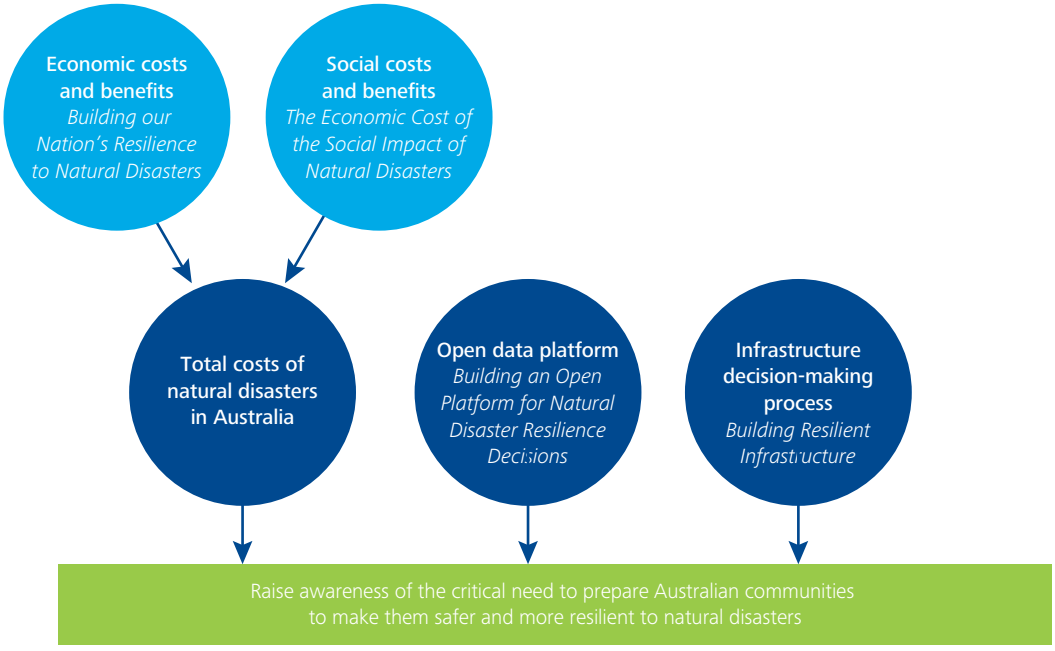
Appendix A: Companion papers

This appendix summarises the key findings and recommendations of three companion reports commissioned by the Roundtable:

- ***Building our Nation's Resilience to Natural Disasters*** (2013) reviewed the economics of mitigating disaster risks facing Australian communities.
- ***Building an Open Platform for Natural Disaster Resilience Decisions*** (2014) provided an overview of natural disaster data and research in Australia, and reinforced the need for better coordination and transparency of disaster risk and resilience information.
- ***Building Resilient Infrastructure*** (2016) was developed in parallel with this paper and investigates the decision-making process for new 'hard' infrastructure assets in light of disaster risks, including the various Commonwealth and state guidelines for comparing project options through cost-benefit analysis. It also builds the case for embedding resilience considerations into this process and offers the practical steps to do so.

The figure below summarises how these three reports relate to each other. Each of the companion reports is outlined in brief on the next pages.

Figure A.1: Summary of the Roundtable's work on natural disaster resilience



Source: Deloitte Access Economics (2016)

Appendix A: Companion papers

Building our Nation's Resilience to Natural Disasters (2013)

The report highlighted the need for a new approach to investment in pre-disaster resilience across Australia, to reduce the economic costs, relieve long-term pressures on government budgets, and most importantly, minimise the longer-term social and psychological impacts of natural disasters.

Quantifying natural disaster costs

Over the period from 1967 to 2012, Australia experienced an average of at least four major natural disasters per year, where the insured loss exceeded $10 million (Insurance Council of Australia, 2013). In addition, there have been numerous smaller-scale disasters with equally devastating local consequences. Chart A.1 illustrates the extent of insured losses from natural disasters in Australia over the period from 1980 to 2012.

It is important to recognise that these losses only represented a proportion of the total economic costs of natural disasters. In addition to insured losses, total economic costs include the cost of damage to uninsured property and infrastructure; the cost of emergency responses; and intangible costs such as death, injury, relocation and stress. Historically, these total costs have been estimated to be two to five times greater than insured costs alone, for most types of disaster (BTE, 2001).

These costs are expected to rise as a result of continued population growth, concentrated infrastructure density and migration to particularly vulnerable regions. While the current annual total economic cost of natural disasters is around $6.3 billion, on average this annual cost is expected to double by 2030 and reach $23 billion in real terms by 2050, as illustrated in Chart A.2. These forecasts do not reflect any expected increase or shift in the currently observed level and severity of disasters that might be caused by climate change.

These rising costs have significant financial implications for all levels of government, which contribute to the cost of recovery, particularly through the Natural Disaster Relief and Recovery Arrangements. Using historical data, Deloitte Access Economics estimates that natural disasters cost the Australian and state governments an average annual real cost of $700 million per year, around 11% of total economic costs. It is estimated that 80% of government expenditure is outlaid by the Australian Government. Based on the forecasts of total economic costs above, it is expected that governments will eventually face an annual cost of around $2.3 billion in real terms, as illustrated in Chart A.3.

The expected future cost of natural disasters clearly highlights the need for governments to place a greater emphasis on improving Australia's resilience. Prioritising pre-disaster investments towards cost-effective resilience initiatives can substantially reduce government expenditure on response initiatives. Doing so will rely on access to accurate, consistent data, and findings from targeted research programs, which provide an essential evidence base for determining the cost-effectiveness of resilience measures.

The case for resilience

Deloitte conducted three cost-benefit analyses of different resilience activities, to illustrate how investing in resilience could generate net benefits for Australian communities.

Overall, it was found that:

- A program focused on building more resilient new houses in areas of southeast Queensland with a high cyclone risk would reduce cyclone-related damage by around two-thirds, and generate a benefit-cost ratio (BCR) of up to 3.0. It is a particular challenge to retrofit resilience into existing houses, but the BCR of retrofits approaches 1.0 in high-risk areas
- Raising the Warragamba Dam wall by 23 metres would reduce annualised average flood costs by around three-quarters, and generate a BCR of between 2.2 and 8.5. This would reduce the present value of flood costs between 2013 and 2050 from $4.1 billion to $1.1 billion, a saving of some $3.0 billion

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Chart A.2: Insured costs of natural disasters ($bn), 1980 to 2012

Source: Insurance Council of Australia (2013)

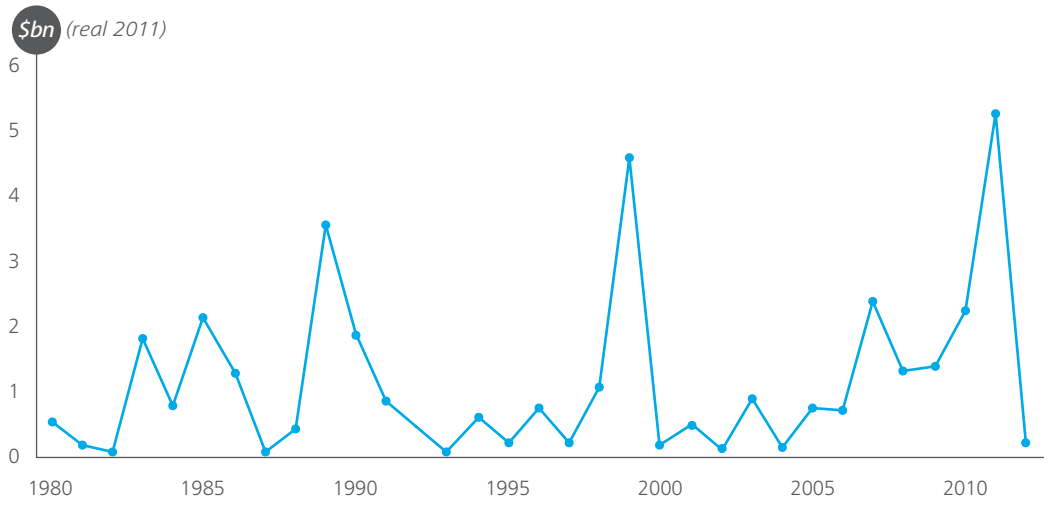


Chart A.3: Forecast total economic cost of natural disasters ($bn), 2011 to 2050

Source: Deloitte Access Economics (2013)

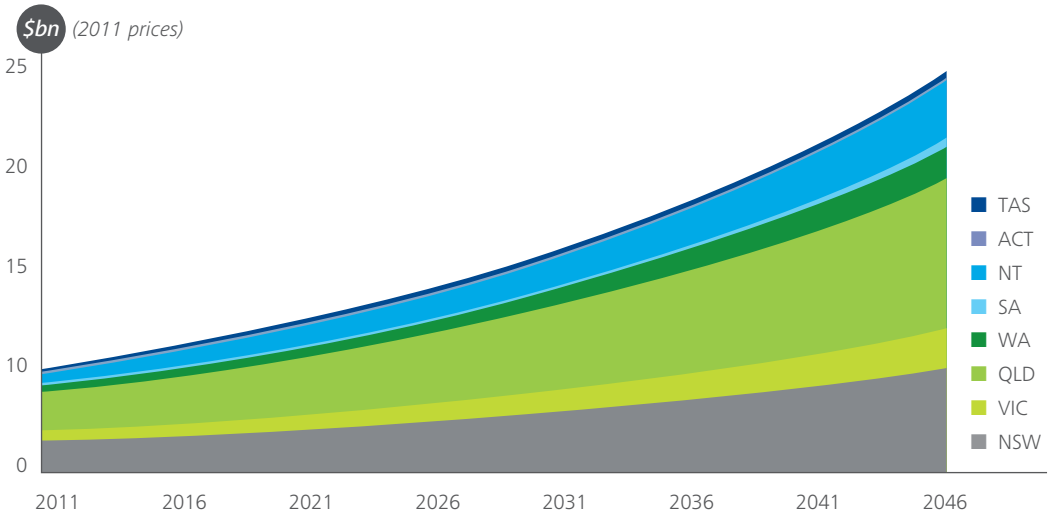
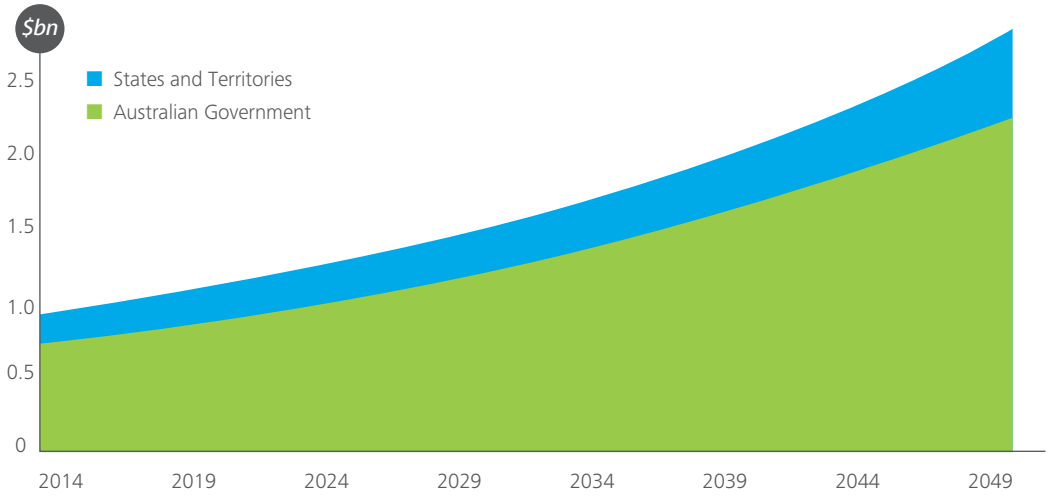


Chart A.4: Forecast annual cost to governments of natural disasters ($bn), 2011 to 2050

Source: Deloitte Access Economics (2013)



- Building more resilient housing in high-risk bushfire areas generates a BCR of about 1.4; better vegetation management results in a BCR of about 1.3; and moving electricity wires underground results in a BCR of about 3.1.

These examples demonstrate that practical resilience measures – which target high-risk locations using an appropriate combination of infrastructure, policy and procedure – have the potential to generate economic benefits. The case studies also highlight the importance of having access to comprehensive information on disaster risk and the effectiveness of adaptation strategies as part of the cost-benefit analysis process.

Recommendations

This report put forward three key recommendations:

- **Improve coordination of pre-disaster resilience by appointing a National Resilience Advisor and establishing a Business and Community Advisory Group**

  Developing resilient communities should be elevated to the centre of government decision-making, to support effective coordination across all levels of government, business, communities and individuals. This should be directly supported by a Business and Community Advisory Group, to facilitate a more coordinated response and ensure businesses and not-for-profits are represented at the highest levels of policy development and decision-making.

- **Commit to long-term annual consolidated funding for pre-disaster resilience**

  All levels of government – led by the National Resilience Advisor – should commit to consolidating current outlays on mitigation measures, and to funding a long-term program that significantly boosts investment in mitigation infrastructure and activities. Critical to this success will be the consolidation of existing information and commissioning additional data where needed. This will help governments, businesses and the community develop and implement effective local responses.

- **Identify and prioritise pre-disaster investment activities that deliver a positive net impact on future budget outlays**

  A program of mitigation activity should be developed, based on a cost-benefit analysis that demonstrates a clear positive outcome from investing in pre-disaster resilience measures. The prioritisation of these activities should be informed by analysis of research, information and data sets, allowing key investment decisions at all levels, including government incentives and price signals from the private sector.

Building an Open Platform for Natural Disaster Resilience Decisions (2014)

This report investigated the decision-making challenge, and identified the strengths and weaknesses of Australia's approach to natural disaster data and research. It made recommendations on how to support Australia to design a more sustainable and comprehensive national approach to safer and more resilient communities.

Accurate data and research is fundamental to better understanding natural disasters and their impact on communities, business and government. It is essential to supporting better decision-making and to prioritising mitigation investments needed to build a safer Australia. Optimal decisions on resilience investments requires access to high-quality data and research.

Providing wider access to accurate, relevant natural disaster data and research could increase government savings by between $500 million and $2.4 billion in present-value terms, over the period to 2050. Data and research that facilitates targeted and prioritised investment could deliver higher overall BCRs of between 1.3 and 1.5. Based on this, total savings to government could rise to anywhere between $12.7 and $14.6 billion in present-value terms, over the period to 2050.

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The decision-making challenge

Natural disaster resilience is an interdisciplinary issue. Multiple agencies are involved in collecting data and conducting research. This produces numerous platforms for accessing and using the necessary information; leads to increased search costs; and often creates complexity and disparity in understanding.

The key set of inputs required by end-users consists of:

- **Foundational data:** data that provides the basic standard layers of locational information. This includes the characteristics of assets at risk, community demographics, topography and weather details, which are also used for other purposes
- **Hazard data:** hazard-specific information on the risks of different disaster types, providing contextual details about the history of events and the risk profile of Australian locations
- **Impact data:** data on the potential and actual impacts associated with natural disasters, including information on historical costs and damage, and the current and future value at risk
- **Research activities:** actions that draw on data and seek to answer specific questions across a range of areas. There is often also feedback from research to data, because research outputs build on the existing stock of data that is available.

A broad range of end-users across communities, business and government are affected by this challenge, and their needs vary significantly. To realise the full potential of decisions aimed at increasing the safety, resilience and productivity of Australian communities, this data and research must be accessible in consistent formats that are fit for this variety of purposes.

Gaps and barriers to optimal decision making

The Australian approach to natural disaster research and data involves no comprehensive mechanisms to ensure inputs are available in a consistent and appropriate format.

Data

There is evidence of **gaps in the critical data inputs** required to inform resilience investments. This significantly limits the ability of stakeholders to understand the exposure of communities and the extent of losses that might arise.

These issues are compounded by barriers that restrict end-users' access to critical data. Barriers include:

- **Reluctance to share data** – the potential legal implications of data sharing are of particular concern for local government
- **Restrictive licensing arrangements**, which prevent wider distribution and use of data
- **The high cost of data collection,** which encourages a piecemeal approach to developing critical data inputs
- **A lack of coordination and standardisation**, which prevents end-users from pooling data from different sources
- **The high cost of providing accessibility and transparency,** which weakens incentives for data sharing if the broader range of benefits are unclear.

These barriers lead to duplicated efforts in data collection, higher transaction costs when using data, and restricted access for end-users. To the extent that the benefits for the full range of end-users exceed the costs of providing data, the current arrangement is inefficient, and fails to deliver the best outcome for Australian communities and taxpayers.

Appendix A: Companion papers

Research

The research found that **less funding** is directed towards understanding **the effect of mitigation, value at risk and the process of coping with natural disasters,** compared with other areas of research such as risk management, vulnerability, hazard detection, policy and decision support. This limits the ability of decision makers to understand the baseline costs associated with exposure to natural disasters, and the benefits that could be achieved through mitigation.

There are strong networks among Australian researchers but from an end-user perspective it is **difficult to identify what relevant research activities are happening,** and how to use research findings to better inform decisions about resilience. Although projects undertaken by the newly established Bushfire and Natural Hazards Cooperative Research Centre (launched in December 2013) explicitly involve end-users, this practice should be adopted more broadly. Increased transparency and better evaluation of the outcomes of research activities would support this change.

Recommendations

Consistent with the recommendation of *Building our Nation's Resilience to Natural Disasters,* a National Resilience Advisor within the Department of Prime Minister and Cabinet would be well placed to address these issues. The business of developing resilient communities should be elevated to the centre of government decision-making efforts, enabling effective coordination of activities across all levels of government, business, communities and individuals.

This report makes three recommendations for an enhanced approach to natural disaster information, focusing on the potential benefits of making optimal end-user decisions around data and research.

- **Efficient and open – deliver a national platform for foundational data**

  Given that foundational data is used for a broad range of purposes beyond the scope of natural disaster issues, the Australian Government should provide a single point of access for all Australians. Although the Bureau of Meteorology and the Australian Bureau of Statistics provide weather information and data on community demographics respectively, this would be improved by allocating responsibility for consistent topography and geocoded asset data at the national level. A national portal for this would support the prioritisation of resilience measures across local government and state borders, in the national interest.

- **Transparent and available – remove barriers to accessibility of data and research**

  Access to data and research is restricted. Greater transparency across the system is required to include the full range of end-users and allow for the development of an access system that weighs up overall costs and benefits. There is a need to clearly delegate responsibility for hazard and impact data (such as hazard mapping) and develop a stronger approach to involving end-users in research. This should also address concerns with legal liability and unnecessarily restrictive licensing, and help ensure standardisation across jurisdictions.

- **Enabling effective decision-making – establish a prioritisation framework.**

A national prioritisation framework for investment in resilience should be established, consistent with the approach adopted by Infrastructure Australia.[6] This will support best-practice use of natural hazard data, allowing research to be collected and disseminated, and ensuring that investments in resilience produce optimal outcomes based on consistent, evidence-based cost-benefit analyses. This approach would build a common understanding of the nation's areas of highest risk, and the most effective measures for reducing that risk and prioritising the research agenda.

6. Infrastructure Australia's Priority List identifies projects of national significance and informs the Australian Government of the highest-priority projects. Infrastructure Australia provides guidelines for cost-benefit analyses, step-by step methodologies for different investment types and links to standardised data sources, to assist in the preparation of submissions. Further details on this approach are provided in Chapter 2.

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Building Resilient Infrastructure (2016)

Both the Productivity Commission and Infrastructure Australia have highlighted the need to prioritise investments that can limit the extent of disaster damage.

- The Productivity Commission's *Natural Disaster Funding Arrangements* inquiry report (2015) revealed that 'Governments overinvest in post-disaster reconstruction and underinvest in mitigation that would limit the impact of natural disasters in the first place. As such, natural disaster costs have become a growing, unfunded liability for governments'
- Infrastructure Australia's *Australian Infrastructure Audit* report (2015) called for increased focus on resilience and improving the maintenance of existing infrastructure, noting that 'The number and intensity of extreme weather events is increasingly likely to threaten certain infrastructure assets'.

In response to the Productivity Commission's *Public Infrastructure* inquiry report (2014), the Commonwealth (2014) has committed to improving the robustness of project selection processes, including favouring projects that deliver long-term priorities. To achieve this, Infrastructure Australia has been given a role to develop and implement a best practice framework for project evaluation. This includes 'determining a robust and consistent methodology for cost benefit analyses for all economic and social infrastructure'.

Planning for resilience has the potential to significantly reduce disaster costs. Most importantly, when considering a new project, there is a need to ensure risks associated with natural disasters are appropriately analysed and all options for resilience are considered during the decision-making process. The current reform agenda provides an invaluable opportunity to embed resilience in the planning process for significant infrastructure.

Investment decision-making and resilience

Infrastructure planning requirements typically make very little reference to resilience. Where references exist, there is a lack of supporting guidelines on how this should be achieved. There is an implicit assumption that land use planning, building codes and standards provide adequate requirements. Yet, for some assets, it is likely to be cost-effective to build to a higher level of resilience than these prerequisites mandate.

The decision-making process for building new infrastructure is often complex, requiring trade-offs between objectives within budget constraints. Cost-benefit analysis (CBA) is a key factor in the decision-making process and is used to prioritise the options with the greatest net benefits.

Yet a review of the CBA guidelines applicable to infrastructure appraisal reveals that, with the exception of Queensland's guideline to measure the benefits of flood-proofing transport infrastructure, there are no explicit guidelines for measuring the benefits of resilient infrastructure.

Appendix A: Companion papers

The economic case for change

Determining which resilience measures are appropriate before a natural disaster event or before infrastructure is built is challenging. It requires a detailed ex-ante assessment of the likelihood of a hazard affecting a proposed asset and a thorough analysis of the possible resilience options that could be implemented to mitigate disaster impacts.

Three ex-post case studies in this report demonstrate that investment decisions on infrastructure projects could be different if that infrastructure's resilience to disaster was evaluated before investments were approved.

- **The loss of electricity services** caused by the 2007 Victoria cost the national economy $234 million bushfires. While it is expensive to build underground transmission lines ($11 million per kilometre), evidence indicates there would be net benefits from this additional resilience measure in some high-risk areas, specifically where the risk of a similar event occurring is greater than 5% per year (a one-in-20-year event).
- **Flooding of a state highway bridge** in regional New South Wales has caused major traffic disruptions six times since its construction in 1987. The cost of future events is estimated at $75 million totalling about $92 million (in present value terms) over the projected life of the asset. This compares to an estimated replacement cost of $7.4 million. The example highlights that the cost of minor disruptions to a local area can be significant over time
- **The loss of telecommunications services** as a result of the Brisbane floods in 2011 cost users about $1 million per day and Optus around $1 million overall. The total future cost of similar events is expected to be about $9 million. In contrast, Optus has invested between $3 and $5 million to improve infrastructure resilience since 2011. The benefits exceed the costs of the measures implemented if the risk of a similar event occurring exceeds 4% (a one-in-25-year event).

In all three cases, greater investment in resilience would have more than paid off in terms of avoiding disaster costs.

A single loss-of-supply incident cost around **$234 million**

Total bridge closure costs are estimated at **$91.8 million**

Lost mobile services cost **$1 million** a day during the Brisbane floods

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Planning for resilient infrastructure

A number of limitations affect the capacity (and incentives) for government and industry decision-makers to invest in resilience for new and replacement infrastructure. These include complex cross-jurisdictional approval processes, intensive data requirements, limited technical capacity, a lack of specific guidelines for CBAs to include resilience benefits and inadequate references to resilience in appraisal processes.

To support the shift to a system in which options for resilience are considered at the planning and decision-making stages in major infrastructure projects, this report offers:

- **Practical guidance** for practitioners to integrate resilience into the CBA process for proposed infrastructure
- **Five principles** for decision-makers (at all levels of government and business) to facilitate comprehensive integration of disaster resilience into infrastructure planning, appraisal and approval processes.

Recommendations

This report offers three key recommendations:

- **Improve infrastructure planning processes**: Integrate resilience in government and industry decision-making by adopting the principles for resilience in infrastructure planning
- **Improve incentives**: Prioritise policy changes and funding arrangements that ensure resilience has been considered and incorporated where appropriate into infrastructure planning
- **Improve capacity**: Government and industry should work to strengthen the technical capacity of practitioners to identify, analyse and evaluate the costs and benefits of resilience options.

These recommendations will help to embed resilience in the decision-making process for new infrastructure. In turn, this will improve the cost-effectiveness of infrastructure spending and, more importantly, mitigate the devastating and costly impacts of disasters on businesses and communities.

People trapped on the Carpendale side of Lockyer Creek survey damage to the bridge after floodwaters from Toowoomba in Queensland caused flash flooding between Helidon and Grantham, after heavy rains caused widespread flooding across the region. *(Aaron Francis / Newspix)*