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HAZARDS CRC

EAST COAST LOW EXTREME WEATHER SCENARIO

Scenario for the 12th Australasian Natural Hazards Management Conference

HOSTED BY THE BUSHFIRE AND NATURAL HAZARDS CRC



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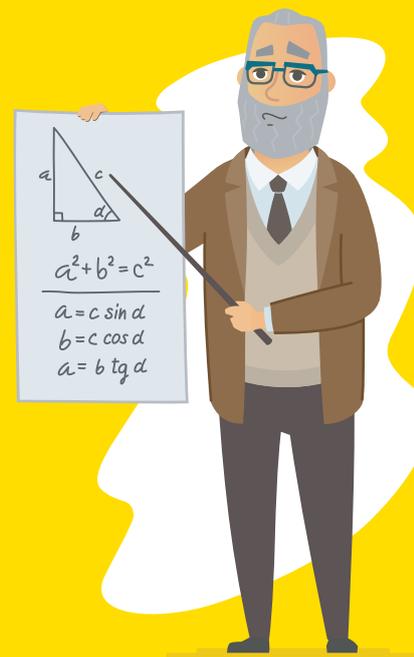
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Scenario overview

This is a fictional scenario developed for use at the 12th Australasian Natural Hazards Management Conference, developed in partnership with the Bureau of Meteorology, Geoscience Australia and Risk Frontiers. This scenario should be read in conjunction with the report on the 12th Australasian Natural Hazards Management Conference, *Cascading extreme weather beyond our experience: are we ready?*, published by the Bushfire and Natural Hazards CRC.

1. DISCLAIMER AND INTRODUCTION

This scenario has been developed for the 12th Australasian Natural Hazards Management Conference. It is based on climate, environment and weather events that are plausible. The combination of events, locations, areas of impact and human behavior are not based on any real event.

As you see what unfolds during the scenario, we ask you to focus on the nature and scale of the events that are unfolding, and the connections between them. And to begin thinking 'what could we do to reduce, minimise or avoid the short and long-term impacts?'

The hypothetical event is based in New South Wales, but can, and should, be considered in the context of any equivalent location across Australia or New Zealand.

The impacts capture a range of likely outcomes to illustrate the extent of the effects of the weather scenario, but do not attempt to catalogue all of the impacts and their extent.

2. SEPTEMBER 2020: CLIMATE OUTLOOK

NSW has been in a period of significant drought since the summer of 2018/2019. Winter rainfalls have been the lowest on record across the state, water storages across Sydney are low and dropping, and the Sydney desalination plant is operating at full capacity.

The Bureau of Meteorology Drought Statement reflects a very dry landscape across NSW and as a consequence,

limited fuel reduction through prescribed burning has been possible because of extremely dry fuels, lack of soil moisture and higher than normal temperatures.

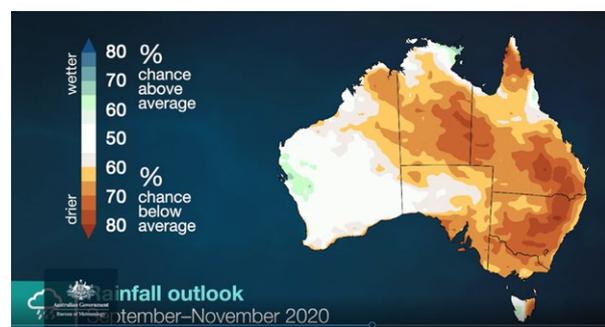


Figure 1: The fictional rainfall outlook for September to November 2020 used in the scenario.

3. WEDNESDAY 16 SEPTEMBER 2020: BUSHFIRES ARRIVE EARLY IN NSW

Wednesday 16 September 2020 is a day of extreme fire danger, strong winds and temperatures exceeding 35 degrees in most of NSW. Multiple fires start and several spread quickly:

- **Blue Mountains (north) fire** - the fire runs fast in prevailing wind and threatens communities including Blackheath and Medlow Bath
 - This fire is controlled with the loss of a few outbuildings, and eventually extinguished, with 5,000 hectares of forest burnt.
- **Snowy Mountains fire** - threatening the Tumut 3 hydro power station, the town of Talbingo and the Bogong wilderness area
 - This fire is controlled and eventually extinguished, with fire suppression effectively protecting the power station and power transmission assets. 12,000 hectares of forest were burnt.
- **Upper Hunter Valley fire** - threatening the Wollemi and Yengo national parks, the Singleton military area and several coal mines (Mulga Coal, Blakefield South Colliery and Hunter Valley Operations North and South)

- The fire is controlled and then extinguished, with the coal mines protected and 3,500 hectares of forest burnt.
- **Blue Mountains (south) fire** - burning in the Blue Mountains National Park and Burragarong Conservation Reserve, forested catchment for the Warragamba Dam
 - The fire is contained, and then extinguished, with 15,000 hectares burnt.
- **Kembla State Forest fire** - burning in the forested catchment for the Avon and Nepean Dams
 - Fire contained, 14,000 hectares burnt, but not before the 330 kilovolt electricity distribution lines through catchments de-energised, but not damaged during fires. The fires posed a short-term risk to power security.

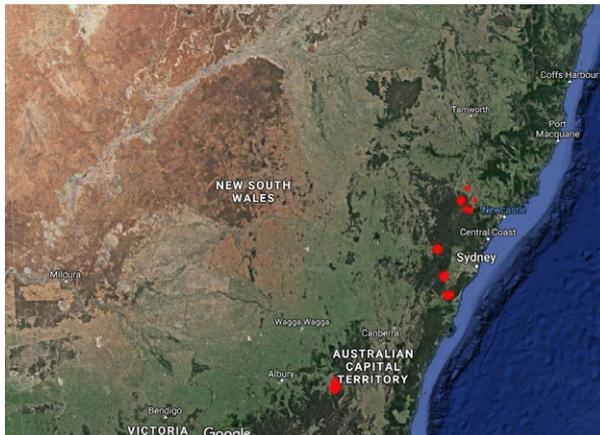


Figure 2: Location of fires in the scenario.

4. WEDNESDAY 7 OCTOBER 2020: SEVERE WEATHER ALERT FOR COASTAL REGIONS OF EASTERN AUSTRALIA

A developing low pressure system is predicted to become a significant East Coast Low. The East Coast Low is predicted to move slowly following landfall, and to have significant storm tides in excess of 2 metres that will be made worse by celestial alignments. It is expected that there will be significant wave action from the north east, with significant coastal erosion.

5. THURSDAY 8 OCTOBER 2020: SEVERE WEATHER ALERT - EAST COAST LOW EXPECTED TO IMPACT NSW COAST FROM WOLLONGONG TO NEWCASTLE

The Bureau of Meteorology released a Severe Weather Warning for an East Coast Low developing off the coast bringing wild and wet weather with potential for heavy rain, flooding and damaging wind over the next

two days. Storms are expected to increase over coastal and central NSW, developing into severe storms over the Sydney area with intense rainfall. The Sydney and Illawarra regions are the most likely to see heavy falls that may cause flash flooding. A flood watch is issued for all coastal rivers. Dangerous wind gusts and hazardous surf conditions are likely to continue into the weekend.

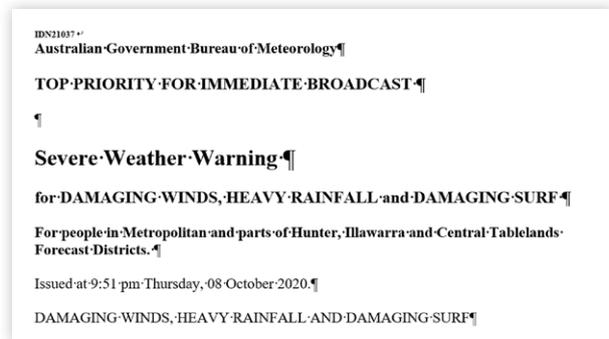


Figure 3: The fictional Severe Weather Warning for 8 October 2020 used in the scenario.

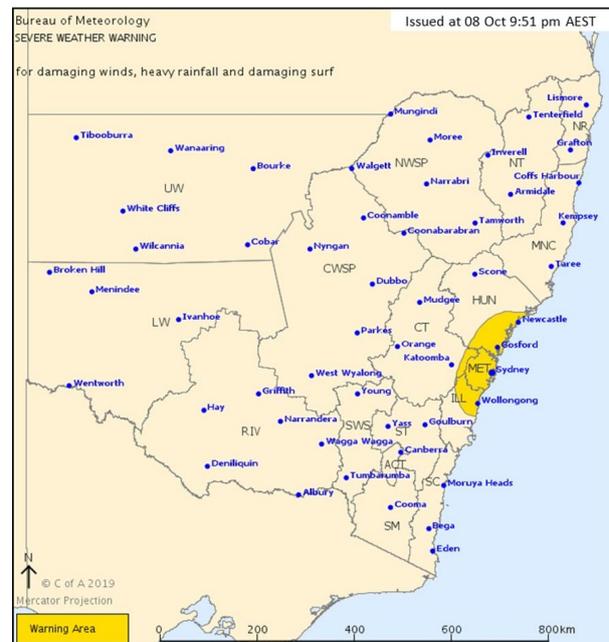


Figure 4: Graphical representation of the area that the fictional Severe Weather Warning for 8 October 2020 applies to.

6. FRIDAY 9 OCTOBER 2020, 9.30 AM: THE RAIN STARTS IN SYDNEY

Rain begins falling at 9.30 am and intensifies quickly after morning travel peak. Some businesses allowed staff to work from home in preparation for the expected severe weather, but more than 70 per cent of the daily workforce are still in the Sydney CBD. More people have

chosen to drive to work, expecting public transport to fail in the bad weather. Some came into work early and were planning to leave early, but the storm and associated flooding and traffic congestion came first, effectively trapping them in the CBD. The emergency services, led by the NSW State Emergency Service, are prepared for the forecast weather system.

Some impacts begin to be felt immediately:

- Renewable energy generation across the area affected by the weather system drops to almost zero.

7. FRIDAY 9 OCTOBER 2020, 10.30 AM: FLASH FLOODING AND BUILDING INUNDATION OCCURS ACROSS THE SYDNEY CBD

Major flooding is experienced in the Sydney CBD, centered around Pitt Street and running down to Sydney Harbour. Water is pooling in low lying areas, including King Street.

Floodwater in Pitt Street is running at depth of 0.5 metres, with fast flow velocities. Significant impacts are causing massive disruptions including:

- Several parked cars are washed down the street.
- Several cars being driven up Pitt Street from Circular Quay are washed backwards down the street with passengers inside.
- Underground carparks and loading docks are flooding.
- Basement shops are flooding.
- Building ground floors and basements are flooding.

Across the greater Sydney area:

- stormwater drains are backing up and overflowing
 - There is fast moving surface water to depth of 20 centimetres in streets leading to Darling Harbour, including Bathurst Street, Market Street and Drutt Street. An unknown number of pedestrians have been swept off their feet by the water and have fallen heavily
- there is significant flooding in Rose Bay, Alexandria, Annandale and Parramatta
- a flood watch has been issued for coastal catchments and all areas throughout the central coast of NSW for moderate to major riverine flooding
- there are warnings for flash flooding in the Illawarra and Shoalhaven areas as the weather system pushes southwards
- flash flooding has been reported around the Sydney basin
 - Across the greater Sydney basin, traffic lights are failing, stormwater is flowing into subway stations, and there have been 50 flood rescues in the first two hours. Four people are still missing in the floodwaters, and more rescues expected.
 - There have been 83 assisted evacuations.
- more than 200 people have been washed off their

feet across the city by floodwaters, half requiring medical treatment for head injuries and bone fractures

- more than 200 significant vehicle accidents have been reported across Sydney requiring emergency services attendance, many more minor accidents are blocking roadways
 - Twenty three of the accidents have been reported with people trapped and with suspected serious injuries.
 - Emergency services are experiencing extreme difficulty in moving response vehicles around the city, and all air fleets are grounded.
 - Major disruptions are affecting the road network:
 - road tunnels are flooding
 - signals are failing
 - there is major surface water inundation
 - stormwater systems are backing up and overflowing, with reports of pit covers exploding.
 - Significantly, central traffic management and coordination systems are failing and there are reports of sinkholes around suspected damaged stormwater pipes in Parramatta Road in Parramatta and Henderson Road near Redfern.

Elsewhere, there is flooding reported in the Chatswood-Sydenham Metro Tunnel and reports of construction workers trapped and unable to evacuate from the construction site. The Barangaroo, Victoria Cross, Martin Place and Pitt Street Metro station construction sites are also flooding.

Shipping movements have stopped, port operations are closed and any boats already at sea must remain away from the coast. Fishing operations are cancelled and the harbour ferries are not running.

Communications systems are struggling to cope. Mobile networks have become unstable, and towers are beginning to fail across the Sydney basin. In areas with power failure, 40 per cent of private residences with NBN lose voice and data communication.

People in high rise buildings are reporting significant immediate threats:

- Lift failures have been reported in 30 buildings, with many people now trapped. Loss of communications means that more people could be trapped in lifts and unable to communicate.
- There has been cracking in internal walls of a newly constructed 50 storey residential tower building in Parramatta. In the same building, the electricity supply has failed, there is flooding in the basement and residents in 38 apartments located on the higher floors are unable to open exit doors. An unknown number of residents are trapped inside apartments. There are reports of fire escape doors being jammed and unable to be opened. On the ground floor of the apartment building, there is a childcare centre with 70 childcare places.

- Scaffolding on the Sydney GPO in George Street is detaching from the building and threatening to fall across George Street.
- The Emu Plains Correctional Facility is at risk of flooding – it is located on the floodplain at Emu Plains in the Hawkesbury-Nepean Valley.

8. FRIDAY 9 OCTOBER 2020, 11.30 AM: EXTREME TIDES, A STORM SURGE AND COASTAL INUNDATION

Impacts are beginning to be experienced in coastal areas. Peak tides of 2.5 metres are reached at 11.30 am, with waves above 4 metres. Massive coastal erosion is being reported at Collaroy beach where buildings are under threat.

There is significant media attention as waves are starting to undermine buildings. The NSW SES is monitoring known coastal erosion hotspots around the Central Coast and the Northern Beaches where local residents remain on edge.

Some brave (foolish) surfers take to the water, risking their lives and the lives of lifeguards. Aircraft have been requested to search for a rock fisherman washed from rocks near Coogee, but are unable to take off because of the extreme weather conditions. The fisherman remains missing.

Several councils commence cutting sand banks to reduce flooding along coastal lagoons.

9. FRIDAY 9 OCTOBER 2020, 11.30 AM: SYDNEY AIRPORT OPERATIONS ARE SEVERELY IMPACTED

The storms have disrupted air travel in and out of Sydney. With low cloud, very heavy rain, significant surface water on runways and a high tide peaking at more than 2.5 metres, a tidal surge begins to impact airport surfaces as drainage becomes ineffective and water can be seen pooling across taxiways and runways.

Ground staff are unable to safely and effectively load aircraft (food, service and luggage) due to the intensity of the rain. Passengers are unable to get to, or leave, the airport due to traffic interruptions. There is a high potential for debris on runways.

10. FRIDAY 9 OCTOBER 2020, 12.00 PM: ABC ULTIMO STUDIO LOSES POWER, IMPACTING ABC'S EMERGENCY BROADCASTING

The substation supplying the ABC building in Ultimo fails, leaving the 14 storey building reliant on two generators. Within 30 minutes, the underground carparks flood. The flooding affects the pumps and fuel supply for those two generators, and the generators fail.

The whole of the ABC Ultimo building is evacuated and shut down within 20 minutes, including:

- ABC Radio Sydney (which does the emergency broadcasting)

- ABC News Channel (showing footage of the cascading event).

Backup plans are put into action and the responsibility for emergency broadcasting is transferred to another ABC facility interstate.

11. FRIDAY 9 OCTOBER 2020, 12.15 PM: MASSIVE INFLOWS BEGIN INTO WATER STORAGE

With significant and continuous rainfall over the last 18-24 hours covering the Sydney basin, central west, Blue Mountains and Wollongong escarpment, large volumes of water are moving into waterways and catchments:

- Warragamba, Nepean and Avon dams receive inflows massively contaminated by ash, debris (burnt vegetation) and soil/mud. Inflows are expected to continue for extended periods of time. It is anticipated that animal carcasses will be washed into the catchments, and that there will be significant erosion of landscape across the burnt areas of the catchments.

12. FRIDAY 9 OCTOBER 2020, 1.00 PM: BLACKOUTS BEGIN ACROSS THE SYDNEY CBD

With the extreme weather battering Sydney, wind gusts in excess of 125 kilometres per hour have been recorded through Sydney, with even stronger gusts along the coast.

Many powerlines have come down across greater Sydney due to wind and tree damage, and the impacts of localised flash flooding. There are power outages across the CBD, the greater Sydney basin, and the Hawkesbury-Nepean Valley. Impacts include:

- An estimated 80,000 customers are without power.
- The biggest outage affects 45,000 customers – an underground cable fault at the Double Bay zone substation¹ is affecting homes and businesses in Randwick, Bondi Junction, Bondi, Kensington, Waverley, Double Bay, Woollahra, Bronte, Bellevue Hill, Clovelly, Coogee and Rose Bay.
- Twenty per cent of backup generators in affected businesses fail within two hours.
- Power issues have been reported at the Prince of Wales and Sydney Children's Hospital.
- Renewable energy sources are not producing electricity.

¹ <https://www.abc.net.au/news/2019-01-31/power-outages-across-sydney-affecting-thousands/10766530>

13. FRIDAY 9 OCTOBER 2020, 1.15 PM ONWARDS: PUBLIC TRANSPORT ACROSS GREATER SYDNEY SIGNIFICANTLY DISRUPTED

There is chaos in the public transport system. Many parts of the rail system are flooded, and power has been lost to significant sections of the network. At many stations, subway access is flooded and unsafe. Some passengers are stuck on trains and others stranded on flooded train platforms after flash flooding hit the Eastwood area.

Buses are unable to move around the streets following designated routes and many passengers are unwilling to get off buses. Where passengers do disembark, there are hundreds of slips, trips and falls.

There are significant rises being recorded along the Georges River with a moderate to major flood warning issued for the catchment. The NSW SES are preparing for the evacuation of around 1,000 people. This follows significant flash flooding throughout the Fairfield area in the early evening.

14 FRIDAY 9 OCTOBER 2020, 11.00 PM: SEVERE WEATHER BEGINS TO EASE, BUT RAIN AND WIND CONTINUES. IN SYDNEY, THE IMPACT OF THE STORM IS NOW BECOMING CLEAR

As the severe weather begins to ease, the impact of the East Coast Low begin to emerge. This includes:

- number of homes without power: 250,000
- number of businesses without power: 35,000
- flood rescues: 194
- assisted evacuations: 1,593
- damaged cars: 537
- roads blocked by fallen trees and power lines: 350
- requests for assistance: over 35,000
- building damage
 - damaged but habitable: 17,500
 - damaged and uninhabitable: 5,300
- people sleeping rough in impact area: 550

Rain and moderate winds continue to impact on the greater Sydney and Illawarra areas overnight, before easing at sunrise.

15. SATURDAY 10 OCTOBER, 9.30 PM: SEVERE STORM DETECTED NEAR BATHURST

The Bathurst 1000 V8 Supercar race weekend is in full swing. Following a full day of racing and an evening concert there is a party atmosphere on the mountain at the Mount Panorama circuit and in the town.

The Bureau of Meteorology issued a severe storm warning, and associated information.



Figure 5: The fictional Severe Thunderstorm Warning for 10 October 2020 used in the scenario.

Emergency services issue a Red Flag Warning, advising all emergency services of the impending safety threat posed by the predicted storm, and advising them to cease all activities and return to their stations. Agencies are permitted to respond to life-threatening emergencies but only if it is safe to do so.

16. SATURDAY 10 OCTOBER, 10.00 PM: MASSIVE SLOW-MOVING HAILSTORM IMPACTS BATHURST AND THE RACE CIRCUIT AT MOUNT PANORAMA

There is limited warning of the severe storm for Bathurst and surrounding areas. Bathurst is at the edge of current weather radar coverage, and the Bureau of Meteorology was unable to get a detailed and accurate estimate of the storm threat prior to the issuing of the warning at 9.30 pm.

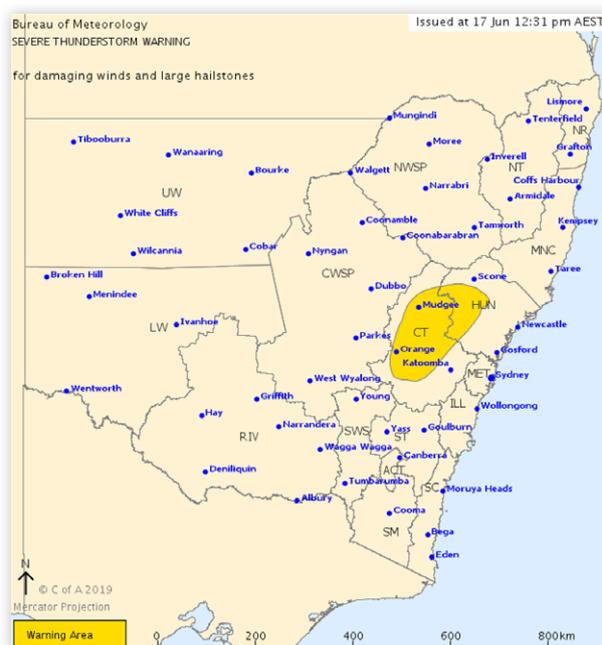


Figure 6: Graphical representation of the area that the fictional Severe Weather Warning for 10 October 2020 applies to.

The area is hit with extreme wind gusts and massive hail. The impact is sufficient to bring down the two power feed lines into the Mount Panorama substation. Powerlines across the area are on timber poles and are expected to have suffered significant damage².

There is an intense hailstorm with large hail up to 5 centimetres in diameter, falling for 30 minutes over Mount Panorama and Bathurst township, accompanied by very strong winds. At the time, there are 33,500 campers on the mountain, many affected by alcohol. Adding to the risks, there are many fire drums across the campsites, some covered with tarpaulin shelters, and there is no real protective cover for people. Approximately a third of the campsites have a car parked onsite.

17. SATURDAY 10 OCTOBER, 10.15 PM: FIRST REPORTS ARE RECEIVED FROM BATHURST

Once the storm passes, an initial impact assessment from the scene (derived from a combination of event management teams and social media reporting) begins to paint a picture of what has happened:

- A very dangerous hailstorm with extremely strong winds has impacted the entire town of Bathurst and Mount Panorama.
- Trees have been blown down, damaging houses and powerlines.
- Temporary structures across the Mount Panorama site have collapsed, trapping campers trying to shelter from the extreme weather.
- Mobile communications have failed across the entire town, and across Mount Panorama (wind and hail damage, loss of electricity).
- NBN based communications have been severely impacted, with more than 70 per cent of homeowners losing data and landline phone services.
- Electricity supply has been lost across the town and at Mount Panorama, the Panorama to Orange and Panorama to Wallerawang 132 kilovolt lines are down in multiple locations, interrupting supply to Bathurst.
- Onsite paramedics and security have been sheltering for their own personal safety; all of their vehicles have been damaged by the hail and are unserviceable. There are a limited number of emergency services vehicles available from the permanent Bathurst emergency services facilities.
- A small number of evacuees from Mount Panorama campsites that have reached the command centre have reported:
 - a high frequency of injuries, including:
 - bruising from hail
 - broken limbs
 - motor vehicle accidents as some people tried to escape the hail and protect their vehicles
 - burns from people pushed into fire drums

- crush injuries from people rushing to try and get out of the hail
- most of the tents have been severely damaged or destroyed
- most mobile homes and cars are badly damaged, the majority with windows broken.

18. SATURDAY 10 OCTOBER 2020 11.00 PM: RAPID IMPACT ASSESSMENT FROM MOUNT PANORAMA AND BATHURST

On Mount Panorama

The scale of the impact has become clearer as race officials and emergency services survey the Mount Panorama area. Communication outages and the scale of the event means that the information at this time is incomplete. What is known is:

- there have been several fatalities:
 - At least five people have been killed by falling trees and the collapse of a temporary grandstand that people were sheltering under.
 - At least 25 people have died from crush injuries as panicked campers desperately sought shelter from the hail.
- there are a massive number of injuries across the mountain:
 - At least 136 crush injuries require hospital care.
 - At least 195 people suffering from trips and falls require hospital care.
 - At least 1,538 hail injuries require medical care, with an unknown number of serious injuries, including head injuries, broken limbs and damage to eyes and faces:
 - over 4,000 less serious injuries not requiring hospital care, including bruising, sprains and strains, and alcohol and drug-related conditions.
- there is extensive damage across the site. The list below excludes racing infrastructure and vehicles:
 - There is extensive vehicle damage including more than 5,000 cars, RVs and 4WDs damaged, many not driveable; and more than 1,000 motor homes damaged, many not driveable.
 - More than 90 per cent of the tents in the camping areas are damaged and unusable.
 - Major infrastructure has been severely damaged and services disrupted:
 - There is a total power failure across the Bathurst region, which is expected to continue for at least 12 hours.
 - All mobile phone tower fixed infrastructure is damaged, and mobile phone services will remain out until transportable communication trailers arrive on scene.

² Source: Darren Spoor, AEMO

- There has been substantial (greater than 70 per cent) loss of terrestrial NBN communications that will continue until electricity supplies are restored.
- There has been a total loss of fixed satellite based NBN communication that will continue until electricity supplies are restored and all damaged equipment has been replaced.
- More than 90 per cent of the food vendors facilities have been destroyed and are unusable.
- Major areas in the camping grounds are inaccessible due to damage from the storm and because they are now crime scenes.
- Sanitation and hygiene facilities on the mountain are significantly damaged.

In the town of Bathurst

In and around Bathurst, the permanent emergency services presence includes:

- 1 x police station
- 2 x fire stations
- 1 x ambulance station
- 2 x SES facilities
- 6 x rural/country fire facilities
- 1 x public hospital, including an emergency department and approximately 100 hospital beds in total
- 1 x private hospital, including 16 overnight surgical/medical beds.

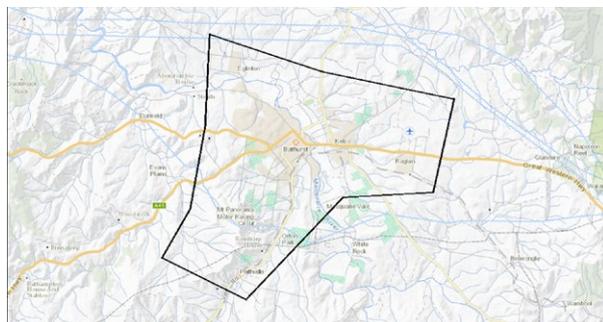


Figure 7: Bathurst and Mount Panorama.

BUILDING EXPOSURE, V9 SEPTEMBER 2017

RESIDENTIAL	EVENT
Population count	29,625
Dwelling count	12,915
Building count	11,768
Pre 1980 construction count	2,211
Pre 1990 probably asbestos containing products	5,002
Reconstruction value	\$7,003,850,000
Contents value	\$894,580,000

COMMERCIAL

Building count	284
Reconstruction value	\$949,270,000

DWELLING ESTIMATES WHERE RESIDENTS:

DEMOGRAPHIC	EVENT	NSW(Av)
Are all aged 65 or over	18.8%	17.4%
Includes persons aged 14 years and under	24.9%	25.3%
Includes an Indigenous person	6.6%	3.6%
Are a single parent family	8.0%	5.4%
Are in need of assistance for self-care activities	10.3%	10.5%
Include persons not proficient in English	0%	1.3%
Do not have access to a motor vehicle	8.1%	9.7%
Have all not completed Year 12 or higher	19.9%	15.5%
Moved to the region in the last one year	9.4%	11%
Moved to the region in the last five years	24.2%	30%

TOP FIVE EMPLOYING INDUSTRY:

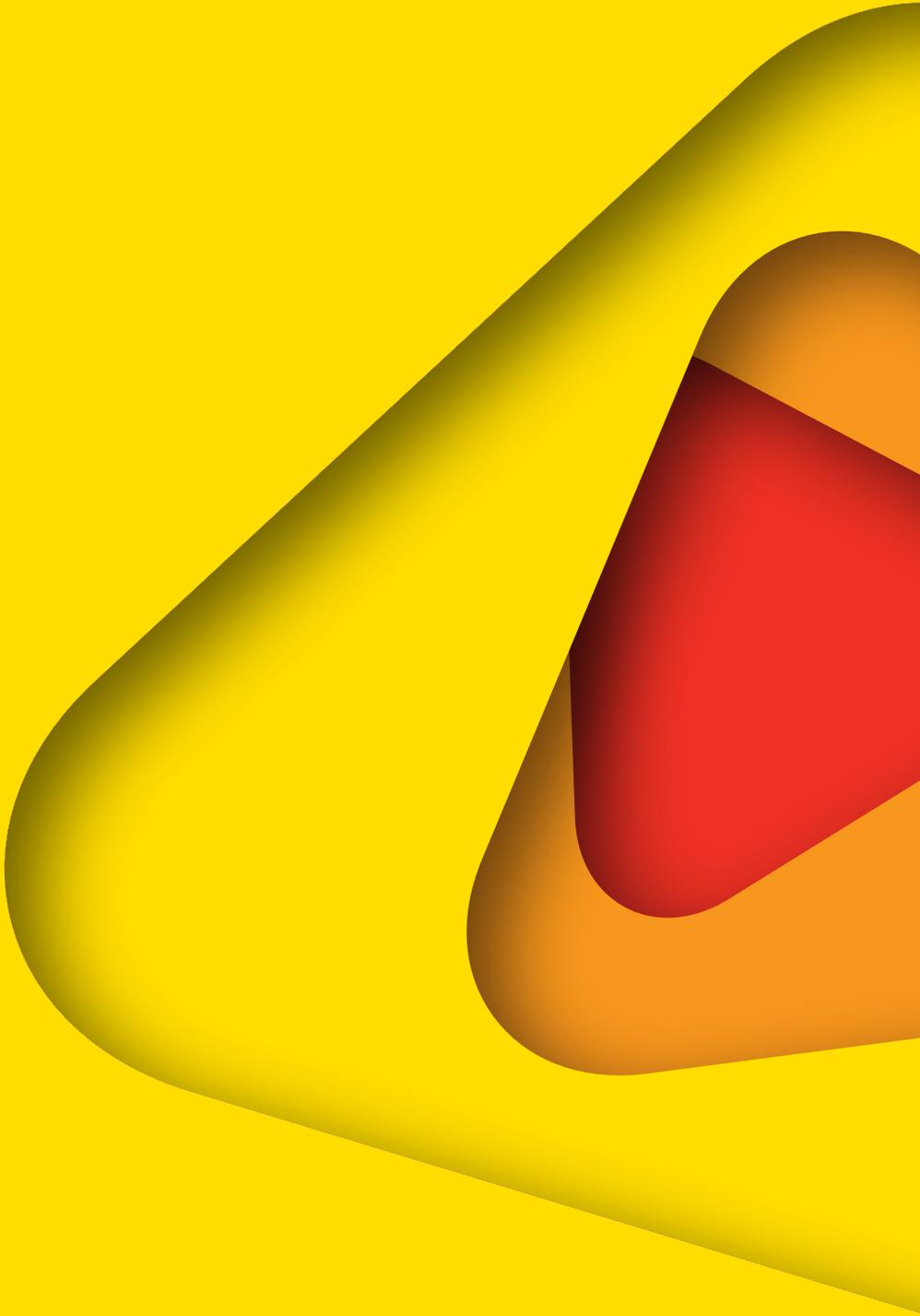
ABS Census 2016 data not available for this release

Table 1: Known assets in Bathurst using the Australian Exposure Impact Platform.

Damage in the town of Bathurst has been less catastrophic than what was experienced at Mount Panorama, but there is still a significant level of damage:

- There are no fatalities in the town, but there are a number of injuries:
 - At least 47 people have injuries caused by the hail that require medical care.
 - Another 281 people are known to have injuries caused by the hail, but do not require medical care.
- There is significant damage to buildings and other infrastructure across Bathurst. The estimates have been based on the known assets in Bathurst, using the Australian Exposure Impact Platform (AEIP, <https://www.aeip.ga.gov.au/>):
 - There are 12,915 dwellings in the impact area, and 30 per cent of these have some level of damaged (hail, wind, rain). 150 houses are known to be uninhabitable.
 - Of the six nursing homes in Bathurst, one is badly damaged and two are moderately damaged. There are two retirement villages and their current status is not known.
 - Accommodation facilities were full for the weekend, and there has been damage:
 - five hotels damaged, with at least 35 rooms unusable
 - unknown number of AirBNB properties are expected to have been damaged and not habitable.
- The Bathurst Correctional Facility is running on backup power.

SCENARIO ENDS



BUSHFIRE AND NATURAL HAZARDS CRC

WAS DELIGHTED TO HOST THE

12TH AUSTRALASIAN NATURAL HAZARDS MANAGEMENT CONFERENCE

📅 17-19 JUNE 2019, AUSTRALIAN INSTITUTE OF SPORT, CANBERRA

The CRC conducts a multi-disciplinary research program on the major national issues across the natural hazards spectrum. The CRC is a partnership of all Australian and New Zealand fire, land and emergency service agencies; more than 30 universities; plus many federal, state and local government departments; professional and volunteer associations; and non-for-profit organisations.

The CRC is providing a long-term knowledge base that directly supports emergency services and other government and non-government agencies to protect their communities through work to prevent, prepare for, respond to and recover from natural disasters.

The utilisation of the research by the end-users to the benefit of the broader Australian community is critical to the whole process. The research program comprises three broad themes, covering 12 clusters of projects, most of which span the priorities for those working in a multi-hazard environment. The themes are:

- Economics, policy and decision making
- Resilient people, infrastructure and institutions
- Bushfire and natural hazard risks

The CRC was created with a mission to:



Reduce the risks from bushfire and natural hazards



Reduce the social, economic and environmental costs of disasters



Contribute to the national disaster resilience agenda



Build internationally renowned Australian research capacity and capability