other types of communication and information that was disseminated during the event
- effectiveness of cooperation between all agencies for response operations at a local, state and national level.

### Out of scope

Recovery activities, coronial matters, agency internal operations, and investigations and inquiries (e.g. Australian Transport Safety Bureau's investigation into the breakaway and grounding of the *CSC Friendship*) are outside the review scope.

Land use planning, development and infrastructure were among a number of important themes raised during community forums and in public submissions. Pages 8–9 and 85 of the Queensland Reconstruction Authority's *2021–22 Southern Queensland Floods State Recovery and Resilience Plan 2022–24* (Queensland Reconstruction Authority, 2022c) discusses these themes ([https://www.gra.qld.gov.au/sites/default/files/2022-08/2021-22%20Queensland%20Floods%20State%20Recovery%20and%20Resilience%20Plan\\_2.pdf](https://www.gra.qld.gov.au/sites/default/files/2022-08/2021-22%20Queensland%20Floods%20State%20Recovery%20and%20Resilience%20Plan_2.pdf)).

## Methodology

IGEM invited submissions from the 23 LGAs activated for Disaster Recovery Funding Arrangements (DRFA).

Submissions were also invited from the community, Queensland Government, relevant federal agencies and other key stakeholders, including elected representatives.

IGEM received 247 submissions from a range of stakeholders, which included:

- 158 from community members
- 20 from local government agencies
- 20 from Queensland Government agencies
- 7 from not-for-profit agencies
- 4 from the Australian Government
- 4 from federal Members of Parliament
- 12 from state Members of Parliament
- 2 from local government councillors.

IGEM:

- hosted 13 community forums
  - Dallarnil, North Burnett Regional Council
  - Caboolture, Moreton Bay Regional Council
  - Yeronga, Brisbane City Council
  - Bellbowrie, Brisbane City Council
  - Sandgate, Brisbane City Council
  - Goodna, Ipswich City Council
  - Gympie, Gympie Regional Council
  - Toowoomba, Toowoomba Regional Council
  - Ashgrove, Brisbane City Council
  - Deception Bay, Moreton Bay Regional Council
  - Elanora, City of Gold Coast
  - Pimpama, City of Gold Coast
  - Lowood, Somerset Regional Council
- observed a community meeting at Maryborough, Fraser Coast Regional Council
- conducted discussions with individuals and groups of relevant entities
- collected and analysed documentation including relevant reviews ([Appendix C](#)), doctrine, plans and website content.

IGEM commissioned research in regard to:

- community perceptions of warnings, messaging and preparedness—Queensland University of Technology ([Appendix D](#))
- alerts and warning message linguistics—Griffith University ([Appendix E](#)), and
- community sentiment through the analysis of Twitter posts—Griffith University ([Appendix F](#)).

# Queensland's disaster management arrangements

Queensland's disaster management arrangements (Figure 1) are established under the *Disaster Management Act 2003* (Qld) (Queensland Government, 2022a) (the DM Act) (Queensland Government, 2022a). The arrangements provide a networked structure, with roles and responsibilities shared across local, district and state levels. It is designed to reduce disaster impacts on the community (Queensland Fire and Emergency Services, 2021, p. 23).

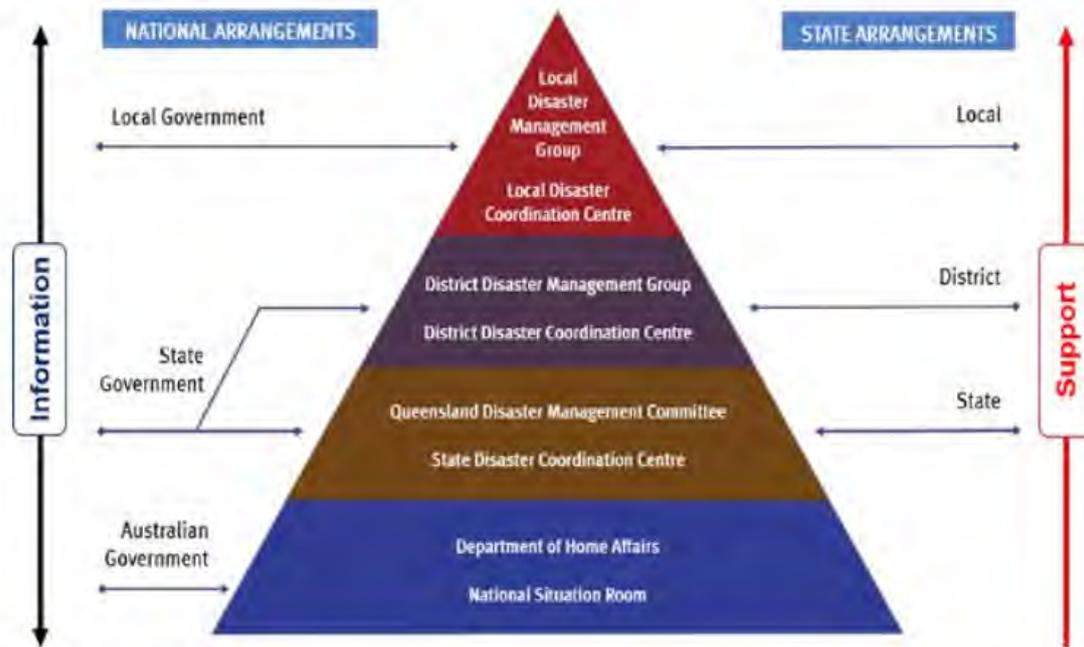


Figure 1: Queensland's disaster management structure

## Commonwealth legislation and policies

### Meteorology Act 1955 (Cth)

*The Meteorology Act 1955* (Cth) (the Meteorology Act) (Commonwealth Bureau of Meteorology, 2014) sets out the roles and functions of the Bureau of Meteorology (the Bureau), including taking and recording of meteorological observations, the forecasting of weather, and the issuing of warnings of gales, storms, and other weather conditions likely to endanger life or property. This includes weather conditions likely to result in floods or bushfires. The Bureau is to perform its functions under the Meteorology Act in the public interest generally and may make arrangements with authorities of a state or territory in order to perform its functions.

Section 7(1) (b) states:

*... the Director may arrange with any Department, authority or person to take and record meteorological observations and transmit meteorological reports and information, and at 7(2) The Departments and authorities with which, and the persons with whom, arrangements may be made under the last preceding subsection include Departments and authorities of a State*

*or Territory and persons in the service of such a State or Territory of such a Department or authority.*

### *Bureau of Meteorology services in Queensland*

The Bureau's role under the SDMP is to provide forecasts, weather warnings and long-term outlooks on environmental phenomena that affect the safety, prosperity, and resilience of Australians. The Bureau collects, coordinates and distributes environmental observation data in support of advices, warnings and briefings. The Bureau also provides seasonal climate outlooks for forward planning.

The *Intergovernmental Agreement on the Provision of Bureau of Meteorology Hazard Services to the States and Territories* (Council of Australian Governments, 2018) intends to formalise and standardise services provided by the Bureau to State and Territory emergency services agencies. It includes roles and responsibilities for each level of government, including local government, in terms of flood management, fire weather management and the management of extreme weather and hazard impact events.

A supplementary service under the *Intergovernmental Agreement on the Provision of Bureau of Meteorology Hazard Services to the States and Territories* provides for the permanent posting of the Bureau personnel within the State Disaster Coordination Centre.

The *National Arrangements for Flood Forecasting and Warning* (Australian Maritime Safety Authority, 2017) provides a summary of the national arrangements and practices for the provision of flood forecasting and warning services in Australia. The national arrangements present the roles and responsibilities of each level of government for delivering flood forecasting services to the community. It incorporates operational responsibilities, policy coordination and review. Specific jurisdictional arrangements and agency roles required to support the national arrangements are also outlined. The national arrangements focus on the current system that prepares and delivers flood warning information to those at risk of riverine flooding.

The *Service Level Specification (SLS) for Flood Forecasting and Warning Services for Queensland – Version 3.3* (Bureau of Meteorology, 2021) outlines the flood forecasting and warning services provided by the Bureau to Queensland within the context of the Total Flood Warning System (<http://www.bom.gov.au/australia/flood/knowledge-centre/about-warning-service.shtml>). The scope of services provided by the Bureau under the SLS is limited to those dealing with riverine flooding where the interval from rainfall to flood is six hours or more. The Bureau's key role in the system is centred on monitoring and prediction, with lesser roles in interpretation, message construction and communication. Under the SLS emergency management practitioners have access to the Bureau's registered user service and receive Queensland observations, forecasts and warnings. Flood forecasting and warnings for Queensland depend on the provision of data from partner agency data networks. Schedule 6 of the SLS outlines a list of data sharing arrangements.

The Queensland Flood Warning Consultative Committee coordinates the development and operations of flood forecasting and warning services in Queensland. Membership of the committee includes the Bureau (Chair), Queensland Government agencies, the Local Government Association of Queensland (LGAQ), Sunwater and Seqwater. The committee is responsible for reviewing the SLS annually or as required.

The communications protocol for flooding in the Lower Brisbane River outlines the agreement between stakeholder groups involved in a flood response in the Lower Brisbane River to ensure there is effective communication during a response. This includes when water is released from Wivenhoe Dam. Communications are generally initiated by the Bureau.

## **Telecommunications Act 1997 (Cth)**

*The Telecommunications Act 1997 (Cth)* (Australian Government, 2022) covers the use of service providers' telecommunications networks to issue Emergency Alerts requested by state and territory governments. Division 4 of the Act provides obligations for service providers to make provision for, and comply with, designated disaster plans (ss 344–345).

## **Australian Government Disaster Response Plan 2020 (COMDISPLAN)**

The responsibility for preparing for and responding to disaster events in Australia resides with the states and territories. If, during a disaster event the responding state or territory is unable to 'reasonably cope with the needs of the situation', there is the opportunity for assistance to be provided by the Commonwealth under the provisions of the COMDISPLAN 2020. COMDISPLAN outlines the '*coordination arrangements for the provision of Australian Government non-financial assistance in the event of a disaster or emergency within Australia or its offshore territories*' (Emergency Management Australia, 2020, p. 4).

Emergency Management Australia monitors events and situations that may impact Australia via the Australian Government National Situation Room. When a disaster has occurred or is imminent, and an official from a relevant jurisdiction has advised the Australian Government National Situation Room of an intention to request assistance, the Director General, Emergency Management Australia will activate COMDISPLAN. In Queensland, requests for non-financial assistance are authorised by the State Disaster Coordinator for consideration.

COMDISPLAN provides for suitable assistance to be drawn from several Commonwealth government agencies, including the Department of Defence. Requests for Australian Defence Force (ADF) assistance are referred to as Defence Aid to the Civil Community (DACC) for disaster requests. Under certain circumstances DACC requests may be approved at a local level without COMDISPLAN being activated. These are category one DACC requests, which can be approved for a set time under local arrangements.

## **Inter-Governmental Agreement on National Search and Rescue Response Arrangements**

The Australian Search and Rescue arrangements are outlined in the *Inter-Governmental Agreement on National Search and Rescue Response Arrangements* (Australian Maritime Safety Authority, 2017). Section 4.3 of this document identifies that the State or Territory has a responsibility for '*coordinating search and rescue operations, including for, persons and vehicles on land; and persons and vessels on inland waterways and in waters within the limits of the ports of the relevant State or Territory*'. Searches for missing persons and vehicles during disaster events are conducted under these arrangements.

## **State legislation and policies**

### **Disaster Management Act 2003 (Qld) and Disaster Management Regulation 2014 (Qld)**

The objectives of the *Disaster Management Act 2003* (DM Act) are to:

- help communities mitigate the potential adverse effects of an event
- prepare for managing the effects of an event

- effectively respond to and recover from a disaster or emergency situation
- provide effective disaster management arrangements for the state.

The objectives are achieved by establishing disaster management groups, preparing disaster management plans and guidelines, ensuring communities receive appropriate information, and providing for the declaration of a disaster situation.

Section 4A of the DM Act provides the guiding principles for how it is to be administered:

*(c) local governments should primarily be responsible for managing events in their local government area;*

*(d) district groups and the State group should provide local governments with appropriate resources and support to help the local governments carry out disaster operations.*

The definition of a disaster is provided at s 13 of the DM Act. It describes a disaster as a serious disruption in a community caused by the event. This includes loss of human life, illness or injury to humans; widespread or severe property loss or damage; or widespread or severe damage to the environment. Section 16 of the DM Act defines an *event* as including a flood, storm, storm tide or other natural happening. The definition requires a significant coordinated response by the State and other entities, with the State represented by its departments and statewide regions.

Disaster management groups at local and district levels have functions that include:

- ensuring the community is aware of ways of mitigating the adverse effects of an event
- preparing for, responding to and recovering from a disaster
- identifying and coordinating the use of resources for disaster operations
- establishing communication systems within the group, between local groups in a disaster district, and between the local group and relevant district group, and
- ensuring information about a disaster in the area is promptly given to the state, district or local groups as appropriate.

Section 34 DM Act establishes the roles of the chairperson and deputy chairperson in respect to a Local Disaster Management Group (LDMG) and provides for their appointment by way of regulation.

Section 10(1) of the *Disaster Management Regulation 2014* (the DM Regulation) prescribes that in relation to s 34(2) of the Act, *'the chairperson and deputy chairperson of a local group are the persons appointed by the relevant local government'*.

Section 10(2) of the DM Regulation prescribes that the *'chairperson must be a councillor of the local government'*.

Section 64 of the DM Act provides that *'the Minister may approve a declaration of a disaster situation by a district disaster coordinator (DDC). A disaster declaration can be made if the DDC is satisfied that a disaster has happened, is happening or is likely to happen, and the exercise of declared disaster powers is necessary or likely to be necessary'*.

As a result of a disaster situation being declared, a DDC may authorise certain persons with necessary expertise or experience to exercise additional declared disaster powers. The powers can be exercised to ensure public safety or order; prevent or minimise loss of human life, illness or injury to humans or animals; and/or prevent or minimise property loss or damage, or damage to the environment. The powers include but are not limited to: controlling movements of persons and vehicles; evacuating persons; moving equipment, persons and materials; and conducting mitigation works.

## **Public Safety Preservation Act 1986 (Qld)**

Section 5 of the *Public Safety Preservation Act 1986* (PSPA) (Queensland Police Service, 2020) provides for a senior officer to declare an emergency situation in respect to a specified area. The PSPA provides certain powers for the emergency commander to assist with the resolution of the situation. These include the power to direct an evacuation, close roads and direct others to assist. Section 6 of the PSPA requires an emergency commander or another senior officer to revoke the Declaration of an Emergency Situation when a disaster situation is declared under the provisions of the DM Act unless there is a belief on reasonable grounds that it is necessary for that emergency situation declaration to remain in force.

## **Police Service Administration Act 1990 (Qld)**

Section 2.3 of the *Police Service Administration Act 1990* (PSAA) (Queensland Police Service, 2022a) outlines the functions of the Queensland Police Service. These functions include, at s 2.3 (g), *'the provision of the services, and the rendering of help reasonably sought, in an emergency or otherwise, as are:*

- (i) required of officers under any Act or law or the reasonable expectations of the community; or*
- (ii) reasonably sought of officers by members of the community'.*

Section 2.4(1) of the PSAA preserves the *'responsibility and functions appropriately had by the community at large and the members thereof in relation the preservation of peace and good order'*. Section 2.4(2) requires the members of the Queensland Police Service to *'act in partnership with the community at large to the extent compatible with efficient and proper performance of those functions'*. This reinforces the principle of a shared responsibility partnership between members of the community and responding agencies.

## **Fire and Emergency Services 1990 (Qld)**

Section 2(a) of the *Fire and Emergency Services Act 1990* (Qld) (FES) (Queensland Fire and Emergency Services, 2021) provides for the prevention of, and response to, fires and other emergency incidents. Section 2(c) establishes a framework for the management of the Queensland Fire and Emergency Services (QFES) and the State Emergency Service (SES). Chapter 3 of the Act establishes QFES and its functions. Chapter 4 of the FES Act establishes the SES and its functions.

The disaster management responsibilities of QFES are outlined in Appendix C of the *State Disaster Management Plan* (SDMP) (Queensland Disaster Management Committee, 2018). This includes:

*Ensuring the safety of the people of Queensland through the provision of effective prevention, preparation, response and recovery activities across a range of emergency situations through the capabilities of Fire & Rescue, Rural Fire Service and State Emergency Service (p. 90).*

The functions of the SES under the FES Act include but are not limited to: *'perform other activities to help communities prepare for, respond to and recover from an event or a disaster'* (s 130(d)).

## **Queensland Reconstruction Authority Act 2011 (Qld)**

The *Queensland Reconstruction Authority Act 2011* (Qld) (Queensland Reconstruction Authority, 2019) provides for appropriate measures to ensure Queensland and its communities effectively and efficiently recover from the impacts of disaster events, and to improve the resilience of communities for potential disaster events (ss 2(a) and (b)). This purpose is achieved through the establishment of the Queensland Reconstruction Authority (QRA) in s 7 of the QRA Act.

The QRA's functions are outlined in s.10 and include to plan for, coordinate and put in place measures to improve the resilience of communities for potential disaster events (s10(1)i).

## **Water Supply (Safety and Reliability) Act 2008 (Qld)**

The *Water Supply (Safety and Reliability) Act 2008* (Qld) (WS (SR) Act) (Queensland Government, 2022b) is administered by the Department of Regional Development, Manufacturing and Water (DRDMW). The purpose of the WS (SR) Act is to provide for the safe and reliable supply of water through the provision of a regulatory framework regarding water and sewage services, recycled water and drinking water quality, referable dams and flood mitigation responsibilities. The WS (SR) Act establishes the role of the Dam Safety Regulator. The regulator's general functions include keeping a register of water dams that pose a life safety risk, prepare and review recommendations about standards and practices, regulate compliance with the WS (SR) Act and other functions.

As the Dam Safety Regulator, DRDMW also provide assistance in relation to Emergency Action Plans (EAPs) through the provision of the *Emergency Action Plan for Referable Dam Guideline* (Dam Safety Regulator of Water Division Department of Regional Development, 2021) that is read in conjunction with the WS (SR) Act.

## **Environmental Protection Act 1994 (Qld) and Environmental Protection Regulation 2019 (Qld)**

The *Environmental Protection Act 1994* (Qld) (Department of Environment and Science, 2022a) (EP Act) is administered by the Department of Environment and Science. The object of this Act is to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (ecologically sustainable development). Under the EP Act, environmental protection policies are developed to cover specific aspects of the environment such as water and wetland biodiversity. The EP Act and its subordinate legislation, such as the *Environmental Protection Regulation 2019* (Department of Environment and Science, 2022b), provides a range of tools to ensure this objective is met, such as for licencing of environmental dams.

## **Queensland State Disaster Management Plan**

The *Queensland State Disaster Management Plan* (SDMP) (Queensland Disaster Management Committee, 2018) establishes the framework, arrangements and practices that enable disaster management in Queensland. It also outlines the arrangements for prevention, preparedness, response, recovery and resilience. The SDMP includes the roles and responsibilities of entities involved in disaster operations and disaster management for events that are likely to happen in Queensland, and the priorities for disaster management for Queensland. The sub-plans of the SDMP include specific plans for hazards.

## Local and District disaster management plans

Disaster management plans at local and district levels must include provision for roles and responsibilities of entities involved in disaster management and disaster operations. They must also include coordination of activities and operations performed by those entities, events that are likely to happen within the relevant area, and disaster management strategies and priorities for the relevant area.

## Policies and guidelines

*Queensland's Disaster Management Strategic Policy Statement* (the Statement) (Department of the Premier and Cabinet, 2017) informs the strategic approach to keeping people safe and making communities more resilient to disaster risks and impacts.

The *Queensland Prevention, Preparedness, Response and Recovery Disaster Management Guideline* (the PPRR guideline) (Queensland Fire and Emergency Services, 2018a) supports the implementation of legislation and complements the Statement, the SDMP and the Standard by providing good practice suggestions and advice for implementing disaster management responsibilities. The PPRR guideline states that:

*local governments, disaster districts and the state prepare for disasters through a continuous cycle of risk management, planning, coordinating, training, equipping, exercising, evaluating and taking corrective action to ensure the effective coordination and response during disasters.*

The PPRR guideline's toolkit includes manuals, reference guides, templates, and handbooks to support stakeholders to fulfil their responsibilities for risk-based planning, disaster management group activation triggers, warnings (including Emergency Alerts), evacuation and emergency resupply.

The *Standard for Disaster Management in Queensland* (the Standard) ([https://www.igem.qld.gov.au/sites/default/files/2021-07/Standard for Disaster Management in Queensland 2.1.1.pdf](https://www.igem.qld.gov.au/sites/default/files/2021-07/Standard%20for%20Disaster%20Management%20in%20Queensland%202.1.1.pdf)) (Office of the Inspector-General of Emergency Management, 2021) establishes the outcomes to be achieved for all entities involved in disaster management. It consists of Shared Responsibilities, Outcomes, Accountabilities and Indicators to support continuous improvement through outcomes-based activities.

The Standard is to be used by all entities in Queensland with a responsibility to contribute to disaster management. This includes those with legislated roles, as well as entities acting on behalf of or under an arrangement with those that do.

# About the event

## Overview

### Event antecedents

Several climate drivers including La Niña in the Pacific Ocean, declared by the Bureau of Meteorology (the Bureau) on 23 November 2021, a positive Southern Annular Mode (SAM), and a negative Indian Ocean Dipole influenced the development and continuation of wetter conditions over 2021 and into 2022.

Nationally, November 2021 was the wettest month on record leading to high levels of soil saturation. Queensland experienced the first major rainfall and flooding event of the season, the Central, Southern and Western Rainfall and Flooding event during 10 November–3 December 2021. December brought recording breaking soil saturation levels, limiting the capacity for the soil to hold further rainfall. Ex-Tropical Cyclone Seth (Figure 2) tracked down the coast from 29 December 2021 to 10 January 2022, causing heavy rainfall and associated flooding in south east Queensland, including intense flooding on the Mary River (Courtney, 2022).

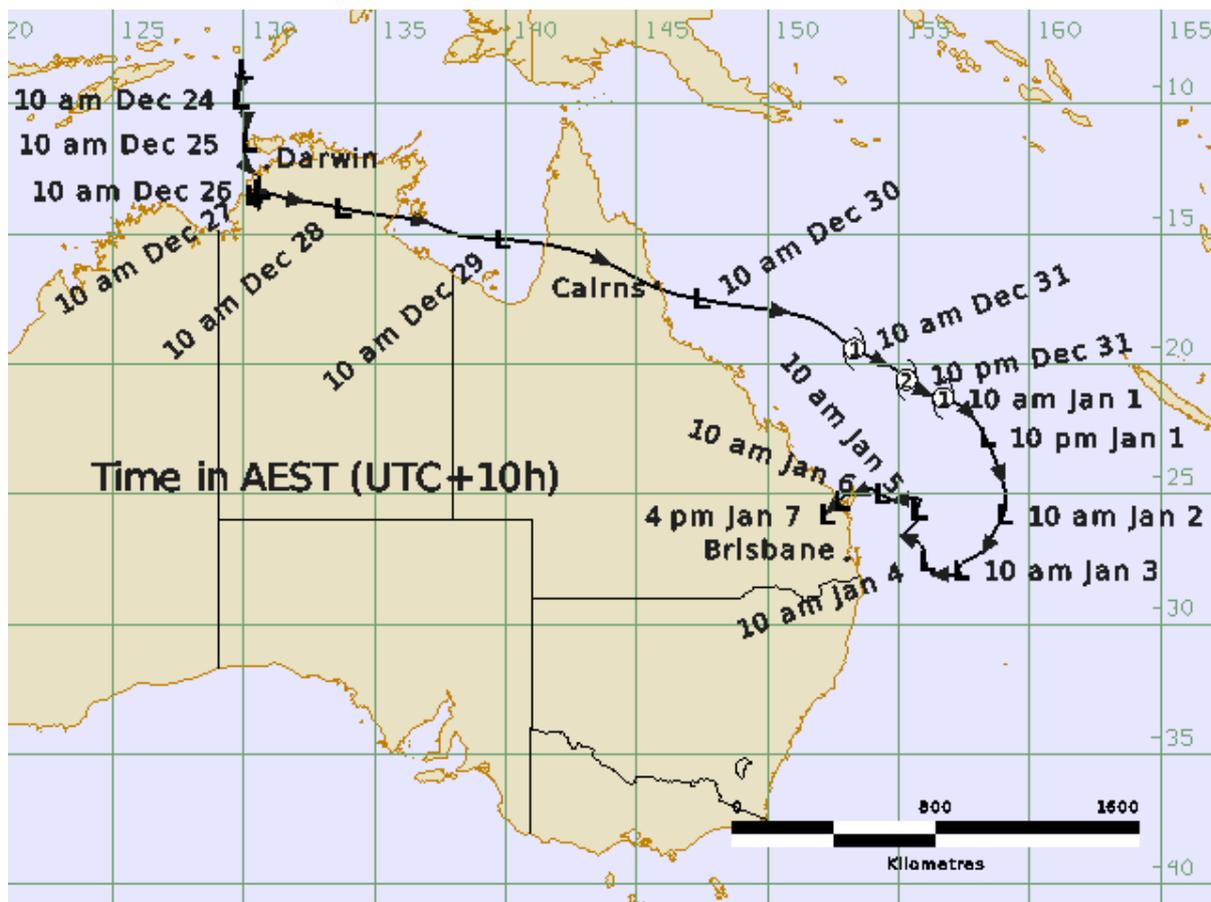


Figure 2: TC Seth tracking (source: <http://www.bom.gov.au/cyclone/history/seth.shtml>)

The confluence of three stronger than usual weather systems resulted in extreme multi-day rainfall and significant flooding in South East Queensland from 22 February to 7 March 2022:

- a low-pressure trough in the Coral Sea brought warm, moist air east from the ocean into the upper atmosphere and over the land
- the trough was held in place for a protracted period by a 'blocking' high-pressure system in the Tasman Sea
- an unusually cold upper atmosphere weather system came across from the Great Australian Bight, condensing the moist air in the trough, and causing large amounts of persistent rain.

The soils saturated from ex-TC Seth and the Central, Southern, and Western Rainfall and Flooding event (10 November–3 December 2021) were a significant contributor to the severity of flooding experienced in eastern Australia.

### South East Queensland Rainfall and Flooding Event

The Bureau issued its first forecast for potentially heavy rainfall for South East Queensland on Monday 21 February 2022.

On Tuesday 22 February 2022, severe thunderstorms developed around Gympie, Somerset, Sunshine Coast, Noosa, and Moreton Bay local government areas (LGAs). The first flood watch for this event was issued at 2.45pm on Tuesday 22 February 2022. The Standard Emergency Warning Signal (SEWS) was appended to a severe thunderstorm warning for intense rainfall at 10.32pm on Tuesday 22 February 2022 for Gympie and Kin Kin. Intense rainfall of 104 millimetres per hour and 63 millimetres per hour of rain were observed at Mount Wolvi and Kin Kin, respectively.

At 10.54pm on Tuesday 22 February 2022, the first severe weather warning was issued for the south east coast, and parts of Wide Bay and Burnett regions. At 11.21pm on the same day, the first flood warning was issued for the Mary River, near Gympie.

On Wednesday 23 February 2022, the first flood warnings were issued for Noosa, the Sunshine Coast, and the Upper Brisbane River. Mount Wolvi recorded 425 millimetres of rain and Kin Kin recorded 355 millimetres of rain in the 24 hours to 9am on Wednesday 23 February 2022. The same day, Noosa LDMG activated to Stand Up level.

By Thursday 24 February 2022, severe weather warnings for intense rainfall and damaging winds continued for the South East Coast and parts of Wide Bay and Burnett, and Darling Downs and Granite Belt Forecast Districts. Gold Coast LDMG activated to 'Stand-up' level.

On Friday 25 February 2022, the Old Range Road rain gauge at Dallarnil, in the North Burnett LGA, recorded the highest daily rainfall of 463 millimetres. Major flood warnings were issued for Mary, Noosa, Sunshine Coast and Upper Brisbane rivers. The first major flood warning was issued for the Lower Brisbane, Logan, and Albert rivers.

The trough and low-pressure system deepened over South East Queensland between Friday 25 February and Sunday 27 February 2022 and remained slow moving. It delivered persistent heavy rainfall with areas of locally intense rainfall associated with embedded thunderstorms.

On Saturday 26 February 2022, 444.4 millimetres was recorded at the Tin Can Bay rain gauge. The Bremer River at Ipswich reached 11.7 metres as Emergency Alerts were issued for Gympie and Ipswich. A disaster was declared for the Gympie District Disaster Area encompassing the Gympie Local Government Area on the same day. Over 400 millimetres of rain was observed in Noosa and Maroochydore.

On Sunday 27 February 2022, the highest daily total of 340 millimetres was recorded at the Clontarf rain gauge. The Mary River at Gympie peaked at 22.96 metres, above the major flood threshold, but below the February 1893 peak of 25.45 metres. The Logan River at Waterford peaked at 11.15 metres, which was the highest level since 1974. The QDMC met in the morning and again in the afternoon.

Also in the afternoon of Sunday 27 February, the Maryborough DDC declared a disaster for the Maryborough Disaster District. The Brisbane DDC declared a disaster for the Brisbane LGA the same day.

On Monday 28 February 2022, the Brisbane River city gauge recorded a peak of 3.85 metres, the Mary River at Maryborough peaked at 10.3 metres, and the Albert River peaked at Wolffdene at 12.30 metres. Upper Springbrook recorded 530 millimetres of rain, Bracken Ridge recorded 444 millimetres and Upper Kedron recorded 374 millimetres.

On Wednesday 2 March and into Thursday 3 March 2022, upper atmospheric troughs moved through South East Queensland, which brought severe thunderstorms, high wind, and hail over recently flooded areas. Queensland experienced increased rainfall and floods over several consecutive months. These cascading events compounded the flood impacts and affected the ability of the community and environment to recover before the event.

Record rainfalls were registered across South East Queensland during this event. Brisbane received 78 per cent of its average annual rainfall total between 23 to 28 February 2022. This was the wettest week recorded since 1900 across the Bureau's Moreton rainfall districts, which includes Greater Brisbane, Gold Coast, Gympie, and Kingaroy. The Brisbane City Gauge recorded its highest daily rainfall for any month on Sunday 27 February 2022 at 228.4 millimetres. The Brisbane rainfall total throughout February was second only to the rainfall levels in February 1893.

The highest weekly rainfall total recorded by the Bureau during this event was at Upper Springbrook with 1334 millimetres of rain. Rain gauges in the flood warning network at Bracken Ridge, Murrumba Downs, Albany Creek, Cooran, Normanby Way, and Youngs Crossing all recorded weekly rainfall totals exceeding 1100 millimetres for the period 22 February to 1 March 2022.

## Impact of the event

This event affected the most densely populated areas of Queensland. Of the 77 LGAs and one town authority in Queensland, 23 were activated for Disaster Recovery Funding Arrangements (DRFA) across the central and south eastern parts of the state. Of those 23, 16 were already recovering from earlier rain events when this event occurred. Tragically, 13 lives were lost during this event. It is also estimated that over 500,000 people or one-tenth of the state's total population were directly affected in some way.

Up to 180,000 electricity consumers lost power with over 20,000 householders placing claims resulting from the loss of an essential service. Over the course of the event, 30,000 dwellings, businesses and vehicles were damaged. This equates to \$1.36 billion in claims with another \$630 million in uninsured losses. Schools, TAFE colleges and universities were closed and/or damaged (Deloitte Access Economics, 2022).

The road network was affected with more than 1400 kilometres of state-controlled roads either closed or restricted, negatively impacting the national supply chain (Queensland Reconstruction Authority, 2022b). Major roads such as the Bruce and Warrego Highways and the Centenary Motorway were closed in several areas, isolating communities. Many kilometres of bikeways and pedestrian routes were also impacted due to debris and damage.

The removal of the Drift Restaurant from Brisbane’s Bicentennial Bikeway and Coronation Drive was undertaken at a cost of more than \$3 million (O’Flaherty, 2022).

Substantial damage was also reported for public transport infrastructure which resulted in disruptions to road and rail services for several days. Ferries and ferry infrastructure were significantly impacted with disrupted services for several months. To date, eight damaged ferry terminals remain under repair in Brisbane (Brisbane City Council, 2022).

Grants for primary producers were activated in 20 of the affected LGAs: 20 for small business and not-for-profit assistance, with 15 of these also activated for the Personal Hardship Assistance Scheme. More than 2500 primary producers reported a 30 per cent total production loss, costing approximately \$254 million (Queensland Reconstruction Authority, 2022c).

**Maps of affected area**

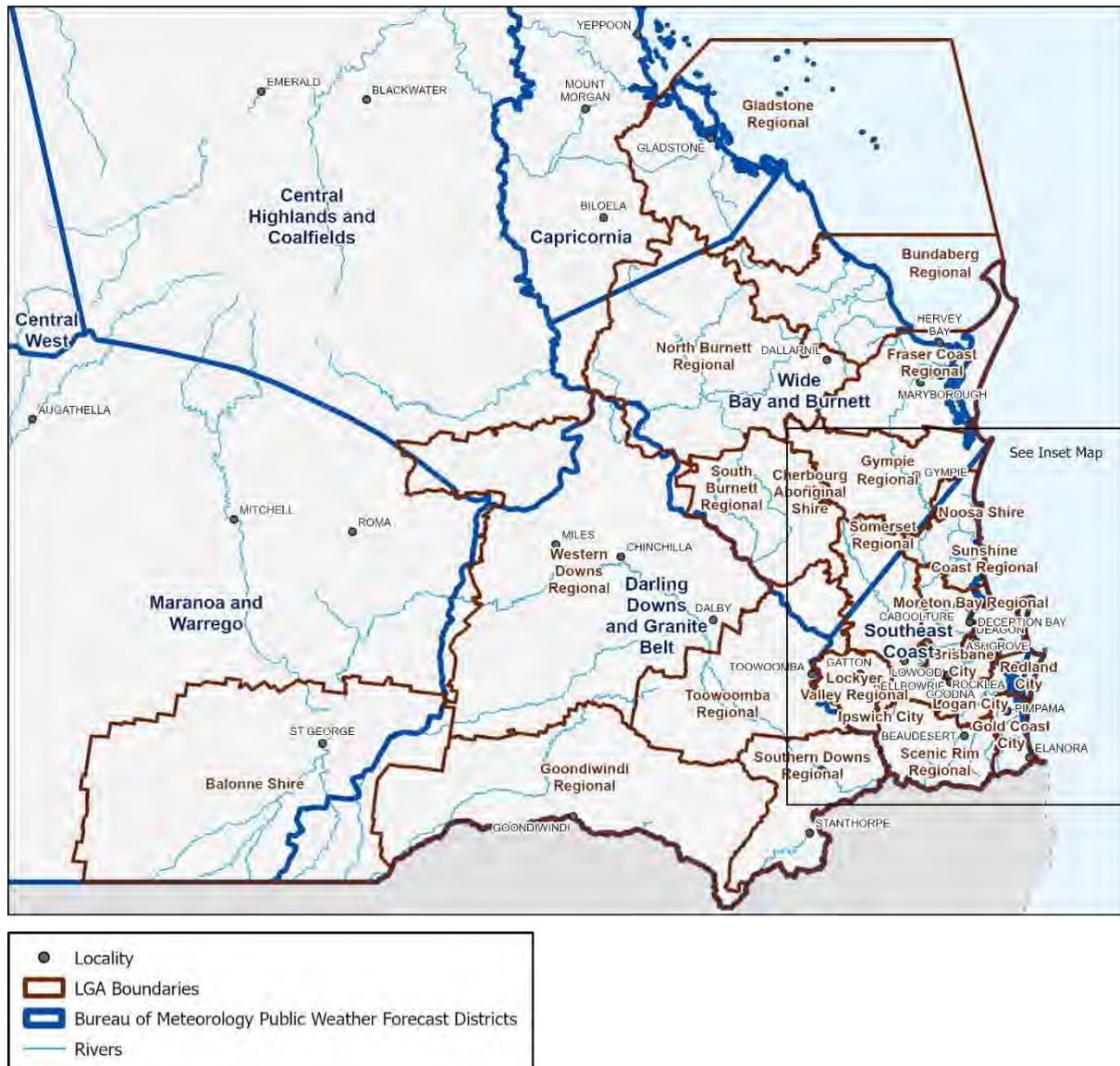


Figure 3: Map of the 23 local government areas affected by this event and the Bureau’s forecast districts (Queensland Police Service, 2022b)



Figure 4: Inset map of the local government areas affected by this event and the Bureau's forecast districts (Queensland Police Service, 2022b)

### Timeline of the South East Queensland Rainfall and Flooding Event

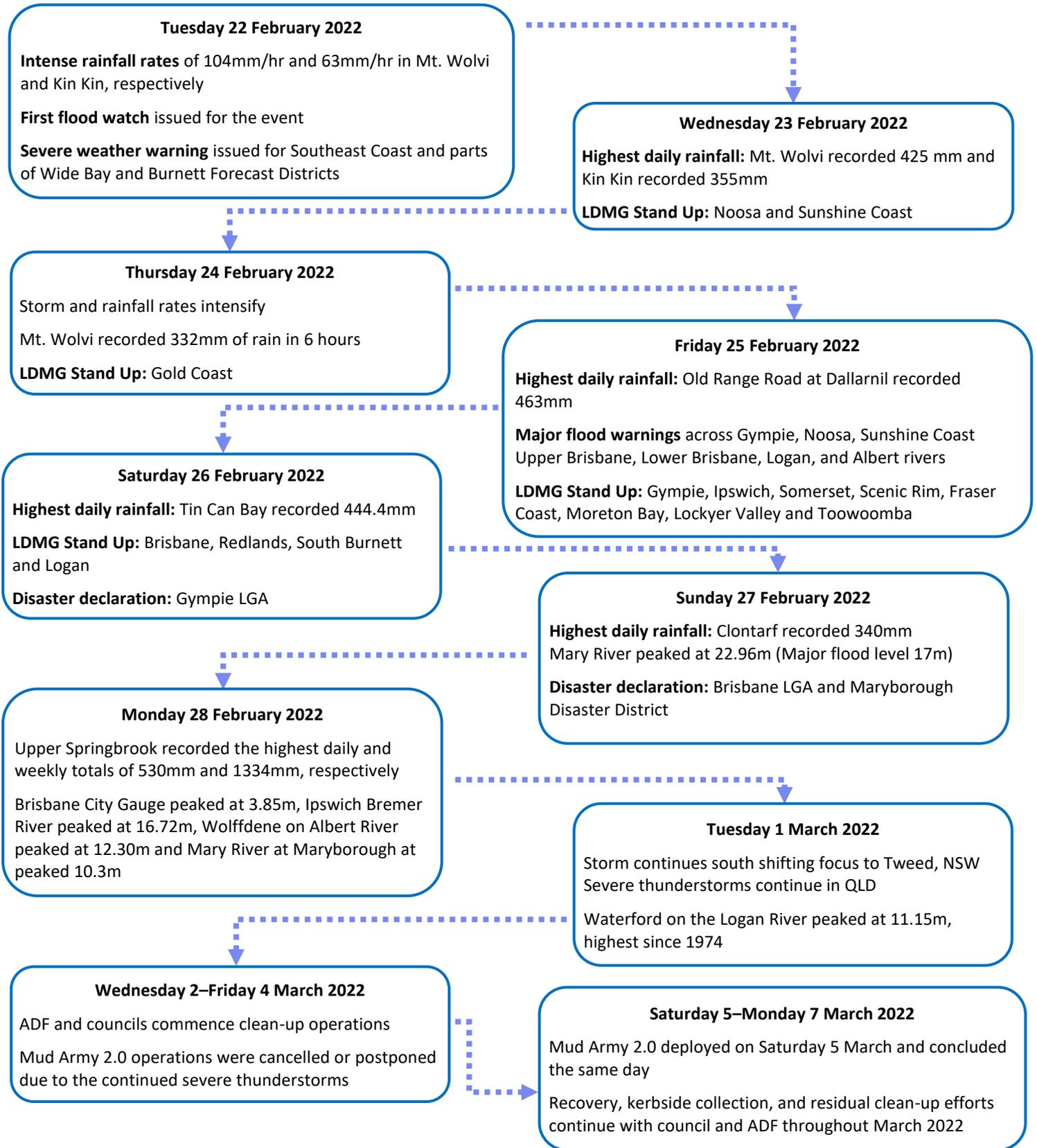


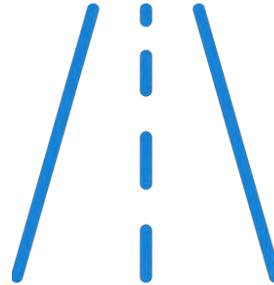
Figure 5: Timeline of the South East Queensland Rainfall and Flooding Event

**Key facts**



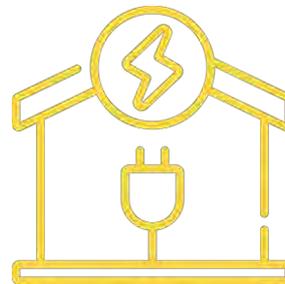
**30,000 dwellings, businesses, and vehicles** damaged across the dates of the event

Over 1400 km of **roads** damaged or closed due to the event



**2500 primary producers** accounted a total loss of their production at 30 per cent costing approximately \$254 million

**180,000 energy customers** lost power



**\$1.36 billion in claims** and \$630 million in uninsured losses

## 23 local government areas

were affected across South East Queensland



**42,131 Tweets**

related to floods in Queensland on Sunday 27 February alone

## 94 Emergency Alerts

issued from 23 February to 3 March



**1334 mm highest weekly rainfall total**

in Queensland during the weather event at Upper Springbrook Alert Station

## 15 local government areas

activated for Disaster Recovery Funding Arrangements



**Over 500 warnings**

issued by the Bureau across the weather event

## **Comparison between 2022 and 2011 flood events**

The event has been compared to the 2011 floods. According to the Bureau, the antecedent climate drivers for the February 2022 and January 2011 events were broadly similar; however, their timing and geographic scale differed. This led to differences in quantity, duration and location of the rainfall and subsequently the scale and extent of flooding at local levels.

Several climate drivers (including a weak to moderate La Niña and a weak negative Indian Ocean Dipole contributed to wetter conditions over 2021 and into the summer 2021 to 2022. Similar combinations of climate drivers led to periods of significant and widespread flooding across the region in 2011.

The Bureau also advised the meteorological characteristics of the events were similar in that:

- they were driven by an upper atmospheric low combining with a surface trough near south-east Queensland while a slow-moving high-pressure system in the Tasman Sea directed very moist, warm easterly flow into South East Queensland
- during both events, very high levels of moisture were present in the atmosphere. The precipitable water (measure of how much liquid water there would be if water vapour in the atmosphere were condensed) for both events was around 60 millimetres, well above the average of 33 millimetres
- the above average rainfall leading into both events meant the landscape in both years was saturated and had little capacity to absorb the intense rainfall to follow. Rainfall in the four weeks prior to the January 2011 flooding was three to four times higher in total than that preceding February 2022.

Importantly, the daily intensity of rainfall was higher in February 2022 than in January 2011. The Bureau confirmed there were higher daily rainfall totals on each of the three main 'rain days' (26–28 February 2022) than occurred on any one day in January 2011. The locations where the rainfall fell most heavily also differed between 2011 and 2022. In 2011 the heaviest falls were north and west of Brisbane. In 2022, they were more coastally focused south of Gympie including greater Brisbane and the Sunshine and Gold Coasts.

Catchment conditions at the start of the event along with the duration, intensity, extent of rainfall and the effect of tributary inflows determined the extent of flooding. Consequently, in February 2022, these differences resulted in some peaks being higher and some being lower than January 2011.

The Bureau highlighted those areas, like the Sunshine Coast, Mary River Valley and Logan River Valley, that experienced significantly higher river levels in 2022 compared to 2011. For example, the Mary River at Gympie in January 2011 peaked at 19.45 metres while during this event the river peaked at 22.96 metres at the same location. Conversely, in 2022 the Brisbane River at Brisbane City peaked on the high tide at 3.85 metres on the morning of 28 February 2022. This was lower than the peak of 4.46 metres in January 2011. The Bremer River, part of the lower Brisbane River catchment, peaked on the morning of 28 February 2022 at 16.72 metres, well below the January 2011 peak of 19.4 metres.

Significantly, for Brisbane and Ipswich, flash flooding was more significant along smaller creeks and tributaries during the February 2022 event compared to January 2011.

## Community insights



*Image of kayak in a flooded street in Fairfield, Brisbane (Image courtesy of Kate Saunders)*

The following insights have been developed from public submissions and community forums.

Many community members shared details of the significant physical, emotional, environmental, and financial impacts that this event had on them, their homes and their communities. There was broad consensus from the community about the magnitude of this event, particularly considering many areas had recently been impacted by earlier flood events. Some expressed the view that these repeated impacts had enabled better awareness and therefore higher levels of preparedness for this event. Others suggested the compounding nature of these events had lowered their overall resilience and ability to cope with subsequent events.

The community raised concerns about the way information was communicated in the lead-up to and during the event. They felt the initial messaging resulted in a false sense of security and in some cases complacency, which led to some community members not taking preparedness actions that they otherwise may have. Many expressed the view that with additional time to prepare, the effects of the event on individuals and businesses may have been able to be significantly reduced. There was consensus about the concern for vulnerable members of their community, such as senior citizens. People also shared a concern about the absence of information identifying safe egress routes due to the rapid onset of flooding across multiple key roads. They spoke of how this adversely impacted their ability to attend sandbag

depots before their properties flooded and particularly impacted their confidence and ability to self-evacuate.

There were varying views within the community about the level of preparedness information and education available to them that would have enabled them to be more prepared for this event. Some expressed disappointment they had not been advised of their risk by a relevant authority. Lived experience of previous events was the trigger for many others to proactively seek information about their risk, and to mitigate against it. Conversely, some communities spoke about a sense of renewed connectedness within their community following events, and the advantages this may bring in the future. Significant population growth and changes in some communities as a result of interstate migration has affected the overall extent of both the lived experience and local knowledge that remains in some communities.

There was significant feedback from the community about the role of alerts and warnings and their effectiveness during this event. Many community members expressed the view, both in community forums and in written submissions, that the warnings they received were not timely and did not provide them with information that prompted them to take appropriate actions. While the Bureau issued warnings, some community members indicated that the messaging failed to communicate the gravity of the risk they faced. Some shared their experience of receiving warnings for this event hours after being affected. Some did not receive a warning and were unable to prepare or self-evacuate. Some received warnings but were unable to verify their source and sought confirmation about their legitimacy by phoning their local government, seeking advice from neighbours and friends, or using social media groups to find more information.

Community members expressed criticism of the quality of the information provided through official channels and found unofficial information sources such as social media pages to be more location-specific and timely. Many expressed the view that they wanted information pushed to them and timestamped to indicate currency, and that they did not have the time or knowledge to interrogate multiple websites to find information that was relevant to them and their situation. One community submission suggested face-to-face flood information sessions and a location-specific disaster dashboard with locally relevant information.

### Community suggestions

Across most forums, attendees expressed a strong desire for more personalised and localised information.

There were many suggestions made by the community, which included:

- returning to traditional methods or practices like Neighbourhood Watch where locals get to know others in their local area to self-identify their community's needs, vulnerable people or households and people who can temporarily house people or loan vehicles in an emergency
- reintroducing local radio stations to provide community-specific information, alerts and advice during emergencies. Examples included using local school message boards (some can be remotely accessed and quickly updated), local grocery stores or libraries, or emergency supply locations (e.g. sandbag depots)
- better use of television and radio to immediately alert people who do not use mobile or digital technology of the need to evacuate
- adopting a warden system where one person is the source of emergency information for their neighbourhood
- creating a local flood committee for flood-prone areas

- involving community members in evacuation exercises to help them understand what is required and be better prepared
- creating a register of vulnerable community members (Note: This may have privacy implications.)
- developing a list of the community transport fleet
- using existing government education platforms and applying this to flood prone communities
- adopting the activities used for annual bushfire awareness including street meetings and letterbox drops for flood preparedness
- libraries extending their community workshops to include disaster and/or emergency education
- local governments holding annual seminars or providing local businesses and new residents with information about potential flood risk
- bespoke communities establishing relationships with local government
- NGOs looking for opportunities to improve community awareness and buy-in and build community volunteers' capacity
- time stamping updates on disaster dashboards in 30-minute intervals, even where there are no updates, to provide better situational awareness
- more electronic flashing signs to better warn road users along known flood-prone roads, including impacted highways, to forewarn motorists that the road ahead is flooded
- installation of more flood gauges positioned further upstream of communities to potentially provide earlier warning
- flood gauges with lowlight-capable cameras to provide greater situational awareness and opportunity for response
- suggestion in respect of adopting overseas early warning systems used in other countries. For example, Japan's tsunami warning system automatically issues warnings within minutes of a severe tsunami being detected. In Chile, alarms sound and power automatically shuts down as part of warning the community of a tsunami or earthquake.
- using drones to monitor river heights
- introducing a dedicated disaster phone number (similar to 13HEALTH) as well as the centralisation of emergency points of contact (e.g. Centrelink, Energex, Australian Red Cross) in a widely accessible manner to help alleviate stress on the community
- easily accessible and more personalised plans and related maps
- easily understood flood water height levels related to individual properties.

## Research insights

### Behavioural responses to warning messages

IGEM commissioned QUT to conduct a survey to examine the impacts of warnings and behaviour during this event ([Appendix D](#)). The research found approximately 79 per cent of the 70 respondents recalled receiving at least one warning during the February–March 2022 event, e.g. Emergency Alerts or insurance company alert via text message. The research found the warnings varied in terms of their timeliness, clarity and consistency.

There was strong appetite for visual cues in warnings and additional information about the expected impact, to support community understanding and situational awareness. There was also clear support for earlier warnings that contain more instructional information to inform the community to take action.

Respondents indicated a desire to receive warnings through multiple channels, including a more central source of information during the event. Many respondents reported that they did not initially know where to seek out specific kinds of information, e.g. flood risk, current road closures, weather events, dam releases. Respondents often searched and triangulated information from multiple sources and channels to improve their understanding of the event but did not appear to take a systematic approach to information seeking.

Most community members expressed a desire for access to current, localised information during the event. They gave examples such as being unsure of the relevancy or timelines of official communications due to the timestamp on a webpage not being regularly updated. They sought collated information specific to their local area and community, including road closure information and contextualised flood heights.

The researchers found that the warning messages were effective at generating a diverse range of appropriate behavioural responses. The warning messages encouraged respondents to seek additional information during the event from a range of credible and appropriate sources, e.g. the Bureau, local government.

The findings of this research provide valuable ideas from participants for those supporting community preparedness, planning and response to future flood events.

## **Understanding and reducing flood risk**

The *Queensland Strategy for Disaster Resilience* (the Strategy) (Queensland Reconstruction Authority, 2017) notes a resilient organisation or community is risk-informed with appropriately prepared individuals. The Strategy aligns with the *Sendai Framework for Disaster Risk Reduction 2015–2030* which is the global blueprint for managing disaster risk reduction. The strategy also notes the adverse effects of disasters are felt first and most significantly by vulnerable people (Queensland Reconstruction Authority, 2017).

Entities within the Queensland disaster management arrangements are responsible for managing disaster risk; however, responsibility for reducing risk is shared with the community, particularly where they have a local understanding of risks and where opportunities exist for them to reduce their exposure. The Standard identifies that entities have a shared responsibility to work together with their community to manage these risks. The impact of disasters on the community can be reduced when entities embed mitigation and risk reduction activities into normal business and encourage and enable the community to help manage their own risks.

Queensland's disaster risk reduction starts with disaster management groups at all levels conducting a risk management process that forms the basis for planning. The *Queensland Emergency Risk Management Framework* (Queensland Fire and Emergency Services, 2022c) is designed to assist disaster management groups to review natural disaster risk management and support enhanced resilience. The SDMP encourages local and district disaster groups to assess the applicability of the statewide assessment of disaster risk. The *2021 State Disaster Risk Report* (the Risk Report) (Queensland Fire and Emergency Services, 2022a) contains information intended to help inform more detailed, place-based and district risk assessment and disaster management plans. The Risk Report encourages the

adjustment of long-term disaster risk reduction planning to consider climate risk as equivalent to disaster risk.

The Risk Report describes four types of flooding (Table 1). Riverine flooding is assessed by the Risk Report as the highest priority for Queensland. It is the only type of flooding assessed as a risk in this report. Flash flooding is a characteristic of small river/creek catchments and is also associated with severe thunderstorms when they produce heavy rainfall (Queensland Reconstruction Authority, 2020a).

Source	General characteristics
Large riverine catchments	Rainfall can build up over hours, days or weeks. The runoff from rainfall flows across and then down gutters, drains, gullies, creeks and rivers and may create significant floods that inundate large areas of land for varying periods of time. With more time to react, flood warning is more effective for these types of floods.
Small river/creek catchments	Heavy, intense rainfall can occur suddenly, and the quickly rising floods caused by this can occur within minutes or hours after the rainfall. Referred to as flash floods, there is often limited time to react, and these events can be difficult to predict manage in real time.
Coast	Large tides and storm surges can flood coastal areas. The affected area can be widespread, however there is usually the opportunity for effective flood warning with these events.
Overland flow	In urbanised areas, the formal draining network is usually designed only to manage small, frequent rainfall events. When these are exceeded, water flows along the low points of the topography, often across private property and roads.

Table 1: Flood types

Recommendation 1
1) The Inspector-General of Emergency Management recommends that Queensland Fire and Emergency Services review and update the <i>State Disaster Risk Report</i> , including re-evaluating the risk of flooding by all types. Queensland Fire and Emergency Services should publish the updated <i>State Disaster Risk Report</i> by 1 November 2023.

### Three-month climate outlook

The Bureau reports a negative Indian Ocean Dipole event is underway, which is associated with above average winter–spring rainfall for much of Australia. On 16 August 2022, the Bureau’s El Niño–Southern Oscillation (ENSO) Outlook moved from La Niña WATCH to La Niña ALERT, indicating a 70 per cent chance of La Niña forming later in 2022. As such, the Bureau advises there is a very high chance of wet conditions over eastern Australia for the next three months. If a La Niña event is established, wet conditions will persist into the summer of 2022/2023.

The Bureau also advises climate change in Australia is having an impact, with heavy rainfall, the frequency of coastal storm surge inundation, and large-scale heatwaves and record-high temperatures increasing.

In light of the Bureau’s recent outlook for above average rainfall, wet soils, high rivers and full dams, an elevated flood risk remains for eastern Australia.

## Flood classification

The Bureau classifies floods through an impact-based classification scheme which defines flooding as minor, moderate, or major at key river height stations. These classification levels appear in, and give meaning to, the Bureau's flood warnings.

Local governments, through their LDMG, are responsible for the initial determination, review and update of flood classifications for their area. This is done in consultation with the Bureau and other relevant agencies so they accurately reflect the impacts at key river height stations (Queensland Reconstruction authority, 2020b).

### Bureau flood classification (Council of Australian Governments, 2018)

**Minor:** Causes inconvenience. Low-lying areas next to watercourses are inundated. Minor roads may be closed and low-level bridges submerged. In urban areas inundation may affect some backyards and buildings below the floor level as well as bicycle and pedestrian paths. In rural areas removal of stock and equipment may be required.

**Moderate:** In addition to the Minor flood effects, the area of inundation is more substantial. Main traffic routes may be affected. Some buildings may experience water above the floor level. Evacuation of flood-affected areas may be required. In rural areas removal of stock is required.

**Major:** In addition to the Moderate flood effects, extensive rural areas and/or urban areas are inundated. Many buildings may be affected above the floor level. Properties and towns are likely to be isolated and major rail and traffic routes closed. Evacuation of flood-affected areas may be required. Utility services may be impacted.

Table 2: Impact-based classification

The Standard identifies that entities have a shared responsibility to work together with their community to develop integrated strategies to manage natural and human-caused hazards. The *Queensland Flood Risk Management Framework* (the Framework) ([https://www.gra.qld.gov.au/sites/default/files/2021-06/queensland\\_flood\\_risk\\_management\\_framework\\_2021\\_qfrmf\\_0.pdf](https://www.gra.qld.gov.au/sites/default/files/2021-06/queensland_flood_risk_management_framework_2021_qfrmf_0.pdf)) (Queensland Reconstruction Authority, 2021a) sets the direction for flood management which is led by the QRA. The model is based on a collaborative, decentralised model with shared roles and responsibilities which sees responsibility primarily sitting with local government.

The *Flood classifications in Queensland—A best practice guide for local governments* ([https://www.gra.qld.gov.au/sites/default/files/2020-06/flood\\_classifications\\_in\\_queensland\\_-\\_a\\_best\\_practice\\_guide\\_for\\_local\\_governments\\_-\\_may\\_2020.pdf](https://www.gra.qld.gov.au/sites/default/files/2020-06/flood_classifications_in_queensland_-_a_best_practice_guide_for_local_governments_-_may_2020.pdf)) was developed by the QRA in consultation with the Bureau to help local governments review their flood classifications. The community may be complacent about the potential severity of flooding if the floods are incorrectly classified. The *QRA Flood classifications in Queensland—A best practice for local governments* encourages an annual assessment of flood impact across all local governments (Queensland Reconstruction authority, 2020b).

### Awareness of potential flood risk

Flood mitigation activities can be planned when it is acknowledged a flooding risk exists. During this event, people who experienced previous flood events indicated this event and its impacts were different. In other cases, people were exposed to previously unknown risks of flooding from small river/creek catchments and overland flow. In some cases, people who

were new to the area or resided elsewhere during previous events were also unaware of their potential flood risk.

It also emerged that tenants or owners of residential and commercial property had not considered or were unaware of the property's potential flood risk. This issue was also identified by the *Queensland Floods Commission of Inquiry in 2011* (Holmes, 2012). Recommendations were made in the Interim Report (Recommendation 4.13) and Final Report (Recommendations 2.16, 2.17, 2.18 and 2.19) that state and local governments take steps to properly inform tenants and prospective buyers of a property's flood risk.

There is a strong appetite for proactive disclosure of potential flood risk. The Mayor of Moreton Bay Regional Council recently indicated he would take a proposal to the LGAQ conference in October 2022 to mandate flood risk disclosure for property buyers (Stone, 2022).

Under the *2021–22 Southern Queensland Floods State Recovery and Resilience Plan 2022–24* (Queensland Reconstruction Authority, 2022c), the QRA is developing ways to disseminate flood information to property owners and tenants in flood-prone local government areas:

*Property flood information systems in flood-prone local government areas will be developed under the Resilient Homes Fund, which will enable property owners, tenants and communities to access property level flood information. Work is currently underway to explore how to best disseminate this information to potential property owners and tenants* (Queensland Reconstruction Authority, 2022c).

### *Research about understanding flood risk and preparedness*

QUT were commissioned to research community understanding of flood risk and preparedness actions ([Appendix D](#)). The researchers found the following:

- Most participants self-reported a good understanding of flood risk, based primarily on past experience. There was variation among participants' understanding of risk and preparedness levels. Approximately two-thirds of the participants self-reported a good understanding of the risks posed to them by flooding. This understanding was predominantly constructed based on past experience with flooding, assessment of flood risk, and assumptions about the physical movement of water. For example, a large majority of participants who reported that they understood flood risk were principally informed by their prior experience with flooding, regardless of the location. One-third of participants reported a poor understanding of their flood risk prior to the event. This lack of understanding was attributed to limited experience at their property and assumptions that past events precluded them from impact. For some participants, their lack of familiarity with flood risk was because they had recently moved to the area. Other participants noted that their understanding of risk was supported by a deliberate assessment of flood risk prior to purchasing property and their knowledge of the area.
- Prior to the event, approximately two-thirds of participants described their preparedness level for floods as being minimal or zero. Some attributed their lack of preparedness to recurring false alarms with weather, lack of previous flood damage during significant events (e.g. 2011 floods), and due diligence and flood assessment prior to property purchase leading to general assumptions of safety. Preparedness ranged from formal planning to key activities such as ensuring sufficient food provisions. Almost one-third of participants felt adequately prepared for a flood. This self-assessment was attributed to their personal circumstances (e.g. high medical needs), and knowledge of, familiarity with, and learning from past flood events.
- Most participants undertook preparatory action in response to the event, including property maintenance and purchase of food and medicines.

- Although participants believed pre-event preparedness information was available, seeking it was not an immediate priority for most. Very few participants actively engaged in directed information seeking to prepare themselves for flooding ahead of the event. Many admitted it was not important or an immediate priority until they were expecting or experiencing flooding.
- Participants had mixed knowledge about how to respond to floods with higher levels of knowledge supported by previous flood experience. Participants predominantly supported the implementation of event-triggered preparedness. They expressed interest in receiving localised impact-based information as events become imminent, alongside a checklist of priority preparatory actions they could take. They believed event-triggered preparedness could be encouraged by trusted sources sharing localised content about the potential impact of the event in a timely manner.
- Some participants thought environmental (e.g. weather) and situational (e.g. purchase of a house) cues presented an opportunity for agencies to engage communities in flood information. Several thought preparedness information should be provided in durable and accessible formats (e.g. fridge magnet checklist), while others suggested it should be delivered through 'push' media channels, often drawing parallels to television advertising around storm season.

Nationally, disaster and emergency management agencies agree on the importance of community engagement in ensuring communities are aware of, understand and share hazard risk. They all agree communities have a shared responsibility to reduce their risk and build resilience.

### **Compounding, cascading and concurrent events**

During 2021–2022 severe weather season, entities responded to several rainfall and flooding events, including:

- Central, Southern and Western Rainfall and Flooding (10 November–3 December)
- Ex-Tropical Cyclone Seth (29 December 2021–10 January 2022)
- South East Queensland Rainfall and Flooding (22 February 2022–7 March 2022)
- Southern Queensland Flooding (6–20 May 2022).

For some local governments and their communities, this resulted in no mental or physical reprieve and the events 'blurring' into one.

These rainfall and flooding events came on top of two years of responding to the Novel coronavirus (COVID-19) global health pandemic.

Under the Queensland disaster management arrangements, pandemics such as COVID-19 are managed and coordinated by the state and informed by national hazard specific plans and arrangements. In contrast, flooding and rainfall events are managed and coordinated by the local government, supported by the state and federal governments as required.

The compounding, cascading and concurrent events, combined with the dual operation of the two hazard-management arrangements, introduced additional complexity to the response to these events.

**Compounding disasters** comprise of:

- two or more extreme disaster events occurring simultaneously or successively
- combinations of extreme events with underlying conditions that amplify their impact
- *combinations of events that are not themselves extreme but which collectively lead to an extreme aggregation of impacts* (Seneviratne and M. Reichstein, 2012).

**Cascading disasters** are extreme events in which a sequence of physical, social or economic disruptions occur over time and generate secondary events of strong impact (Pescaroli and Alexander, 2015).

**Concurrent disasters** are defined as independent events occurring (Inter-Parliamentary Union (IPU) and the United Nations Office for Disaster Risk Reduction, 2021)

Responding to multiple rainfall and flooding events concurrent to the COVID-19 pandemic placed significant strain and fatigue on affected communities, as well as agency staffing and resourcing capacities. COVID-19 posed challenges in terms of social distancing, fatigue and staff absences and reaffirms the need to ensure that there are additional staff trained in key roles to mitigate the impact of illness.

Local governments that have succession planning, mentoring and job swaps processes in place to enable staff to gain expertise within the disaster management realm prior to the event will benefit from this resilience

Queensland already experiences climate extremes such as floods, droughts, heatwaves and bushfires. Climate change is likely to exacerbate the frequency and/or severity of these events and can be an amplifier of these and other hazards. As climate change brings about these more intense and frequent disasters, the likelihood of cascading, compounding and concurrent disaster events will increase.

It is imperative that entities work collaboratively to prepare and plan more mature practices through new strategies, risk assessments, organisational structures, and methodology to identify and manage the effects of cascading and compounding disaster events. These practices will require stronger emphasis on joint decision-making, joint-risk assessment and further developing cross-agency capabilities. This requires a greater attention and understanding of the totality of disaster/hazard impacts and the consequential impacts. There is benefit to considering compounding and cascading events and climate change when reviewing plans. Plans need to consider these complex risk environments.

## **Preparation and planning**

The Queensland State Disaster Management Plan defines preparedness as:

*Preparedness is the taking of preparatory measures to ensure that, if a disaster event occurs, communities, resources and services are able to cope with the effects of that event. It is a critical element in minimising the consequences of an event on a community and ensuring effective response and recovery (p. 37).*

Preparedness is defined in the Queensland Disaster Management Lexicon (the Lexicon) as:

*The knowledge and capacities developed by governments, response and recovery organisations, communities and individuals to effectively anticipate, respond to and recover from the impacts of likely, imminent or current disasters.*

The Lexicon (<https://www.igem.qld.gov.au/lexicon>) further describes preparedness (p. 19) as being based on ‘a sound analysis of disaster risks.’ It includes activities such as ‘contingency planning, the stockpiling of equipment and supplies, the development of arrangements for coordination, evacuation and public information, and associated training and field exercises.’

The Standard provides a shared understanding of the risks associated with localised hazards, including how these risks will be managed and coordinated to reduce community impacts through open and proactive community engagement. Disaster management plans are developed based on risk assessments and cover all phases of disaster management, namely prevention, preparedness, response and recovery. These plans should detail how the impact of disasters on the community will be mitigated. They should enable communities (and the supporting entities within them) to make informed choices on how to manage and act on their risks.

This is also reflected in the PRR guideline 4.1, which identifies effective disaster management planning as a key element of being prepared, and of establishing community networks and arrangements to reduce disaster risks. Disaster management plans enable disaster management stakeholders to understand their roles, responsibilities, capability and capacity when responding to an event. From a community perspective, effective disaster management includes educating, raising awareness and engaging with the community to create collaboration, cooperation and understanding. Community preparedness programs should focus on creating resilient communities that understand their disaster risks and are well prepared to take action based on that understanding.

## **Agency preparedness**

Under the Standard, preparedness and planning falls under two shared responsibilities, namely Planning and Plans, and Capability Integration. Planning is the process by which partners communicate and discuss the risks and hazards and how they will work together for a shared outcome, identifying priorities and responsibilities for performing functions and providing for regular review. This plan reflects the arrangement agreed to. Capability integration addresses the requirement to develop capabilities that work together in an integrated manner to achieve disaster management outcomes and is recognised in the Standard’s indicators across all shared responsibilities.

Entity preparedness should place a strong emphasis on the notion of ‘hope for the best, prepare for the worst’. Queensland is the most disaster-prone state in Australia. Well-practised and locally informed disaster preparedness is essential to reduce and mitigate the impact of disasters on communities, resources, and essential services. Local knowledge can be pivotal to community risk reduction and can assist in recovery operations. Preparing from a more risk-informed position may reduce the impacts of a disaster on both the responders and the affected community. This approach also enables agency resources, community preparedness, and distribution of relevant community information to be undertaken in a timely manner.

Comprehensive, effective planning can establish processes and outcomes to prevent or mitigate the effect of disasters. The output of the risk-based planning process results in

documented disaster management plans, business continuity plans, operational plans and contingency plans to deal with specific events. Effective planning involves entities working with the community to prioritise how their collective and collaborative efforts will mitigate the impact of disasters on the community. LDMGs and district disaster management groups (DDMGs) should consider these community engagement activities as a key part of preparedness planning.

Local and district disaster management plans are publicly available online and are reviewed and assessed by the disaster management groups each year. The testing of plans with partners is an important aspect of reviewing relevancy, currency, application of lessons identified and preparation for the seasons ahead.

**Maryborough temporary levee**

The Maryborough central business district (CBD) is highly susceptible to flooding from the Mary River. The Fraser Coast Regional Council designed and implemented a temporary CBD flood levee after the ex-Tropical Cyclone Oswald flood in 2013 to mitigate this risk.

The levee is approximately 150 metres long and can hold back flood waters up to a height of 11 metres. It operates with a penstock gate and protects over 100 small businesses located in a flood-prone section. (The local government determined the location for the temporary levee after consulting business operators.) The local government practices erecting the temporary levee each year. This practice coincides with a large public ‘Get Ready’ promotional expo and concert. This approach heightens community awareness about preparing for the severe weather season, which is when flooding is more likely to occur.

The temporary flood levee was first tested during a flood from 7 to 10 January 2022. The penstock gate failed during that event, resulting in flood waters impacting the Maryborough CBD. In response to the failure, and due to the forecast potential for a second flood event during the ongoing severe weather season, the local government installed a locally engineered and constructed penstock gate within six weeks. They also requested the Bureau provide supplementary localised flood reports for Maryborough.

The local government was better prepared for the February 2022 flood event as a result of applying the lessons identified in the January floods. The successful operation of the levee and replacement penstock gate protected over 40 small businesses from flood waters during the event. The CBD was also re-opened rapidly enabling support to the local community.



*Image taken by QFES Drone capturing Fraser Coast Regional Council Levee in Maryborough. (Image courtesy of Queensland Fire and Emergency Services RPAS (Remotely Piloted Aircraft Systems) Team)*

## *Capability integration*

### **Training**

The DM Act requires people involved in disaster operations to be appropriately trained. Mandatory training is undertaken in accordance with the Queensland Disaster Management Training Framework (QDMTF) (Queensland Fire and Emergency Services, 2020). Seventy per cent of training is conducted in person by QFES Emergency Management Coordinators (EMCs) with thirty per cent conducted online. Local government widely recognise and value the commitment and efforts of EMCs in assisting them to meet their training requirements. The trainers are predominately QFES EMCs who are officers with relevant disaster management content, knowledge, training and assessment qualifications.

It is noted that several entities include other agencies such as the Australian Red Cross, Lifeline, Uniting Care, the ADF, GIVIT and state agencies in their training to enhance relationships and interoperability. Multi-agency training and exercises also help entities better understand the policies and procedures of support agencies.

Agencies, local government and non-government organisations (NGOs) are responsible for providing appropriate training for their staff and volunteers to ensure they are skilled and prepared for the function their agency provides. Australian Red Cross and the Salvation Army both conducted pre-season training for their staff. IGEM is aware, for example, that the Australian Red Cross focuses their training on evacuation centres operations.

Further developing the skills level of LDMG and DDMG staff remains a focus of continuous improvement.

### **Exercising**

Exercising is key to entities developing integrated capabilities to reduce the impacts of disaster on the community. The role of EMCs, disaster management officers (DMOs) and XOs includes assisting with exercises. Most entities at all levels of the disaster management arrangements conduct or participate in annual or regular exercises to test their preparedness for future events and usually involve other stakeholders and agencies. Local government and agencies who exercise their plans tend to achieve better outcomes in events.

Exercises are valuable as they create opportunities to learn, develop and re-establish working relationships. They also help to develop a shared understanding of roles and the operating requirements of other entities and agencies.

The Sunshine Coast DDMG exercises in 2021 centred on response activities associated with weather events, multi-agency communication and interoperability as a key element for the LDMGs and DDMG. A district exercise was developed and conducted with the assistance of the Executive Officers (XOs) of three other disaster districts. The exercising of evacuation before the event at a different district helped expedite the establishment of evacuation centres. That exercise also enabled collaboration and coordination through the positive relationships established.

There is an opportunity for exercises to explore the impact of cascading, compounding and concurrent events in the context of areas of responsibility within the disaster management arrangements. This may inform and change risk thresholds and identify opportunities caused by concurrent or protracted events. A benefit is developing clarity in joint-risk assessment and enhanced interoperability to managing the impacts of complex events.

Annual or regular exercises are an effective means of mitigating the risk associated with changes to key staff performing disaster management roles. They enable critical relationships

to be formed and trust to be built and strengthened. This results in increased collaboration and cooperation during events that test the capacity and capabilities of entities. Exercises that include both the state-managed approach for specific hazards and the locally managed approach for responding to disasters would enable better understanding of the dual operating models associated with managing concurrent events.

Exercising may also benefit from adopting the Tactical Exercises Without Troops (TEWT) measure. This entails simulating an operational situation on the ground which excludes the deployment of staff. It focuses on controllers, operation officers and other key staff practising and testing their skills in applying operational procedures. Entities who elect to further enhance their disaster preparedness may opt to incorporate 'red teaming' into their exercises to stress test their plans. This involves subject matter experts being part of the exercise to pose counter narratives to enhance the exercise participants' understanding of their plans and procedures.

Documenting the lessons identified and those which were learned during exercises is an essential part of continuous improvement. A lessons management approach also helps manage key corporate knowledge particularly for entities who may experience high staff turnover or who infrequently experience significant events.

## **Community preparedness**

Entities use different methods to improve community preparedness. Identifying and actioning lessons learned from previous events and applying this to future events is one method. Others use promotional activities over a variety of platforms to enhance community preparedness; for example, the 'If it's flooded, forget it' campaigns. Other methods include promotion of disaster preparation via local government dashboards and websites, short videos, emergency checklists, radio broadcasts, advertising on social media and face-to-face engagement. Most local governments report increased use of their disaster dashboards as community members seek information that is relevant to them, particularly during disaster events. Nevertheless, many community members were unaware of campaigns or didn't know what action to take despite receiving preparedness information. This highlights the need for the effectiveness of community preparedness programs to be assessed.

Community members consistently expressed a desire for consistent, simple, clear and location-specific messaging. The QRA has developed a Flood Communication Toolkit (<https://www.qra.qld.gov.au/resilience/resources-resilience-practitioners/flood-and-bushfire-communication-toolkits>) (Queensland Reconstruction Authority, 2022a) for local governments and state agencies, designed to increase community awareness and resilience to floods. Importantly, it provides comprehensive and consistent flood messaging and explains warnings the community may receive during an event. This toolkit gives local governments the ability to customise messaging, which may assist in improving community understanding and response. The QRA is to be commended for the implementation of this toolkit, and entities are encouraged to use it.

The importance of being aware of their community's demographics and vulnerabilities is clear. Significant benefits are gained when there is local investment in forging strong relationships with communities. This can be further cemented through formalised engagement practices.

**Unique community engagement to promote disaster preparedness**

Logan City Council uses chalk stencils as part of a holistic marketing campaign for disaster preparedness. In the lead-up to severe weather and bushfire seasons, they paint chalk stencils promoting their disaster dashboard and its opt-in warning system at various locations on its more than 100 kilometres of pathway.

Through establishing partnerships with emergency services, community groups and community services, who provide input on the messaging, Logan City Council has ensured the chalk stencil messaging is targeted and accessible to all parts of the community. These stencils include taglines about the disaster dashboard, hashtags, and information about signing up to warning messaging systems. For example, they saturate a local area with an image and a call to action such as 'Download Logan Early Warning'.

The stencils are innovative, visually interesting, environmentally friendly, and quick and easy to implement. Their temporary nature also means they can be easily updated or removed as required.



*Image of Logan chalk messaging. (Image courtesy of Logan City Council)*

Local government disaster dashboards are a good source of information; however, they complement face-to-face consultation and discussion. As has been noted elsewhere within this report, developing relationships and sharing information are best at a personal level. A common topic noted by local governments was the desire to create more resilient, less reliant communities.

Important information can be shared between local governments and locally established community volunteer groups during disaster events. The provision of timely situational awareness to the LDMG by these groups aids in enhanced response operations. The establishment of a place of refuge in Kenilworth by one such community group provided situational awareness which led to the coordination of support from the Sunshine Coast LDMG. To further enhance these community-based programs, some local governments undertake preparedness exercises with small community groups. IGEM was advised that, while these programs require considerable input from local government, the overall benefits cannot be understated.

Fraser Coast Regional Council (FCRC) holds quarterly Community Coordination Committee meetings to bring remote and isolated communities together to discuss local disaster management. FCRC advised IGEM that these forums include guest speakers, post event

debriefs and information sessions. At one such forum, FCRC conducted an informal debrief of this flooding event to provide the community an opportunity to understand what occurred, and an avenue to raise concerns for FCRC to follow up. It's worth noting FCRC had daily communications with these groups during the last four flood events, and issues raised during the forum held on 6 May 2022 didn't identify any new concerns. During the recent meeting with the Community Coordination Committee, FCRC utilised the QRA floor map to enable attendees to see spatially how their catchment works.

The *Royal Commission into National Natural Disaster Arrangements Report* identified that, 'in significant emergencies and disasters, emergency management personnel do not have the capability and capacity to solve the emergency threat for every individual at risk' (Binskin et al., 2020).

While entities can promote and distribute information, it is still up to individuals, families and businesses to have an emergency plan and be prepared.

There were varying levels of preparedness in the community. IGEM found the experience of having lived through a significant flood did not always correlate with better preparedness. For example, some community members who were regularly isolated during flood events did not have adequate supplies on hand to last at least three days. Others advised the water levels or messaging in this event gave them a false sense of security, leading to a belief that they would not be flooded on this occasion. This reinforces the importance of preparing for the worst in respect to the advice given.

## Community engagement

Under the Standard, community engagement is a shared responsibility. Entities must engage with communities and provide them with relevant and tailored information that enables them to prevent, prepare for, respond to and recover from events. Equally, individuals have a responsibility to be aware of their surroundings and related risks, including which actions to take to prepare for and mitigate risks.

### *Community education*

The Australian Institute for Disaster Resilience (AIDR) identifies that community engagement is a key element for disaster resilience. The Standard indicates that communities that are educated and understand local risks are more likely to be better prepared and make informed choices as a disaster event unfolds. Community education and engagement programs provided by local government, state agencies and NGOs play a vital role in engaging and educating communities.

The Royal Commission into National Natural Disaster Arrangements (Binskin et al., 2020) found that, to be effective, education and engagement programs should provide information that:

- *'ensures that individuals and communities, including children, are aware of the specific hazards and natural disaster risks to which they are exposed and understand the importance of being prepared*
- *develops awareness of local, regional and state emergency plans*
- *reinforces the responsibilities that individuals have (particularly those in high-risk environments) and reminds them of the importance of being prepared for natural disasters*

- *encourages individuals and communities to develop natural disaster survival plans, and ensure that they are aware of evacuation routes and the locations of evacuation or relief centres*
- *ensures that individuals and communities understand that vital services such as electricity and telecommunications (including internet-based services) might be disrupted and unavailable during a natural disaster*
- *encourages individuals and communities to ensure that they have adequate emergency supplies (such as water, food, a radio and batteries) to withstand essential service outages*
- *ensures that individuals and communities, especially those near a state or territory boundary, understand the meaning of emergency warnings and know where to find information during an emergency*
- *is in digital and non-digital formats, as well as in a range of languages that meet accessibility requirements.'*

IGEM has been provided with multiple examples of local governments and state agencies working collaboratively to educate community members on disaster preparedness. A strong theme was the benefits of local expertise being used to inform disaster education packages.

The Royal Commission into National Natural Disaster Arrangements also identified that individuals and communities, particularly those in high-risk areas, have a shared responsibility to be prepared for natural disasters; however, community forums and submissions frequently indicated community members did not observe or absorb community education and preparedness programs, and the community is not aware of the disaster arrangements. It is difficult to expect community members to seek to understand and mitigate their personal risk when they are not aware of it.

Community forums and submissions clearly identified a significant desire for tailored disaster education and information programs. For example, community members wanted to easily access and understand what the flood risk was for their street and their house. They also wanted to easily understand what the Australian Height Datum (AHD) means in the context of their property. Figure 6 and Figure 7 show examples of visual aids to contextualise flood risk. Other key themes raised around community education included a better understanding of where and how to access this information, and the importance of information being collated by an authoritative source. The community forums outlined the importance of locally identified and understood evacuation routes, local communication mediums, localised education for businesses, and the importance of including local demographics (such as vulnerable, culturally diverse and low socio-economic populations) in disaster education programs.

Through their submission, the Insurance Australia Group (Insurance Australia Group, 2022) advocated for access to higher quality, consistent data that can be shared across entities to help communities understand risk and make informed choices. The Insurance Australia Group advised that a nationwide natural hazard database where flood risk data can be included by individual local governments would enable a 'source of truth' on flood risk, allowing all stakeholders and community members to make consistent decisions about flood risk. Research undertaken for IGEM supported the proposition that face-to-face community information sessions are a strong tool for achieving greater community preparedness and resilience.



Figure 6: The flood marker on the Bond Store in Maryborough CBD.  
(Image courtesy of Fraser Coast Regional Council)

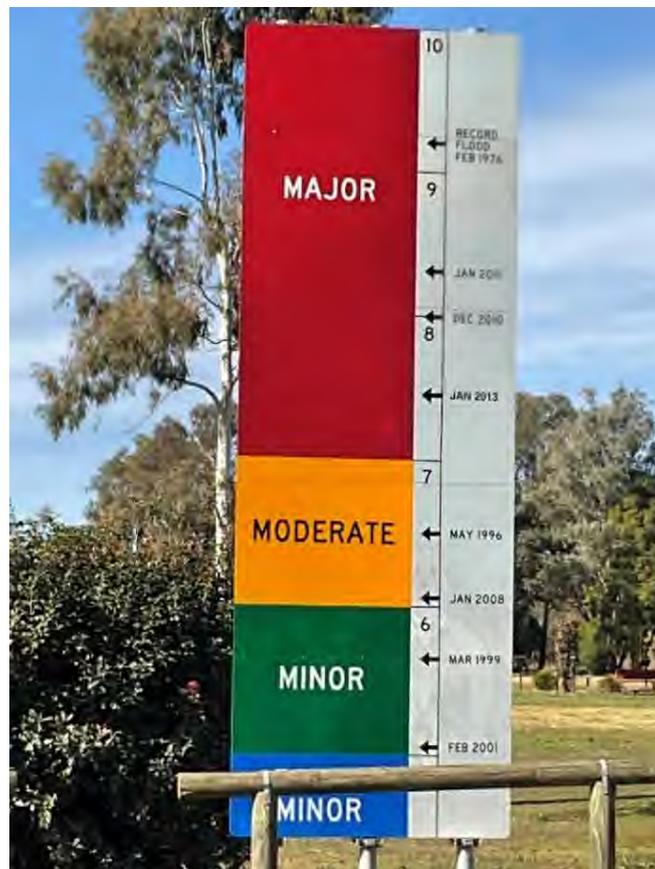


Figure 7: Large Warwick sign provides flood height visual reference (Image courtesy of QPS)

## *Disability and aged care*

Vulnerable community members such as seniors and those with electronic disability aids can be adversely affected by disaster events as they can be the least prepared for such events. Diminished sensory awareness, multiple chronic health conditions and/or socio-economic limitation can reduce their ability to prepare for and respond to a disaster event (Department of Communities, 2016). Significant work to support people with a disability and those in aged care to prepare for disasters. Some local councils have partnered with state government agencies, such as QFES and QAS, to provide aged care facilities with information on disaster management preparedness, planning and the importance of exercising. The Australian Red Cross developed a series of RediPlan (<https://www.redcross.org.au/prepare>) guides to help vulnerable members of the community, seniors and people with disabilities to prepare for disasters.

The Department of Communities, Housing and Digital Economy (DCHDE) requested the support of the University of Sydney to develop a collective framework for local action on disability inclusive disaster risk reduction. In collaboration with multiple Queensland state government agencies and community stakeholder representatives such as Queenslanders with Disability Network and the Community Services Alliance Industry the Person-Centred Emergency Preparedness (PCEP) planning toolkit was developed (Villeneuve, 2020). The PCEP toolkit was co-designed with people with disability and provides step by step information for people with disability to assess their needs and tailor an individual emergency plan with their support network in their community. A number of local governments are advocating the use of PCEP planning through their disaster preparedness activities to support their communities.

The DCHDE advised it prepared and activated its plans early to assist vulnerable community members. The early activation, accompanied by consultation and collaboration with partner agencies, enabled a deep understanding of emerging challenges. Similarly, the Department of Energy and Public Works (DEPW) advised it works with client managers to establish the required assistance for residential occupants to ensure they are better prepared for disaster events.

## *Culturally and linguistically diverse communities*

Queensland is comprised of many culturally and linguistically diverse communities (CALD). The latest Census data indicates 28.6 per cent of Queensland's population was born outside of Australia and some 304 different languages are spoken in Queensland. The *Emergency Resilience in Culturally and Linguistically Diverse Communities* report launched by the Australian Red Cross in November 2021 outlines the challenges and opportunities. CALD communities—migrants, refugees and asylum seekers—are widely considered more vulnerable to disaster impacts due to factors such as their unfamiliarity with Australia's physical and social environment, low English proficiency, poor awareness of local hazards, undeveloped support networks or previous traumatic experience (Chandonnet, 2021).

As outlined in the Standard, it is important entities proactively and openly engage with their communities and support them to understand their risks and prepare for disasters. Understanding the composition of communities delivers better outcomes, as it enables greater opportunities for appropriate engagement, and using established networks to connect with people in respectful ways.

Local governments and community members identified the need to better identify vulnerable communities and use this information to help raise awareness of risk and create a shared understanding of disaster preparedness.

QFES and Multicultural Australia conducted a disaster management workshop in early 2022 to discuss the upcoming storm season and preparedness. The CALD community leaders who attended indicated disaster preparedness was not a priority for their community until an event was seen as imminent. Following this event, a second workshop was held to gain insight into the experiences of CALD communities. The community leaders reported a feeling of isolation within CALD communities outside of greater Brisbane and the perception agencies place greater emphasis on response than preparation. They identified a need for an education pack, in language, that included information about how to prepare, local risks and the dangers and consequences of risk-taking behaviour, such as driving into flood waters. A desire to have CALD representation in the SES was also expressed.

Other positive work being undertaken to better inform and prepare CALD communities include leader-focused sessions, networking with key community members, the production of useful disaster preparedness booklets, templates and planning tools in multiple languages and incorporating an online translation function in disaster dashboards.

Twenty-five per cent of the residents in the Brisbane local government area speak one of 15 languages other than English at home. Recognising this, the Brisbane City Council (BCC) has increased engagement with its CALD communities and now partners with a local multicultural radio station to relay important disaster related information. It also adopts a 'train the trainer' approach with trusted community members to further enhance its disaster education and preparedness programs across CALD communities.

There is an opportunity for agencies to increase their reach into CALD communities by promoting the translated fact sheets about the five most commonly experienced natural disasters and how to prepare for them on the [www.qld.gov.au](https://www.qld.gov.au) website: <https://www.qld.gov.au/community/disasters-emergencies/disasters/resources-translations/disaster-information-language/fact-sheets-disasters>.

### *Get Ready Queensland*

The QRA administers Get Ready Queensland, which can be located at the following address <https://www.getready.qld.gov.au>. The QRA manages the funding program, allocating \$2 million annually to help local governments improve their communities' resilience. Each local government in Queensland receives funding, based on the size of their population, to use on locally led resilience-building projects.

Special interest groups, including CALD communities, are engaged with the QRA to co-design Get Ready Queensland preparedness resources to ensure they are inclusive and accessible across different populations. These resources are available for local governments to share with their communities at <https://www.getready.qld.gov.au>.

Examples of locally led Get Ready Queensland-funded programs include:

- an independent television advertising campaign by Sunshine Coast Regional Council to raise awareness for disaster preparedness
- an annual storm season radio campaign by Noosa Regional Council
- Balonne Shire Council holding an annual Get Ready Day that incorporates information on the levee system and flood gates on and near properties
- Bundaberg, North Burnett and Fraser Coast Regional Councils combining funding to run a television marketing campaign extending the reach of their storm season preparedness and highlighting the local disaster dashboard

- Sunshine Coast Regional Council hosting a Disaster Preparedness Expo in partnership with the Queensland Police Service (QPS), the Queensland Ambulance Service (QAS) and QFES
- the Community Disaster Volunteers program initiated by Scenic Rim Regional Council which helps build community awareness and resilience, bridging the gap between community and local government.

The QRA evaluates the impact of Get Ready Queensland campaigns through statewide research involving a survey, focus groups and in-depth interviews (Figure 8 and Table 3). Research results inform Get Ready Queensland’s strategic priorities, and in 2022–23 additional funding has been secured to enhance community preparedness in flood-hit localities.



South East Queensland includes:

- Brisbane
- Gold Coast
- Ipswich
- Lockyer Valley
- Logan
- Moreton Bay
- Noosa
- Redland
- Scenic Rim
- Somerset
- Sunshine Coast
- Toowoomba

Figure 8: Map of Queensland

	South East Queensland	Queensland
<b>Disaster Preparedness Index (scale 0:100)</b>	70.7	72.27
<b>Understand risk (rating of 0-10)</b>	7.24	7.49
<b>Have an emergency plan</b>	58%	62%
<b>Have an emergency kit</b>	45%	50%
<b>Registered to receive emergency alerts</b>	59%	57%
<b>Have building and/or contents insurance</b>	84%	84%
<b>Have an evacuation plan</b>	51%	53%
<b>Attend council disaster information session</b>	5%	8%

Table 3: Preparedness behaviours and attitudes in South East Queensland compared to Queensland

*‘If it’s flooded, forget it’ campaign*

The QFES ‘If it’s flooded, forget it’ campaign is an annual public safety advertising campaign initiated in 2015 that aims to change Queenslanders’ attitudes about driving through flood water. It consists of broad media placement through a range of channels during spring and summer, coupled with contingency spending ahead of, and during, peak wet weather events.

This campaign reflects the intent of the Standard, through promoting a shared understanding of risks, proactively and openly engaging with communities, and enabling communities to make informed choices about disaster management and act on them.

The campaign targets those drivers who are most likely to drive through flood water, as identified through research: men aged 18 to 39 years, 4x4 and utility drivers, pressured parents, young drivers facing peer pressure, and inexperienced urban drivers. QFES advised the campaign has been successful in reaching women but indicated there are still challenges in convincing some men about the dangers of driving through flood waters.

Secondary taglines to the core 'If it's flooded, forget it' message have evolved over time to address message fatigue and to better target key audiences. These have included:

- 'No matter who you are or what you drive, always have a plan B.'
- 'Prepare to stay safe' so people plan ahead and are not caught unaware.
- 'Prepare for your decision to affect others' prompted males to consider the loss to their family and friends when making decisions that risk their lives.

The 'Back it Up' tagline was introduced in 2019. It provided drivers with an option and informed them that turning around when faced with a flooded road was 'the smartest and bravest thing to do'. 'Back it up' was used again in the 2020/21 and 2021/22 seasons. It achieved a significant boost in recall to 58 per cent in 2021/22, up from 45 per cent in 2020/21 and 35 per cent in 2019/20.

The core 'If it's flooded, forget it' message has been retained throughout these iterations and had a strong recall of 92 per cent in 2021/22. QFES research indicates that 'If it's flooded, forget it' remains a strong, clear and relevant message to Queensland drivers, with message wear out low at 7 per cent.



*Image of flooded street, including a submerged car, in Windsor, Brisbane, at 12.40pm on 27 February 2022  
(Image courtesy of IGEM)*

### *Australian Broadcasting Corporation and Special Broadcasting Service*

The Australian Broadcasting Corporation (ABC) is the official emergency broadcaster for Australia. In Queensland, most ABC radio reporting for disaster events is undertaken by locally based ABC teams. During large disasters, a support team can be deployed to supplement and provide frontline support to the local ABC teams. During this event, the ABC support team operated from the Gold and Sunshine Coasts.

The ABC has identified that as the severity of a disaster increases, the community relies more on ABC radio for information, compared to other broadcast mediums. The community is seeking relevant, location-specific information about what is occurring or is forecast to occur, as well as actions they might need to take.

Community expectations have changed since the events of 2011. The amount, frequency and timeliness of information provided needs to be of a very high standard. This also means being inclusive and getting the right information to the right community. This can be challenging when a large event is occurring, and the ABC is currently investigating options on how to best achieve it to improve its current capability.

In flood events, the ABC receives a large volume of weather forecasts and warnings from the Bureau. The focus is on the messages and warnings about events that have a clear potential for impact to the community and that include a call to action. By proactively and openly engaging with communities, the ABC demonstrates the shared responsibility of community engagement under the Standard.

The Special Broadcasting Service (SBS) is a linguistically diverse broadcaster providing a wide variety of content in over 60 languages, reflecting Australia's multicultural society. SBS advised it reaches its audiences across three platforms—radio, television and digital—and has high awareness and trust among Australia's CALD communities. SBS possesses live coverage interpreting capabilities in a variety of languages, a repository of on-demand educational tutorials, and numerous other media and content designed to help connect communities.

In 2016 SBS launched its Settlement Guide ([Settlement Guide - Migrating to Australia \(sbs.com.au\)](https://www.sbs.com.au/settlementguide)) for new arrivals to Australia. It comprises more than 50 SBS language services including topics that explain preparation for disasters such as floods in the migrant's preferred language. This is important as recent arrivals to Australia may not be literate in English, and in some cases may be illiterate in their native language.

To build this partnership further, an offer will be extended to SBS by the IGEM to participate in the Research Advisory Panel.

### *Evaluation of community preparedness*

Traditional methods for gauging levels of community disaster preparedness and awareness rely on static/point-in-time questionnaires and interviews. Establishing metrics about preparedness and awareness that represent 'community' is challenging. Communities exist within a complex dynamic of social, economic, physical and technological systems and networks. All of these systems and networks generate 'noisy environments' within which communities look for and process information. COVID-19 has added additional noise and revealed new vulnerabilities within communities once considered resilient and prepared. The ability to have information at our fingertips, acquire new information on demand, influence those around us and process information in a noisy environment needs to be reflected in how we measure awareness and preparedness for disasters.

Johnston et al identified that:

*At the heart of improved flood preparedness efforts lies monitoring and evaluation. Councils need to follow best practices in planning and implementing campaigns and projects. Just showing that an activity occurred is not enough to ensure that community members are prepared.*  
(Johnston et al., 2019)

Community hazard and risk awareness engagement programs are generally measured in two ways:

- 1) headcounts or number of events, recording the number of people attending or spoken to
- 2) measuring increases in preparedness levels of individuals and communities.

A headcount or counting the number of events held on disaster preparedness is a form of program evaluation or measurement; however, it does not determine whether the people who attended are more prepared or more likely to be prepared after they attended the events. The second method of evaluating the programs measures the increases in preparedness;

however, it does not account for whether the program reached the intended audience, or whether the right people in the community were engaged.

Researchers have identified that the evaluation of engagement activities needs to be part of the culture of an organisation, accompanied by a strategic approach to engagement. Evaluation should be part of the conceptualisation of any strategic engagement program, nested within programming as a baseline, to monitor progress and determine outcomes at the end of the program.

The first step of any community engagement should be about personalisation of risk and potential impact. Researchers Johnston, Ryan, & Taylor (Johnston et al., 2019) developed 'The Australian generative model of community engagement for preparedness' (Figure 9), within which they identified five stages comprising Research, Monitoring, Evaluation and Learning (MEL), as well as accompanying strategies to support meaningful evaluation:

- 1) **Community Profiling**—This stage allows agency staff to gain a sense of the strengths and areas for improvement in a community. This formative research provides a baseline to measure the outputs, outcomes and impacts of the later phases
- 2) **Relational Ties**—This relates to a community that needs to build relationships and knowledge of risk and is one that the agency and other organisations have had little engagement with. It will be low on the preparedness scale with either no or little recognition of risk, or is a community that is aware of the risk but is not sure where to start to get ready
- 3) **Capacity Building**—This relates to a community that is ready for engagement. It is where relationships are forming or pre-existing, and there are segments of this community that are motivated and on the verge of (or at) medium levels of preparedness
- 4) **Community Programs**—Communities at this level are generally highly knowledgeable about their risk and are actively working to reduce the risk. These communities seek guidance and support, but the agency may be moving from the role of facilitator to critical friend
- 5) **Local Hazard Action**—The local hazard action phase is a 'tailoring' opportunity for specific hazards. Everything that goes before this phase is useful for all hazards. This model suggests that no matter where/what the risk or hazard is, there are fundamental approaches to community engagement that span all types of communities—and it is at the top of the model where communities seek, or agencies give, very specific hazard information and guidance on action.

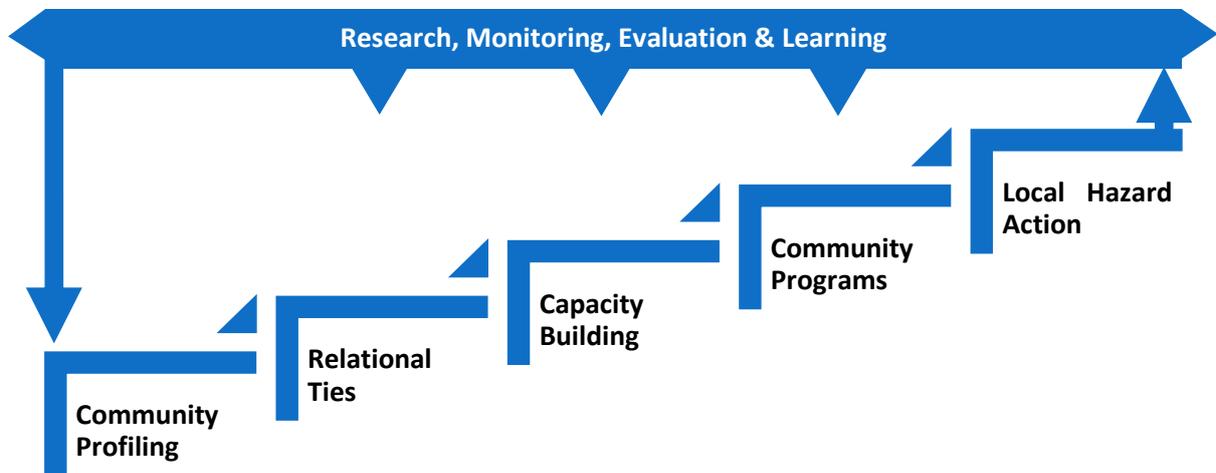


Figure 9: Australian Generative Model of Community Engagement (Johnston et al., 2019)

Several councils engage directly with communities through schools, aged care facilities and other organisations to present education programs, which is to be commended. IGEM notes Sunshine Coast Regional Council has provided educational presentations and activities at local schools, in aged care facilities and within local CALD communities. Noosa Shire Council has utilised its Get Ready funding to develop disaster preparedness education packages for Year 5 students. Gold Coast City Council provides outreach into schools regarding disaster preparedness. Southern Downs Regional Council officers attend schools and speak to students in Years 5 to 11 regarding storm preparedness. They also provide information packs intended to be taken home to parents to assist them in disaster preparedness.

IGEM notes that information gained through community forums and submissions suggests an opportunity for further assessment of community education programs to determine their effectiveness in developing enhanced community disaster preparedness and resilience. Many local governments acknowledged that, despite conducting community education programs, many community members were not adequately aware of their flood risk or sufficiently prepared for flooding. This included those community members whose properties and businesses were either directly impacted by flooding or were isolated (cut off) by flood waters. IGEM understands this situation was further compounded by a noticeable increase in the number of 'new arrivals' to SEQ communities who were not familiar with local flood risks and were therefore not properly prepared.

Some local governments advised that although they don't undertake formal assessments of the effectiveness of all their community education and preparedness programs, there is anecdotal evidence to suggest they may be having a positive effect. Toowoomba Regional Council indicated it saw more community compliance with council-issued recommendations, signifying residents were observing warnings and taking responsibility for themselves during the event. North Burnett Regional Council indicated preparedness messaging may have worked to some degree as there were only two resupplies needed in the community during this event.

Various government and non-government agencies have previously conducted research around community education and disaster preparedness and resilience. The results are not always consistent; however, differing results across research projects are not uncommon, as they are dependent on several factors, including the timing, method adopted, questions provided, focus area/s, recent events/impacts, and sample size. There is an opportunity to enhance the connection between research results, community sentiment and behaviours, and the community education programs implemented.

## **Response to the event**

### **Weather warnings**

Over the course of this event, the Bureau issued over 500 warnings and briefings to the community, government, emergency management practitioners and stakeholders, including one-on-one briefings for LDCCs impacted by flooding of the Brisbane and Mary Rivers.

SEWS is a distinctive audio signal used in assisting the delivery of public warnings and messages for major emergency events. The signal is sounded immediately before an emergency warning message being played on public media broadcasts, in the potential or likely impacted areas (Queensland Fire and Emergency Services, 2018b). During this event it was requested for use by the Bureau on 21 occasions:

- 20 Severe Thunderstorm Warnings
- 1 Major Flood Warning for the Logan and Albert Rivers.

In this event, flooding was caused by riverine and creek flooding and overland flow. Flash flooding is a characteristic of small river and creek catchments and is also associated with severe thunderstorms when they produce heavy rainfall.

Flood or Flooding is defined under Schedule 3 of the *Inter-Governmental Agreement on the Provision of Bureau of Meteorology Hazard Services to the States and Territories* (Council of Australian Governments, 2018) as:

*'... the covering of normally dry land by water that has escaped or been released from the normal confines of:*

- 1) *Any lake, or any river, creek or other natural watercourse, whether or not altered or modified; or,*
- 2) *Any reservoir, canal or dam.'*

Flash flooding is defined under Schedule 3 of the *Inter-Governmental Agreement on the Provision of Bureau of Meteorology Hazard Services to the States and Territories* as: *'any Flooding of short duration with a relatively high peak discharge in which the time interval between the observable causative event and the Flood is less than six hours'* (Council of Australian Governments, 2018).

Section 6.5 of the *Inter-Governmental Agreement on the Provision of Bureau of Meteorology Hazard Services to the States and Territories* (Council of Australian Governments, 2018) states that *'all levels of government will collaborate in preparing the community for the potential of Flash Flooding'*. It goes on to note that the responsibility for flash flood warnings lies with the State in partnership with local government. The Bureau is responsible for providing *'forecasts and warnings for severe weather conditions and potential heavy rainfall conducive to Flash Flooding and to carry out applied research and development to improve the provision of severe weather information'*. It is also responsible for providing riverine flood warnings. The State and local government generally determine localities at risk of flash flooding from previous flood studies as part of risk assessments, supported by the Bureau.

These arrangements, whereby local government is responsible for providing flash flood warnings and the Bureau is responsible for providing riverine flood warnings, creates the potential for gaps and overlaps in resourcing, and provision and communication of forecasts and warnings. Further, the widely distributed responsibility for creating and issuing flash flood forecasts has resulted in inconsistent standards for delivery of both tasks.

### *Weather and hydrological forecast modelling*

Meteorologists and hydrologists use weather observations, computer weather models, knowledge, and experience to develop forecasts. Forecasting techniques employed by the Bureau to assess the likelihood of flood include hydrological models (observed rainfall and river height data) as well as empirical forecasting techniques, which use historical data about river height or rainfall at another key location downstream. Rainfall and river height data is collected at field stations located throughout river catchments using a variety of methods including stand-alone radio networks, mobile phone networks and satellite. The data is collected directly by the Bureau and other agencies. The data is processed and sent to the Bureau's flood forecasting systems for visualisation by flood forecasters and use in hydrological forecast models. Rainfall and river height data is automatically imported into the flood forecasting system every three minutes while processing of data for flood modelling automatically occurs every 15 minutes. This means datasets are generally available to flood forecasters and models within minutes of being recorded in the field.

The Bureau advises the weather in Queensland is complex, arguably more so than most places in the world. The weather is highly dynamic and can change rapidly over small distances in short timeframes. Despite a high overall reliability of meteorological predictions, weather forecasts carry an inherent uncertainty, particularly at local scales.

The forecasts for the rapidly evolving situation required the Bureau’s hydrologists to provide frequent updates to the flood forecasts to account for high volume local water inflows. This gave rise to a perception that forecasts were constantly changing during this event. Forecasts were continuously updated based on new weather intelligence or information.

For this event, the Bureau acknowledged that the modelling did not initially capture how slowly the weather systems were moving. Initially, modelling showed the upper low pressure system moving more quickly to the east and off the coast. Instead, the system moved more slowly in a southerly direction and into Northern New South Wales (NSW). Consequently, it continued to rain heavily in South East Queensland on 26 and 27 February 2022, resulting in both flash and riverine flooding.

The Bureau considers the official rainfall and flood forecasts for this event performed well given the inherent uncertainties, although it is noted that in some places the rainfall exceeded the rainfall forecasts issued on the day prior. For example, on Saturday 26 February 2022, the Bureau forecast for Sunday 27 February 2022 a 25 per cent chance of rainfall exceeding 170 millimetres and a 10 per cent chance of rainfall exceeding 240 millimetres for the Brisbane area. The four official automatic weather stations in Brisbane recorded between 250 millimetres and 470 millimetres of rain on Sunday. This demonstrates the importance of response agencies and the community adopting a high risk threshold and taking a conservative approach to planning and preparation (that is, plan for the worst-case scenario and hope for the best-case scenario) to ensure preparatory actions are taken for extreme weather events.

**Getting on the front foot**

The Moreton Bay Regional Council (MBRC) learned from the 2015 east coast low event that every minute of extra planning and preparation is critical to providing an effective disaster management response. Flooding in the Moreton Bay region is predominantly caused by rain falling directly within the region. Floods in the region’s catchment areas can be extremely rapid and serious major flooding can occur where rainfall exceeds 300 millimetres in a 12-hour period.

MBRC adopts a high risk threshold, based on a 10 per cent probability of the area receiving more than 100–150 millimetres of rainfall in a 24-hour period. This conservative approach ensures that MBRC is well prepared. The 10 per cent trigger results in MBRC’s severe weather response plans and LDMG regularly being activated and exercised to Lean Forward and Stand Up, with staff considering this business as usual. It also ensures preparations are underway for response if the forecast rainfall totals are exceeded.

During the 2022 event, the 10 per cent trigger enabled early proactive planning and critical information sharing between MBRC and a core group of LDMG and DDMG members. Twice-daily meetings continued throughout the event, and MBRC shifted to 24-hour operation and pre-deployed staff to open seven evacuation centres.

Early planning also allowed MBRC to establish 13 sandbag stations to enable residents access to them before the severe weather. While the duration and impacts of the event across the region tested the planning capabilities of all agencies, use of the early activation trigger meant that MBRC’s preparedness measures were in place 36 hours before the event’s peak.

Advances in forecasting science and technology have made it possible to better understand the range of rainfall and flood outcomes that can be expected from a given event. Access to this information, tailored for use, enables emergency management practitioners to better envisage the timing, behaviour and potential extent of flooding. The ability to prepare for ‘most likely’ and ‘worst-case’ scenarios, particularly in complex events occurring in multiple locations, improves the ability of emergency management practitioners to establish response priorities in urgent and uncertain situations.

**The Bureau pilot project: Hawkesbury–Nepean Valley catchment probabilistic flood forecast service**

The Bureau, in collaboration with Infrastructure NSW, NSW SES, and WaterNSW have developed a probabilistic flood forecasting service that provides valuable information on river height, behaviour and timing which enables additional lead time to make risk-based decisions during floods.

The service also provides flood scenarios and their associated probabilities and provides additional lead time of up to 36 hours. Each extra hour of flood forecast translates to an additional 600 vehicles able to evacuate to a place of safety. The complex hydrological modelling used in the service provides greater confidence when predicting complex river behaviour.

The service has been evaluated through a pilot for the Hawkesbury-Nepean Valley, the highest flood exposure area in NSW, over four years, and was tested during the 2020 flood. The service will be fully implemented in 2023 and will supplement core flood products issued by the Bureau.

*Current programs underway to improve Queensland’s flood warning systems*

Queensland continues to improve the state’s Total Flood Warning System through the QRA partnering with local governments. This system is currently funded for multiple years through joint Commonwealth, State and local government funding programs.

Major flooding events this year have demonstrated the need for further investment in flood risk management activities to support evidence-based response, mitigation, and resilience strategies to manage river, creek and overland flood risk. Since 2017, the QRA has secured \$17.32 million in funding for flood gauges and other flood warning infrastructure across Queensland through various resilience funding programs and DRFA packages. This includes \$8 million for projects in the final stages of completion and \$5.17 million worth of projects currently in delivery.

Several programs the QRA is currently delivering to improve flood modelling in Queensland include:

- Queensland Strategic Flood Warning Infrastructure Plan
  - Complete the implementation of the remaining Network Investment Plans including the automation of Queensland’s flood warning network, which ensures an effective and fit-for-purpose network of assets that contributes to timely and accurate forecasts and flood warning and provides a shared situational awareness between responding agencies and the community.
  - Establish effective governance arrangements to ensure confidence in Queensland’s flood warning infrastructure network.

- Establish and facilitate opportunities for further collaboration between stakeholders on key issues such as network efficiency, asset management, joint purchasing, resource, and data sharing.
- Promote and encourage opportunities for new or innovative technologies and/or delivery arrangements that will benefit flood warning.
- Flood Warning Infrastructure Network (FWIN)
  - Following the successful implementation of the \$8 million Flood Warning Infrastructure Network (FWIN), the QRA is continuing to liaise with the Bureau about establishing a new national standard for alternative assets that are more cost effective. The QRA is also working with the Department of Transport and Main Roads (DTMR) and local governments to focus on improving flood cameras, electronic signage, and river height and rainfall gauges to ensure Queensland’s Flood Warning Infrastructure Network is fit-for-purpose.
- Flood Risk Management Program
  - The \$28 million Flood Risk Management Program, jointly funded by the Queensland and Australian Governments under Category D of the DRFA, provides funding for the 39 local governments in LGAs impacted by the South East Queensland Rainfall and Flooding event, the Central, Southern and Western Queensland Rainfall and Flooding event and the ex-Tropical Cyclone Seth event to undertake key activities to support evidence-based response, mitigation and resilience strategies to manage their river, creek and overland flood risk. The program’s outcomes include improved critical baseline data and information to inform flood studies and risk assessments, improved flood intelligence to be better able to prepare for and respond to flooding events, and ultimately to inform the prioritisation of future investment in flood risk management.

### *Flood Warning Infrastructure Network*

Queensland has more than 3200 rainfall and river gauges that inform statewide flood warnings and forecasts. These flood warning infrastructure assets are owned and operated by more than 60 entities that include state and local government, the private sector, and the Bureau.

In 2016-17, the QRA, in conjunction with the Bureau, engaged 60 local governments across Queensland to produce 43 Network Investment Plans to identify gaps and recommend improvements to flood warning systems, and design improved networks for the river systems and catchments in which they are located.

The QRA published the *Queensland Strategic Flood Warning Infrastructure Plan* (the Infrastructure Plan) (Queensland Reconstruction Authority, 2021b) in June 2021. The Infrastructure Plan outlines actions to improve community resilience to flood events through the development of a best practice network of flood warning gauges. The Infrastructure Plan will continue to implement the remaining Network Investment Plans in Queensland.

In 2021–2022, the QRA implemented an \$8 million FWIN project to support recovery in 28 LGAs following the 2019 Monsoon Trough disaster event. This project is part of the \$242 million Category C and D exceptional DRFA package. As part of the FWIN project, 180 locations in North Queensland received new and improved flood warning infrastructure assets, successfully completing the investment plans from Mackay, west to Diamantina, and north through to the Gulf of Carpentaria and Cape York.

Alongside this work in early 2021, the Bureau commenced a scoping study in consultation with the QRA and LGAQ, on potential improvements to the ownership and management of Queensland’s flood warning gauge network. As part of the scoping study, the Bureau

proposed an investment of approximately \$161 million for new and improved network infrastructure. They also proposed taking ownership of all flood warning gauge assets (made up of rainfall and river height gauges) currently owned and managed by local governments. The QRA is continuing to advocate for the Bureau to proceed with its proposed plan to purchase and upgrade Queensland's flood warning infrastructure assets.

### Recommendation 2

- 2) The Inspector-General of Emergency Management recommends the Queensland Reconstruction Authority and the Bureau of Meteorology investigate options for the consolidation of ownership, renewed capital and maintenance in the flood warning network in consultation with flood warning infrastructure asset owners.

## Timing and effectiveness of Emergency Warnings and Alerts

Warnings and alerts play a critical role in protecting lives and property. They are intended to provide point-in-time information about a hazard that is affecting or may affect a community. Warnings should be timely, targeted and tailored to describe the expected effects on a community including advice on what people should do.

### Emergency Alert system

The Emergency Alert system is the national telephone emergency warning system and was introduced in 2010 following the 2009 Black Saturday Victorian Bushfires.

Emergency Alerts are an important real-time community notification tool that complements other warning methods such as disaster dashboards, social media, local TV, radio, opt-in warning systems, sirens and door knocking.

Emergency Alerts have three different warning levels: *Advice*, *Watch and Act* and *Emergency Warning*. *Emergency Warning* is the highest level of alert.

The Emergency Alert system operates by sending targeted warning messages called Emergency Alerts to landlines or mobile phones using voice, text message – short message service (SMS), or a combination of these modes. There are two types of SMS which may be used to deliver Emergency Alerts to persons in an identified location:

- Location Based Solution SMS uses the last known location of a device at the time an Emergency Alert is sent. This is referred to as SMS—Location Based in Queensland; and
- Location Based Number Store SMS uses the location of the device's service address. This is referred to as Service Address Based in Queensland.

Location-Based Solution SMS is the fastest method of distributing an Emergency Alert, while Location Based Number Store voice messages are the slowest method.

Emergency Management Victoria manages and administers the national Emergency Alert system through an intergovernmental agreement. QFES is responsible for the management and administration of the Emergency Alert system in Queensland.

### *Emergency Alert system updates*

The recent update of the Emergency Alert system went live nationally on 1 September 2021 and was the version used during this event. It has additional functionality compared with the previous version, including an increase of text limit from 160 to 612 characters, improved

mapping functionality, and the ability to disseminate voice, location-based and service address SMS simultaneously.

### *Emergency Alert system workflow process*

The process for requesting Emergency Alerts in Queensland can be found in *the Queensland Emergency Alert Manual – M.1.174* (the manual). A request can be made at the local, district and state levels of the disaster management arrangements. Emergency Alerts are requested from the originating authority via email on a Microsoft Word template, or via a direct phone call to the State Disaster Coordination Centre (SDCC) Watch Desk when email is not available to arrange authorisation and release. Authorised officers are defined under the *Telecommunications (Data for Emergency Warning Systems) Instrument 2020* (Cth) (Commonwealth of Australia, 2020). Phone approval arrangements are in place should there be no-one available at the SDCC to approve an Emergency Alert.

### *Emergency Alert use during the event*

Between 2.43am on Wednesday 23 February 2022 and 10.00pm on Thursday 3 March 2022 there were 94 Emergency Alert campaigns. Of these, 17 were Advice level, 59 were Watch and Act level, and 18 were Emergency Warning level ([Appendix G](#)).

Emergency Alerts were requested by 16 of the 23 LGAs in scope of this review and their use varied. Some were issued in a timely manner, and others were received by people after homes were inundated by flood waters.

### *Emergency Alert system constraints*

There are constraints of the Emergency Alert system and the telecommunications infrastructure it relies on. The users require an understanding of these constraints to ensure the community they intend to warn receives a timely warning and is aware that the warning could potentially leech into areas not intended to receive the message.

The capability of the core Emergency Alert system determines how many messages can be forwarded at any given time. These limits vary between the chosen delivery method, for example a voice message takes longer to distribute than an SMS message. Emergency Alerts covering large, populated areas often need to be split into several smaller packages to overcome these constraints. If the number of recipients in a targeted area exceeds the maximum number of recommended recipients, the targeted area is divided into smaller polygons (a defined area on a map) to reduce the number of recipients per polygon. The Emergency Alert is then sent in priority order. When an Emergency Alert is sent to multiple polygons, an interval of 10 to 20 minutes between each package depending on how it is being delivered is recommended to address system load and performance constraints.

The impact of the recommended time intervals between polygons needs to be considered for an entire community to receive an Emergency Alert. On occasions, this will mean that by the time the Emergency Alert is received by a person, the conditions, risk and warranted actions may well have changed.

Some local governments advised that, on occasion, Emergency Alert requests were returned with suggested changes to the wording of the message. When this occurs agreement must be reached between the requesting agency and the authorising officer before the Emergency Alert can be issued. This can cause a delay from when it is requested to when it is received by the targeted community.

For example, at 7.07pm on Sunday 27 February 2022 the Brisbane LDMG requested an advice-level Emergency Alert for distribution using a Location-Based Solution SMS. It took 37 minutes for the Brisbane LDMG and the authorising officer at the SDCC to agree on the wording of the message.

Issuing of the message commenced at 7.51pm. Due to the size of the target population, and to keep within the system's constraints, it was necessary to send the Emergency Alert through 22 separate polygons. The Emergency Alert was then issued to each polygon, with the application of the recommended time interval of 10 to 15 minutes between distribution of each of the 22 packages to ensure the system was not overloaded.

At the time the SDCC Watch Desk was issuing the Brisbane Emergency Alert (advice level), it received requests for Emergency Alerts from the Logan, Gold Coast, and Scenic Rim local governments, resulting in an additional 17 packages. These 17 packages were of higher warning levels (Watch and Act and Emergency Warning), or required prioritisation for other reasons, so were manually prioritised and issued prior to the conclusion of the Brisbane Emergency Alerts. The application of the recommended time interval between each of the 39 packages total being issued contributed to the delay of the Brisbane Emergency Alert.

In addition, during processing of the Brisbane, Logan, Gold Coast, and Scenic Rim local government Emergency Alerts on the morning of Monday 28 February 2022 there was an outage of the Emergency Alert system that occurred for approximately 1 hour and 15 minutes. Telstra advised the most likely cause of the outage was that the application was being utilised beyond its capacity.

The combination of these factors impacted on the timely issuing of the Brisbane LDMG's Emergency Alert campaign, which was not completed until the morning of Monday 28 February 2022, more than 12 hours after it commenced. Conditions changed significantly during this time. A tidal cycle occurred in the Brisbane River and rainfall conditions also changed. This affected the relevance and need for the Emergency Alert campaign. Some residents in Brisbane reported receiving this message well after their properties were inundated.

To ensure Emergency Alerts reach the intended audience in a timely manner, users of the Emergency Alert system should consider the following:

- A message will not be received when using Location-Based Solution and Location Based Number Store campaigns if a device does not have reception for the duration of the Emergency Alert campaign; however, a message using Location Based Number Store based campaign will be received if the device regains reception during the campaign.
- For a Location-Based Solution campaign, a device will become part of the recipient list if they have reception when the Emergency Alert campaign is initiated. It will not receive the message if the device does not regain reception during the campaign timeframe.
- A location buffer is applied to Location-Based Solution campaigns to capture mobile devices which may be within the impacted area but are connected to a cell tower located outside of it. This can lead to some mobile devices outside of the impacted area being captured on the recipient list as their device is connected to the cell tower within the location buffer.
- The increased character limit has several consequences:
  - They create an additional load to the core system which results in delays to issuing the campaigns

- The text message display may differ between newer and older mobiles. The message may be segmented on older mobiles.
- Some characters are unable to be sent through the system. Where this happens, the system should prompt the user to remove them before the system will allow the campaign to proceed.
- The system can send Location Based Number Store and Location-Based Solution voice and text alerts within a single campaign; however, this may also cause an additional load on the core Emergency Alert system, creating potential delays.
- Currently, the Standard Emergency Warning Signal (SEWS) tone plays for all voice alert messages sent through the system.
- The process to prioritise Emergency Alert campaigns is complex. It depends on several factors which include the nominated alert priority, type of campaign and the timing of campaign initiation.

There appears to be general lack of awareness by local governments regarding the Emergency Alert system’s constraints. Several local government practitioners advised they were not aware the Emergency Alert system had been upgraded and were unaware of its extra functionality. Some LGAs were aware of the changes due to their own investigations. Many advised they are yet to receive training in the new system or were unaware of the differences from the previous version. QFES advises that extensive communications took place regarding this upgrade.

There are mandatory training requirements in Emergency Alerts outlined in the QDMTF for some designated disaster management roles. The mandatory training requirements for officers authorising Emergency Alerts is outlined in the Emergency Alert Manual and includes QDMTF modules. QFES have advised additional training for authorising officers has been incorporated into Module 2 of the QDMTF Emergency Alert training package.

An emphasis on providing users with further training, greater exercising and improved guidance will assist users to gain a better understanding of the functionality, complexities and constraints of the systems. This in turn will lead to better constructed Emergency Alert messages and timely advice to the community.

<b>Annual exercising of Emergency Alerts</b>
<p>The Cairns Disaster District includes 15 LDMGs and each year the district facilitates an exercise ‘Semper Paratus’ to test the issuing of Emergency Alerts through the State Disaster Coordination Centre (SDCC) at times of disaster when communications infrastructure may fail. The exercise is designed to assess communications capability, identify gaps, and enhance cooperative arrangements for the district disaster management group.</p> <p>The district evaluates the exercise seeking to improve the process for Emergency Alerts giving council and LDMGs confidence in their communication capability before the severe weather season.</p>

*Timeliness of Emergency Alerts compared with other media*

Local governments requesting an Emergency Alert would normally be publishing similar warning messages through other media such as dashboards and social media. As these messages are not subject to the delays identified in the above paragraphs, they are generally issued rapidly and maintain their relevance to the conditions. There can be significant issues if there are delays in issuing the Emergency Alert. Conditions on the ground may have

changed significantly resulting in the Emergency Alert being ineffective or unnecessary, or the community not warned.

It is possible for messages and polygons to be pre-formatted by local governments prior to a hazard season (bushfire, flood) and provided to QFES for consideration. These can be stored by QFES so that if an event occurs they can be more rapidly issued. The system which stores pre-formatted Emergency Alerts was changed around the same time as the Emergency Alert System upgrade. Some local governments were unaware of these changes. This resulted in one local government having to recreate an Emergency Alert campaign. This had the potential to delay their Emergency Alert campaign.

The SDMP encourages the development of pre-formatted messages which can be uploaded to the system prior to an event. QFES advised that pre-defined polygons were not requested to be used by any of the requesting entities during this event. There is an opportunity to enhance the Emergency Alert process by asking local governments whether they want to utilise their pre-formatted Emergency Alerts. Prioritisation of polygons to determine the order of issuance could also be done prior to events which may improve the timeliness of Emergency Alerts. The Emergency Alert process could be further strengthened by regular training and exercises. IGEM intends to examine the pre-formatted polygons and messages for Emergency Alerts, to ensure they emulate the findings of this review in future disaster management plan assessments.

### *Clarity of Emergency Alert warnings*

QUT researchers found that clear warnings are deemed to be those that are easy to understand and can be used to formulate an assessment of risk and hazard impact, with actions to respond. Respondents in the commissioned research ([Appendix D](#)) indicated that the warnings, particularly those received as text messages, conveyed the flood risk level with clarity and sufficiency; however, many respondents indicated that warnings provided mixed clarity around flood risk impact. That is, some respondents indicated that clarity around the extent and severity of the expected impact of the event was lacking. The researchers concluded that respondents' perceptions of how clear they found the warnings varied but generally they expressed a desire for more instructional information in the warnings.

The community expects and needs relevant information to respond effectively. Many warnings were not timely, and in some cases, residents were flooded without prior warning.

In some cases, flood mapping linked to warnings failed to convey potential impacts of flooding to community members. The level of inundation depicted in maps was also difficult for residents to interpret.

Concerns were raised by some disaster management practitioners that the Emergency Alert system had been previously used for non-critical message resulting in the community placing less importance on it. Their view was that the system should be reserved for critical, life-threatening messages only.

During the event many agencies adopted a multimodal approach to warn and disseminate information to the community. Using multiple channels to deliver warnings builds redundancy against, and helps address, challenges such as how to reach a community with no mobile phone reception, internet, or power. Community messaging should be based on local circumstances and needs.

*Queensland Emergency Alert Manual – M.1.174*

The manual (Queensland Fire and Emergency Services, 2022b), last updated on 15 February 2022, provides the framework for the issuing of Emergency Alerts in Queensland.

As identified during the event, delays were experienced in issuing alerts across the system. Upon interrogation it was suggested that one of the contributing factors for the delays, was the requirement for officers to ensure messages complied with obligations imposed by the *Telecommunications Act 1997 (Cth)* (Australian Government, 2022).

The manual, at page 9, chapter 2.1 states:

*... that the use or disclosure of information obtained by telecommunications carriers is prohibited under ss 276 and 277 of the Telecommunications Act 1997 (Cth) and s 80Q of the Privacy Act 1988 (Cth). This includes information held in the Integrated Public Number Database (IPND). Access to this data imposes on Queensland a number of legal obligations which are summarised at Appendix 1 of the manual.*

It is noted that Appendix 1 of the manual is titled 'Legislative Obligations' however upon review of this appendix it fails to identify the specific areas of the legislation to which these obligations are identified. The manual also notes that:

*Section 285A of the Telecommunications Act 1997 (Cth) permits disclosure of the information to Emergency Management Person (EMP) who are prescribed in the Telecommunications (Data for Emergency Warning Systems) Instrument 2020 (Cth) for the purposes connected with alerting members of the public to a disaster or emergency situation.*

As stated in the appendix of the manual: '*Jurisdictions must have in place clear decision-making processes to ensure accurate, timely and relevant warnings are issued and agencies should be mindful of the criticality of a timely warning system*' (Queensland Fire and Emergency Services, 2022b).

Given that urgency and clear decision-making practices are key to a highly effective Emergency Alert system, it would be beneficial for the manual to be reviewed and amendments made to ensure the manual is a useful operational tool that includes an outline of the authorising environment, particularisation of any specific legislative requirements and identification of the operational impacts of the legislation and describes the constraints, capability and complexities of the Emergency Alert system.

## **Brisbane City Council Flood Review 2022 Report**

On 1 March 2022, BCC '*announced an independent and comprehensive review be conducted into the 2022 Brisbane Flood event*' (BCC Review). The BCC Review would be '*led by the Honourable Paul de Jersey*' (de Jersey, 2022).

The first part of the BCC Review focused on the extent of compliance by the BCC with recommendations made by the previous 2011 Flood Response Review Board and the Queensland Floods Commission of Inquiry. As noted by His Honour, '*the first of the Terms of Reference invites an 'audit' of the extent to which those recommendations have been implemented over the ensuing 10-11 years.*'

The second part of the BCC Review required a consideration of the effectiveness of the BCC disaster management framework and adequacy of the BCC's public warnings and advice.

Additionally, the BCC Review required consideration of matters that sit outside IGEM’s review Terms of Reference such as planning and infrastructure.

Of note, in undertaking the BCC Review, His Honour made the following three key recommendations in relation to the Emergency Alert system and the Emergency Alert process at pages 78 and 80 (de Jersey, 2022):

*‘5.1 EA [Emergency Alert] System Review – that Council advocate that the QFES undertake a review of the system that distributes the EAs to determine whether there is a more efficient method by which EAs can be distributed, particularly in circumstances where the EA must be distributed to a large number of people.*

*5.2 EA Process Review – that Council review the ‘request for EA process’ with QFES as there seemed to be some delay in the review and approval by QFES of the wording of the EA and timing of the issue of the EA. This process and QFES’ expectations for the EA scripting could, for example, be agreed to prior to the event such that the fact-specific EA during an event might be the refinement of pre-agreed templates.*

*5.3 EWAS [Early Warning Alert Service] Uptake – that Council rigorously promote community uptake of the Weatherzone severe weather and creek alerts system.’*

### Distinctions between BCC and IGEM review

It is important to note the clear differences between the purpose and approach of the two reviews. Those differences can be identified as follows:

	BCC Review	IGEM Review
Timing	Announced: 1 March 2022 Delivered: 9 May 2022	Announced: 15 March 2022 To be delivered: 31 August 2022
Geographic	BCC local government area only	Consideration of 23 local government areas, including BCC local government area
Evidential basis	Submissions received from council and councillors	Submissions received from community members, QFES, QPS, QRA plus other local, state and federal agencies e.g., the Bureau and other relevant entities e.g., Australian Red Cross
Community engagement	Submissions direct from the community although not directly sought were presented via local councillor submissions	Submissions were invited from community members and community forums were also held
Terms of reference	Focused on: Audit of extent of compliance with previous recommendations from 2011 event and assessment of effectiveness of measures recommended to protect flood prone properties. Assessment of BCC disaster management framework and adequacy of public warnings to BCC community. Assessment of resilience of riverine/waterways infrastructure and effectiveness of changes in planning regulations.	Focused on: Effectiveness of preparedness activities by many disaster management entities. Timing and effectiveness of emergency alerts, use of national system, opt in systems, Timing and effectiveness of co-operation between disaster management entities Effectiveness of cooperation between all entities responsible for response.
Out of scope		It is noted that infrastructure and planning sit outside IGEM’s terms of reference

Table 4: Differences between BCC Review and IGEM Review

As the table above identifies, this review required a broader consideration of the impact of the event across 23 local government areas. The IGEM review has received a significant number of submissions from the community and been informed by disaster management entities and stakeholders.

The BCC Review identified a number of key insights and recommendations related to the event and the utilisation of warnings and alerts.

His Honour outlined at page 78 of the BCC Review his recommendations in relation to Emergency Alerts. Following his recommendations, the following statements are made at page 79 (de Jersey, 2022):

*These recommendations are made in recognition of considerable community concern about the adequacy of warnings. More should be recorded of this.*

*The experience within the community, reflected by respondents, suggests warning to evacuate came too late, with houses already flooding up to a day and a half before that warning was issued...*

*A limitation of the existing systems is that the BoM [the Bureau] flooding predications are based on river flooding only. The Brisbane 2022 Flood event saw creek systems already overwhelmed before the river flooding warnings were issued. The existing system which gives warning about creek flooding is Weatherzone which is controlled by Council. It uses real time telemetry within the creek network (meaning there was no warning of forecasted flooding). It was reported to work without issue during the 2022 event, but is subscriber based with low take up.*

This review had a broader remit and operated from a different data set to inform the review. IGEM was able to consider the experiences of both disaster management personnel that operate the Emergency Alert system during an event and the community as the key recipient of the Emergency Alert. Having considered the information presented, IGEM also arrived at similar conclusions and recommendations in relation to Emergency Alerts.

There is clear alignment between the three recommendations made by His Honour as part of the BCC Flood Review and the IGEM recommendations as they relate to Emergency Alerts.

### **Point of difference**

The following statement is made at page 80 of the BCC Review (de Jersey, 2022):

*The Brisbane 2022 Flood event was rapidly changing, with BoM advice changing many times over the course of Saturday 26 February – Sunday 27 February. There is evidence that Council acted promptly on this advice each time, issuing updated weather warnings and updating the flood maps. Once the advice came from BoM at 6pm on Saturday 26 February that a major flood was likely the following day, Council immediately put in the steps to issue the evacuation warning via the State's EA system. Due to the limitation of the EA system (as discussed above) that warning was not received by some until Sunday evening.*

In the review process, IGEM has identified post event that the earliest experiences of flooding commenced in the early evening of Friday 25 February 2022. Flooding was experienced at various locations across Brisbane on both Saturday 26 February and Sunday 27 February 2022.

His Honour identified that the Bureau advice, received at 6.00pm on Saturday 26 February 2022 indicated that a major flood was likely the following day. The formal request from

Brisbane LDCC to issue an Advice Emergency Alert (priority 3—lowest) was received by the SDCC at 7.07pm on Sunday 27 February 2022.

IGEM has no information that supports a request for an Emergency Alert was made prior to this time.

### *Flood types and alert responsibilities in practice*

The overall aim of emergency information and warnings is to safeguard life, property and the environment. The value of the Emergency Alert system is in the impact it is able to achieve, placing a community at risk on notice to provide them with an understanding of what they might expect, how they should act and where they can seek help.

Emergency Alerts are an important tool in the suite of options that are available for use by local governments to inform their community. As noted previously, the current Emergency Alert system has a number of constraints and complexities that need to be considered when planning for and using Emergency Alerts during an event. As such, they should be prepared and submitted early in the context of an event in recognition of how they may be impacted by the constraints of the system and the load being experienced by the system during the event.

It should be noted there are no limitations on the type of disaster event an Emergency Alert can be used for, i.e. it is a tool that can be utilised across all hazards. Of the seven most significant natural hazards identified in the SDMP and recognised in the Risk Report, the high priority areas are identified as riverine flooding and severe weather events.

During the review consultation process it was identified that, as the disaster event unfolded and the flood waters rose, the community had little regard to the type of flood event they were experiencing (i.e. there was no differentiation between small river or creek flooding, overland flooding, flash flooding or riverine flooding).

The flood event of February–March 2022 caused *‘a serious disruption in the community’* that required *‘a significant co-ordinated response by the state and other entities to help the community recover from the disruption’* (s 13 DM Act). The overarching principles identified in the SDMP and the functions outlined in the DM Act make it clear that LDMGs (required to be established by local governments) are primarily responsible for managing disaster events in their local government area. The scale and impact of this event is reflective of a volatile, uncertain, complex and ambiguous environment (VUCA) where gaining situational awareness and achieving a common operating picture is complex but necessary.

Community has a key role in preparing for, and responding to, a disaster event (as identified in the SDMP at 1.4.4.3 and 5.2 as well as the Standard). The premise of disaster management in Queensland is that shared responsibilities exist between disaster management agencies and the community. In managing risk, there needs to be a shared understanding of risk so that impacts of events on the community can be mitigated.

The DM Act, at s 30(e) provides that a function of the LDMG is *‘to ensure the community is aware of ways of mitigating the adverse effects of an event, and preparing for, responding to and recovering from a disaster’*. This reflects the importance and benefit that is placed on early community engagement to support informed decisions and risk assessments by communities specific to each individual’s unique circumstances.

Emergency Alerts are a national system that provides an option to all LDMGs that is complementary to their localised communication and engagement toolkits. As noted in the manual at page 7, *‘EA provides a platform for local and state agencies to issue public information and warnings. EA is an effective means of delivering messages directly to a*

*person's mobile or landline phone, often complementing other forms of public information such as traditional media, social media and website updates'.*

As previously identified, the Emergency Alert system provides for three levels of warning messages. Those levels are Advice (priority 3—lowest), Watch and Act (priority 2) and Emergency Warning (priority 1—highest). Message priority order is based on the message severity selected, i.e. level 1 or 2 will be sent before level 3.

To maximise the value an Emergency Alert can realise during an event, it should be considered as an important part of localised toolkits in the provision of information, warnings and alerts to the community. In accordance with the continuous improvement practices identified in the PPRR guideline, and in line with the Lessons Management Framework, IGEM recognises the value of regular training and exercising. To harness learnings, identify good practice and innovation, IGEM encourages the use of reflective practices to inform and educate both internal users (i.e. disaster management practitioners) and external users (i.e. the community) about the emergency alert system and their role in it.

**Recommendations 3–10**

- 3) The Inspector-General of Emergency Management recommends Queensland Fire and Emergency Services lead an urgent multi-agency (including but not limited to the Queensland Police Service and Brisbane City Council) review of the workflow, of the current Emergency Alert system, including requesting, composing, authorising and issuing of Emergency Alerts by 1 November 2022.
- 4) The Inspector-General of Emergency Management recommends Queensland Fire and Emergency Services, in consultation with the Queensland Police Service, incorporate into the workflow of the current Emergency Alert system a process that ensures the inclusion of an 'urgent approval and distribution without delay' process for Emergency Alert messages by 1 November 2022.
- 5) The Inspector-General of Emergency Management recommends Queensland Fire and Emergency Services update and deliver training on the workflow reviewed (as per Recommendation 3) of the current Emergency Alert system to all persons responsible at a local, district and state level by 1 November 2022. Training should address system constraints and system complexities in addition to the process of requesting, composing (including Clear Explicit Translatable Language [CETL]), authorising and issuing Emergency Alerts.
- 6) The Inspector-General of Emergency Management recommends Queensland Fire and Emergency Services develop and publish an operationally based quick reference guide that complements the training offered (as per Recommendation 5) by 1 November 2022. The guide will identify key and critical aspects of the Emergency Alert system in relation to the development, composition, request for and authorising of Emergency Alerts and will include a template and an example of 'good' messaging using concise, minimal language and Clear Explicit Translatable Language (CETL).
- 7) The Inspector-General of Emergency Management recommends that all local governments that currently use pre-formatted messages within the Emergency Alert system review and, where necessary, redraft messages using the principles of Clear Explicit Translatable Language (CELT).
- 8) The Inspector-General of Emergency Management recommends that all local governments that do not have pre-formatted messages and polygons engage with Queensland Fire and Emergency Services and determine whether their local disaster management group capability could be improved through the development of pre-formatted polygons and messages.
- 9) The Inspector-General of Emergency Management recommends Queensland Fire and Emergency Services conduct annual exercises with every local disaster management group and district disaster management group to confirm the process for developing, approving and issuing of an Emergency Alert, including the use of pre-formatted polygons and messages. Upon completion of the initial statewide exercise, Queensland Fire and Emergency Services will furnish an exercise evaluation report to the Office of the Inspector-General of Emergency Management by 1 November 2023.
- 10) The Inspector-General of Emergency Management recommends Queensland Fire and Emergency Services review the *Queensland Emergency Alert Manual – M.1.174* in its entirety by 1 November 2023. The manual should specifically address the authorising environment, legislative obligations and the capability and complexities of the Emergency Alert system.

Cell broadcast national messaging system

The Commonwealth Department of Infrastructure, Transport, Regional Development, Communication and the Arts is leading a project to investigate the use of Cell Broadcast (CB). CB is a method of delivering messages to multiple mobile telephone users in a specified area at the same time and could complement the current Emergency Alert system in Australia. Cell Broadcast is used in New Zealand, North America and some European countries. The technology is a point-to-area communication between a mobile network operator’s radio cell towers and mobile telephone devices linking to the handset rather than the subscriber’s number.

The system provides:

- simultaneous message delivery
- freedom from network congestion
- the capacity to deliver messages to mobile phones that are on silent or on do not disturb mode
- for messages to be received in multiple languages
- message priority options to reflect the urgency and gravity of the warning.
- The system does not deliver messages to landline telephones, is not compatible with satellite technology, and cannot confirm receipt of messages. Like the Emergency Alert system, it remains susceptible to disruptions to telecommunications infrastructure.

**Australian Warnings System**

Agencies currently use different warning systems for various hazard types and locations across Australia. This lack of uniformity poses complexity in relation to consistent messaging and public education.

The Australian Warning System (AWS) (<https://www.australianwarningsystem.com.au>) was developed by the Australasian Fire and Emergency Services Authorities Council (AFAC) Public Information and Warnings Group. It is a new national approach to warnings across five key hazards: bushfire, flood, severe weather (storm), cyclone and extreme heat (Figure 10). The AWS has three warning levels—Advice, Watch and Act, and Emergency Warning—with message content and colour coding designed to provide communities with clearly understood and timely warnings to enable them to make informed decisions about their individual circumstances.



Figure 10: Australian Warning System icons (<https://www.australianwarningsystem.com.au>)

AWS implementation is the responsibility of the Australian states and territories, each of which has varied implementation timelines. In Queensland, QFES has responsibility for the AWS and currently chairs a multi-agency working group tasked with introducing the AWS in phases. QFES has proposed introducing the AWS for flood by October 2023.

QFES' Public Information and Warnings Unit conducted extensive stakeholder engagement regarding the implementation of the AWS in Queensland to ensure recommendations about the future approach to warnings are well-informed and evidence based. Stakeholders were engaged from various sectors, local government and communities. Engagement insights, extensive research review, and lived experiences have been combined to inform the implementation of the AWS in Queensland.

*How the Australian Warning System was used during the event*

While the AWS has not been implemented in Queensland for flood, the community forums identified that some communities did not understand the urgency of the situation portrayed in some of the warnings they received. Based on the warnings they received, some community members were unsure of whether it was safe to collect supplies. This led to instances of risky behaviour, such as driving through flood water to collect sandbags. The Advice, Watch and Act, and Emergency Warning levels of the AWS system could help mitigate this uncertainty.

Although the AWS has not yet been implemented for flood in Queensland, Ipswich City Council proactively used the AWS symbology and templates during this event to deliver warnings on its disaster dashboard and social media platforms. Ipswich City Council's approach demonstrates enthusiasm in making the change. It is perhaps timely and advantageous in assisting other local governments in a supported rollout of the AWS. This would provide consistency in warning messages.

**Recommendations 11–12**

- 11) The Inspector-General of Emergency Management recommends Queensland Fire and Emergency Services implement the Australian Warning System for all nationally agreed hazards by 1 November 2023. Implementation should include guidance and training to all local governments and agencies operationally involved in disaster management, with emphasis on those agencies with hazard specific responsibility.
- 12) The Inspector-General of Emergency Management recommends Queensland Fire and Emergency Services establish a community education program by 1 November 2023 that complements the implementation of the Australian Warning System. An evaluation process should be incorporated into the program to determine effectiveness.

**Local government disaster dashboards**

Some Queensland local government websites include disaster dashboards providing important information to support local communities during and after disaster events. The Queensland Reconstruction Authority also has a link to all the disaster dashboards across Queensland which can be located at the following: [Local government disaster dashboards | Community support | Queensland Government \(www.qld.gov.au\)](#).

The disaster dashboards include information such as:

- evacuation centre openings and locations
- river heights

- road conditions and closures
- power and phone outages
- helpful contacts.

Twenty-one of the 23 local governments affected during this event have a disaster dashboard. Cherbourg Aboriginal Shire Council and BCC do not have a dedicated disaster dashboard. Cherbourg Aboriginal Shire Council provides information to their community via their website and other channels such as local community radio. BCC advised that their corporate website is the entry point to access disaster information.

Some community members highlighted disaster dashboards as a great resource. Others remained unaware of them, relying on word-of-mouth as a source of information which led to misunderstandings and confusion surrounding current conditions and warnings. There is an opportunity for greater education and promotion of disaster dashboards, particularly preceding severe weather seasons and events.

The community identified that some disaster dashboards did not provide sufficient localised information and needed more granular detail and regular timestamping of information to provide greater assurance the information was current.

It was identified through submissions and conversations that the management of disaster dashboard can become labour intensive during an event. Strategies need to be identified to manage this as they are a valuable source of information for the community.

### Opt-in systems

Opt-in systems can be beneficial as they enable community members to subscribe to information they consider relevant, such as an alert or warning for a specific area regardless of their current location.

Ten of the 23 local governments impacted by this flooding event had some form of opt-in system. Many opt-in systems simply republish the Bureau warnings. Some local governments value-added to these warnings, and others pushed out bespoke warnings, alerts, and road closure information. One local government provides the ability to opt-in to weather warnings outside their LGA for residents working in neighbouring areas.

Some opt-in systems provided for targeted warning messages upon activation by a trigger. For example, some local governments provide their community the ability to receive a warning when a flood gauge reaches a pre-determined height. Some have warnings based on property address, while others are based on smaller areas such as sub-catchments.

The subscription rate for opt-in warning services is generally approximately 10–15 per cent of residents. Although these subscription rates are low, one particular sub-catchment warning area achieved almost 100 per cent subscriptions.

MBRC conducted a survey of its opt-in alerting system finding respondents overwhelmingly agreed the alerts were easy to understand and provided sufficient information to assist them to decide upon actions. It was suggested the information could be timelier and more targeted to assist in communicating the seriousness of the situation.

Some local governments raised concerns that republishing the Bureau's warnings through opt-in systems could be perceived as spamming. One local government that republishes the Bureau's warnings was reconsidering the need noting a push warning weather capability was added to the Bureau's Weather App in May 2022.

Warning or alert fatigue is a concern, as it leads to the potential for people to unsubscribe to a service if they believe warnings are duplicated or not relevant to them.

Sunwater and Seqwater both have opt-in systems to notify of dam releases. Not all community members are aware of this service. Those who are subscribed provided feedback that the content was general and difficult to interpret.

Dam alerts are one source of information and should form part of a suite of information that community members can access to inform them of potential risks and appropriate actions. Dam message alerts directing the community to disaster dashboards for further information may assist community members to form a more accurate, holistic picture of their individual circumstances.

As previously noted, the BCC Review included a recommendation specific to BCC’s opt in system. It was recommendation of the BCC Review that Council rigorously promote community uptake of the severe weather and creek alerts system having regard to limited uptake (14 per cent take up rate for residents of Brisbane City).

IGEM supports this recommendation and makes a similar recommendation to all local governments. While it is preferred that warnings should be contextualised for the intended users in the community (i.e. not simply a republishing of other warnings), opt in systems are a valuable tool, and provide another avenue for the delivery of warnings and alerts to the community.

**Recommendation 13**

13) The Inspector-General of Emergency Management recommends all local governments that offer an opt-in system develop strategies to increase the number of subscribers who elect to use this service. As part of the annual disaster management plan assessment process for the period 2023–2025, the Office of the Inspector-General of Emergency Management will request information from the relevant local disaster management groups to highlight and share innovative practices that have led to an increase in subscription levels for opt-in services.

**Social media**

In addition to using other channels, entities have adopted the use of social media such as Facebook, Twitter and LinkedIn to warn their communities. Community members consider these channels to be an authoritative source.

Several agencies were found to be effectively using social media for disseminating information such as warnings and alerts during the event, pointing the community to disaster dashboards for further or updated information. Social media posts relating to this event from one local government were viewed more than 1 million times and engaged with on 8600 occasions. One post reached over 135,700 people with more than 1800 comments on these posts collectively.

Social media alone is not an effective way of messaging a large part of the community as access can be impacted by internet and power outages. It also requires community members to engage with it, for example, by liking or following the account, or by following a particular hashtag.

To effectively harness the capability and capacity of social media to disseminate key information in a consistent manner, councils should give consideration to their social media policies and platforms and ensure the primary communication account is the relevant local council. Using the local council social media accounts as the origin source for all information,

and encouraging all local councillors to repost, can result in a broader reach across the community. Further, ensuring that the messaging is consistent across all social media accounts (i.e. each time a message is sent it is posted across all social media accounts in use e.g. Facebook, Instagram, Twitter) ensures that community members receive a consistent message and are not required to establish and access multiple social media accounts.

To understand the sentiment of the community during the event, IGEM engaged Griffith University to review Twitter activity related to the Queensland flood event during the period 20 February 2022 to 10 March 2022 ([Appendix F](#)). Words are associated with emotions (Mohammad and Turney, 2013). Sentiment analysis uses a base Lexicon or glossary to associate the words found in tweets and other social media content with emotions such as sadness, anger, fear, surprise, joy, trust, and disgust. Each emotion is associated with a range of words, taken from Roget’s Thesaurus (Chapman, 1992), with each of these words then categorised as either positive, negative or neutral (between -1 and +1). A negative value represents a negative sentiment and positive value conveys a positive sentiment. For example, there are 691 words associated with the emotion ‘joy’ and 1,483 words associated with the emotion ‘fear’. When analysing social media posts, computer models run through the text and assign a value or weight to each word, which combines to give an overall rating or number for the emotion. Trends or patterns can then be identified to establish whether the social media content tells us that the community is feeling anger or sadness or trust, for example, about an event, issue, or topic. Appendix F provides further information about the Twitter analysis, including the categorisation of negative, positive and neutral.

The researchers found that the bulk of activity on Twitter related to this event occurred between 26 February and 9 March 2022, with the peak occurring on 27 and 28 February 2022. On these two days, 42,131 and 38,891 relevant tweets were posted respectively. The average number of retweets started to rise from 26 February 2022. The most retweeted post was ‘These flood monitoring cameras demonstrate the extent of the rainfall and just how quickly waters rose, causing major damage during the recent #seqfloods’ (6041 retweets).

Below is the stacked bar graph showing total number of tweets each day (and then categorised positive, neutral, negative).

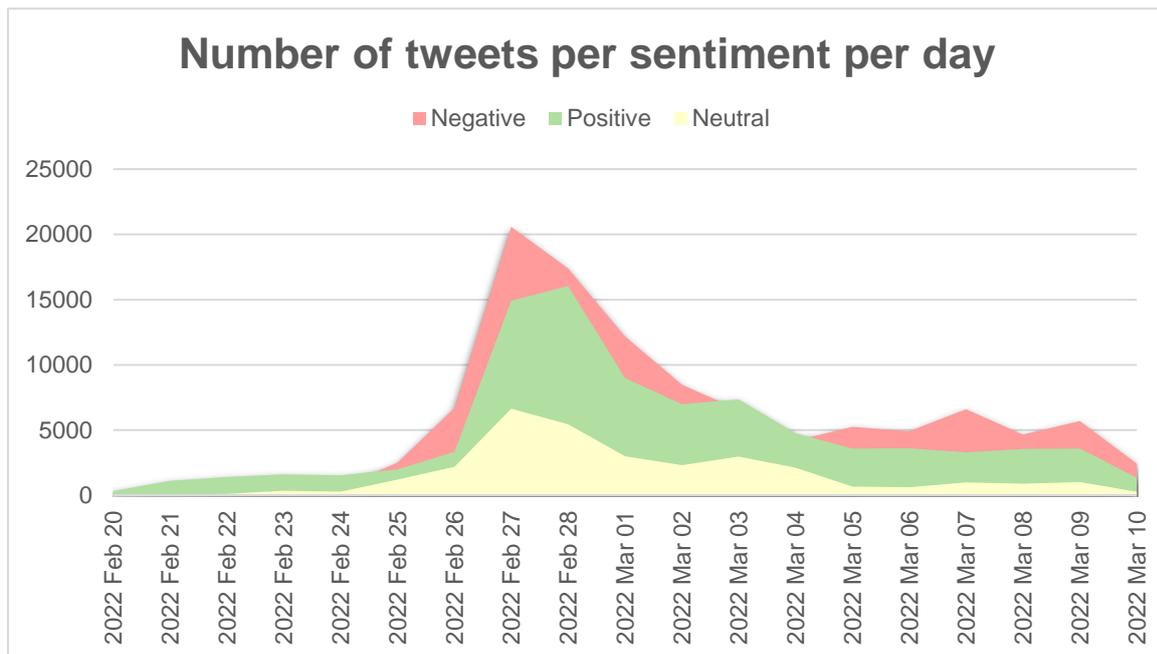


Figure 11: Number of tweets per sentiment per day

Tweets captured across the analysis period showed 48 per cent conveyed a negative sentiment, 39 per cent a positive sentiment, and 13 per cent were neutral. Negative sentiment peaked on 27 February 2022. Fear was by far the strongest emotion portrayed through tweets made during 26 to 28 February 2022. Trust was the second strongest emotion that was portrayed in the tweets analysed. The researchers noted that tweets portraying the emotion trust were associated with measures introduced to support the community. Breaking the results down across the individual days shows that the emotions of anger and sadness significantly increased over time as well. The positive posts during that time were related to community support and encouragement of people impacted by flooding.

The words that were most frequently used in the tweets were QLD, Queensland, #qldfloods, Brisbane, people, help, amp, Morrison and government. Some of the words or phrases that were most frequently used within the tweets identified as having a negative sentiment were: Qld, Queensland, #qldfloods, #auspol, BREAKING, disaster, people, Emergency, Brisbane, NSW, warning and government. Some of the words or phrases that were most frequently used in tweets identified as having a positive sentiment were: help, Queensland, QLD, amp, McKenzie, Morrison, people, Brisbane, TODAY and support.

This research provided valuable insights into how the community felt in response to the unfolding flood event. Monitoring of different communication channels during an event provides insight about which communication channels are effective, the impacts the event is having on the community, and can also inform the type of information sought by the community.

## Effective messaging

### *What is an effective message?*

Research has shown that effective warning messages should (Mehta et al., 2021, Whittaker et al., 2020, Dootson et al., 2021, Bean et al., 2015):

- a) describe the hazard or event, including the threat posed, the consequences of the hazard's impact, and how advised actions can reduce such consequences
- b) provide protective action guidance, explaining exactly how to take recommended actions
- c) specify the location of the event, stating who will and will not be affected and where people who will need to take protective action are located
- d) provide a time when people should begin taking protective action and when it should be completed
- e) state who the message is from, preferably a mixed panel of the most credible official and familiar sources
- f) be clearly worded, specific about what is said, accurate and complete in the information provided, clear, unambiguous and consistent.

Recent research has noted the difference between 'operational-oriented' warnings and 'behaviour-oriented' warnings. Operational-oriented warnings are technical and provide information about the hazard; however, they lack content that motivates adaptive behaviour. Behaviour-oriented warnings prioritise guidance content and interpret technical and operational content about the situation to specify adaptive behavioural actions that should be undertaken, including preparation to evacuate.

Whittaker, Taylor and Bearman (Whittaker et al., 2020), Bean et al (Bean et al., 2015), Dootson et al (Dootson et al., 2021) and Mehta (Mehta et al., 2021) have identified a range of features

that can be used in the development of templates and messages and contribute to the effectiveness of warnings such as:

- the use of a clear headline that reflects behaviour-linked guidance (e.g. a call to action) alongside hazard content (e.g. flood warning level)
- the use of sub-headings to support reader movement through the warning
- the personalisation of the hazard through local information, visuals, and environmental cues
- clear behavioural guidance or instructions (e.g. if the road is flooded, do not attempt to cross it).

IGEM engaged Griffith University to review seven warning messages and Emergency Alerts from this event using a linguistic technique called minimal languages approach or Clear Explicit Translatable Language (CETL).

The researchers found the messages and Emergency Alerts had many strengths; however, building small changes into some messages can make them clearer and easier to translate. Research has shown that (Bromhead, 2022, Bromhead, 2021):

- the Australian Government Style Guide recommends that public communication about disasters be written at a Year 7 level
- disaster information is often written at levels higher than recommended
- simpler texts are more easily understood by populations with high literacy levels
- many disaster messages prove difficult to translate into languages and terminology accessible and culturally relevant to CALD communities.

## Information systems

The review team found that in most cases there were few barriers in sharing information between entities during the event and that the information shared was generally of a high quality. There were also instances where information needs were addressed and collaboratively solved during the event.

Although information flow was effective overall, entities should be reminded that too much information can slow down the process of highlighting important facts.

## Incident management systems of response agencies

All three levels of Queensland's disaster management arrangements utilise information technology (IT) operating systems to manage events, share and disseminate information. At the State level, QFES and the SDCC manage disasters using the Event Management System (EMS). At the district level, the QPS utilise the Disaster Incident Event Management System (DIEMS) while at the local government level, the most commonly used system is Guardian™; however, it is noted that each local government determines the appropriate system for its area and funds its use.

The Information Exchange Platform (IXP) All Hazards Information Management System was developed in 2011 to share information between the three IT systems. At present, the IXP is only able to share Requests for Assistance (RFAs) between the three levels of the disaster management arrangements. It is noted that automatically generated situation reports informed by the three systems cannot be produced. The IXP also require users to manually integrate SES RFAs from the SES Assistance app, the SES call centre and the BCC Call Centre that

are placed in SES Task and Management System (TAMS). Should the IXP fail, RFAs are required to be managed manually through emails and phone calls.

The lack of interoperability between the three systems plus the limitations of the IXP system itself, particularly when placed under duress in high volume events, has previously been identified by IGEM in both the TC Debbie Review 2017 and the Monsoon Trough Rainfall and Flood Review 2019 and was again identified as a concern by stakeholders in this review.

#### Recommendation 14

- 14) The Inspector-General of Emergency Management recommends Queensland Fire and Emergency Services lead an inter-agency IT system assessment with Queensland Police Service and local governments to identify disaster management systems currently in use and develop options to enhance connectivity and interoperability between systems. Outputs to be considered include, but are not limited to, consideration of requests for assistance (RFA) and the production of situation reports.

## Information sharing and cooperation

### Information flow and cooperation

In undertaking the review, IGEM was required to assess the effectiveness of cooperation between all agencies for response operations at a local, district, state and national level.

There are many entities that have roles or responsibilities in the disaster management system. This includes all tiers of government, NGOs, not-for-profit organisations, disaster management groups, government owned corporations and other entities with legislated roles in disaster management.

To assess the level of information and cooperation, IGEM referred to the Standard, which identifies outcomes to be achieved for all entities involved in disaster management. Shared responsibilities are a key concept within disaster management and are defined in the Standard as (Office of the Inspector-General of Emergency Management, 2021):

*The shared responsibilities are the elements of disaster management that all entities should deliver against and that everyone within the sector is responsible for contributing to. Shared responsibilities should not be considered in isolation – they are the interconnected responsibilities that collectively make up the disaster management system in Queensland.*

In assessing the levels of cooperation and information flow during this event, IGEM invited more than 200 entities to provide a submission reflecting upon their experience of the event as it related to the terms of reference.

IGEM conducted a qualitative analysis of the information gathered through discussions held across 13 community forums, 23 local governments, and 9 state government entities, combined with the written submissions received.

Overall, entity cooperation during this event was considered to range from good through to excellent. It is encouraging that Queensland disaster management entities, on the whole, have a strong culture of sharing, whether that be knowledge, information, or resources such as staff or equipment.

### *Local level*

During the review, examples were provided of high levels of cooperation and information sharing. In addition to timely activation of the LDMG, forward planning and establishing strong relationships between entities prior to an event will assist in achieving positive outcomes. Noosa Shire Council provided a notable demonstration of collaboration and cooperation between key agencies through initiating key liaison activities with the QPS, SES and other agencies for the early deployment of emergency response personnel to known flood risk communities. As a result, Noosa Shire Council was able to gain greater situational awareness, and easier coordination of additional support and quickly establish easily accessible places of refuge for isolated community members.

The Cherbourg Aboriginal Shire Council is based 170 kilometres north-west of Brisbane and serves a population of approximately 1250 residents. It is in Wakka tribal boundaries, near the border of Gubbi territory. Flooded roads isolated the Cherbourg community for several days during this event. Advice surrounding the impending weather delivered by the local government using Facebook, email, door knocking and the community radio station 94.1FM. The advice enabled community members to purchase supplies and prepare prior to becoming isolated. This reduced the impact on and built resilience within the community.

Another example, reflective of the Council-to-Council assistance program, was demonstrated by Toowoomba City Council who provided both personnel and physical resources to affected neighbouring local governments.

### *District level*

There was a strong level of cooperation reported across the district and local levels during the event.

Numerous examples were provided where strong cooperation was reported across agencies.

- At Oakey, Queensland Health, QFES and Toowoomba Regional Council worked together and supported the precautionary and temporary relocation of aged care residents (including their safe return).
- In Brisbane, Queensland Health worked collaboratively with Brisbane DDMG and the relevant Hospital and Health Services to ensure health care needs were met at evacuation centres.
- At Noosa, SES, QAS, QFES and Noosa Shire Council worked together to ensure a heavily pregnant woman in an isolated location was transported to a place of safety.

The Department of Environment and Science (DES) advised they have agency representation on 22 DDMGs in Queensland. Due to these strong relationships and open dialogue with stakeholders, DES worked in partnership with several DDMGs and Maritime Safety Queensland (MSQ) to manage the debris removal and initial clean-up of certain waterways following this event. Additionally, there was strong communication and support provided by the SDCC to the DDCCs.

### *State Emergency Services*

The State Emergency Service (SES) is a community-based, not-for-profit, volunteer emergency service enabled by state and local government and sponsor partnerships. It has been an integral part of Queensland's emergency response for more than 47 years and helps the community to prepare for, respond to and recover from an event or disaster. There are over 5000 SES volunteers in Queensland who are trained to be ready when needed (<https://statements.qld.gov.au/statements/95177>).

In its role the SES helps communities prepare for, respond to and recover from natural disasters. It also conducts tasks such as search and rescue operations, crime scene/forensic searches, community preparedness/safety education and support for other emergency service organisations (<https://www.qld.gov.au/emergency/emergencies-services/response/ses>).

The State Emergency Service website identifies that the:

*SES assistance is provided for non-life threatening emergency situations during floods, storms or other similar events. SES also support other agencies such as Queensland Police Service and Queensland Fire and Rescue Service to perform additional functions and different types of disasters and emergencies such as:*

*Vertical Rescue; Flood Boat Rescue; Road Crash Rescue; Urban, Rural and Evacuation Searches; Emergency Traffic Management; Urban Search and Rescue; Agency Support; Incident Management; and Community Education. [State Emergency Service | Queensland Fire and Emergency Services \(qfes.qld.gov.au\)](https://www.qfes.qld.gov.au)*

The management and control of SES in Queensland is a shared partnership between local government and QFES:

- Local governments provide vehicles, depot facilities and access to information and communications technology hardware and systems. They are also responsible for maintenance and servicing of SES equipment.
- QFES is responsible for establishing management and support services for the SES and developing policies to help the SES perform its functions effectively, efficiently, and safely (Queensland Fire and Emergency Services, 2021). QFES also provide some operational equipment to SES, such as power tools, chainsaws, generators, lighting, ladders and flood boats.

SES volunteer members operate within SES units, groups and teams. An SES Unit is based within local government area and manages several groups. Within each group there are several teams. When activated these teams undertake tasks assigned by the unit.

For this event, the SES in the 23 impacted local government areas were activated. Approximately 1600 SES volunteers were deployed, with 12,782 requested tasks completed, and nearly 3,500 hours of flood boat operations. SES assistance was provided to both members of the public and other disaster response agencies. Most of the completed tasks were for storm damage operations which included temporary repairs, sandbagging and debris clean-up. Other tasks related to incident management and flood boat operations to assist with evacuation, resupply and searches.

### **Tasking of State Emergency Service**

Requests for SES assistance from the community and response agencies are recorded in the SES Task and Management System (TAMS). These requests are automatically prioritised by TAMS and allocated as tasks to SES groups, using geolocation. The tasks are then allocated to SES teams for completion. The priority of a task can be changed by an SES unit, group or team where circumstances have changed.

The SES team will update TAMS on arrival, and on completion of the task will add notes, risk assessments and photographs into TAMS via a handheld mobile device before moving to another allocated task.

The Watch Desk monitor TAMS and provide manual notification of the task if it has not been accepted by the relevant SES group; however, in large scale events, SES groups are encouraged to change their notification status to 'Monitoring TAMS'. When this occurs the Watch Desk will not contact an SES group to accept a task and will not begin monitoring until the status in TAMS is changed by the group from 'Monitoring TAMS' to 'Auto Notify', where incoming requests get channelled to nominated SES Group mobile phones by text message.

SES teams may also conduct 'jobs of opportunity'. Jobs of opportunity are additional tasks identified by SES teams while working in the field that have not already logged into TAMS. For example, a flood boat team tasked to evacuate residents from a flooded house, may identify residents in other houses who also require evacuation and there is no existing task to evacuate these additional residents. Many of these jobs of opportunities do not appear to be logged into TAMS, nor communicated by radio to the SES group's coordination centre. This situation is problematic as the identification of assisted persons, including those who are vulnerable, may not be able to be confirmed at a later time.

The advice provided by the Information Commissioner's webpage, '*Privacy flexibility in disaster management—information sharing scenarios*'

(<https://www.oic.qld.gov.au/guidelines/for-government/guidelines-privacy-principles/applying-the-privacy-principles/privacy-and-managing-disaster-events/privacy-flexibility-in-disaster-management-information-sharing-scenarios>) is that while operating in response phase of disaster (Office of the Information Commissioner Queensland, 2022):

*'The privacy principles in the Information Privacy Act 2009 (Qld) (IP Act) provide generous flexibility for disaster event managers and other Queensland public sector entities to deal with personal information in a range of circumstances as indicated below*

*Key points to note include:*

- *personal information can be used or disclosed where it is reasonably necessary to lessen or prevent a serious threat to the life, health, safety or welfare of an individual, or to public health, safety or welfare*
- *recovery efforts may not necessarily involve a serious threat to the health and safety of individuals affected by a disaster event (agencies may wish to consider utilising a consent model when sharing information for the coordination of recovery efforts)*
- *the IP Act applies to Queensland public sector agencies including the Department of Communities, and Housing and Digital Economy, Queensland Fire and Emergency Services, Queensland Police Service (QPS), local governments, and State, district and local disaster management groups*
- *other legislated restrictions about confidentiality may apply and will override privacy obligations.'*

The recording of details of persons assisted by a unit in response operations does not breach privacy.

Also, the record of work undertaken does not reflect the true extent of work undertaken by the SES.

### **Recommendation 15**

- 15) The Inspector-General of Emergency Management recommends Queensland Fire and Emergency Services review and implement State Emergency Service (SES) protocol by 1 November 2023 outlining procedures to be undertaken to ensure persons uplifted from places of immediate danger or risk are transferred to a place of safety.

**Transporting persons to safety**

At the community forums, community members shared their experiences of and gratitude for being rescued by the SES.

There have been a number of instances identified to IGEM during this review where persons who have been rescued from immediate flood danger, were left in situations without protection from the elements, without transportation and advised to make their own arrangements in order to move to a place of safety. Where persons are removed from danger or potential danger, they should be taken to a place of safety. QFES advise that, in respect to transport arrangements, the SES complies with the arrangements of the requesting agency regarding where to drop off, and for jobs of opportunity, this will be coordinated with the SES Incident Management Team, LDCC or Watch Desk. In any event a rescued person should be left in a place of safety which should form part of the overall plan.

**Recommendation 16**

- 16) The Inspector-General of Emergency Management recommends Queensland Fire and Emergency Services review the tasking protocols used to manage State Emergency Service (SES) tasks undertaken in the response phase of a disaster to enable more complete recording of details for all 'jobs of opportunity' (including the personal details of those assisted and/or rescued) to enable better coordination of tasks and reflect outcomes of activities by 1 November 2023.

**Communications in SES operations**

SES members operating in south east Queensland are equipped with hand-held and vehicle radios which operate on the Government Wireless Network (GWN) in those areas of South East Queensland with GWN coverage. A key objective of the GWN is to enhance interoperability between disaster management entities. Over 130 SES groups within the local government areas impacted by this event have GWN radios. That is to say the radios are either enabled to operate on the GWN or can be enabled to operate on the GWN. This includes groups in areas with limited or no GWN coverage as the radios retain capability for use in local operations without using the GWN. Should one of these groups be conducting operations in south east Queensland, they each have an allocated inventory of cache radios enabled to operate on the GWN for use when they are deployed. SES utilise dedicated GWN talk groups to communicate across SES units, groups, teams, and members.

Table 5 shows the SES units issued with GWN radios and the extent of GWN coverage.

It is noted that regardless of the home location of the SES unit, if members are deployed into south east Queensland, that is an area with GWN coverage, they will have a radio that operates on GWN. It is also recognised that these radios are able to operate in 'simplex' mode, within teams without utilising the GWN.

Outside of the GWN coverage area, the SES use GWN compatible radios suitable to their operational circumstances. Generally, each SES team member has a radio. The SES Team Leader is issued with two radios; one for communicating with their team and the other to communicate with the group, unit, or coordination centre.

Local Government Area SES Units	GWN Radios Used	GWN Contracted Radio Coverage	Areas where GWN Radio Coverage may be available but is outside contracted area
Balonne Shire	Yes	No	Nil
Brisbane City	Yes	Yes	N/A
Bulloo Shire	Yes	No	Nil
Bundaberg	Yes	No	Nil
Fraser Coast	Yes	No	Minimal
Gold Coast City	Yes	Yes	N/A
Goondiwindi	Yes	No	Minimal
Gympie	Yes	Yes	N/A
Ipswich City	Yes	Yes	N/A
Lockyer Valley	Yes	Yes	N/A
Logan City	Yes	Yes	N/A
Maranoa Regional	Yes	No	Nil
Moreton Bay	Yes	Yes	N/A
Murweh Shire	Yes	No	Nil
Noosa	Yes	Yes	N/A
North Burnett	Yes	No	Minimal
Paroo Shire	Yes	No	Nil
Quilpie	Yes	No	Nil
Redland	Yes	Yes	N/A
Scenic Rim Regional	Yes	Yes	N/A
Somerset Regional	Yes	Yes	N/A
South Burnett Regional	Yes	No	Minimal
Southern Downs Regional	Yes	No	Minimal
Sunshine Coast	Yes	Yes	N/A
Toowoomba Regional	Yes	Yes	N/A
Western Downs Regional	Yes	No	Minimal

Table 5: SES GWN radio issuance and GWN coverage

The Terms of Reference requires IGEM to assess 'overall coordination and deployment of personnel and equipment' ([Appendix A](#)). During an event, the SES coordination centres at the SES group level monitor operations and SES radio communications. QFES advises that if the needs of the task and situation demand it, safety measures can be initiated by an SES Group/Unit whereby situation reports can be provided at regular and set intervals. In submission and engagement, has identified a non-standard practice as teams providing situation reports to the SES group approximately every 30 minutes. The QFES Fire Communications Centres (Firecom) do not monitor SES radio communications across their dedicated GWN channels, but Firecom do monitor duress functions on all GWN channels utilised by SES. Firecom monitors SES communications when they are working alongside another QFES service to perform a task.

The current business practices do not lend themselves to operators obtaining a common operating picture if, for example, SES is tasked separately to other QFES assets during disaster deployments. This also can lead to a single task being allocated to more than one unit on different radio 'talk groups'. This most likely accounts for the information provided to IGEM through community engagement activities, relating to duplicity in tasking and broader situational awareness. This raises the question of how a common operating picture is derived.

As disaster events occur, information is received by communication centres which is to prioritise and allocate tasks to responding teams. The information contained in the tasking, and the responses provided contribute towards the overall information package relating to the task. When SES and QFES communication centres and teams are operating independently this may benefit individual team taskings, however this may come at the expense of resources having a common operating picture.

Teams working in close proximity may not have visibility of teams operating close by. They may be in possession of information pertaining to the task or conditions and may not realise the value of that information to another team. Teams may also be unaware of any duplicity in taskings or that another team is available to assist or support them if necessary. A common operating picture facilitates collaborative planning and assists to achieve situational awareness.

Keelty reported that *'The review team found that this lack of common situational awareness poses the single greatest risk to the efficacy of the disaster management system'* (Keelty, 2013).

While much has improved since then in terms of agencies working together with a shared understanding of their task and environment, opportunities to enhance the common operating picture between assets remain. To obtain synergy through a common operating picture it is important that staff who are tasking SES (whether by radio or otherwise), and other agencies working with them in disaster management operations gain a holistic understanding through a common operating picture of the event and specific identified taskings so that the right people with the right training and the right equipment are tasked to the incident.

When SES and QFES communication centres and teams are operating independently there are options for establishing a common operating picture such as a common radio net or an exchange of liaison offices. A common operating picture facilitates collaborative planning and assists to achieve situational awareness.

**Recommendation 17**

- 17) The Inspector-General of Emergency Management recommends Queensland Fire and Emergency Services adopt measures to achieve a common operating picture between deployed Queensland Fire and Emergency Services assets in disaster management operations by 1 November 2023.

*Commonwealth level*

It is important to note that under Queensland's Disaster Management Arrangements, LDMG's primarily engage and receive support from the District and State. The Commonwealth, through its relevant agency, the National Recovery and Resilience Agency (NRRA), soon to be the National Emergency Management, Resilience and Recovery Agency (NEMRRA), engages with the State to provide support when required. In the instance of activation of DRFA funding, under the Disaster Recovery Funding Arrangements, 2018 the State, through the Minister for Fire and Emergency Services is responsible for the activation of relief and recovery measures. For extraordinary assistance measures the Prime Minister and Premier agree to measures on the advice of QRA and NRRA. The Commonwealth engages through the QRA, which coordinates the flow of information from state and local authorities required to ensure swift activation of assistance.

This was the case during the South East Queensland Flood Events, NRRA provided volunteers to assist with Damage Assessments, data and information to support DRFA activations and subsequent extraordinary assistance packages were sourced through state agencies and local governments via QRA.

It is anticipated the proposed NEMRRA will build upon the established relationship with the Queensland Reconstruction Authority to support activities that enhance locally led recovery and resilience building within Queensland's well-practiced disaster management arrangements.

**Australian Defence Force**

Australian Federal government support via EMA is available if a jurisdiction has exhausted all its government, community and commercial options. EMA maintains COMDISPLAN, which governs federal non-financial assistance to Australian states and territories in an emergency or disaster. COMDISPLAN includes provision of assistance from the ADF.

Seven requests for Australian Government assistance were submitted during this event. ADF assistance was subsequently provided in the form of rotary wing search and rescue, aerial imagery, hydrographic survey and diver support, flood inundation support to local governments and planning support to the QRA. The ADF commenced its clean-up support operations across South East Queensland on Wednesday 2 March 2022 and remained active until Thursday 24 March 2022.

*Non-government organisations*

There are many NGOs that provide valuable assistance to the community when disaster events occur in Queensland. They work in partnership with government agencies and corporations to support people affected by disaster events. These NGOs provide outreach services, help with clean up and can source goods and donations to assist members of the community affected by disasters.

Examples of NGO support during the event include:

- Volunteering Queensland manages the Emergency Community Response to Extreme Weather program which links spontaneous volunteers with requesting councils and community organisations in times of natural disaster according to their needs.
- Australian Red Cross have assisted in supporting over twenty evacuation centres and recovery hubs, helped with grant applications and provided financial and emotional support to communities impacted by this event.
- Neighbourhood Centres Queensland (NCQ) collaborated with partners and government to increase community and social resilience. Neighbourhood centres were opened as recovery hubs in some of affected local government areas.

NGOs continue to build strong relationships across the disaster sector to help assist Queenslanders during times of need. Their valued support and contribution to the Queensland community during this event is acknowledged.

## Relationships

Disaster management in Queensland is a shared responsibility. The development of partnerships between and across all entities in disaster management helps strengthen relationships providing the foundation for effective communication and cooperation. This is especially important in the response phase of an event.

Participation, whether actual or virtual, in regular training exercises, meetings, debriefings and community events help establish and maintain the relationships between disaster management stakeholders and the community. These enablers also provide opportunities for mentoring, learning and succession planning, and the development of arrangements between partnering entities (Standard for Disaster Management in Queensland, Outcomes 12 and 13).

These relationships enabled response agencies and Local Governments to share resources and provide a surge capability when needed. Relationships with NGOs and similar service providers are also important. These strong relationships enabled support to be directed to impacted communities during this event. Some examples are:

- Local governments shared evacuation centre trailers, provided support staff, plant and other equipment and assisted with road closure management.
- Liaison officers from neighbouring local government areas, including New South Wales, were present in LDMGs sharing real time information about the changing environmental and weather conditions. This joint effort reflects the application of shared responsibility and drives the outcome the response required.

### *Impact of technology on relationships*

The use of technology to conduct meetings, briefings and provide information to disaster management stakeholders has increased. This became the preferred method of communication for many workers who had been working from home due to the impact of the COVID-19 pandemic and isolation due to road closures and other impacts from previous cascading rainfall events. Entities who had adopted this technology during COVID-19 adapted and extended virtual meetings during this event to include LDMG meetings and enable responses to developing incidents.

The use of platforms designed to facilitate these meetings has created efficiencies, saved time and alleviated challenges such as isolation, enabling a coordinated response to this event across entities.

*Agencies representatives with multi-disaster management group responsibilities*

There are 101 disaster management groups throughout Queensland, comprised of 78 LDMGs and 23 DDMGs, the SDCG and QDMC that other agencies may be required to support in times of disaster. To meet their responsibilities, smaller agencies often appoint a single member as their representative on more than one LDMG or DDMG. During a disaster where multiple LDMGs and DDMGS are simultaneously activated (as was the case in this event), the ability for smaller agencies to attend and inform each group can be difficult. This can be ameliorated through sound contingency plans between agencies and disaster management groups.

**Elected representatives**

As part of the review Terms of Reference, IGEM was required to assess the timing and effectiveness of information provided by LDMGs to elected representatives.

IGEM wrote directly to Federal and State elected representatives seeking submissions and/or information they may wish to provide to assist with the review. 21 (19 per cent) of the 111 elected representatives that were contacted provided information to the review by way of submission, letter, or email. Various issues regarding the event were submitted with communication of information to the community being raised by 14 (12.5 per cent) elected representatives. The provision of information to elected representatives from LDMGs was raised in 6 (5.5 per cent) submissions. These concerns were related to access and timeliness of relevant information.

As previously identified, some elected representatives have legislated roles and responsibilities under the disaster management arrangements. No concerns regarding the flow of information to these representatives were raised.

During this event, the chair of the QDMC invited Mayors to attend a number of meetings. This practice supports the delivery of relevant and timely information to elected officials.

Most local governments have protocols in place for communicating and sharing information to their local councillors.

**Elected representatives assist with information flow**

During a disaster, elected representatives can play an important role in promoting consistent messages to, and advocating for, their community. They can also support the flow of information to a disaster management group by sharing community sentiment and community intelligence during an event. Two examples are:

- The development of a resource package by Ipswich City Council to assist elected representatives to be aware of disaster roles and responsibilities and how they may advocate for and support their community.
- DCHDE distributed information packs during the event to mayors and state elected officials in areas where grants under the Personal Hardship Assistance Scheme had been activated. DCHDE also created a liaison officer for elected representatives to facilitate the flow of information about support for their community. This helped key information reach the community during the event.

## **Border community cooperation**

The Border Regional Organisation of Councils (BROC) was established around 1995, to enable local governments from both sides of the Queensland/NSW border to work together more effectively. In Queensland, the BROC extends along the state border from Southern Downs Regional Council to Bulloo Shire Council. The BROC is administered by a constitution, which outlines the governance and structure of the organisation. The BROC objectives include providing a forum for members to consider and discuss matters affecting the region and ensuring the sustainability of the region through contributing to the effectiveness of all members.

Current members are:

- Balonne Shire Council
- Bulloo Shire Council
- Goondiwindi Regional Council
- Gwydir Shire Council
- Inverell Shire Council
- Moree Plains Shire Council
- Paroo Shire Council
- Southern Downs Regional Council
- Tenterfield Shire Council
- Walgett Shire Council.

During this event the BROC supported members and their LDMGs in the response phase through enhanced border community relationships, which greatly assisted in information-sharing, disaster management briefings and resource availability. The disaster management benefits associated with the BROC have been identified as providing a platform to discuss cross-border disaster management matters. Thereby enabling a briefing capability for all groups associated with the BROC, which provides continuity of information and identifies potential resource-sharing opportunities. These activities support educational and situational awareness on disaster management systems and processes used across the region.

IGEM notes that DTMR also has a close working relationship with Transport for New South Wales in respect to the operation of the Tugun Bypass Tunnel and other cross-border routes. Arrangements are in place to ensure consistent traveller information on both the NSW Traveller Information webpage Live Traffic and TMR's QLDTraffic.

It is understood that other border local governments are also exploring the establishment of a disaster coordination group liaison between Queensland and NSW. The positive relationships established via the BROC has proven to be of benefit over past disaster events, in developing a shared understanding of the risk and operational support.

Another state border arrangement is in place aimed at improving relationships and cooperation between Queensland and NSW. The Logan DDMG, worked with its cross-border counterpart, the NSW Regional Emergency Management (REM) Committee and engaged a liaison officer from the REM Committee to the Logan DDMG, to enhance the response to border communities through a shared understanding of the information and risk, provision of an enhanced coordinated response, and mutual support. This enabled the exchange of information, and coordination of resources and actions between disaster management agencies on either side of the state border.

## Brisbane River management

During the 2011 flood event a multitude of vessels, pontoons, building infrastructure, debris and other large, untethered items were pushed by the flood waters downstream in the Brisbane River. During the 2022 event, the redesigned Brisbane Riverwalk and ferry terminals withstood the flooding for the most part; however, many large items broke free and floated downstream reaching the mouth of the Brisbane River, in some cases reaching open water where they not only posed a threat to maritime safety but also to the environment. Pontoons were located washed up on beaches both north and south of the Brisbane River, including at Noosa North Shore and K'gari (Fraser Island). MSQ recovered more than 6,700 tonnes of debris from the Brisbane River. This included 40 pontoons and 60 vessels deemed as salvageable. By 1 April 2022, MSQ had returned 48 of the 100 items recovered to their owners.

There are currently no state or Commonwealth regulations requiring the identification of pontoons linking them to their owners. IGEM was advised, by both responsible agencies and the community, of the need for pontoons to be identifiable so they can be returned to owners, and salvage and other costs potentially recovered. Pontoons breaking up and spreading polystyrene particulate matter across waterways and beaches raised concerns around environmental damage. LGAs, along with MSQ, DES, private contractors and community volunteers, undertook the task of cleaning up the debris.

In May 2022, MSQ established and now chairs an inter-agency working group to address pontoon-related issues. This working group is investigating new whole-of-life standards for pontoons, including identification, flood restraints and a review of materials used to reduce and contain waste in future events. MSQ and partnering agencies are to be commended for this initiative. It should be noted that IGEM was considering a recommendation in this regard, however based on the proactive work being undertaken a recommendation is not provided and IGEM looks forward to the outcomes of the working group.



*The Brisbane River at West End. (Image courtesy of ABC News: Grant Sherlock)*

*Brisbane River stakeholder engagement*

**Lower Brisbane River Communications Protocol**

Following previous weather events, the Lower Brisbane River Communications Protocol (LBRCP) was created, designed to disseminate information into a community of practice which includes the Bureau, Seqwater, BCC, Somerset Regional Council, Lockyer Valley Regional Council, and Ipswich City Council.

The protocol informs agencies on weather events affecting the Brisbane River and ameliorates confusion by delivering a single operating picture across agencies. As part of the protocol, the agencies meet annually and run exercises based on the involved stakeholders' needs:

- In November 2020, Exercise Cascade was undertaken, which focused on identifying single points of failure and cross-agency dependency.
- In December 2021, Exercise Black Swan focused on a 1 in 10,000 Annual Exceedance Probability (AEP) flood, measured at the Brisbane City gauge, and its potential impacts to the lower Brisbane River catchment. These exercises involved the members of the LBRCP, as well as other agencies such as QRA, QFES, the QPS and DES.

**The event**

The LBRCP met 25 times between 22 February 2022 and 9 March 2022, with their meetings increasing in frequency during the peak period over the weekend of 27 and 28 February 2022.

As per the LBRCP governance structure, the Bureau provides the agenda for these meetings to the relevant stakeholders. The aim of the meetings is to coordinate communication and information sharing during flood operations. The meetings enabled stakeholders to adjust and regroup due to the dynamic nature of the event. The Bureau provided Flood Scenario reports to entities throughout the event, which contained flood modelling information. These meetings provided weather intelligence to allow entities to make informed decisions about their next actions during the event.

**Port of Brisbane**

The Port of Brisbane is located at the mouth of the Brisbane River. It has 29 operating berths including nine deep-water container berths and three deep-water bulk berths as well as 17 bulk and general cargo berths. In total the port facilitates more than 2,600 ships each year and transports more than 28 million tonnes of cargo each year.

During the event, due to the identification of significant safety factors caused by high-velocity flood waters in the Brisbane River, the Port of Brisbane was closed by MSQ, and oil tankers and ships waiting offshore were restricted from docking and loading and unloading cargo. The resources held on the tankers included vital crude oil supplies destined for the nearby refinery.

The decision to close the Port of Brisbane was not made lightly. MSQ is acutely aware of the supply chain impact of closing the Port of Brisbane. Safety factors that influenced the decision included large floating debris, river depth changes, and broken or destroyed maritime beacons, all of which required remedial action before port operations could recommence.

In order to identify hazards and maintain a suitable, safe depth for the passage of vessels, MSQ obtained support from the Royal Australian Navy to conduct hydrographic surveys and hazard/object identification of the Brisbane River. This ADF support enabled the Port of Brisbane operations to recommence as quickly as possible. In addition, BCC provided MSQ with river velocity mapping (via the Brisbane DDMG), which supported vessel pilots practising required manoeuvres on ship simulators that had incorporated current river conditions. These

activities led to the Port of Brisbane operating under constraints one-week post-event, with the port progressively opened up within three weeks to full 24/7 operations.

The review observed there were many valid but competing interests regarding shipping movements and priority at the Port of Brisbane. Stakeholders were concerned about shipping schedules, with up to 50 ships requiring docking, which placed significant pressure on the Harbour Master's office. This included pressure to prioritise crude oil tankers so the Brisbane oil refinery could continue operating. Once operations began, all shipping movements at the Port of Brisbane were prioritised and undertaken based on safety and good practice.

Opportunities exist for agencies with a critical stake in the operation of the Port of Brisbane to continue to work collaboratively with each other to address the complexities surrounding these competing interests. Greater improvements are gained when agencies address broader impacts and stakeholders in the development and exercising of their plans. Exercises also maintain and aid in developing stronger working relationships and networks, support continuous improvement in disaster management planning and build resilience through a shared understanding of risk.

**Keeping the supply chain moving**

As outlined above, MSQ reopened the Port of Brisbane a week after the event through careful planning around safety considerations and operational constraints and consulting up to 100 stakeholders to determine shipping priorities. Through this measured, systematic approach, MSQ safely managed a backlog of up to 50 vessels to resume port operations.

Before reopening the port, MSQ tested its reopening plan using Smartship Australia to simulate the departure and arrival of a vessel during flood conditions. The simulation was created using the shipping, Port of Brisbane, and environmental models. The environmental model was created by using data from Seqwater dam releases, the Bureau's weather forecast, and data from environmental sensors. Drawing in information from a range of authoritative sources enabled MSQ to build a fuller picture and consider all relevant safety factors and operating constraints.

*Brisbane River Catchment Flood Study*

Managing riverine flooding requires an understanding of what flooding may occur and how it can affect the community. The *Queensland Floods Commission of Inquiry* (Holmes, 2012) recommended a catchment approach to assessing flood risk for the Brisbane River. In 2017 the Brisbane River Catchment Flood Study (BRCFS) was released, providing a catchment-wide assessment of flood behaviour (<https://www.gra.qld.gov.au/brcfs/brisbane-river-catchment-flood-studies>). The BRCFS was undertaken by the Queensland Government in partnership with Seqwater, BCC, Ipswich City Council, Somerset Regional Council and Lockyer Valley Regional Council and included two major components:

- The hydrologic assessment investigated how combinations of rainfall, dam levels, ground conditions and tide influences could merge to create potential flood events within the floodplain. This assessment considered the entire Brisbane River catchment (including the Lockyer Valley and other regions outside of the Brisbane River floodplain).
- The hydraulic assessment used the data inputs from the hydrologic assessment to model how flood waters progressed through the Brisbane River floodplain, taking into account terrain characteristics of rivers, creeks and floodplains, and infrastructure such as bridges, stormwater networks, dams and levees. The hydraulic assessment models the lower Brisbane River downstream of Wivenhoe Dam.

Following the BRCFS, the Brisbane River Strategic Floodplain Management Plan (Strategic Plan) (Queensland Reconstruction Authority, 2020a) was developed to provide a framework for the consistent approach to managing flood risk across the floodplain. The intent of the Strategic Plan is to ensure residents, businesses, community groups and governments work together to better manage flood risk and strengthen the resilience of communities, economy, infrastructure and the environment.

The plan provides a framework for the four local governments (and other entities) to strategically assess and develop regionally consistent approaches to improving community resilience to the impact of future floods.

QRA coordinates the implementation of actions arising from the Strategic Plan, which includes each of the four participating local government areas developing their own Local Floodplain Management Plan.

Collaboration at a whole-of-catchment level is consistent with a shared responsibility and guidance from the local plans will enhance the effectiveness, integration and consistency of these local approaches and contribute to community resilience.

### Road closures



*Image of road closure signage and road flooding. (Image credit: Gympie Regional Council)*

The Queensland road network (including toll roads) is primarily made up of state-controlled roads and local controlled roads. State controlled roads are the responsibility of DTMR. Locally controlled roads are the responsibility of local government.

A theme that emerged during the review was the challenge of managing road closures during this event, which included verification of the road condition, the physical closing and opening of the road, and related community messaging. Entities expressed concern about community

members regularly not complying with road closure signage. They also questioned the effectiveness of the messaging about the dangers of driving on flood-affected roads during the event.

This event resulted in 876 local road closures and 482 state road closures due to flood water flowing across roads or damage to the road system being provided as traveller information through QLDTraffic. The location, nature and timeframes required to safely close these roads varied, depending on the type of rainfall, the degree of flooding and damage that occurred. Many local governments reported flood waters rising and falling multiple times in the one location over the course of the event. Consequently, it was not uncommon for local governments to remove road closure signs, only to have to return a short time later to re-install the signs. To further exacerbate this situation, some local governments had exhausted their supply of signs and barricades as they had been deployed across their road network; yet they still had a growing number of roads being impacted by flooding. In some cases, it was not possible to have personnel attend to sites due to safety concerns. Multiple submissions identified local governments and other agencies working cooperatively to best manage road closures within this rapidly changing and challenging environment.

Road closure delays were also compounded by the weather conditions, staff being required to attend to other high priority disaster-related tasks, the impact of the COVID-19 pandemic on staffing levels, and staff being personally affected by the event. Such challenges meant in some areas the focus was directed to high usage roads, for example ones that allowed transit through communities.

Rapidly changing conditions in events such as this event make the timely recording of road closures at state and local level very challenging. In response to such challenges, DTMR started a policy framework review of temporary restrictions/road closures on state-controlled roads due to wet weather and flooding in May 2022. The focus on this was on the operational component of the framework, and how best to support all stakeholders to achieve operational efficiencies, provide decision support, remain contemporary and support modernisation. In addition, one local government is re-evaluating its road signage terminology and compliance of road signage guidelines. Signage on roads in the local government's area include 'road closed', 'water on road' and 'flood water'. The local government is considering updating its signage to effect behavioural change to enhance compliance with signage and deter driving into flood water. Sadly, in this event alone 13 people lost their lives, when vehicles they were travelling in drove on flood impacted roads into flood waters. These events are currently with the Coroner and are out of scope for this review.

There is an expectation for road closure information to be readily available and accurate. The provision of this information is not only of benefit to the community but also to emergency service personnel and agencies responsible for critical infrastructure.

Many local governments publicly record road closures via their disaster dashboard. Some local governments also relay road closure information to subscribed members via an opt-in service that delivers an SMS to a subscriber's mobile phone. The implementation of automated road closure systems at sites that frequently flood is another piece of technology utilised by some local governments to inform motorists. This removes the necessity to manually close those roads. In some instances, when signage at these sites is activated, the road closure advice automatically appears on the relevant disaster dashboard and sends a message to subscribers. This information is also provided to DTMR's QLDTraffic system.

The QLDTraffic website and smartphone app, as well as the 13 19 40 phone service, provides an overview of road conditions in the state allowing motorists to plan their journeys, including

the optimum route, before departure. The website is operated by DTMR. QLDTraffic provides information about alerts regarding events, route directions, road closures and road works.

While DTMR maintains information on road conditions and road closures of state roads, it also sources road conditions and closures for locally controlled roads from the relevant local government. There are several ways for this information to be incorporated into the state system. It can be achieved through an account access portal operated by a local government directly into the DTMR system or via localised protocols such as email and telephone. The most common method involves the transfer of this information via Guardian™, which automatically transmits the data to DTMR. Data from QLDTraffic is then shared for use by external parties such as the Royal Automobile Club of Queensland (RACQ) for their webpages.

Opening or closing a road in the QLDTraffic system requires verification by DTMR or a trusted and approved source. This is to ensure the information is accurate before publication. DTMR advised verification can be undertaken in several ways, including via CCTV, or via the QPS, road crews and intelligent transport systems such as flood gauges. Where alternate verification avenues are not available, DTMR personnel are required to verify the condition of the road in person. On a number of occasions alternate verification avenues were not available and the response by DTMR personnel to the various locations was hampered due to the magnitude of the event and flood-related constraints (e.g. safety), resulting in the verification process being delayed. Some stakeholders expressed a view there should be a review to consider the introduction of an additional road status of 'unconfirmed' for roads that have not been verified as safe to travel on. This would provide a warning to the community that road conditions are unknown, drive to the conditions and not to drive through flood waters.

The local governments that used Guardian™ to integrate their road data with DTMR, did not raise any issues regarding data being transferred; however, that did not mean all the provided data was complete or accurate. One local government advised that it embeds road network staff in the DTMR Traffic Management Unit during events to ensure a shared understanding of the road conditions, which is then provided to the LDCC. The local government is integrated closely with DTMR road systems and cameras, and it displays a hazard map on the disaster dashboard; however, in significant events they acknowledge the mapping can be very busy and difficult to interpret. In events where flash flooding may occur, travel that is not essential should be reconsidered. Local knowledge of alternative routes allows early self-evacuation to occur.

Those local governments that do not use Guardian™ have an alternative process to update road closures, which are individually negotiated with DTMR. For example, in 2006, Brisbane City Council and DTMR jointly established the Brisbane Metropolitan Transport Management Centre (BMTMC). The BMTMC is the transport management centre for the greater Brisbane area. It services road users and public transport patrons 24 hours a day, seven days a week. During the event the BMTMC uploaded data in respect to road corridors of significance, due to the sheer volume of information available.

Through the community forum conversations, it was apparent that the community does not distinguish between state and locally owned roads. Forum participants expressed a desire for clear, timely, collated road closure information. They also sought greater visibility of signage, including warnings and detours where possible.

DTMR is currently finalising a staged technology roadmap to further develop external facing Traveller Information Systems, which subject to funding, should address this matter. IGEM is aware that an update to the QLDTraffic app has already occurred, which appears from initial review to have noticeable changes and enhancements. Furthermore, DTMR advises that it is

in the process of evaluating the concept of an 'unconfirmed' road status which forms part of the staged roadmap.

There should be regular reviews of information that is being pushed to the community pertaining to the incident. Where a review reveals the situation has not changed and the original information stands as accurate then the time / date stamp should be updated to reflect a review of the information was undertaken. This will enhance confidence in the system.

### *Evacuation centres*

Planning around evacuation centres or similar places of safety was raised in community forums relating to the location of some centres which the community felt did not correlate with the impacted community's location. They identified that evacuation centres were either too detached or remote, or due to road closures were not accessible. As a consequence there was an emergence of organic places of refuge. There are opportunities for evacuation centres to be more accessible, clear of danger (e.g. flooding) and located in closer proximity to impacted communities. This is seen as good practice and aligns with the Standard, as it plans and manages risk to reduce the impact of disasters and response operations on the community.

Local governments and other agencies are encouraged to utilise *The State guideline: Flood evacuation route improvements* and supporting materials located on the QRA website. This provides guidance on a process to support the identification of 'fair and reasonable' flood evacuation route improvements in Queensland. It outlines an options assessment process that supports decision making in relation to flood evacuation route improvements. It can be used to inform flood risk management activities and has been designed to be used by local governments, state agencies and Queensland's disaster management groups. Additional information relating to this guideline is available on the QRA website (<https://www.qra.qld.gov.au/resilience/flood-resilience/flood-evacuation-route-improvements-state-guideline>).

## **Essential services**

### *Electricity*

In times of disaster, such as floods, energy providers isolate power from community sectors for reasons of safety, both for community members and disaster first responders. This is also undertaken to protect energy provider assets from long-term damage. Attempts are made to keep the level of impact to the community to a minimum. Sometimes, for these safety reasons, including rapid onset of events, there is insufficient time for energy providers to provide advance warnings about impending power outages. It is acknowledged this has the potential to create significant impacts for community members, businesses and first responders.

Energy providers deliver public communication through the outage finder available on the Energex and Ergon websites. The community is able check the electricity status for their location on these websites, or by calling their 24/7 hotline. Energy providers also provide agency updates to the SDCC in relation to the number of outages including key locations, as well as network restoration updates.

As community expectations have shifted there is a desire for more information to be 'pushed' to the community from authorities across multiple channels, i.e. social media, text messages, etc. Energy Queensland informed IGEM that community safety was a key focus of both its proactive and reactive public communication activity during this event. Community messaging was provided via traditional news media (television, radio, print and online) as well as social

media and included network impact and restoration updates as well as key electricity related safety messages.

### *Water*

As a resilience strategy, IGEM was advised that Queensland Urban Utilities and local governments have mitigation policies in place in flood prone areas. For example, with water pumping stations impacted by flooding, power is turned off and the switchboards removed. Following the event, the facility is washed out, switchboard reinstated, and power turned on. IGEM notes that where communities are geographically isolated over a large LGA, it can present challenges in relation to maintaining consistent water distribution and sewage.

IGEM was advised that for the Mt Crosby (East Bank) Water Treatment Plant, DTMR worked collaboratively with Seqwater and undertook remedial action to restore vehicle access through the severely impacted Pullenvale and Moggill Roads intersection. This enabled heavy vehicles to deliver water treatment chemicals and enable Seqwater to reinstate the East Bank Water Treatment Plant.

### *Emergency supply*

Under the PPRR guideline, emergency supply is the acquisition and management of emergency supplies and services in support of disaster operations. IGEM notes several LDMGs undertook emergency supply activities throughout this event. As an example, Scenic Rim Regional Council noted that minor rain events prior to the February and March event helped to enhance a sense of preparedness in the community. The township of Flying Fox had previously experienced isolation due to rain events and responded by constructing a temporary flying fox to ferry urgent supplies across a flooded creek.

Somerset Regional Council also advised a local community member, assisted by QPS personnel from Moreton Bay, used a drone to deliver necessary medical supplies to Kilcoy. The same occurred in Lockyer Valley Regional Council, where medical supplies were delivered by drone to the community with the assistance of QFES.

## **Data sharing constraints**

Privacy obligations apply whenever a Queensland government agency deals with personal information, i.e. information about a living person who can be identified directly, or reasonably indirectly from the information.

Some entities identified barriers to sharing data as a result of privacy concerns. In one case, in order to ensure privacy obligations were met, data was re-collected to ensure consent was gained in a manner in which it could be shared. There are valid concerns that obtaining data a second time might increase the risk of retraumatising a person and delay connecting that person to the services they need urgently.

Concerns regarding the sharing of data between entities have been raised previously. This resulted in the IGEM initiating work with the Office of the Information Commissioner to provide guidance. IGEM is also aware that functional recovery groups have identified this issue and requested similar advice. Since this work was undertaken, and prior to the South East Queensland Rainfall and Flooding Event, IGEM has been informed of a further instance where the sharing of particular information to disaster management stakeholders was affected by privacy related concerns.

The Office of the Information Commissioner Queensland has made available on their website a guideline 'for public service officers who need to use, disclose, or access personal

information in a disaster or emergency event.’ There are flexibilities within the IP Act that allow for information to be exchanged during a disaster event without compromising the privacy of that information once the event has been ‘dealt with’.

The single most relevant privacy exemption in disaster events is identified in the Information Privacy Principle 10, Information Privacy Principle 11 and s 33 of the IP Act, which allow dealings with personal information where:

*... the agency is satisfied on reasonable grounds that the [dealing] is necessary to lessen or prevent a serious threat to the life, health, safety or welfare of an individual, or to public health, safety or welfare’.*

Additionally, disclosure of personal information may be required by law, e.g. authorising provisions within emergency management laws or where an individual provides their consent for their personal information to be provided which is the strongest permission.

IGEM recognises the importance of sharing data in disasters, particularly when the event is transitioning from response into the recovery phase. It is noted by the Information Commissioner that ‘recovery efforts may not necessarily involve a serious threat to the health and safety of individuals affected by a disaster event and agencies may wish to consider utilising a consent model when sharing information for the coordination of recovery efforts.’ In considering a consent model, it is noted that where consent is sought in advance of a disaster event it will not breach privacy principles (Office of the Information Commissioner Queensland, 2022).

Entities that collect personal information during a disaster event may wish to consider a consent-based model (either pre-event or during an event) for improved outcomes for the community.

## Dam operations

### *Referable dams*

The regulation of referable dams in Queensland is provided for by the WS (SR) Act, which is administered by DRDMW (Queensland Government, 2022b). The WS (SR) Act also establishes the role of the Dam Safety Regulator (DS Regulator) (where the regulator is the chief executive in accordance with s 10).

There are currently 107 referable dams in Queensland.

A dam is referable (in accordance with s 341 of the WS (SR) Act) if a failure impact assessment of the dam demonstrates there would be two or more people at risk if the dam was to fail. All referable dams have an approved Emergency Action Plan (EAP) in place. Referable dams do not include structures that store hazardous water and other materials that may have potential environmental impacts (refer to Environmental Dams).

While the DS Regulator is responsible for regulating the safety of referable dams, dam safety remains the responsibility of each dam owner. In accordance with s 352P of the WS (SR) Act, it is noted that the DS Regulator collects information on testing of EAPs in October of each year as part of the wet season preparedness activities.

DRDMW reported that prior to the event all referable dams in the state had appropriate emergency response and dam operations documentation in place and all dam owners had completed wet season preparedness activities.

During the flood event 32 referable dams were affected. No major dam safety issues were raised at any of these 32 dams, despite some experiencing a flood of record.

Following an emergency event, all referable dam owners are required to provide the DS Regulator with an Emergency Event report. These reports identified post event repair and maintenance schedules including recommendations to allow EAPs to deal with similar future flood events more effectively. Following receipt of these reports, the DS Regulator observed that there had been a consistent underestimation of forecast rainfall intensities throughout the event. A project to better integrate the use of rainfall forecasting into gated operations decision-making during floods is being considered.

**Emergency Action Plans**

The WS (SR) Act outlines the information that must be contained within all EAPs and also establishes the approval and consultation process between agencies. To further assist dam operators develop their EAPs, the DS Regulator provides an EAP for Referable Dam Guideline (the RD Guideline) that is available online (Dam Safety Regulator of Water Division Department of Regional Development, 2021).

As noted in the RD Guideline, the EAP is a standalone plan detailing the actions to be undertaken to minimise the risk of harm to persons or property if a dam hazard event or emergency event for the dam occurs (refer to s 352E(2)). The EAP is implemented by the dam owner.

The purpose of an EAP is to identify each of the hazards that could become a dam hazard event and escalate to an emergency event. Dam hazards may include such events as flooding within the dam catchment resulting in an increase in the dam storage level and spillway discharged, embankment stability hazards and seepage.

It is acknowledged that the complexity of each EAP is directly related to the circumstances of each referable dam and the impact the dam has on downstream communities.

There are a number of steps that must be completed before the EAP can be submitted to the DS Regulator for approval. Those steps are outlined in Figure 12, which is also found in the RD Guideline.

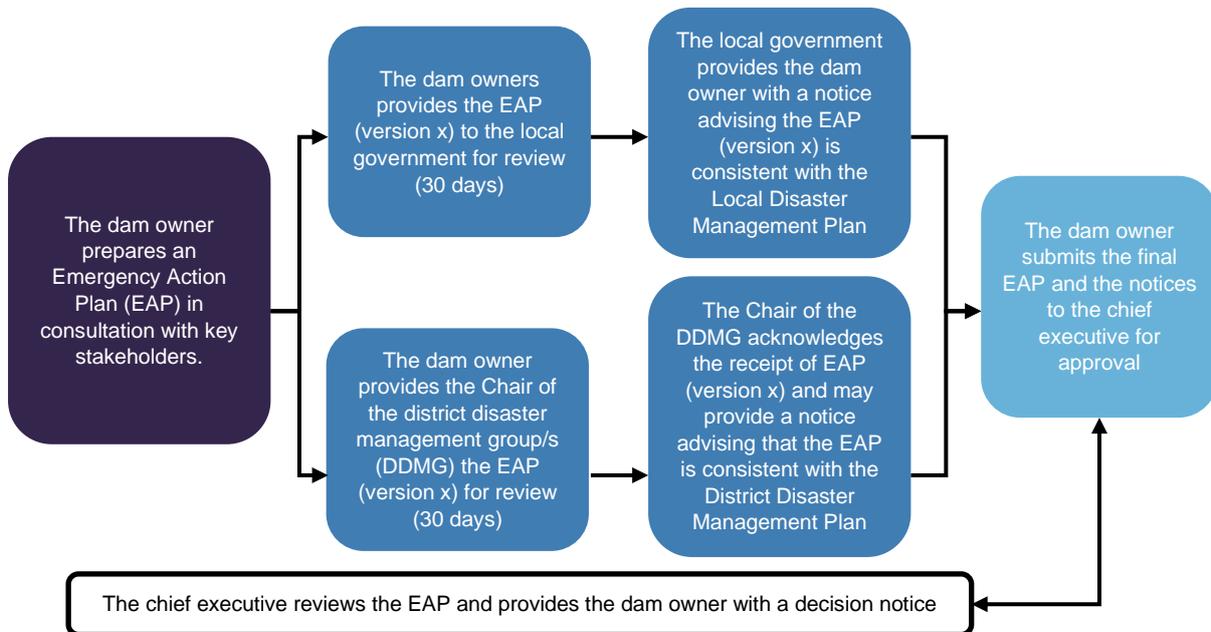


Figure 12: EAP workflow approval process

It is clear that the legislation contemplates both the local government and DDMG reviewing the draft EAP. The purpose of the review is to consider whether the EAP is consistent with each local government and DDMG’s disaster management plan.

It is a requirement of the WS (SR) Act that local governments provide a response; however, there is no requirement for DDMGs to respond.

**Dam hazard events and emergency events**

Both ‘dam hazard events’ and ‘emergency events’ are defined at s352A of the WS (SR) Act (see also Table 6).

Both definitions also rely upon the definition of dam hazard, which is defined in the WS (SR) Act as:

*... a reasonably foreseeable situation or condition that may either cause or contribute to the failure of the dam, if the failure may cause harm to persons or property; or require an automatic or controlled release of water from the dam, if the release of the water may cause harm to persons or property.*

Dam hazard event	Emergency event
An event arising from a dam hazard if:	An event arising from a dam hazard if:
Persons or property are at risk of harm due to the event and	Persons or property are at risk of harm due to the event and any of the below apply
Actions undertaken by dam owner are unlikely to require a co-ordinated response involving two or more relevant entities identified below	Actions undertaken by dam owner are likely to require a co-ordinated response involving two or more relevant entities identified below.
The event is not an emergency event.	The event is arising from a disaster situation declared under the DM Act 2003.
	An entity performing functions under the State Disaster Management Plan may, under that plan, require the owner of the dam to give the entity information about the event.

Table 6: Event definitions

The ‘relevant entities’ are defined at s 352A are:

- *‘The persons who may be affected, or whose property may be affected, if a dam hazard event or emergency event were to happen for the dam;*
- *Each local group and district group for the EAP;*
- *Each local government whose LGA may be affected if a dam hazard event or emergency event were to happen for the dam;*
- *The Dam Regulator;*
- *Another entity the owner of the dam considers appropriate’ (e.g. the QPS)*

### **Annual review of EAPs**

In undertaking the annual review of the EAP each year, the RD Guideline states (at page 29) *'dam owners should consider:*

- *contact details and prioritisation of relevant entities, including the PAR are correct*
- *currency of flood inundation models and associated maps*
- *approved or proposed residential and/or commercial development downstream of the dam*
- *wording and frequency of notification and warning message are relevant*
- *if the pre-prepared EA System GIS polygons are appropriate, tested and lodged with the QFES*
- *if the EAP is consistent with the disaster management plan(s)*
- *content from any Emergency Event Reports (EER) that were submitted for the dam in the previous 12 months*
- *learnings from EAP training scenarios.'*

### **Dam impact upon the community where dam failure is not a consideration, e.g. spillway overflow**

It is clear from a review of the legislative framework that exists and the operational documents that have been developed, that where dam failure is the catalyst for the emergency action plan to be activated, there are significant systems in place and there is clarity of process and ownership of responsibilities to ensure that all relevant stakeholders are informed in a timely manner to ensure informed decision making can occur.

However, in undertaking this review concerns have been identified with respect to the ability of the system to manage an event where dam failure is **not** an issue but where dam management may impact upon the event.

This issue is most clearly highlighted by the example of the impact the spilling of Enoggera Dam had on the flood response.

### **Enoggera Dam example**

Enoggera Dam is an un-gated dam, which means that when it reaches maximum capacity, water flows over the spillway and out of the dam and into Enoggera Creek downstream. The dam has a two-level spillway. The lower level has two rectangular culverts that tunnel under the concrete crest. When the supply level is reached, water flows through the culverts and out of the dam. The upper spillway has a concrete ogee crest. During major floods, water will also flow over the upper spillway.

All un-gated dams help mitigate flooding to some extent. The peak outflow from an un-gated dam during a flood event is less than the peak outflow that would have occurred had the dam not been built. This means that water flow slows down as floods pass through the dam. It is noted that Seqwater, the dam owner, provides an opt-in alert system that community members can sign up to receive free dam release/spill notifications.

### **Application of legislation**

Water spilling over the spillway of an un-gated dam is unable to be controlled. When the issue of control is considered against the legislative definition of 'dam hazard' (as defined at s 352A of the WS (SR) Act)—namely *'a dam hazard is a reasonably foreseeable situation or condition*

*that may require ... an automatic or controlled release of water from the dam, if the release of water may cause harm to persons or property*—consultation with key stakeholders has identified they lack clarity with respect to whether this scenario would fall within the definition of a ‘dam hazard’ (Queensland Government, 2022b).

The current legislation requires the mutual agreement and acceptance of the contents of an EAP including responsibilities for notifications and response during events. This reflects the individual circumstances at dams that will heavily influence roles and responsibilities. However, feedback received during the review process identified that greater clarity, in relation to scenarios where dams are un-gated and are spilling, may assist.

In order to manage the risk and ensure there is a shared understanding in accordance with the shared responsibilities outlined in the Standard, policy direction provided by the Dam Regulator as part of the EAP annual review process, that contemplates the differences between gated and un-gated dams and the resultant ‘dam hazard’ and the responsibility that flows from that point from a disaster management response would assist. This could then be applied within the EAP to ensure a clear and co-ordinated approach was identified prior to any event and could also be exercised.

### The February–March 2022 event

As noted previously, the flood event experienced in February–March 2022 was different from other floods experienced in the south east corner of Queensland. There were many factors that contributed to the flood event including, but not limited to, the already soaked grounds, the amount of rain that fell below the catchment area, the impact of creeks and tributaries overflowing as well as the release of water from dams.

Enoggera Dam experienced a Flood of Record during the event. The peak lake level was 81.39 metres Australian Height Datum (AHD). In accordance with the EAP, the Lean Forward emergency condition level was reached and activated at 12.02 am on Saturday 26 February 2022. Multiple sources acting in combination influenced the flooding in Enoggera Creek. Rain falling directly on properties and streets caused localised flooding. Enoggera (with a dam), Fish and Ithaca Creeks drained the upstream catchments. Backwater effects from the Brisbane River included high tides, storm tides and river flooding. Each source can directly cause flooding, but conditions are typically more severe when occurring in combination. For further information on the impact of creek flooding BCC’s flood awareness maps provide valuable information on the likelihood of flooding.

The relevant stakeholder agencies for Enoggera Dam include Brisbane LDMG, Brisbane DDMG, QFES, DRDMW and the Bureau. The review has identified that the EAP, including the requirement to notify the various stakeholder agencies for Enoggera Dam, was complied with by the dam owner, Seqwater.

As per the EAP, BCC were advised at various points in time that Enoggera Dam was spilling, was heading towards a Flood of Record, that it had reached Flood of Record and that it was spilling over its auxiliary spillway.

The EAP for Enoggera Dam provides that where the EAP Phase is described as ‘Lean Forward’ (as was the case in this situation), Seqwater was required to notify QFES, DRDMW and the relevant disaster management group (i.e. Brisbane LDMG) and they were required to do so through direct phone calls to stakeholders, made in a pre-prepared, sequential and prioritised order, or via ‘Talking points’ or ‘Situation Report’ updates issued a minimum of twice daily unless it is agreed that less frequent updates are appropriate. Seqwater provided this advice.

In relation to provision of alerts and notifications, Seqwater has clearly articulated in the Enoggera Dam EAP it does not provide alerts or warnings to the public where the dam is not at risk of failure (apart from the opt in alert system for dam release/spill noted above). In accordance with the approval process required for EAPs, the Brisbane LDMG were required to advise whether or not the EAP was consistent with their LDMP. As the EAP is an approved document, for which consultation with LDMGs is required under the WS (SR) Act, Brisbane LDMG have been appraised of the position of Seqwater regarding responsibility for the issuing of Emergency Alerts in an environment where dam failure was not in issue.

However, a review of a BCC Flood Information Centre Situation Report issued (which is also noted to be described as a template document in its page footer) states the following: '*Alerts are issued by Seqwater (not Council)*'.

This statement is clearly in direct conflict with the approved EAP for the Enoggera Dam. Therefore, this raises significant concerns regarding the clarity of system operations between the dam operators and LDMG officials, particularly as it relates to ownership and responsibility regarding the issuing of warnings and alerts.

In discussions with disaster management operational staff, feedback has been provided that the EAPs are difficult to understand and apply, particularly in the high stress environment of a disaster. Additionally, opportunity exists where enhancements to the system can be achieved where current processes are amended to reflect the shared responsibility that exists within disaster management by ensuring dam owners and LDMGs (across Queensland) work more collaboratively, particularly with lesser resourced local governments, to ensure the community is provided with timely, accurate and easily understood warnings and alerts during times of flood.

As was identified in the Callide Creek Flood Review 2015, EAPs for Referable Dams and LDMG plans need to be aligned to require dam operators, local governments and LDMGs to collaborate in planning for events.

This was further recognised in the Paradise Dam Preparedness Review 2019 where recommendations were made to ensure a shared understanding of risk, enable coordinated plans to be put in place, for work to be undertaken collaboratively and enhancement of shared capacity across agencies was facilitated. The result achieved was a greater shared understanding of the risks and a shared responsibility across community, dam owners, LDMG and DDMG.

**Recommendation 18**

- 18) The Inspector-General of Emergency Management recommends the Dam Safety Regulator review the Emergency Action Plan for Referable Dam Guideline with particular regard to the distinction between the process required by a flood event as compared to a dam failure event by 1 November 2023. The Emergency Action Plan for Referable Dam Guideline review will be informed by a discussion, facilitated by the Dam Safety Regulator, between dam owner Seqwater, the Brisbane City Council Flood Information Centre, the Brisbane Local Disaster Management Group and the Brisbane District Disaster Management Group. The purpose of the facilitation is to achieve inter-agency understanding of warning and notification responsibilities.

The reviewed Emergency Action Plan for Referable Dam Guideline should be published, promoted and shared via a stakeholder engagement exercise with Queensland's referable dam owners, disaster management stakeholders including local disaster management groups and district disaster management group.

## **Wivenhoe Dam**

Wivenhoe Dam is South East Queensland's largest water storage. It has a total storage capacity of 3.132 million megalitres. At current full supply level (65.9 AHD FSL [full supply level]) it will hold 1.051 million megalitres. Its primary function is to provide safe drinking water supply to Brisbane and surrounding areas including Ipswich.

Wivenhoe Dam is a gated dam which allows the dam operator to make controlled water releases during times of heavy rain. During a flood event, as part of its flood mitigation function the dam is designed to hold back close to two million megalitres on top of its drinking water storage capacity. (More information on the operation of the Wivenhoe Dam can be located on the Seqwater website.)

During a flood event, Wivenhoe Dam and Somerset Dam are managed in accordance with the Manual of Operation Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam.

As previously noted, all referable dams are required to have an approved EAP. In addition to their EAP for Wivenhoe Dam, Seqwater have also developed the Seqwater Communication Protocol for Flood Releases from Seqwater's Gated Dams (the protocol) for events which are for flooding but not involving actual or potential dam failure. The protocol defines the specific responsibilities for Seqwater in relation to communication arrangements in the lead up to and during a Flood Event.

Under the protocol, Seqwater provides actual and projected Wivenhoe Dam release data to the Bureau and local governments. This is used as an input into their flood warnings and in preparation for other flood response activities. This dam release data is prepared based on rain on ground predictions with the Seqwater Flood Forecasting System as required by the flood manual. It is noted that the Bureau issues flood warnings based on forecast rainfall.

While the modelling used may be different, in a flood situation dam release information alone does not define downstream flooding. Total downstream flooding is a consequence of the dam releases, and the downstream catchment flows and, in the 2022 flood event, the amount of rain that is falling downstream of the catchment. Dam release information is one input into larger considerations.

Of note, during the event, with the flooding situation escalating rapidly over the course of the Saturday 26 and Sunday 27 February 2022, a demand for more rapid sharing of flood information was identified by Seqwater. To assist, Seqwater developed and then produced six reports (when they had the capacity to do so) described as '*FOC [flood operations centre] current release strategy status Brisbane River modelling report*'. The reports, which were primarily a series of charts from the Seqwater Flood Forecasting System, set out rain on ground predictions (with and without Wivenhoe Dam releases) for the flow at Lowood, Savages Crossing and Moggill. The reports also provided the then-current target flow at Moggill and the estimated or actual start time of releases from Wivenhoe Dam.

While it was an informal strategy report, developed quickly in response to the need that was identified—it was a document that assisted key stakeholder agencies responsible for flood response, in particular assisting in appreciation of the potential for downstream flooding, escalation or where there was a notable change in release plans. While it is appreciated that this informal reporting may not be replicated for future events, Seqwater should be commended for identifying the need and establishing a process that added value to the identification of risk and management of an event in an ever-changing environment.

Having regard to all the factors, IGEM found Wivenhoe Dam was well managed, particularly around the timing of water release that had regard to downstream tributary flows and upstream inflows to mitigate impact downstream with community submissions also supporting this view.

**Exercising example: Seqwater**

As was identified and noted by the DS Regulator, Seqwater prioritises disaster management. They deliver regular, high level exercising such that during the event it was noted by staff that the event was unfolding like a training exercise. Further, this high level of exercising allowed senior engineers to consider opportunities to better manage the dam through approval of an Alternative Operating Procedure (AOP) at the height of the event. They managed staff well and were able to place dam operators at most of their referable dams for the duration of the event. Following this event, any damage was quickly identified and required repairs were conducted in a timely manner with a sense of urgency. Seqwater's dam safety management, including the capabilities of its engineers and operators, is considered to reflect good practice across the industry.

The value of an agency prioritising disaster management training exercises that are run annually and that reflect real life scenarios is demonstrated by the way in which Seqwater managed their own disaster related obligations as well as having the capacity to assist stakeholders during the event.

**Alternative operating procedure: Seqwater**

During the event, Seqwater sought permission from the DS Regulator to authorise an AOP. An AOP is sought where during a flood event, the flood mitigation manual does not provide for the flood event, or an aspect of a flood event. In this event, the alternative operational strategy proposed was to reduce releases from Somerset Dam to reduce the discharge into Wivenhoe Dam, thus increasing the flood storage capacity at Wivenhoe dam and reducing the flood releases from Wivenhoe Dam.

In the circumstances, it was agreed an alternative operating procedure was worthwhile exploring. The process commenced at approximately 4:00pm Sunday 27 February 2022 and was approved at 12.39am on Monday 28 February.

The AOP was designed to:

- Be practically a minimal to zero threat to the safety of Somerset Dam
- Temporarily reduce outflows from Somerset Dam into Wivenhoe Dam
- Assist to slightly reduce the peak level in Wivenhoe in combination with avoiding or minimising a need to increase outflows from Wivenhoe Dam into the Brisbane River.

In making the decision, senior flood engineers from Seqwater, meteorological and hydrological information and the opinion of senior department engineers were all taken into consideration.

The key outcome achieved through strong management of the dam (that included the application of the AOP), was the threshold for transitioning from Flood Mitigation Strategy to Dam Safety Strategy (Procedure 3c) was not met. Invoking the Dam Safety Strategy would have required increased emphasis to be placed on the primary objective in the flood mitigation manual of preventing structural failure of the dam.

**Alternative operating procedure: Seqwater**

The dam is required to move to the Dam Safety Strategy if predicted peak lake level is judged as very likely to exceed 75 metres AHD. In this event, the peak lake level of Wivenhoe Dam reached 74.61 metres AHD, which is 0.39 metres below 75 metres AHD.

Therefore, there was only approximately 60,000 megalitres of additional storage between 74.61 and 75 metres AHD (or approximately 5 per cent of the total volume of the Flood Storage Compartment reserved for flood mitigation purposes). The dam operators utilised almost the entire flood storage compartment, which delivered a close to optimal flood mitigation benefit to residents downstream.

*Farm dams*

The DRDMW categorises a small dam to be less than 10 metres in height and that store fewer than 1500 megalitres. There are thousands of these dams in Queensland. Many are on private properties and play a vital role in providing water for farming, livestock and natural resource industries.

Small dam owners are responsible for the dam, including any impacts on life, property and the environment should the dam ever fail. They are regulated differently to larger dams, reflecting a lower risk of levels. A small dam is still a referable dam if two or more people would be at risk if it were to fail; it would then require an EAP.

IGEM was informed that small dams, referred to as farm dams, were a concern of a number of local governments and community members. The review team were advised a number of these breached or partially breached during the event. The review team heard there were some that fail regularly. These dams are not designed for the event experienced. The review team also heard the structural integrity of these dams may have been affected due to drought which has led to cracking. Although farm dams are not recognised as referable dams, safety concerns were raised by dam owners and the community concerning a breach or potential breach of the dam and the possible consequences.

Concerns of one farm dam failing tied up valuable resources of local government staff and in one instance required the doorknocking of residents to advise them to evacuate due to the level of a farm dam. This same dam caused community panic due to a post on social media advising a dam was about to burst, which was confused with Wivenhoe Dam.

Another local government advised of dams breaching and affecting the road network. One local government advised that even though it was not their or the QPS's responsibility to undertake works on private property, it was deemed that a duty of care existed to the public through risk to safety of nearby pedestrians and motorists and therefore some roads were temporarily closed. The review team were also advised of impacts of erosion and silt when these dams failed.

One local government advised that clean-up operations to desilt roads can cost local governments upwards of \$5 million, with a combined cost of \$10 million across a number of local governments. Where topsoil is lost from farms due to flood or rain events, local governments are legally unable to return the soil back to primary producers. It can be expensive for council to rectify the issues caused by the runoff and debris. They advised changes in property ownership can cause issues, as new owners do not always have a solid understanding of the legacy issues of the property, such as structural issues with dams and previous flooding.

DRDMW advised that there are specific criteria for a dam to be considered a referable dam. The failing of a small dam resulting in a traffic accident death would not deem it a referable dam. DRDMW investigations into earth embankment dams on rural properties considered that these dams would not place two or more people at risk if dam failure occurred (making it a referable dam), therefore the department had no power or authority to take action over those dams during the event.

The DRDMW have a 'small dam' information pack for small dam owners, which includes a checklist to help manage a small dam effectively. Dam owners are responsible for the consequences of dam failure such as impact to life, property and the environment. The information pack has a checklist of things small dam owners should regularly consider regarding their dam. While not having a formal regulatory role, the DS Regulator does provide ad hoc support and guidance to local governments and emergency responders in managing safety events involving farm dams.

Local governments are encouraged to consider the risks associated with farm dams as part of their planning schemes and processes for development applications. Again, engagement with the DS Regulator is available.

One local government raised a level of uncertainty regarding local government responsibility in this area, and were concerned about the continual impact of dam failures on the community. Their view was that there was not a clear understanding in the community of responsibilities, particularly in the case of existing dams and the requirements of a dam to be referable.

Disaster management practitioners, local government and dam owners are encouraged to contact the DS Regulator should there be any concerns relating to farm dams.

### *Environmental dams*

The DES regulate environmentally relevant activities on industrial or intensive animal industries where there is potential to release emissions or contaminants that can impact on the environment and surrounding land uses.

The DES provides Environmental Authorities for a wide range of activities such as aquaculture, sewage treatment, cattle feed lotting, mining, and resource activities such as petroleum (which includes coal seam gas), geothermal and greenhouse gas storage activities. Environmental Authorities prescribe activities for determined water release for contaminated water.

Where a site is overwhelmed by water during a rainfall or flooding event, a temporary emissions licence can be issued for releases off-site under strict circumstances. These releases must be monitored for environmental impact and there are triggers to initiate a cessation of release activities; however, a high level of water can dilute the excess nutrients in the contaminated water.

During the event DES issued 26 temporary emissions, for various time periods and purposes. Some licences were issued for water releases, and others to relax noise conditions to allow industry to operate out of hours. A number of licences were also refused due to risk of contamination to neighbouring lands, which could have caused legacy issues for property or business owners.

The DES advised during the event they were notified of a number of illegal releases by community members via the Pollution Hotline reporting issues. Some of these reports included problems with fuel storage and effluent being pumped into creeks. DES staff were able to complete 775 on ground inspections during the first three weeks, however there were issues deploying staff due to flood conditions and impacts to road networks. DES followed up reports

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of illegal releases and took steps to bring operators into compliance including enforcement action where necessary.

The DES indicated that during the event there was a high demand on their staff to process applications in tight timeframes. There were scientists able to assist with decision making, and entities were able to receive their temporary licences for the required period, revert to their normal conditions of operation after the deemed period. Where necessary DES was able to provide provisions for changes to normal licences to address identified issues in an environmentally safe way.

## Monitoring and evaluation

In 2020, IGEM established a formal monitoring, evaluation and reporting (MER) program to evaluate the progress and implementation of recommendations published in IGEM reviews.

These recommendations are crafted following analysis of relevant information collected throughout the review process. This analysis forms observations and insights leading to IGEM review report findings and finally, where applicable, recommendations.

The monitoring and evaluation of recommendations is intertwined with lessons management.

In a broad sense, lessons management refers to collecting, analysing, disseminating and applying learning experiences from events, exercises, programs and reviews. This review has made recommendations based on information collected and analysed as part of the review process.

Lessons, whether identified through review reports and presented as formal recommendations, or captured through inter de-brief or lesson management processes, offer opportunities for agencies to implement change and drive improvement across the agency and disaster management sector. The MER program supports lessons management processes across all lead agencies, providing a mechanism to track progress of recommendations through to implementation. The monitoring, evaluation and reporting on recommendations, supports key agencies to embed these lessons (here identified as recommendations) and implement enduring change to improve and enhance outcomes in the disaster management sector.

### Recommendation 19

- 19) The Inspector-General of Emergency Management recommends this report be returned to the Office of the Inspector-General of Emergency Management to monitor, evaluate, and report on progress and implementation of the recommendations that are accepted in whole or in part by government.

## **Appendix A: Review terms of reference**

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### **Purpose**

Section 16C of the Disaster Management Act 2003 outlines the following functions for the Office of the Inspector-General of Emergency Management, including:

- 'to regularly review and assess the effectiveness of disaster management by the State, including the State disaster management plan and its implementation;
- to regularly review and assess the effectiveness of disaster management by district groups and local groups, including district and local disaster management plans;
- to regularly review and assess cooperation between entities responsible for disaster management in the State, including whether the disaster management systems and procedures employed by those entities are compatible and consistent;
- to identify opportunities for cooperative partnerships to improve disaster management outcomes;
- to report to, and advise, the Minister about issues relating to the functions above
- to make all necessary inquiries to fulfil the functions above.'

In accordance with these functions, for the South East Queensland Rainfall and Flooding that occurred from 22 February to 7 March 2022, the Office of the Inspector-General of Emergency Management (the Office) will assess:

- 1) the effectiveness of preparedness activities undertaken by Queensland Government (including Government Owned Corporations and Statutory Bodies), relevant local government agencies, and other agencies engaged in response operations in all of the Local Government Areas activated for disaster recovery funding arrangements (DRFA);
- 2) the timing and effectiveness of Emergency Alerts that were issued to the community of the flooding event, including:
  - a. interactions with the national Emergency Alert System, and any relevant local government issued warnings
  - b. the relative effectiveness of different operating systems between opt-in systems and automatic geographic notifications at a state/national and local government level;
- 3) the timing and effectiveness of other types of communication and information that was disseminated during the event, including information provided by LDMGs to elected representatives; and
- 4) the effectiveness of cooperation between all agencies for response operations at a local, state and national level.

In conducting the Review, the Office will ensure good practice and any opportunities for enhancement are included in the report.

## Approach

For the South East Queensland Rainfall and Flooding from 22 February to 7 March 2022, the Office's Review team will work closely with the Queensland Police Service, Queensland Fire and Emergency Services, Queensland Reconstruction Authority, local, State, and federal agencies, and other relevant entities to assess:

- the preparation and planning by the Queensland Government and relevant local government agencies;
- the response to the weather event, including measures taken to:
  - inform the community;
  - protect life;
  - protect private and public property;
  - manage the supply of essential services;
  - manage dam operations, in particular for the Wivenhoe Dam, and associated emergency procedures, including consideration of the flood event reports prepared by referable dam owners as required by the Water Supply (Safety and Reliability) Act 2008 and provided to the Dam Safety Regulator of Queensland;
  - resourcing, overall coordination and deployment of personnel and equipment; and
  - other related matters the Inspector-General of Emergency Management considers relevant.

The Review will identify enhancements to inform and ensure continuous improvement in Queensland disaster management arrangements. The scope of these enhancements will be bound by the Standard and other relevant doctrine.

In conducting the Review, the Office will consider the views of community members, relevant agencies and operational staff, and also be informed by any relevant expert advice.

In conducting the Review, the Office will also have regard to other relevant reviews that have been conducted, or which may have been announced or commenced which are relevant to this review, including for example: reviews by other governments, coronial inquiries/reviews, commissions of inquiry, etc.

## Report

In providing its report, IGEM can consider whether to provide an interim report into any of the individual matters raised above, including for example, the Emergency Alerts that were issued in relation to this event prior to the final report. Any interim report is to be provided to the Minister for Police and Corrective Services and Minister for Fire and Emergency Services by 30 June 2022.

The final Review Report, including executive summary, is to be provided to the Minister for Police and Corrective Services and Minister for Fire and Emergency Services by 31 August 2022.

## Appendix B: Glossary

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ABC Australian Broadcasting Corporation

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ADF Australian Defence Force

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AEP Annual Exceedance Probability

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AFAC Australasian Fire and Emergency Services Authorities Council

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AHD Australian Height Datum

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AIDR Australian Institute for Disaster Resilience

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Alert  
(level of activation) A level of activation.  
A heightened level of vigilance due to the possibility of an event in the area of responsibility. Some action may be required. The situation should be monitored by someone capable of assessing the potential of the threat.

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AWS Australian Warnings System

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AOP Alternative Operating Procedure

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BCC Brisbane City Council

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BMTMC Brisbane Metropolitan Transport Management Centre

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BRCFS Brisbane River Catchment Flood Study

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BRSFMP *Brisbane River Strategic Floodplain Management Plan*

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BROC Border Regional Organisation of Councils

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CALD	Culturally and linguistically diverse
CETL	Clear Explicit Translatable Language
COMDISPLAN	<i>Australian Government Disaster Response Plan 2020</i>
COVID-19	The illness caused by the SARS-CoV-2 virus
DACC	Defence Aid to the Civil Community
DAF	Department of Agriculture and Fisheries
DCHDE	Department of Communities, Housing and Digital Economy
DDC	District Disaster Coordinator
DDCC	District Disaster Coordination Centre
DDMG	District Disaster Management Group
Deputy LDC	Deputy Local Disaster Coordinator
DEPW	Department of Energy and Public Works
DES	Department of Environment and Science
DIEMS	Disaster Incident Event Management System
DM Act	<i>Disaster Management Act 2003</i>
DM Regulation	Disaster Management Regulation 2014
DMO	Disaster Management Officer

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DRFA	Disaster Recovery Funding Arrangements
DRDMW	Department of Regional Development, Manufacturing and Water
DS Regulator	Dam Safety Regulator
DTMR	Department of Transport and Main Roads
EA	Emergency Alert
EAP	Emergency Action Plan
EER	Emergency Event Reports
EMC	Emergency Management Coordinator
EMS	Event Management System
ENSO	El Niño–Southern Oscillation
EP Act	<i>Environmental Protection Act 1994 (Qld)</i>
EWAS	Early Warning Alert Service
FCRC	Fraser Coast Regional Council
FES Act	<i>Fire and Emergency Services Act 1990 (Qld)</i>
FOC	Flood operations centre
FSL	Full supply level
FWIN	Flood Warning Infrastructure Network

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IGEM	Office of the Inspector-General of Emergency Management
IGEM (the)	The Inspector-General of Emergency Management
IP Act	<i>Information Privacy Act 2009</i> (Qld)
IT	Information technology
IXP	Information Exchange Platform
LBRCP	Lower Brisbane River Communications Protocol
LDC	Local Disaster Coordinator
LDCC	Local Disaster Coordination Centre
LDMG	Local Disaster Management Group
Lean forward	A level of activation.  An operational state prior to 'stand up' characterised by a heightened level of situational awareness of a disaster event (either current or impending) and a state of operational readiness. Disaster coordination centres are on stand by, prepared but not activated.
LGA	Local government area
LGAQ	Local Government Association of Queensland
MBRC	Moreton Bay Regional Council
Met Act	<i>Meteorology Act 1955</i> (Cth)
MSQ	Maritime Safety Queensland

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# PUBLIC

## Inspector-General of Emergency Management

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NEMRRA	National Emergency Management, Resilience and Recovery Agency
NGO	Non-government organisation
NRRA	National Recovery and Resilience Agency
PCEP	Person-Centred Emergency Preparedness
PPRR guideline	<i>Queensland Prevention, Preparedness, Response and Recovery Disaster Management Guideline</i>
PSAA	<i>Police Service Administration Act 1990 (Qld)</i>
PSPA	<i>Public Safety Preservation Act 1986 (Qld)</i>
QAS	Queensland Ambulance Service
QDMC	Queensland Disaster Management Committee
QDMTF	Queensland Disaster Management Training Framework
QDN	Queenslanders with a Disability Network
QERMF	Queensland Emergency Risk Management Framework
QFES	Queensland Fire and Emergency Services
QPS	Queensland Police Service
QRA	Queensland Reconstruction Authority
QRA Act	<i>Queensland Reconstruction Authority Act 2011 (Qld)</i>

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QUT	Queensland University of Technology
REM	Regional Emergency Management
RACQ	Royal Automobile Club of Queensland
RD Guideline	Referable Dams Guideline
RFA	Requests for Assistance
SBS	Special Broadcasting Service
SCRC	Sunshine Coast Regional Council
SDC	State Disaster Coordinator
SDCC	State Disaster Coordination Centre
SDCG	State Disaster Coordination Group
SDMP	<i>State Disaster Management Plan</i>
SES	State Emergency Service
SEWS	Standard Emergency Warning Signal
SLS	<i>Service Level Specification for Flood Forecasting and Warning Services for Queensland</i>
Stand up	A level of activation. The operational state following 'lean forward' whereby resources are mobilised, personnel are activated, and operational activities commenced. Disaster coordination centres are activated.

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TAFE	Technical and Further Education
TAMS	Task and Management System
the Bureau	Bureau of Meteorology
the Framework	<i>Queensland Flood Risk Management Framework</i>
The Infrastructure Plan	<i>Queensland Strategic Flood Warning Infrastructure Plan</i>
the Lexicon	<i>Queensland Disaster Management Lexicon</i>
the manual	<i>Queensland Emergency Alert Manual – M.1.174</i>
the Risk Report	<i>2021 State Disaster Risk Report</i>
the Standard	<i>Standard for Disaster Management in Queensland</i>
the Statement	<i>Strategic Policy Statement</i>
the Strategy	<i>Queensland Strategy for Disaster Resilience</i>
VUCA	Volatile, uncertain, complex and ambiguous
WS (SR) Act	<i>Water Supply (Safety and Reliability) Act 2008 (Qld)</i>
XO	Executive Officer

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## Appendix C: Relevant reviews

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Other relevant reviews that have been considered by IGEM to inform the report:

- IGEM Queensland review reports considered as part of the Monitoring, Evaluation and Reporting program:
  - K'gari (Fraser Island) Bushfire Review
  - Paradise Dam Preparedness Review
  - 2019 Monsoon Trough Rainfall and Flood Review
  - The 2018 Queensland Bushfires Review
  - The Cyclone Debbie Review
- IGEM Queensland review reports exempt from the Monitoring, Evaluation and Reporting program:
  - 2015 Callide Creek Flood Review
  - Review of Capability at a district and local level—Mackay disaster district
  - Review of capability at a district and local level—Townsville Disaster District
  - Review of cyclone and storm tide sheltering arrangements
  - Review of local governments' emergency warning capability
  - Review of Seqwater and SunWater warnings communications
  - Review of state agency integration at a local and district level
- ATSB Transport Safety Report—Breakaway and grounding involving CSC Friendship Preliminary Report
- Brisbane City Council 2022 Flood Review
- Deloitte Access Economics report—The social, financial and economic costs of the 2022 South East Queensland Rainfall and Flooding Event
- Queensland Floods Commission of Inquiry (2011)
- Review of the Bureau of Meteorology's capacity to respond to future extreme weather and natural disaster events and to provide seasonal forecasting services
- Royal Commission into National Natural Disaster Arrangements Report.

# Appendix D: Towards effective flood communication: community preparedness and responses to flood warnings issued in the February–March 2022 flood event

Report prepared for the Office of the Inspector-General of Emergency Management Queensland Prepared by Dr Lisa Schuster, Professor Amisha Mehta, Associate Professor Dominique Greer, Dr Jennifer Doig, Mr Ritesh Jain, Dr Robert Mitchell, and Ms Lily Kennedy Queensland University of Technology

Prepared on 15 July 2022

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For further information, contact:

Dr Lisa Schuster QUT Business School  
Phone: + 61 7 3138 2426  
Email: [lisa.schuster@qut.edu.au](mailto:lisa.schuster@qut.edu.au)

## Executive summary

This research report examines (a) community preparedness and (b) behavioural responses to warning messages issued during the South East Queensland rainfall and flooding event that occurred in February and March 2022. The research comprises interviews with 70 community members from seven local government areas in South East Queensland:

- Brisbane City Council
- Gold Coast City Council
- Gympie Regional Council
- Ipswich City Council
- Lockyer Valley Regional Council
- Moreton Bay Regional Council
- Somerset Regional Council.

These community members, on average, indicated that they were mildly to moderately impacted by the February–March 2022 event. Over three quarters (approximately 79 per cent) of the community members in the sample recalled receiving at least one warning during the February–March 2022 event, although participants took a broad view when defining warnings, which may differ from operational norms and legislative requirements.

The findings of this research provide data to support reporting requirements for the Office of the Inspector-General of Emergency Management (IGEM) and its South East Queensland

Rainfall and Flooding Event February–March 2022 Review. The findings are summarised according to the lines of enquiry noted by IGEM:

**Line of Inquiry 1: Effectiveness of preparedness activities and maintaining essential services**

**Key Question: How prepared was the community before the event?**

The majority of participants self-reported they were not prepared or only minimally prepared for flooding prior to the event. Preparedness represented a broad scope of behaviour for participants, from formal planning to the event-triggered task of purchasing supplies. The generally low level of preparedness was attributed to a lack of damage from previous flood events and due diligence in purchasing property outside of flood risk areas and was underpinned by participants' self-reported high understanding of risk. Despite these factors, however, some participants were unexpectedly impacted by the February–March 2022 event.

When asked about the preparatory activities they had undertaken prior to the February–March 2022 event, most participants did not (or could not) distinguish between general hazard preparation (e.g. stocking a supply of food and medicine or making adjustments to property prior to an event occurring) and event-triggered preparation (e.g. immediately purchasing food and medicines after receiving a warning). When asked what could encourage community preparedness prior to flood events, most participants indicated a desire for event-based cues, such as the potential scale and impact of events, which indicates that preparation may only begin once an event is imminent; however, general preparatory information, such as checklists of what to do and who to contact during events, could be provided as enduring reference material (e.g. fridge magnets) for future events. Overall, event-triggered preparedness was the normative position for most participants.

**Line of Inquiry 2: Effectiveness of Emergency Alerts and other warnings to the community**

**Key Question: Were the warning messaging received timely, clear, and consistent during the event and were they understood and actioned?**

Participants' perceptions of the effectiveness of warnings in terms of their timeliness, clarity and consistency varied widely, possibly owing to the different messages issued across the seven local government areas at different times and frequency during the February–March 2022 event. Most participants indicated they received a warning through a text message (e.g. Emergency Alert, insurance company alert). Many participants indicated that the warnings clearly indicated the level of flood risk and were useful, but there was strong appetite for visual cues in warnings and additional information about expected impact to support community understanding and situational awareness.

There was also clear support for earlier warnings that contain more instructional information to support the community to take protective action as well as for warnings delivered via multiple channels (including text messages). There is evidence of a community expectation that text messages would be issued to encourage people to prepare, but this expectation should be weighed against the challenge that more frequent messaging could lead to warning fatigue.

Last, some participants expressed a desire for a more central source of information during the February–March 2022 event, which may be because many participants were unsure of who was responsible for issuing warnings. Participants identified a range of expected sources of warnings, including but not limited to their local council, the Bureau and the SES.

This presents an opportunity to raise community awareness of the official sources of warnings and flood information.

**Line of Inquiry 2: Effectiveness of Emergency Alerts and other warnings to the community**

**Key Question: How effective were the warning messages during the event?**

The warning messages were effective at generating a diverse range of appropriate behavioural responses in community members who received them. Participants reported that warning messages encouraged them to seek additional information about the event, prepare and monitor their property, check on family and friends, share localised information and assist their neighbours, check or obtain household provisions (e.g. water, food, fuel, medical supplies), engage in complex logistics planning to manage the event, and prepare to evacuate and/or evacuate. Some participants reported that they did not engage in a behavioural response following a warning because they were already prepared. Collectively, these behaviours were adaptive and appropriate to the level of risk each participant perceived they were exposed to. The participants reported very limited examples of maladaptive or inappropriate behaviour (e.g. travelling into affected areas to visualise flooding).

In particular, warning messages encouraged participants to seek additional information during the event from a range of credible and appropriate sources (e.g. the Bureau, local councils). Many participants reported that they did not initially know where to seek out specific kinds of information (e.g. flood risk, current road closures, weather events, dam releases). Participants often searched and triangulated information from multiple sources and channels to improve their understanding of the event but did not seem to take a systematic approach to information seeking. Visual cues were a notable source of information, as participants reported that they monitored local waterways, drains, and pooling water around their property, which improved their situational awareness of the event. Overall, participants reported that they valued highly localised, geographically recognisable, up-to-date information.

**Emergent findings related to preparedness and warnings**

Emergent findings not directly related to the focal Lines of Inquiry comprised ideas from participants about how to enhance community attention to event-triggered preparedness and warnings. First, participants predominantly supported the implementation of event-triggered preparedness. Specifically, participants were interested in receiving localised impact-based information as events become imminent, alongside a checklist comprising several priority preparatory actions they could take. Second, in relation to warnings, participants indicated warning fatigue could be overcome by creating clearer criteria for communicating warnings versus public information and more clearly signalling updated or the most up-to-date content. In addition, warnings could provide more visual and localised content about potential or actual impact and information.

# Appendix E: Making messages more effective for all—flood warnings and alerts February–March 2022 briefing document

Helen Bromhead  
Research Fellow in Linguistics  
Griffith University

## Part 1: Summary

All people need to understand warnings and alerts in an emergency. Culturally and linguistically diverse (CALD) communities are very at risk in emergencies such as flooding. They often rely on unofficial community translators in disasters.<sup>1</sup> These community translators sometimes do not find the original message easy to translate or interpret into their own languages. Also, people who speak English as a first language may find some warnings and alerts unclear.<sup>2</sup>

This piece of research analyses seven text messages from the February–March 2022 flooding event. It uses a linguistic technique called minimal languages approach or Clear Explicit Translatable Language (CETL).<sup>3</sup> This document suggests some ways that the wording of warnings and alerts could be changed. This could make messages more accessible and effective. See: Aide Memoire (Part 4) and the original wordings assessed for accessibility with suggested rewording (Part 5). Part 2 explains the analysis. Part 3 presents general findings.

## Part 2: Analysis

This analysis builds on the state's strengths in messaging. It adds a point-of-view from linguistics. The State manual, Queensland Emergency Alert Manual–M.1.174<sup>4</sup>, and Australian Institute for Disaster Resilience Guide<sup>5</sup>, have been consulted. Yet the Aide Memoire (Part 4) goes into specific details of wording, making sure wordings are clear and easy-to-translate. The Aide Memoire is divided into lettered points. They state the reason for the suggested change. See:

- (i) Making words easier to translate
- (ii) Making words simpler

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<sup>1</sup> Shepherd J, van Vuuren K, *The Brisbane flood: CALD gatekeepers' risk communication role*. Disaster Prevention and Management, 2014. 23(4): 469-483.

<sup>2</sup> Ogie RI, Perez P, *Collaborative translation of emergency messages (Co-TEM): An Australian case study*. Int J Disaster Risk Reduct, 2020. 50:101920–101920.

<sup>3</sup> Studies in the collection Goddard C. (ed.), *Minimal Language in Action*. Palgrave, 2021.

<sup>4</sup> Queensland Emergency Alert Manual–M.1.174. PPRR DM GUIDELINE–SUPPORT TOOLKIT v. 1.5. State of Queensland (Queensland Fire and Emergency Services), 2021.

<sup>5</sup> Guideline 1: Warning Message Construction: Choosing your words (AIDR 2021).

- (iii) Unpacking ideas that may not be clear
- (iv) Making old fashioned words more up to date.

Each section gives the type of words. See:

- Doing words (Verbs)
- People, places, things (Nouns)
- Explaining words (Adjectives and Adverbials).

The research balances between making the wording accessible and keeping to character limits.

### Part 3: General findings

The Emergency Alerts (EAs) given to Queenslanders during heavy rainfall, flooding and other hazards have many strengths. Building on these foundations, small changes to some messages can make them clearer and easier-to-translate. A minimal languages approach could give community translators more accessible information. This could help make sure that they are able to put messages, either in text or voice, in a way that best resonates with their communities; however, authorities cannot assume that all people with lower English skills or reading levels know people who could help them, such as community translators.<sup>6</sup> The suggestions in the Aide Memoire could be used in both text or voice messages. They may also be able to be used during other kinds of disasters.

### Part 4: Aide Memoire for practitioners

#### General

The current practice of using the three levels (Advice, Watch and Act, Emergency), and adding the name of the issuing authority makes warnings and alerts consistent and recognisable. It also helps makes sure that the community sees messages as trustworthy.

#### Specific — (i) Making words easier to translate

##### *Doing words (Verbs)*

	Use	Avoid
<b>A</b>	happening now	occurring
<b>B</b>	have to	need
<b>C</b>	think carefully about	consider

<sup>6</sup> Grey A, Severin A, Building towards best practice for governments' public communications in languages other than English: a case study of New South Wales, Australia. Griffith Law Review, 2022. 31(1): 25–56.

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	Use	Avoid
D	do the things you have to do	take the necessary steps
E	stay where you are	shelter in place
F	know	plan

## *People, places, things (Nouns)*

	Use	Avoid
G	places	areas
H	people	residents

## *Explaining words (Adjectives and adverbials)*

	Use	Avoid
I	if you can	if possible
J	more	further
K	other	additional

## **(ii) Making words simpler**

### *Doing words (Verbs)*

	Use	Avoid
L	begin	commence
M	go to	attend, visit, refer to
N	go and stay	evacuate to
O	make sure your pets are safe	provide shelter for your pets
P	lock	secure
Q	evacuate	leave

### *(ii) People, places, things (Nouns)*

	Use	Avoid
R	house or home	property
S	the way you will go	journey

*Explaining words (adjectives and adverbials)*

	Use	Avoid
<b>T</b>	very dangerous flash flooding	life-threatening flash flooding

Note: life-threatening emergency can be retained.

**(iii) Unpacking ideas that may not be clear**

*Doing words (Verbs)*

	Use	Avoid
<b>U</b>	expand 'check roads' to 'check where roads are closed'	'check roads' alone
<b>V</b>	drive, walk or ride	enter

*People, places, things (Nouns)*

	Use	Avoid
<b>W</b>	Explain 'evacuation centres', e.g. safe places, evacuation centres	'evacuation centres' alone

*Explaining words (Adjectives and adverbials)*

X. Use. Unpack *if required* and *if necessary*.

	Use	Avoid
<b>X</b>	<ul style="list-style-type: none"><li>if it is not safe and if you have nowhere else to go</li><li>unpack 'if required' and 'if necessary'</li></ul>	NA

**Updating old-fashioned words**

*Doing word (Verb)*

	Use	Avoid
<b>Y</b>	call	dial

## Part 5: Original wording assessed for accessibility with suggested rewording

Key:

- italics: indicates where suggested rephrasing is different from the original
- Level 1: clear
- Level 2: could be made clearer
- Level 3: unclear

Tweet no.	Original text	No. characters	Level	Suggested text	No. characters
1	Evacuate now.	12	1	Leave now.	9
2	Evacuate if required.	20	2	<i>Leave if it is not safe to stay.</i>	31
3(i)	Major flooding is occurring in xxx and may impact your property.	64	2	Major flooding is <i>happening now</i> in xxx and may impact your <i>home</i> .	64
3(ii)	You may need to consider leaving your property.	47	2	You may <i>have to think carefully about</i> leaving your <i>home</i> .	56
4(i)	You should take the necessary steps to provide shelter for your pets.	69	2	You should <i>do the things you have to do to make sure your pets will be safe</i> .	76
4(ii)	If you need to leave then please take essential medication, secure your property and go and stay with family or friends on higher ground.	137		If you <i>have to</i> leave then please take essential medication, <i>lock your house</i> and go and stay with family or friends on higher ground.	132
4(iii)	If necessary, you can attend council run evacuation centres at the xxxx centre, or the xxx showgrounds.	103	2	<i>If you have nowhere else to go, you can go to safe places,</i> council run evacuation centres at the xxxx centre, or the xxx showgrounds.	133
4(iv)	In a life-threatening emergency dial 000. For further information please visit: <a href="https://disaster.XXXX.qld.gov.au">https://disaster.XXXX.qld.gov.au</a> .	112	1	In a life-threatening emergency <i>call 000</i> . For <i>more</i> information <i>go to</i> <a href="https://disaster.XXXX.qld.gov.au">https://disaster.XXXX.qld.gov.au</a> .	101

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Tweet no.	Original text	No. characters	Level	Suggested text	No. characters
5(i)	Major Flooding likely on the Brisbane River.	44	1		
5(ii)	Stay out of flood water.	24	1		
5(iii)	Check roads and plan your journey if evacuating.	47	2	<i>Check where roads are closed and know the way you will go.</i>	56
5(iv)	Refer to link below for Councils evacuation centre information. Visit <a href="http://www.XXXX.qld.gov.au">www.XXXX.qld.gov.au</a> .	89	2	For Councils evacuation centres information about go to <a href="http://www.XXXX.qld.gov.au">www.XXXX.qld.gov.au</a> .	75
6(i)	EMERGENCY WARNING. From XXX.	28	1		
6(ii)	Life threatening flash flooding is occurring.	45	2	<i>Very dangerous flash flooding is happening now.</i>	47
6(iii)	Shelter in place unless it is unsafe to do so.	46	2	<i>Stay where you are unless it is not safe.</i>	41
6(iv)	Access to area is cut and inaccessible in multiple places.	58	3	<i>Many roads are closed and cars cannot leave or come into the area.*</i>	66
6(v)	Do not enter flood waters.	26	2	<i>Do not drive, walk or ride into flood waters.</i>	45
7(i)	EMERGENCY EMERGENCY EMERGENCY WARNING FLOOD.	44	1		
7(ii)	Wivenhoe dam releases will be commencing from 4am Sunday 27 February.	69	2	Wivenhoe dam releases will be <i>beginning</i> from 4am Sunday 27 February.	68
7(iii)	Additional areas are expected to be impacted by life threatening flooding occurring across the XXXX Council area.	113	2	<i>Other places</i> are expected to be impacted by <i>very dangerous</i> flooding happening in the XXXX Council area.	103
7(iv)	Residents in low lying areas should prepare to leave and warn others.	69	2	<i>People in</i> low lying areas should prepare to leave and warn others.	66
7(v)	Evacuate to friends and family if possible.	43	2	<i>Go and stay with</i> friends or family <i>if you can</i> .	46

<b>Tweet no.</b>	<b>Original text</b>	<b>No. characters</b>	<b>Level</b>	<b>Suggested text</b>	<b>No. characters</b>
7(vi)	An evacuation centre is open at the xxxx Showgrounds.	53	2	<i>If you have nowhere else to go, go to an evacuation centre at the xxxx Showgrounds.</i>	83
7(vii)	For more information visit <a href="https://disaster.xxxx">https://disaster.xxxx</a> .	43	2	For more information go to <a href="https://disaster.xxxx">https://disaster.xxxx</a> .	48

Table 7: Original and suggested wording

\*The meaning of this sentence was not clear to the analyst. The suggestion is approximate.

### Annotated messaging

The researchers annotated the following messaging to demonstrate opportunities for enhancement.

**3 steps to get ready...**

When it comes to extreme weather events in Queensland, it's not a matter of 'if' but 'when'.  
Storms, floods, cyclones and bushfires can hit at anytime and anywhere. Be aware and be prepared to protect what's most important to you.

**STEP 1: Make a plan**

**STEP 2: Pack supplies**

**STEP 3: Make sure you're covered**

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**Annotations:**

- Many complex ideas.
- Hard to understand ideas.
- "Make" can have many meanings.
- "Supplies" may not be clear.
- Sense unclear from text.

**A minimal languages approach makes messages clearer and easier to translate**

**...in simpler words**

There will be more extreme weather in Queensland. We just don't know when.  
Storms, floods, cyclones and bushfires can happen anytime and anywhere. You don't want bad things to happen to you, your home and your family. It's good if you do these things now.

**STEP 1: Think about what you will do. Write it down.**

**STEP 2: Pack what you will need if you have to leave home quickly.**

**STEP 3: Have a good insurance policy. Know what it says.**

**Annotations:**

- Clear, definitive statements.
- Ideas are unpacked.
- Explains process.
- Explains kinds of "supplies".
- Makes clear what people require.

Figure 13: Annotated messaging (Bromhead, 2021)

## Appendix F: South East Queensland flood review community sentiment



*Moggill Ferry in Moggill, Brisbane. (Image courtesy of Tina Gorman)*

Project leader: Professor Bela Stantic  
Co-investigators: Dr Mardé Helbig, Dr Jinyan Chen  
Research Assistant: Mrs Tina Gorman  
Big Data and Smart Analytics Lab—IIS, Griffith University

### Executive summary

Traditional methods of monitoring the opinion of social communities rely on user study methods, such as questionnaires and interviews, to collect statistical data; however, due to the trend of globalisation, modern society becomes a complex dynamic of social and technological factors with different demographics and characteristics. For organisations reaching out to community members to conduct user studies it is a difficult task. Thanks to the advances of communication technologies, people are connected not only in the physical dimension but also in a virtual dimension via social media, in which people are sharing their opinions and individual/social activities. The real-time availability of social media data opens an opportunity to capture the opinion of the community regarding the flooding in a ubiquitous manner and enables timely interventions.

This research project, commissioned as part of the Review into the Flood and Rainfall Event February-March 2022 by the Office of the Inspector-General of Emergency Management (IGEM), used Twitter posts to examine how people reacted to the event, levels of community sentiment and emotions.

### Methods

The sample frame is limited to Queensland. The collection of data relied on the academic level of the Twitter Application Programming Interface (API) access to public Twitter data. Historical

scraping of Twitter data is filtered by identified keywords. Collected posts are stored before further processing is conducted in a MongoDB NoSQL Database running on the Big Data and Smart Analytics lab Cluster. Some pre-processed data was uploaded into MySQL databases for faster processing and to take advantage of a powerful Structured Query language (SQL).

## **Keywords/phrases search criteria**

The search for posts related to floods in QLD initially relied on general keywords/phrases such as 'flood', and relevant posts sent from Australia. In addition, terms and areas of interest and objectives provided by the Office of the Inspector-General of Emergency Management were incorporated. The search considered the requested time frame 20th February 2022–10th March 2022.

## **Data structures**

Collected data is stored using JavaScript Object Notation (JSON), which is a lightweight data-interchange format. This format is easy for humans to read and write and is also easy for machines to parse and generate. Twitter data consists of several objects where each object offers a unique value for analysis. The Geo Object of the Tweet can be associated with a location and is generated when the 'geo-tag' is enabled. Tweet locations can be an exact 'point' of the location (to the accuracy of 1cm), in such a case it has a type of 'Point'. Alternatively, it can be a place defined as a 'bounding box' that describes a larger area ranging from a venue to an entire region, where it has a type of 'Polygon' defined with longitudes and latitudes.

The search considered the requested time frame from 20<sup>th</sup> February 2022 to 10<sup>th</sup> March 2022. The initial search collected posts that contained posts with relevant #hashtags, followed by 18 different searches that collected all combinations of relevant locations and key terms. Multiple searches were required as the inclusion of all search terms into one query would be longer than the allowed Twitter query length.

Many users do not enable geo-location tagging on their posts, so to ensure all relevant posts were collected, we elected to relax the geo-location search criteria and initially searched by keywords/phrases. The specific nature of searches that in the first part had Queensland locations, ensured that the post was related to Queensland flooding.

## **Analysis employed**

This section discusses the various analyses that were employed, namely the emotion analysis, sentiment analysis and location analysis.

### **Emotion analysis**

The appraisal theory of emotion explains that a human's emotion responds from a subconscious evaluation of a particular stimulus and its relevance to one's goals or needs (Le et al., 2020). The appraisal theory helps explain emotions evident in Twitter conversations concerning the topic and how these might change in response to different events. The emotion analysis portion of this research adopted the National Research Council Canada (NRC) emotion lexicon, which established a list of words and their associated strength with eight emotions: anger, fear, anticipation, trust, surprise, sadness, joy, and disgust (Mohammad and Turney, 2013) (Mohammad and Turney, 2013). The emotion lexicon was built through mixed methods, with both human annotations and automatic processes. Mohammad and Turney (2013) first identified a list of words and phrases to be annotated from Macquarie Thesaurus

(57,000 commonly used English words and 40,000 commonly used phrases) and further matched those terms that frequently occurred in the Google anagram corpus, resulting in 10,170 words for annotation.

*... we asked if a word is associated with a certain emotion, and another independent set of annotations where we asked whether a word evokes a certain emotion (Mohammad & Turney, 2013).*

This automatic method looks for the emotional words in the Tweets and matches them with words in the lexicon. Therefore, one Tweet could demonstrate multiple emotions simultaneously, which reduces the bias of the results as some Tweets can express more than one emotion. If the Tweet was found with one emotional word in the lexicon, the emotion would be added one, so if multiple words match the emotional words, the intensity of the emotion in Tweets is higher. The intensity of emotions helps detect the dominant emotion for a particular topic.

Emotions are not only expressed with facial expressions or biological reactions, but they can also be revealed through specific words people use in their communication with others (Mohammad & Turney, 2013). People can even express emotions in language to the extent that new words are created. The analysis of language can be a powerful conduit for uncovering underlying emotions. Not all emotions are expressed in language, but social media 4 J. CHEN ET AL. nevertheless provides an important window into verbal expressions of feelings. For example, to indicate the emotion of joy, people can enhance words by using emojis or other expressive symbols (e.g. exclamation marks). Therefore, language plays an important role in people's processing of communication inputs (e.g. about a government intervention or message), how they perceive a situation and how this is expressed emotionally.

### *Emotions defined*

Words are associated with emotions. Sentiment analysis uses a base Lexicon or glossary to associate the words found in Tweets and other social media content with emotions such as sadness, anger, fear, surprise, joy, trust, and disgust. Each emotion is associated with a range of words, taken from the Roget's Thesaurus, with each of these words then categorised as either positive or negative. For example, there are 691 words associated with the emotion 'joy'. The following table (Table 8) provides examples of the words associated with six emotions and whether that association is positive or negative. When analysing social media posts, computer models run through the text and assign a value or weight to each word, which combines to give an overall rating or number for the emotion. Trends or patterns can then be identified to establish whether the social media content tells us that the community is feeling anger or sadness or trust, for example, about an event, issue, or topic.

Emotions							
	Fear	Trust	Joy	Sadness	Anger	Disgust	Surprise
Definition	An unpleasant emotion caused by the threat of danger, pain, or harm.	Firm belief in the reliability, truth, or ability of someone or something	A feeling of great pleasure and happiness	The condition or quality of being sad	A strong feeling of annoyance, displeasure, or hostility	A feeling of revulsion or strong disapproval caused by something unpleasant or offensive	An unexpected or astonishing event, fact, etc., to feel mild astonishment or shock
Positive	Advance, Alertness, Cautiously, Courageous, Defend, Defence, Elevation	Accountability, Achieve, Believing, Familiar, Foresee, Govern, Hero, Hope, Neighbour, Nurse, Reward, Wisdom	Aesthetics, Charity, Garden, Generosity, Grateful, Healthful, Memorable, Obtainable, Pride, Prosperous, Sunshine, Thankful				Advance, Astonishment, Compliment,
Negative	Afraid, Apprehension, Avoid, Disruption, Emergency, Fearfully, Frantic, Punish, Resistant, Shock	Bureaucracy, Censor, Counsellor, Deceiving, Doubt, Fabrication, Libel, Mislead, Pawn, Tribunal, Unaccountable		Absent, Badly, Conceal, Denied, Exhausted, Devastation, Dire, Disaster, Grief, Impossible, Lose, Overdue, Overwhelmed	Allegation, Contradict, Complaint, Dismay, Disturbance, Escalate, Interrupt, Ordeal, Subversive	Abnormal, Bribery, Bureaucrat, Dishonesty, Falsify, Misguided, Questionable, Spoil, Unsatisfactory, Waste	Catastrophe, Erratic, Unpredictable, Trick, Wild

Table 8: Emotions defined

## Sentiment analysis

Sentiment analysis is regarded as an efficient method for analysing social media content. Assessing and scoring sentiment is an analytical approach that converts subjective and unconstructed text into constructed data. The purpose is to extract information that reveals critical events, patterns and trends, and assists in determining the sentiment tone behind textual data to gain an understanding of attitudes and opinions. When using publicly available Twitter data, a first useful step is to understand what people are talking about when they are in a particular location and whether their tone is positive or negative.<sup>7</sup>

There are different methods of sentiment analysis. In this work, the Griffith researchers adopted the Valence Aware Dictionary for Sentiment Reasoning (VADER) approach (Hutto and Gilbert, 2014), which was extended in the Big Data and Smart Analytics lab at Griffith University to further improve the accuracy and speed. VADER was specifically developed to analyse social media text. It is a rule-based model that combines a general lexicon/dictionary and a series of intensifiers, punctuation transformation, emoticons, and many other heuristics to compute the sentiment polarity of a review or text. The VADER sentiment lexicon is composed of more than 7,000 items along with their associated sentiment intensity measures, validated by humans. The sentiment score ranges from minus one (negative) to plus one (positive), with the middle point being considered neutral. The VADER lexicon only provides sentiment for English Tweets, and for text written in other languages, it assigns neutral polarity.

## Location analysis

Location-based analysis of Twitter data is complicated by the fact that Twitter allows users to turn on/off geotagging (location data) of their Tweets. This means that in the interest of privacy, most users do not have this feature enabled for their Twitter accounts. Determining the posting location of a Tweet is almost impossible given these parameters, resulting in having to turn to either the location the Twitter account was created with or searching for location-specific words within the body of the Tweet text.

When a user creates a Twitter account, the location the user enters passes no formal validation by Twitter, so where one user may be specific with the location, for example, 'Brisbane, QLD' another may pinpoint 'The Universe' or 'This Country' as their location. Further complications arise trying to gather and group the locations to provide some basic statistical analysis, because, for example, 'Brisbane, QLD' may be specified by any of the following (or more!) ways:

- Brisbane, QLD
- Brisbane, Queensland
- BNE
- Meanjin
- Brisvegas.

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<sup>7</sup> Ranju Mandal, Jinyan Chen, Susanne Becken, Bela Stantic, Tweets Topic Classification and Sentiment Analysis based on Transformer-based Language Models, Ranju Mandal et al., Tweets Topic Classification and Sentiment Analysis based on Transformer-based Language Models, Vietnam Journal of Computer Science, doi: 10.1142/S2196888822500269

For this report, the researchers incorporated location-specific terms within the search parameters of the Tweet data capture exercise to provide statistics for location-based analysis of Tweets.

## Age distribution

Using deep learning, it was possible to label the Tweets with a range of ages which fit the profile based on the description the user provided in their Twitter account. As part of the Climate Action Beacon project, funded by Griffith University, 10,000 climate change related Twitter posts have been annotated and age was assigned based on the description users provided in their profiles. It is common for users to specify in their profile description their current status, job, study, interest, etc, (such as: 'retired', 'study', 'plays rugby'). Based on annotated data a dedicated system was built using deep learning PyTorch and sklearn library to train the model. On test data, the trained model showed a prediction accuracy of 82 per cent.

## Key results

The following key results are based on Twitter activity captured during the 21st of February and the 10th of March 2022.

## Overall sentiment and emotion

The bulk of the Tweet activity occurred between the 26th of February and the 9th of March 2022, with the peak occurring on the 27th and 28th of February. On these two days, 42,131 and 38,891 relevant posts were sent respectively. In addition, 19,135 and 13,482 comments were made respectively on these posts.

The average sentiment of Tweets per day for the captured time period is presented in Graph 3. Prior to the event, the average sentiment of Tweets was positive. This started to decline into the neutral and negative range between Thursday the 24th and Sunday the 27th of February. Average Tweet sentiments remained in the negative to low neutral range for another 11 days.

Out of all Tweets captured for the Queensland floods, 48 per cent had a negative sentiment, 39 per cent positive, and only 13 per cent neutral.<sup>8</sup>

The lowest average negative sentiment was recorded on the 26th of February (-0.15). Considering this negative sentiment is the average of all 12,249 posts sent on the 26th of February this value is very negative when compared to other days. This negative sentiment trend correlates with the timing of floods and the concern people raised.

The temporal distribution of the average sentiment for the Tweets made between 26th and 28th February indicates negative sentiment from 26th 6 pm, reaching a minimum on 27th in the afternoon.

The average number of retweets began to rise from the 26th of February (average of 130.95 retweets per Tweet) and ended on the 10th of March (average retweet value of 1523.38 per Tweet). This huge number of retweets reflects the engagement of people as well as their

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<sup>8</sup> From Stantic Team previous research, when compared to other assessed topics in the past when neutral posts are around 20%, the proportion of neutral posts was much lower, which indicates that people clearly reflected their emotions in fear, anger, or trust.

concern about the situation or need to share information. The most retweeted post ‘These flood monitoring cameras demonstrate the extent of the rainfall and just how quickly waters rose, causing major damage during the recent #seqfloods’ with being retweeted 6,041 times, triggered people to share their concern.

When looking into the breakdown of sentiment by date. The largest peak with regards to all sentiments can be observed on 27th February, with a total of 42,131 Tweets sent where 14,906 are positive, 6,645 are neutral and 20,580 are negative. In contrast to the 26th of February, on 27th February, negative sentiment was experienced throughout the day.

The sentiment was again mostly negative on the 28th February, with just a few hours of positive sentiment 8am, 2pm and 3pm respectively. It should be noted even though the sentiment is mostly negative, the results show the level of negative sentiment is less than the 26th and 27th.

Fear was by far the strongest emotion for Tweets made during the 26th to the 28th of February, which also accounts for the almost 50 per cent majority of negative sentiment values.

Breaking the results down across the individual days shows that the emotions of anger and sadness significantly increased over time as well. The words that were most frequently used in the Tweets were QLD, Queensland, #qldfloods, Brisbane, people, help, amp, Morrison and government.<sup>9</sup>

## Impact of previous disasters

The researchers compared the Sentiment and Emotions of the communities which had already been affected by TC Seth earlier in the year—Maryborough / Fraser Coast LGA, Gympie and North Burnett)—with the Brisbane region. Findings indicate that the average sentiment for those already affected by TC Seth is more negative than the average for all other areas. For example, the average sentiment in North Burnett LGA is almost more than four times lower than in other areas. Also, the Gympie LGA sentiment is twice lower than for other areas. The average sentiment in the combined LGAs which were affected by Tropical Cyclone Seth is twice as negative (-0.102) as the average sentiment for the rest of the data (-0.055). This indicates that repeating disasters could cause more dissatisfaction in the community.

## Emotions across the LGAs

Seven LGAs from Bundaberg to the Gold Coast City were found and several locations in those LGAs (with sufficient Tweets in order to analyse) were identified. The emotions contained within the texts, identified as originating from accounts that were created in these locations, were investigated. The locations were chosen according to the highest number of Tweets found, and are as follows:

- Bundaberg LGA—Bundaberg/Gin Gin
- Fraser Coast LGA—Hervey Bay / Maryborough / Fraser Island
- Sunshine Coast Regional LGA—Sunshine Coast / Caloundra / Bli Bli / Nambour / Maroochydore / Mooloolaba

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<sup>9</sup> As there were over 200,000 Tweets analysed in this report, the minimum number of repetitions before a word was considered to be frequent, was set to 200.

- Moreton Bay Regional LGA—Redcliffe / Caboolture / Bribie Island
- Brisbane City LGA—Brisbane / Meanjin / Brisvegas / Moorooka / Turrbal / Jagera / Yagera
- Logan City LGA—Logan / Eagleby / Beenleigh / Tanah Merah
- Gold Coast City LGA—Gold Coast / Nerang / Surfers Paradise / Currumbin / Miami.

**Fear** is by far, the most common emotion seen in all the Tweets for all the LGAs across the timeframe of this report. The average strength of the emotion Fear is presented in Figure 14, with values ranging from 0.81 (Moreton Bay LGA) to 1.08 (Fraser Coast LGA). The most common words in posts with the Fear emotion and reflecting a negative sentiment included: disaster, government, flooding, warning, federal, south, weather, minister, climate, mitigation, water and rain. The most common words in posts with the Fear emotion and reflecting a positive sentiment included: help, support, emergency, disaster, situation, stay, gofundme, safe, government and relief.

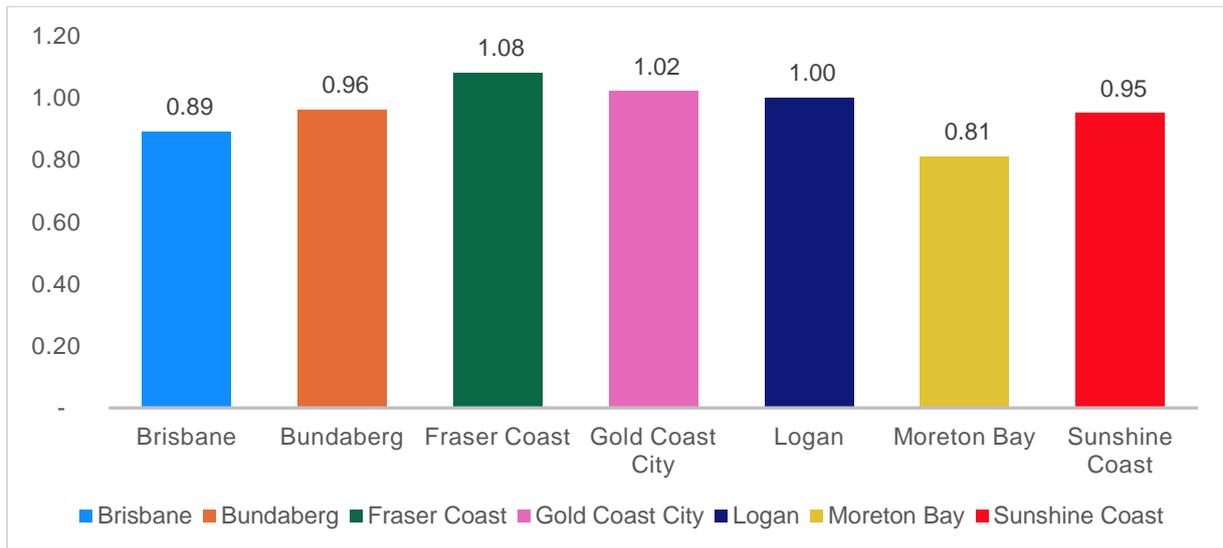


Figure 14: Average strength of the emotion Fear

**Trust** is the second most occurring emotion found in the body of the Tweets examined in the LGAs in question. The average strength of the emotion Trust across the seven LGAs for the entire timeframe of this report is shown below in Graph 17. The average strength values range from 0.51 (Moreton Bay LGA) to 0.74 (Fraser Coast LGA). Two LGAs (Fraser Coast and Logan) have average strength values above 0.7, with only one LGA with a strength value below 0.6 (Moreton Bay).

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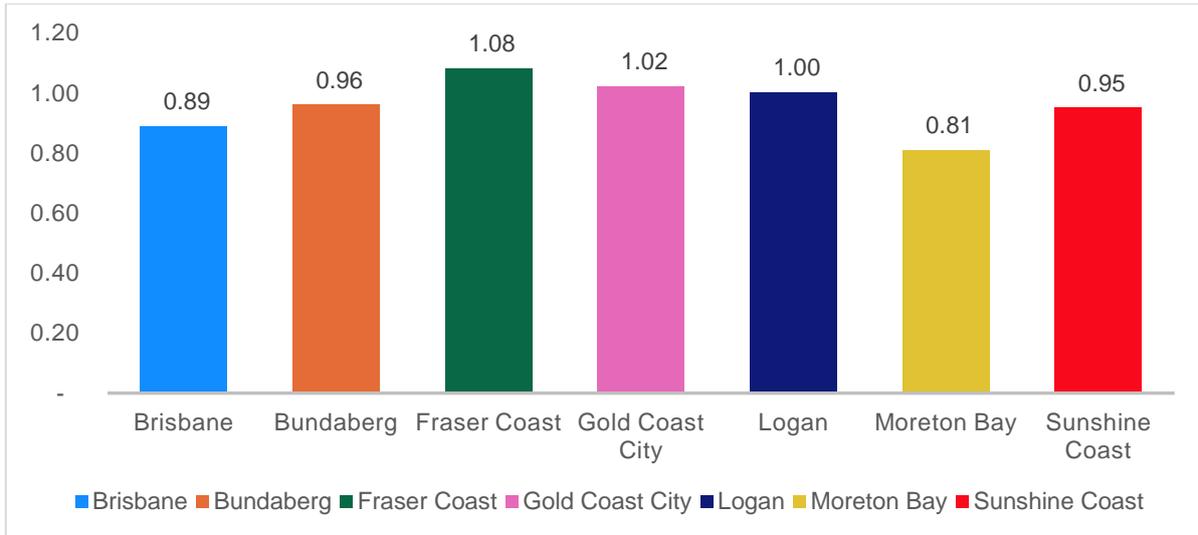


Figure 15: LGA averages

The most common words in posts with the Trust emotion and reflecting a negative sentiment included: flooding, emergency, federal, help, water, warning, weather, government, crisis and devastating. The most common words in posts with the Trust emotion and reflecting a positive sentiment included: support, volunteers, assistance, clean, local, home, rescue, safe and like.

It is interesting to note that Trust peaked at different times in the various LGAs. Brisbane and Gold Coast did not really experience peaks. Bundaberg experienced positive peaks of Trust on 28<sup>th</sup> February, 4<sup>th</sup> March and 9<sup>th</sup> March, and negative peaks on 25<sup>th</sup> February and 7<sup>th</sup> March. Fraser Coast had peaking Trust values on 4<sup>th</sup> and 9<sup>th</sup> March, with a negative peak on 25<sup>th</sup> February. Logan peaked on 21<sup>st</sup> February, after which Trust declined, peaking again on 2<sup>nd</sup> March and then remaining relatively low. Moreton Bay experienced negative Trust levels most of the time, with small positive peaks on 21<sup>st</sup> February and 4<sup>th</sup> – 5<sup>th</sup> March, and a high positive peak on 10<sup>th</sup> March. Sunshine Coast experienced positive peaks on 21<sup>st</sup> February and 24<sup>th</sup> February, and then remained relatively low throughout.

The average strength of the emotion Anger across the seven LGAs for the entire timeframe of this report, is presented in Figure 16. The average strength values range from 0.40 (Brisbane LGA) to 0.53 (Bundaberg LGA) and are very similar across the various LGAs.

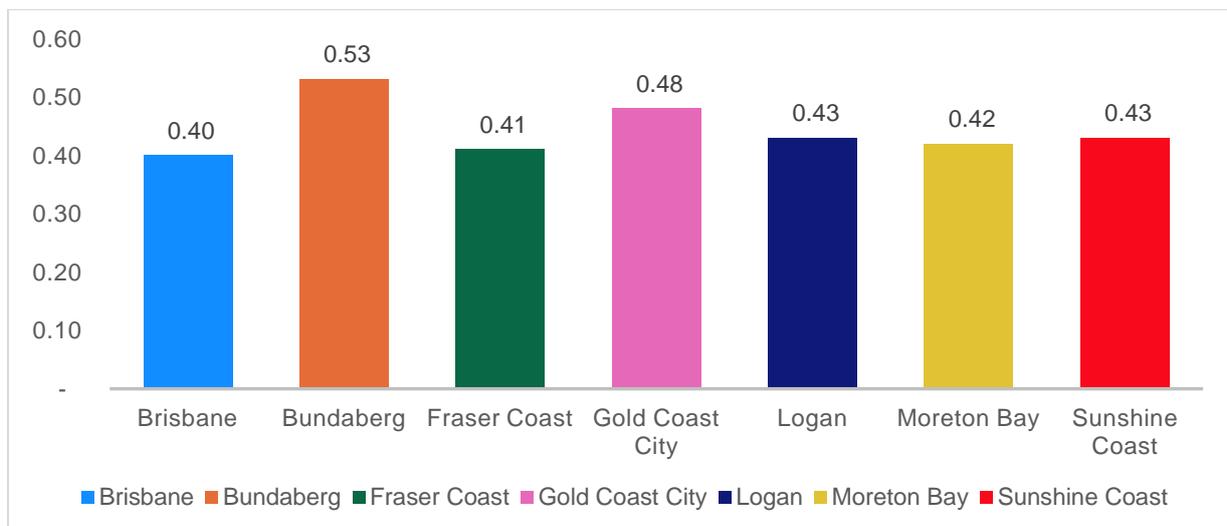


Figure 16: Average strength of the emotion Anger

When looking into the location of users that commented on floods it was found that the most negative sentiment is from the Moreton area with an average of -0.244 other areas had positive sentiment for example Brisbane +0.71, Fraser +0.219, Gold Coast +0.0445, and Logan +0.0868

## **Preparation, preparedness, emergency kit**

736 Tweets were found when searching the data using the keywords '*preparation, preparedness, emergency kit*'. Almost half (47.83 per cent) of the Tweets record a positive sentiment value, with 44.43 per cent recording a negative sentiment.

## **Dam, Wivenhoe, water release, flood gates**

A total of 4,771 Tweets, 57.01 per cent with negative sentiment, while positive sentiment only 25.7 per cent overall. The average sentiment from the 26<sup>th</sup> of February is steady in negative. Fear is the strongest emotion displayed.

## **Flash flooding, flooding, road closures, inundation**

A total of 8,717 Tweets. Interestingly, almost half (49.52 per cent) of the Tweets showed a neutral sentiment value, with negative sentiment of 42.47 per cent, and only 8.01 per cent positive sentiment. The average sentiment value sits well below the (0.0) line, to the extent of very negative -0.62 reflecting very negative sentiment in the community toward flash flooding and river rises. Fear was the dominating emotion followed by Anger and Trust both less than half the strength of Fear.

## **Statewide analysis of influential actors and networks**

When users often mention each other in Tweets, they potentially share similar interests (regardless whether they agree or disagree with one another), which creates communities based on their interactions. This work will build a network among the user who was involved in the topic on Twitter and segment the user into different communities, presented in different colours. Since the community's size can be very large, it can be difficult to interpret the information. Therefore, this work will only use five colours assigned to the top five communities based on the number of users in each community. On Twitter, people can tag and retweet other users, and these interaction among users (or nodes) represent a network. Examining the characteristics of a network can help understand information flows, and who is seen as influential in a network community. To this end, a directed network relevant to aviation-climate change discussions on Twitter was generated using Gephi (2020). The connections of users in the network were measured by degree centrality whereby the more connections one user has the more likely it is that this particular actor has influence over the topic (Becken, et al, 2022).

In the different communities, users who are always being tagged or retweeted could be considered important or even 'influential', because they will be the centre of the communities. Therefore, their voice can pass to more users and their actions could potentially attract and strengthen their communities. In this case, we will calculate the number of connections to visualize the influential users in different communities.

To build such a network, the actor-network is created using social network analysis. The software package 'Gephi' is used to analyse and visualize the resulting networks. In social network analysis, each node represents a user, and edges are the interaction between the users (e.g. retweet or tag any users). The node size is proportional to the number of

connections they have. Therefore, if the node size is bigger, the user is at the centre of attention, and potentially an influential user.

In the network, some people like to send many messages and tag other users in their messages, however, if they do not have many followers their message cannot propagate to the broader community, therefore they are not influential. On the other hand, some users do not post many Tweets, but still, because of their profile (being a celebrity, politician or other official organisation) with many followers, they are often influential as information in their posts can propagate quickly and reach the wider community.

	Percentage of users	Account Profile	Total centrality
	16.72%	Federal Government Level	5227
	9.26%	State Government Level	2356
	8.61%	Media	3638
	6.24%	Federal Government Level	571
	4.4%	Non-government	592

Table 9: Dominant users in the top five communities

Community colour	Percentage of users	Account Profile	Total centrality
	18.47%	Federal Government Level	3593.0
	10.84%	State Government Level	1285
	3.89%	State Government Level	1172
	3.74%	Federal Government Level	2225
	3%	Private users	119

Table 10: Dominant users in the top five communities in the positive network

### Timing and effectiveness of Emergency Alerts issued

This section discusses the timing and effectiveness of Emergency Alerts that were issued during the period being investigated.

#### ***Tweets found by searching for ‘Emergency Alert’***

There was a total of 300 Tweets made on the 26<sup>th</sup> February which included the words ‘Emergency Alert’ in the body of the Tweet. Of the 300 Tweets sent, 267 were retweets and 33 were ‘original’ Tweets. Fear, Surprise and Sadness scored the highest values, with Joy scoring the lowest value. Fear is the strongest emotion in all the Tweets. across the 24-hour period.

## Keywords/phrases search criteria

Initially, posts that contained the following #hashtags were collected:

1. 'SEQfloods' OR 'qldfloods' OR 'QLDTraffic' OR 'brisbanefloods' OR 'bnefloods'

Secondly, posts with a combination of locations of interests and key terms were collected. Due to the complexity and to ensure that all relevant posts were collected, the search was divided into multiple individual searches reflecting all possible combinations of locations and key terms. At the end, all posts were imported into a single collection and multiple copies of the same posts were discarded (in case one post met several considered criteria in separate searches and therefore was collected more than once).

2. ('SEQ' OR 'QLD' OR 'Queensland' OR Brisbane OR 'Gold Coast' OR Bundaberg OR Maryborough OR 'Fraser Coast') AND ('flood' OR 'floods' OR 'flooding' OR 'warning' OR 'evacuate' OR 'evacuation' OR 'evacuated' OR 'leave now' OR 'clean up' OR 'disaster' OR 'alert' OR 'alerts')
3. ('Beachmere' OR Caboolture OR Gympie OR 'North Burnett' OR Gailes OR Redcliffe OR Goodna OR Rocklea OR Oxley) AND ('flood' OR 'floods' OR 'flooding' OR 'warning' OR 'evacuate' OR 'evacuation' OR 'evacuated' OR 'leave now' OR 'clean up' OR 'disaster' OR 'alert' OR 'alerts')
4. (Auchenflower OR 'St Lucia' OR Yeronga OR Graceville OR Cherbourg OR Deagon OR Wivenhoe) AND ('flood' OR 'floods' OR 'flooding' OR 'warning' OR 'evacuate' OR 'evacuation' OR 'evacuated' OR 'leave now' OR 'clean up' OR 'disaster' OR 'alert' OR 'alerts')
5. (Balonne OR 'Fraser Coast' OR Gladstone OR Goondiwindi OR Gympie OR Ipswich OR 'Lockyer Valley' OR Logan) AND ('flood' OR 'floods' OR 'flooding' OR 'warning' OR 'evacuate' OR 'evacuation' OR 'evacuated' OR 'leave now' OR 'clean up' OR 'disaster' OR 'alert' OR 'alerts')
6. ('Moreton Bay' OR Noosa OR Redland OR 'Scenic Rim' OR Somerset OR 'South Burnett' OR 'Southern Downs') AND ('flood' OR 'floods' OR 'flooding' OR 'warning' OR 'evacuate' OR 'evacuation' OR 'evacuated' OR 'leave now' OR 'clean up' OR 'disaster' OR 'alert' OR 'alerts')
7. ('QFES' OR 'QPS' OR 'Sunshine Coast' OR Toowoomba OR 'Western Downs') AND ('flood' OR 'floods' OR 'flooding' OR 'warning' OR 'evacuate' OR 'evacuation' OR 'evacuated' OR 'leave now' OR 'clean up' OR 'disaster' OR 'alert' OR 'alerts')

The second group of combinations of locations and related terms are:

22. ('SEQ' OR 'QLD' OR 'Queensland' OR Brisbane OR 'Gold Coast' OR Bundaberg OR Maryborough OR 'Fraser Coast') AND ('preparedness' OR 'preparation' OR 'help' OR 'swift water' OR 'rescue' OR 'water release' OR 'flood gates')
23. ('Beachmere' OR Caboolture OR Gympie OR 'North Burnett' OR Gailes OR Redcliffe OR Goodna OR Rocklea OR Oxley) AND ('preparedness' OR 'preparation' OR 'help' OR 'swift water' OR 'rescue' OR 'water release' OR 'flood gates')
24. (Auchenflower OR 'St Lucia' OR Yeronga OR Graceville OR Cherbourg OR Deagon OR Wivenhoe) AND ('preparedness' OR 'preparation' OR 'help' OR 'swift water' OR 'rescue' OR 'water release' OR 'flood gates')

25. (Balonne OR 'Fraser Coast' OR Gladstone OR Goondiwindi OR Gympie OR Ipswich OR 'Lockyer Valley' OR Logan) AND ('preparedness' OR 'preparation' OR 'help' OR 'swift water' OR 'rescue' OR 'water release' OR 'flood gates')
26. ('Moreton Bay' OR Noosa OR Redland OR 'Scenic Rim' OR Somerset OR 'South Burnett' OR 'Southern Downs') AND ('preparedness' OR 'preparation' OR 'help' OR 'swift water' OR 'rescue' OR 'water release' OR 'flood gates')
27. ('QFES' OR 'QPS' OR 'Sunshine Coast' OR Toowoomba OR 'Western Downs') AND ('preparedness' OR 'preparation' OR 'help' OR 'swift water' OR 'rescue' OR 'water release' OR 'flood gates')

The third group of combinations of locations and related terms are:

32. ('SEQ' OR 'QLD' OR 'Queensland' OR Brisbane OR 'Gold Coast' OR Bundaberg OR Maryborough OR 'Fraser Coast') AND ('relief' OR 'road closure' OR 'inundation' OR 'place of refuge' OR 'support' OR 'payment' OR 'looting')
33. ('Beachmere' OR Caboolture OR Gympie OR 'North Burnett' OR Gailes OR Redcliffe OR Goodna OR Rocklea OR Oxley) AND ('relief' OR 'road closure' OR 'inundation' OR 'place of refuge' OR 'support' OR 'payment' OR 'looting')
34. (Auchenflower OR 'St Lucia' OR Yeronga OR Graceville OR Cherbourg OR Deagon OR Wivenhoe) AND ('relief' OR 'road closure' OR 'inundation' OR 'place of refuge' OR 'support' OR 'payment' OR 'looting')
35. (Balonne OR 'Fraser Coast' OR Gladstone OR Goondiwindi OR Gympie OR Ipswich OR 'Lockyer Valley' OR Logan) AND ('relief' OR 'road closure' OR 'inundation' OR 'place of refuge' OR 'support' OR 'payment' OR 'looting')
36. ('Moreton Bay' OR Noosa OR Redland OR 'Scenic Rim' OR Somerset OR 'South Burnett' OR 'Southern Downs') AND ('relief' OR 'road closure' OR 'inundation' OR 'place of refuge' OR 'support' OR 'payment' OR 'looting')
37. ('QFES' OR 'QPS' OR 'Sunshine Coast' OR Toowoomba OR 'Western Downs') AND ('relief' OR 'road closure' OR 'inundation' OR 'place of refuge' OR 'support' OR 'payment' OR 'looting')

Additionally, sample post analysis enabled further refinement to search for an exact match or only a presence of words in phrases anywhere in the posts. When more than one term was in the search and connected with 'AND', for example ('Brisbane' AND 'flood'), the criteria required that 'Brisbane' and 'flood' had to be in the same Twitter post for that post to be included, however, they could be in any order and at any location within the post. If more than one word, like 'Moreton Bay', was within quotation marks, only posts that contained the exact phrase were considered.

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## Appendix G: Further Emergency Alert information

The table below outlines the number of Emergency Alert campaigns sent, between 23 February and 3 March 2022, by local government areas, their severity level and the suburbs targeted.

The table is arranged in chronological order of when the first Emergency Alert was sent by each the local government area.

LGAs and targeted areas	Advice	Watch and Act	Emergency Warning	Total
<b>Gympie</b>		<b>6</b>	<b>1</b>	<b>7</b>
Cedar Pocket Dam		1		1
Goomeri, Woolooga, areas west of Gympie		1		1
Greater Gympie		1	1	2
Imbil		1		1
Kandanga		1		1
Normanby Bridge and Pengellys Bridge		1		1
First Emergency Alert sent was Emergency level at 2:43am, 23 February 2022				
<b>Noosa</b>	<b>1</b>	<b>4</b>		<b>5</b>
Greater Noosa	1	1		2
Noosa		3		3
First Emergency Alert sent was Watch and Act level at 6:00am, 23 February 2022				
<b>Sunshine Coast</b>	<b>2</b>	<b>1</b>		<b>3</b>
Greater Sunshine Coast area	1			1
Mooloolah		1		1
Sunshine Coast area	1			1
First Emergency Alert sent was Advice level at 6:16am, 23 February 2022				
<b>Scenic Rim</b>	<b>2</b>	<b>8</b>	<b>1</b>	<b>11</b>
Beaudesert		1	1	2
Canungra		1		1
Flying Fox Bridge	1	1		2
Logan River at Beaudesert		1		1
Peak Crossing		1		1
Scenic Rim area	1			1
Tamborine		1		1
Teviot Brook at Coulson Crossing		1		1

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LGAs and targeted areas	Advice	Watch and Act	Emergency Warning	Total
Warril View, Harrisville		1		1
First Emergency Alert sent was Watch and Act level at 6:10pm, 24 February 2022				
<b>North Burnett</b>		<b>1</b>		<b>1</b>
North Burnett area		1		1
First Emergency Alert sent was Watch and Act level at 7:11am, 25 February 2022				
<b>Toowoomba</b>		<b>3</b>	<b>1</b>	<b>4</b>
Cooby Dam, Cooby Creek		1		1
Greater Toowoomba area			1	1
Oakey		1		1
Toowoomba		1		1
First Emergency Alert sent was Emergency level at 10:46am, 25 February 2022				
<b>Lockyer Valley</b>		<b>1</b>	<b>5</b>	<b>6</b>
Forest Hill			2	2
Grantham		1		1
Helidon, Grantham			1	1
Lockyer Valley council area			2	2
First Emergency Alert sent was Emergency level at 11:11am, 25 February 2022				
<b>Somerset</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>6</b>
Cressbrook Dam		1		1
Fielding Rd, Forest Hill Fernvale Rd, Wivenhoe Pocket			1	1
Greater Somerset area	2			2
Lockyer Creek			1	1
Wivenhoe Pocket			1	1
First Emergency Alert sent was Advice level at 2:16pm, 25 February 2022				
<b>Moreton Bay</b>	<b>2</b>	<b>6</b>	<b>1</b>	<b>9</b>
Greater Moreton Bay		3		3
Moreton Bay Region	1	3	1	5
White Patch	1			1
First Emergency Alert sent was Watch and Act level at 2:26pm, 25 February 2022				
<b>Fraser Coast</b>		<b>1</b>		<b>1</b>
Maryborough		1		1
First Emergency Alert sent was Watch and Act level at 6:48pm, 25 February 2022				
<b>Ipswich</b>		<b>1</b>	<b>2</b>	<b>3</b>

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LGAs and targeted areas	Advice	Watch and Act	Emergency Warning	Total
Ipswich area		1		1
North Booval			1	1
Wivenhoe Dam			1	1
First Emergency Alert sent was Watch and Act level at 10:34pm, 25 February 2022				
<b>Logan</b>	<b>1</b>	<b>21</b>		<b>22</b>
Albert River, Beenleigh		1		1
Greater Logan area		12		12
Logan and Albert Rivers	1	1		2
Logan area		1		1
Logan River—Macleans Bridge and Waterford		5		5
Waterford, Waterford West		1		1
First Emergency Alert sent was Watch and Act level at 2:14pm, 26 February 2022				
<b>Gympie DDMG</b>	<b>1</b>		<b>1</b>	<b>2</b>
Greater Gympie			1	1
Gympie and Southside	1			1
First Emergency Alert sent was Emergency level at 2:59pm, 26 February 2022				
<b>South Burnett</b>		<b>1</b>		<b>1</b>
South Burnett area		1		1
First Emergency Alert sent was Watch and Act level at 4:48pm, 26 February 2022				
<b>Moreton Bay Regional Council and Unitywater</b>	<b>1</b>			<b>1</b>
Beachmere	1			1
First Emergency Alert sent was Advice level at 5:30am, 27 February 2022				
<b>Gold Coast</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>8</b>
Albert and Logan River	1	1	2	4
Tallebudgera and Currumbin Catchments	2	1	1	4
First Emergency Alert sent was Advice level at 2:38pm, 27 February 2022				
<b>Brisbane</b>	<b>2</b>	<b>1</b>		<b>3</b>
Brisbane River	2	1		3
First Emergency Alert sent was Advice level at 7:51pm, 27 February 2022				
<b>Western Downs</b>		<b>1</b>		<b>1</b>
Myall Creek, Dalby		1		1
First Emergency Alert sent was Watch and Act level at 8:27am, 28 February 2022				

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LGAs and targeted areas	Advice	Watch and Act	Emergency Warning	Total
<b>Total</b>	<b>17</b>	<b>59</b>	<b>18</b>	<b>94</b>

Table 11: Further Emergency Alert information

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Office of the Inspector-General of Emergency Management

Phone (07) 3029 8813  
Email [info@igem.qld.gov.au](mailto:info@igem.qld.gov.au)  
Web [www.igem.qld.gov.au](http://www.igem.qld.gov.au)  
Postal address GPO Box 1425, Mail Cluster 15.7  
Brisbane, Queensland 4001

